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National security vs. human rights: A game theoretic analysis of the tension between these objectives

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Abstract

We explore why human rights violations take place in the midst of a rebellion. Authoritarian governments may not care for human rights but surprisingly several democratic governments have also condoned such violations. We show that the primary cause of such violations is faulty intelligence. There are two type of defective intelligence that can occur viz., missed alarm and false alarm. We consider each of these cases and determine the optimal human rights standard of the government. We then examine the effect of a decrease in the human rights standard on the probability of quelling the rebellion. In our theoretical model, this effect is indeterminate (i.e. can be positive or negative). We empirically quantify this effect using the case of Armed Forces Special Powers Act in India. Since the probability of quelling the rebellion is not directly observable, we use the magnitude of violence as its indicator. The magnitude of violence should be negatively related to the probability of the government's success. We find that a lowering of the standard of human rights increases violence (i.e. reduces the chance of quelling the rebellion) and this effect is statistically significant.
Keywords: OR in Defense; Government; Tactics/Strategy; Military; Insurgency

1 Introduction

The objective of this paper is to explore why human rights violations take place in the midst of a rebellion. Authoritarian governments may not care for human rights but that is not very surprising. What is intriguing however is the fact that there are several examples of democratic governments that condone human rights violations. For example, in 1980, the democratically elected government of Peru allowed the military to violate human rights in an effort to crush an insurgency led by the Shining Path guerillas (Cornell and Roberts 1990). More recently, in Myanmar, the democratically elected government of Suu Kyi has allowed the military to essentially ethnically cleanse the Rakhine province of a minority group known as the Rohingyas (Geneva International Center for Justice 2017). We are primarily interested in understanding why governments, even democratically elected ones, permit human rights violations in response to a rebellion and if they have anything to gain from it. Therefore, we consider a government that faces an insurgency and needs the help of its army to quell the rebellion. In order to empower the army, it is willing to reduce the standard of human rights if necessary. However, at the same time, it wants to preserve some checks and balances in order to protect the human rights of its loyalists.

We show that the primary cause of human rights violations is faulty intelligence which prevents the armed forces from distinguishing a loyalist from a rebel. Indeed, in our model, human rights violations never occur if intelligence is perfect. There are two types of defective intelligence that can occur. These are commonly known as false alarm and missed alarm (or type I error and type II error). We consider each of these cases and identify the incentives of the government to allow its armed forces to violate human rights. We then determine the optimal human rights standard of such a government. Finally, we perform sensitivity analyses of the effect of a reduction in the human rights standard on several key endogenous variables, such as the probabilty of quelling the rebellion, the rate of participation of the local populace in the insurgency, etc.

We are particularly interested in examining the effect of the human rights standard on the probability of quelling the rebellion. In our theoretical model, this effect is indeterminate (that is, can be positive or negative). This is because the standard of human rights affects the probability of quelling the rebellion through two channels. On the one hand, a lower standard of human rights makes it easier for the armed forces to fight insurgents, thereby increasing this probability. However, on the other hand, a reduction in the human rights standard changes the motivation of the local populace to participate in the insurgency. If this motivation goes down because of a fear of repression, this effect further increases the probability of quelling the rebellion. However, it is also possible for the motivation to increase in response to more repression. In such a case, the two effects counteract each other and the net direction of change of this probability cannot be determined theoretically.

We therefore empirically quantify this effect using the case of the Armed Forces Special Powers Act (AFSPA) in India. We describe AFSPA in detail later in the paper. Briefly, it is a law that protects soldiers from prosecution if they kill or injure a person in the course of duty. The law is applied only in selected regions of India during times of a major disturbance. Since the probability of quelling the rebellion is not directly observable, we use the magnitude of violence as its indicator. The magnitude of violence should be inversely related to the probability of the government's success. That is, a decrease in violence should indicate that the government has the upper hand, which means that the probability of crushing the rebellion is higher. We find that a lowering of the standard of human rights increases violence (that is, it reduces the probability of quelling the rebellion) and this effect is statistically significant. Therefore, the empirical analysis allows us to find the effect of the human rights standard on the probability of quelling the rebellion in the case of India.

The rest of the paper is organized as follows: In Section 2, we review the literature. We describe the model in Section 3. The analysis of the model is described in Sections 4-5. We then describe the Armed Forces Special Powers Act (AFSPA) in Section 6. The empirical analysis is then described in Sections 7-9. We conclude in Section 10.

2 Literature Review

We are primarily interested in understanding if human rights violation is an effective tool in countering insurgencies. According to the United Nations, "Human rights are rights inherent to all human beings, regardless of race, sex, nationality, ethnicity, language, religion, or any other status. Human rights include the right to life and liberty, freedom from slavery and torture, freedom of opinion and expression, the right to work and education, and many more." McInerney-Lankford and Sano (p. 18, 2010) provide a list of measurable attributes of human rights that was developed by the United Nations High Commission for Human Rights. The most relevant ones for this paper are the rights to life, liberty, expression, fair trial and freedom from torture. There are several known indices of human rights such as the CIRI Human Rights Data Project, American Bar Association Judicial Reform Index, etc.

Unfortunately, governments have a tendency of violating human rights, particularly when dealing with an insurgency. For example, there are allegations of human rights violations against the Sri Lankan government for its policies during the civil war that ended in 2009. According to Amnesty International, "Enforced disappearances, extrajudicial executions, torture and other serious human rights violations and abuses were committed with impunity before, during and in the aftermath of the armed conflict between government forces and the Liberation Tigers of Tamil Eelam (LTTE) that ended in 2009." There are many instances of human rights violations during the civil war in erstwhile Yugoslavia (United Nations Economic and Social Council 1996, Human Rights Watch 1999). These are but two examples. Instances of human rights violations are quite ubiquitous. Sano and Lindholt (2000) studied human rights standards in 70 countries and found that torture and ill-treatment was prevalent in 60 of them.They also found evidence of disappearences and extra-judicial killings in 41 of these countries.

In principle, a government can follow either a coercive policy (sticks) or a conciliatory policy towards terrorist groups (carrots). Sticks can take several forms, such as decapitation (Johnston 2012, Jordan 2014), indiscriminate targeting (Lyall 2009), etc. The effects of conciliatory policies such as ceasefires have been discussed in Walter (2006) and Dugan and Chenoweth (2012). Bier and Hausken (2011) consider these two kinds of policies in a theoretical model and identify circumstances under which each kind of policy is optimal. Asal et al. (2018) consider both of these policies and empirically find that coercive tactics are likely to result in more terrorism. Paul and Bagchi (2019) find that more civil liberties in the MENAP (Middle East, North Africa, Afghanistan and Pakistan) region is associated with less domestic terrorism. In our theoretical model, we discuss why this effect can go either way. However, in our empirical analysis, we find that the imposition of AFSPA (a coercive law) in several disturbed provinces of India actually resulted in more terrorism. Therefore, our empirical finding is in line with Asal et al. (2018) and Paul and Bagchi (2019). This result is also similar to Vadlamannati (2011) who posits that the rebellion in the North-Eastern states of India worsened when the government responded by instituting the Armed Forces Special Power Act. Meenakshi Ganguly, the South Asia Director of Human Rights Watch similarly writes that "AFSPA, designed as an emergency measure but now in force for decades, has contributed to, rather than reduced, violence in India." (Ganguly 2014).

This paper is also closely related to Walsh and Piazza (2010). They show, using data from several countries, that violation of human rights through measures such as extrajudicial killings, torture, disappearances, etc. lead to an increase of terrorism.This is because such measures make it harder for the government to gather intelligence and also reduces support for the government's counter-terror policies. We find a similar result empirically. However, we also use a model to examine this question theoretically. Our theoretical results clearly show that this result can go either way. We also identify conditions under which human rights violations increase/decrease violence. Our work is also related to Kress and Szechtman (2009) and Kress and Atkinson (2014) in the context of espionage and insurgency. Kress and Szechtman (2009) show that if the government can accumulate significant accurate intelligence when the rebellion is very small, it can reduce the rebellion to a small manageable size. Further, actions such as reconstruction and civil-support may positively affect the population support for the government and this in turn improve intelligence obtained from human sources. Such strategies would only positively impact government chances of quelling the rebellion. In an extension of sorts, Kress and Atkinson (2012) highlight the impact of intelligence/targeting accuracy on effectiveness of coercion against rebels. Specifically, they show that if the government has poor targeting accuracy (i.e., limited intelligence about the rebels (identity, location, weapons, etc.)), it must be exceedingly cautious when using violence against them as it might end up alienating the government supporters due to unintended violence against supporters and resultant collateral damage. The government while on one hand should aim to accomplish perfect accuracy for itself and poor accuracy for the rebels through intelligence investments, on the other it should use this information on the rebels and entice them to act and jeopardize their mission. In the literature, the role of espionage in protecting infrastructure has also been discussed. Bagchi and Paul (2014) show that the government can adequately secure an airport by screening a fraction of the passengers, provided this policy is backed by adequate intelligence about the passengers. Bagchi and Paul (2017) consider a trusted trader program known as C-TPAT and show that some of its features should ideally depend upon the government's espionage capability. More recently, Bagchi and Bandyopadhyay (2018) consider a cyber security game and show that as long as the government has adequate intelligence gathering capability against adversaries and passes on that information to potential victims, there are circumstances in which it is socially optimal to let the private sector decide how to to thwart cyber attacks. In other words, it is not always necessary for the government to take over the provision of security, as is done in airports or ports. In contrast to these papers, this model extends the role of espionage in understanding why human rights violations take place.

Our paper is also related to literature featuring defense games involving imperfect false targets. Levitin and Hausken (2009a) study the deployment of false targets as part of a strategy by the defender aiming to minimize defense costs and expected losses. The authors analyze a situation wherein the defender has a single genuine target that can be destroyed by the attacker. They find that the optimal number of false targets in general depends on the resources at the disposal of the attacker and the defender, the false target cost, and the contest intensity. Further, the effectiveness of the false targets is dependent on the ability of attacker to distinguish them from the genuine target. Levitin and Hausken (2009b) extend this work to account for intelligence investments by both attacker and defender, this transforming the game to an intelligence and impact contest between the agents. Zhuang et al. (2010) apply game theory and dynamic programming to model a multiple-period, attacker–defender, resource-allocation and signaling game with incomplete information to model strategies of secrecy and deception. Their analysis indicates that there exist equilibria in which secrecy and/or deception are strictly preferred by some types of defenders to pose as defender types of less interest to attackers or to differentiate themselves from those that are of greater interest to attackers. Specifically, secrecy can be an equilibrium strategy when the attacker is uncertain about the defender expense effectiveness and the asset valuation. In a similar vein they find that deception can also be an equilibrium strategy when the attacker is uncertain about the defender costs.

This paper is also related to the vast literature on the causes of terrorism. One causal factor that is of particular interest to us is the role of discrimination or injustice in fomenting terrorism. Choi and Piazza (2016) and Boylan (2016) show that exclusion of ethnic groups from political power is a cause of terrorism. Building on their work, Hansen, Nemeth and Mauslein (2018) show a similar result, but add that the effect of such exclusion can be magnified by certain local factors such as population density, per capita income and country regime type (that is, whether the country is a democracy or not). Interestingly, they find that the effect of exclusion on terrorism tends to be magnified in democracies. In our theoretical model, we assume that individuals earn a payoff if an insurgency succeeds but we are agnostic about the origin of such a payoff. This payoff can originate because of several causal factors mentioned above. For example, the primary cause of insurgencies in the Indian state of Nagaland is a perception among its residents that they are different from Indians and would lose political power in the Indian union (Kashyap and Gupta 2015). This is similar to the idea of political exclusion as described in Choi and Piazza (2016) and Boylan (2016). In the state of Assam, the primary cause of insurgency is resentment against unchecked illegal immigration from Bangladesh and the perception that the rest of India exploited natural resources of Assam without adequate compensation (WTD News 2016). Other troubled states have similar stories.

3 Model

Consider a province of a country in which there are strong separatist sentiments. The government of the country would like to prevent the province from seceding. There are some rebels who participate in an insurgency and the government uses its army to fight insurgents. Below, we describe a game that involves the government, its army and the rebels.

There are 4 periods in this game. In the first period, the government specifies the rules of engagement of the army, that is, it specifies the standard of human rights that the army has to follow. The government operationalizes this policy by choosing the expected penalty $c \in [\underline{c}, \overline{c}]$ that the army will pay if it wrongly arrests a loyalist. A higher human rights standard is associated with a higher c. In particular, $\overline{c}$ is the expected penalty of the army for a human rights violation in a peaceful province while c is the corresponding penalty in a disturbed province. One way of measuring these differences is by considering the difference in conviction rates and the quantum of punishment of convicted soldiers under the two situations. It is also possible that the government may have some obligations under international law. This is captured by the term $\underline{c}$. If c is equal to $\underline{c}$, it means that the government is willing to implement the lowest possible standard of human rights that is consistent with international law. The purpose of the government is to maximize welfare, which is defined to be a weighted sum of the payoffs of the army and loyalists. The weight on the army's payoff signifies the government's prefererence for national security while the weight on the loyalists' payoff signifies the government's preference for human rights.

In the second period, each person in the province decides whether or not to participate in the insurgency. This decision depends upon the payoff of the person given the outcome of the insurgency. A person's payoff is w if he chooses to remain a loyalist and is not erroneously arrested by the army. This payoff depends on factors such as the average income in the province. It is possible that w may be affected by the level of violence. However, the relationship between civil war and economic growth is not the focus of this paper and hence we make the simplifying assumption that w is a constant and is the same for everyone in the province. If a person participates in the insurgency, his payoff is $b \in \left[0, \overline{b}\right]$ if the rebellion succeeds and if he is not arrested; $w < \overline{b}$. Such a person's payoff is 0 if the insurgency fails. Finally, a person's payoff is also 0 if he is arrested, regardless of whether he participates in the insurgency or not. We interpret the term 'arrest' broadly to refer to all kinds of human rights violations, such as incarceration, killing, torture, etc. Further, it is important to keep in mind that an arrest made in a peaceful zone is not similar to an arrest in the war zone and the latter has a higher likelihood of human rights violations. This is especially true given the ease with which an arrest can be made and relatively relaxed accountability in a war zone. We assume that b varies from one individual to another depending on their preferences. It will be high if a person expects to gain a lot from secession, while it will be small otherwise. Let $b^\star$ be the payoff of the marginal insurgent, that is, the person who is indifferent between participating in the insurgency or remaining a loyalist. In equilibrium, all persons with $b > b^\star$ participate in the insurgency while those with $b < b^\star$ choose to remain loyalists. The value of b is known only to an individual. To the army, it is a random variable whose domain is $\left[0, \overline{b}\right]$ and follows the distribution function $F(b)$. The density function is denoted by $f(b)$.[1]

The decision about participating in an insurgency is captured by the binary variable θ that takes a value 1 if a person participates in the insurgency and is 0 otherwise. Since the army does not know the value of b for a particular person, the value of θ for this person is also unknown to it. In period 3, the army receive a signal s about the decision of each individual. This signal takes a value of either 1 or 0. If the signal takes a value of 1 (resp., 0), the army guesses that the individual is (resp., is not) a rebel. The signal is the intelligence assessment about a person. In period 3 itself, the army decides whether or not to arrest an individual based upon the signal. Let α_s denote the probability that a person will be arrested if the army receive a signal of s. We allow for the signal to be faulty. Therefore, it is possible that the signal takes a value of i when θ takes the value j; $i, j = \{0, 1\}$; $i \neq j$. The joint probability distribution of (s, θ) is given by $\Pi_{ij} = \Pr\{s = i,\ \theta = j\}$, where $\Pi_{ij} \in [0, 1]$ and $\sum_{i=0}^{1}\sum_{j=0}^{1}\Pi_{ij} = 1$. In this model,

$$\Pr(s = i|\theta = j) = \frac{\Pi_{ij}}{\Pi_{ij} + \Pi_{jj}}; \quad i \neq j$$

and

$$\Pr(s = j|\theta = j) = \frac{\Pi_{jj}}{\Pi_{ij} + \Pi_{jj}}$$

depend upon the intelligence capability of the government and are assumed to be exogenously determined.

There are two cases when the army makes a wrong assessment about a person. In the first case, it may mistakenly believe that a person is a loyalist when in fact he is a rebel (missed alarm), while in the second

[1] An important issue is how to estimate the distribution function $F(b)$. The main challenge is that b is unlikely to be observed by the econometrician. One can however have much better information about the proportion of people who participated in an insurgency and the corresponding value of w (per capita income) at various points in time. Therefore, it is possible to estimate a logit regression, which can used to predict the probability that a randomly chosen person will participate in the insurgency, as a function of w. The predicted probabilities can be used to determine the distribution function of b.

Table 1: List of Notations

Notation	Description
c	expected penalty of the army if they wrongly arrest a loyalist
w	a person's payoff if he is a loyalist and is not erroneously arrested by the army
b	payoff of an insurgent if the insurgency succeeds
$F(b)$	distribution function of b
$f(b)$	density function of b
θ	binary variable that depicts a person's decision to participate in the insurgency
s	signal that the army observes about θ
α_s	intelligence assessment about a person based upon s
p	probability that the army wins the contest
e	effort exerted by the army in the contest
r	net proportion of insurgents in the population
V	expected payoff of the army
Ψ	social welfare function
λ	weight on the army's payoff in the social welfare function
b^*	payoff of the marginal rebel, that is, the person who is indifferent between participating and not participating in the insurgency

case, it may mistakenly believe that a person is a rebel when in fact he is a loyalist (false alarm). We would like to isolate the role of each of these errors. Therefore, we consider them one at a time.

Suppose it is the case that

$$\Pi_{10} = 0 \text{ but } \Pi_{01} > 0. \tag{1}$$

Consequently,

$$\Pr(s = 1|\theta = 1) = \frac{\Pi_{11}}{\Pi_{01} + \Pi_{11}} > 0 \text{ but } \Pr(s = 1|\theta = 0) = 0,$$

that is, the chance of a false alarm is 0. In this case, a signal of 1 can originate only from a rebel. As we will show later, this implies that the optimal response of the army is to arrest all individuals against whom there is an adverse intelligence assessment. Also,

$$\Pr(s = 0|\theta = 1) = \frac{\Pi_{01}}{\Pi_{01} + \Pi_{11}} > 0 \text{ and } \Pr(s = 0|\theta = 0) = 1,$$

that is, a signal of 0 can originate from either a rebel or a loyalist. Since a signal of 0 does not automatically establish a person's innocence, the army arrests some people with a favorable intelligence assessment. Such a tactic might appear to be unfair but this is a rational response of the army to faulty information.

Next, let us consider the implication of assuming

$$\Pi_{10} > 0 \text{ but } \Pi_{01} = 0. \tag{2}$$

If (2) is true,

$$\Pr(s = 1|\theta = 1) = 1 \text{ and } \Pr(s = 1|\theta = 0) = \frac{\Pi_{10}}{\Pi_{10} + \Pi_{00}} > 0,$$

that is, a signal of 1 can originate from either a rebel or a loyalist. However,

$$\Pr(s=0|\theta=1)=0 \text{ and } \Pr(s=0|\theta=0)=\frac{\Pi_{00}}{\Pi_{10}+\Pi_{00}}>0,$$

that is, the chance of a missed alarm is 0. In this case, a signal of 0 can originate only from a loyalist. Consequently, the army will never arrest a person if there is a favorable intelligence assessment (that is, if the signal is 0). However, if there is an adverse report, there is a chance that such a person may be arrested. Notice that even in the case of an adverse report, a person may still escape being arrested by the army as long as there are penalties for arresting a loyalist.

In period 4, there is a contest between the army and the insurgents. The outcome of the contest is determined according to a contest success function. In this contest, the army wins if it can permanently and irreversibly destroy the insurgency. On some occasions, this occurs if the rebels surrender. However this may not always occur, particularly if there are multiple rebel groups. In such cases there are other ways of determining the decline of the insurgency such as disintegration of rebel groups, lack of popular support, lack of resources, etc. The signing of an accord between the government and insurgent groups in which the insurgents win only a fraction of their initial demands is also an indication of the army's win. Let p denote the probability that the army wins the contest. This probability depends upon the effort of the army e and the proportion of rebels in the population r. The net proportion of rebels (that is, excluding those who are arrested) in the population is captured by

$$r=\Pr(\theta=1)\left\{1-\sum_{s=0}^{1}\alpha_s\Pr(s|\theta=1)\right\}. \tag{3}$$

The term in the braces is the probability that a randomly selected rebel will not be arrested by the army and therefore will be able to contribute to the insurgency. The term $\Pr(\theta=1)$ is the proportion of the population that desires to participate in the insurgency. Therefore, the product of these two terms is the proportion of the population that is actually involved in the insurgency. There are several ways of measuring the effort of the army. One way is to consider the additional number of soldiers deployed in the province as a proportion of the peacetime deployment. Another way is to consider the additional security expenditure in the province as a proportion of the expenditure during peacetime.

The contest success function $p(e,r)$ is modeled following the literature on contests (Skaperdas 1996, Corchon 2007, etc.). The contest success function is assumed to satisfy the following restrictions when e and r are both positive:

$$\frac{\partial p(\cdot)}{\partial e}>0,\ \frac{\partial p(\cdot)}{\partial r}<0. \tag{4}$$

In order to satisfy the second order conditions, we assume that

$$\frac{\partial^2 p(\cdot)}{\partial e^2}<0 \text{ and } \frac{\partial^2 p(\cdot)}{\partial r^2}>0. \tag{5}$$

The analytical discussion is considerably simplified if the following condition holds:

$$\frac{\partial^2 p(\cdot)}{\partial e \partial r} < 0. \tag{6}$$

Most of the key results hold if this condition is violated, but the presentation will be convoluted. Hence, as a first pass, we maintain this assumption in the analytical discussion. In the Appendix, we present results of a simulation where we relax this assumption. The timeline of the game is summarized in Figure 1.

Let us clarify the difference between the army's decision to arrest a person in period 3 and its effort in the contest in period 4. The former is a preemptive action while the latter (effort in the contest) is an action taken after the fact, that is, after the person attacks the government on behalf of the insurgents. The preemptive arrest in period 3 makes it easy for the army to prevail over the insurgents but it exposes the army to a charge of human rights violations. These two considerations mean that the army cannot afford to arrest everyone in period 3 for fear of human rights violation, nor can it let off everyone in period 3 for fear of losing the contest.

Let us now consider the payoff functions. The expected payoff of the army is given by

$$\begin{aligned} V &= p(e,r) - e - c\sum_{s=0}^{1} \Pr(s)\,\alpha_s \Pr(\theta = 0|s) \\ &= p(e,r) - e - c\left[\alpha_0 \Pi_{00} + \alpha_1 \Pi_{10}\right] \end{aligned} \tag{7}$$

where c is the penalty that the army pays when it mistakenly arrests an innocent.[2] The interpretation of V is as follows: Suppose the army's ex post value of winning is Γ and the unit cost of effort is τ. Then the expected gain of the army from winning is $p(e,r)\Gamma - \tau e$. From this, we subtract the expected penalty from human rights violations $c\sum_{s=0}^{1} \Pr(s)\,\alpha_s \Pr(\theta = 0|s)$ to determine the net gain of the army from winning. In this model, the parameters Γ and τ do not play any major role and are set equal to 1. Hence V is the net payoff of the army.

The army chooses α_0 and α_1 in period 3 and e in period 4. The notations are summarized in Table 1.

4 Scenario 1: Problem of missed alarm

In this section, we assume that (1) holds, that is, the probability of a false alarm is 0 and determine the subgame perfect equilibrium of this game under such a scenario. Therefore, we examine the equilibrium in period 4 first.

[2] In the right hand side of (7), the term $\alpha_0 \Pi_{00}$ is the number of arrests the army makes even though intelligence is correct and favorable, while the term $\alpha_1 \Pi_{10}$ is the number of arrests the army makes because of faulty intelligence. It might seem that the former is more egregious and hence the army should be penalized more in that case. In our model, the term 'army' describes the entire security apparatus which includes the armed forces, intelligence agencies, police and paramilitary forces. We do not consider the distribution of the total penalty among these entities. Hence, we do not impose different penalties for the two types of human rights violations.

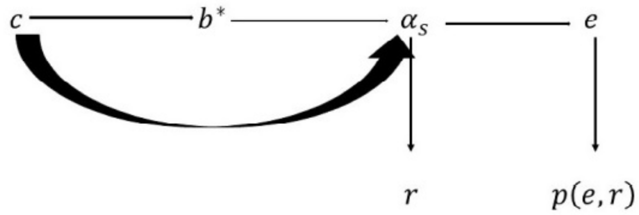

Figure 1: Timeline of the model

4.1 Period 4

Using (1), the expression in (7) can be simplified as follows:

$$V = p(e,r) - e - c\alpha_0\Pi_{00}. \tag{8}$$

In this period, the army chooses e to maximize (8). The first order condition is given by

$$\frac{\partial V}{\partial e} = \frac{\partial p(e,r)}{\partial e} - 1 = 0. \tag{9}$$

The second order condition is satisfied because of (5). The above condition implies that in equilibrium, the army chooses a level of effort that balances its marginal probability of winning with the cost of effort.

4.2 Period 3

In this period, the army chooses α_s for $s = 0, 1$. Notice that $p(e,r)$ indirectly depends on α_s because r depends on α_s (see (3)). Hence, using (9), it follows that

$$\frac{dV}{d\alpha_0} = -\frac{\partial p(e,r)}{\partial r}\Pi_{01} - c\Pi_{00}. \tag{10}$$

Also, $\frac{d^2V}{d\alpha_0^2} = -\frac{\partial^2 p(e,r)}{\partial r^2}\Pi_{01}^2 < 0$ because of (5). It follows from (10) that the army chooses α_0 at a level that satisfies $\frac{dV}{d\alpha_0} = 0$ and this can be simplified as follows:

$$-\frac{\partial p(e,r)}{\partial r} = c\frac{\Pi_{00}}{\Pi_{01}}. \tag{11}$$

In order to interpret (10), consider the marginal cost and the marginal benefit to the army of arresting a person who has a favorable intelligence assessment. The marginal cost is the expected amount of penalty that the army pays if it wrongly arrests a loyalist (based upon its signal of 0) and is given by $c\Pi_{00}$. Next, notice that if a rebel is not arrested, he would contribute to the insurgency and this would reduce the army's winning probability by $\frac{\partial p(e,r)}{\partial r}$. The marginal benefit of the army of arresting a person with signal 0 (that is, a person perceived by the army to be a rebel) therefore is $-\frac{\partial p(e,r)}{\partial r}\Pi_{01}$. It follows that the army chooses α_0 to balance the marginal benefit with its marginal cost.

Finally, it can be shown that $\frac{\partial V}{\partial \alpha_1} = -\frac{\partial p(e,r)}{\partial r}\Pi_{11} > 0$ and therefore

$$\alpha_1 = 1. \tag{12}$$

This implies that if the army observes a signal 1 about a person, he is arrested for sure. The reason is that such a signal can only originate from a rebel because of (1) and consequently the army need not fear about any human rights violation in this case.

For later reference note that using (12), we can re-write (3) as follows:

$$r = [1 - \alpha_0] \Pr(s = 0|\theta = 1) \Pr(\theta = 1). \tag{13}$$

In this model, there are two ways in which faulty intelligence contributes to human rights violations. The first way is that intelligence may wrongly indicate that a person is a rebel when he is in fact a loyalist, resulting in his arrest. This occurs only in Scenario 2 that is discussed in the Appendix. The second way (and clearly the more subtle way) is that the intelligence assessment about a person may be correct but the army does not always base its action upon such intelligence because it is not completely credible. This situation arises in Scenario 1. Indeed, in this case, a loyalist is arrested with probability α_0 even though the intelligence about him correctly indicates that he is not a rebel. The reason is that a signal of 0 can also originate from a rebel in this scenario. It follows that a rebel is arrested with probability

$$\frac{\alpha_0 \Pi_{01} + \Pi_{11}}{\Pi_{01} + \Pi_{11}}.$$

If the army reduces α_0 too much in an effort to reduce instances of human rights violations of loyalists, too many rebels escape allowing them to increase their numbers.

4.3 Period 2

In this period, we consider the decision of an individual to participate in the insurgency. The expected payoff of an individual from being a loyalist can be written as $[1 - \alpha_0] w$. The expected payoff from participating is $[1 - p(e,r)][1 - \alpha_0] \Pr(s = 0|\theta = 1) b$. Hence, a person participates in the insurgency if

$$b \geq \frac{1}{1 - p(e,r)} \frac{1}{\Pr(s = 0|\theta = 1)} w. \tag{14}$$

Let b^* be the type of the marginal rebel, that is, the person who is indifferent between participating and not participating in the insurgency. At b^*, (14) holds with an equality. Using (13) and (14), the type of the marginal rebel is determined by the following condition:

$$[1 - p(e,r)] \Pr(s = 0|\theta = 1) b^* - w = 0 \tag{15}$$

Note that the proportion of the population who participate in the insurgency is $(1 - F(b^*))$, and hence,

$$\Pr(\theta = 1) = 1 - F(b^*). \tag{16}$$

Let us now examine how a change in b^* affects other endogenous variables - e, r and α_0. In order to present the proposition below, we introduce the following notations:

Let $E_{1-\alpha_i,b^*} = \frac{d[1-\alpha_i]}{db^*}\frac{b^*}{1-\alpha_i}$ be the elasticity of the rate of let offs $(1 - \alpha_i)$ with respect to b^* $(i = 0, 1)$ and let $E_{1-F(b),b} = \frac{d[1-F(b)]}{b}\frac{b}{1-F(b)} = -\frac{f(b)}{1-F(b)}b$ be the elasticity of the proportion of rebels with respect to the marginal rebel type. Note that $E_{1-F(b),b} < 0$ and that $\left|E_{1-F(b),b}\right|$ is a monotonic function of the hazard rate.

Proposition 1 *A change in b^* affects α_0, r and e as follows:*

$$\frac{d\alpha_0}{db^*} < 0, \tag{17}$$

$$sign\left(\frac{dr}{db^*}\right) = sign\left(E_{1-\alpha_0,b^*} - \left|E_{1-F(b^*),b^*}\right|\right),$$

and

$$sign\left(\frac{de}{db^*}\right) = -sign\left(\frac{dr}{db^*}\right).$$

Proof. See the Appendix. ■

It follows from (17) that $E_{1-\alpha_0,b^*} > 0$.

Notice that if there is less participation in the insurgency (that is, if b^* increases), the army responds by arresting fewer persons with a favorable intelligence assessment. As a result, the number of rebels increases if the rate of arrests falls faster than the rate of participation. The fact that the rate of arrests may fall too rapidly may be surprising but this phenomenon can be explained by examining the proof of Proposition 1. It follows from that proof that the change in α_0 depends upon three factors all of which are independent of $F(b)$: (a) The marginal impact on the contest success function of the number of rebels, (b) $\Pr(s = 0|\theta = 1)$, that is the miss rate, and (c) the standard of human rights. In particular, the marginal change in α_0 will be small if the net number of rebels is large, or the miss rate is small or if the human rights standard is low. In such cases, $\frac{d\alpha_0}{db^*}$ is relatively small in absolute value. Hence there are circumstances in which $E_{1-\alpha_0,b^*} > \left|E_{1-F(b^*),b^*}\right|$ and in such situations, the number of rebels increases when b^* increases (that is, the participation rate decreases). Following similar logic, it can be shown that it is also possible for $E_{1-\alpha_0,b^*} < \left|E_{1-F(b^*),b^*}\right|$ under some circumstances.

If the net number of rebels increases in response to an increase in b^* (that is, if $\frac{dr}{db^*} > 0$), the army responds by exerting less effort in the contest (that is, $\frac{de}{db^*} < 0$). On the other hand, if the number of rebels decrease, the army exerts more effort.[3]

Also, note that $\frac{dp(\cdot)}{db^*} = \frac{\partial p(\cdot)}{\partial e}\frac{de}{db^*} + \frac{\partial p(\cdot)}{\partial r}\frac{dr}{db^*}$. It can be easily shown using (4) and Proposition 1 that $\frac{dp(\cdot)}{db^*} > 0$ if $E_{1-\alpha_0,b^*} < \left|E_{1-F(b^*),b^*}\right|$ and $\frac{dp(\cdot)}{db^*} < 0$ if $E_{1-\alpha_0,b^*} > \left|E_{1-F(b^*),b^*}\right|$. Therefore, a reduction in participation in

[3] The net number of rebels is the total number of people who participate in the insurgency less the number of arrested participants. Hence, there is no one-to-one correspondence between b^* and r.

Table 2: Impact of a change in b^* under Scenario 1

	$E_{1-p,b^*} < 0$	$E_{1-p,b^*} \geq 0$
$\frac{d\alpha_0}{db^*}$	$-$	$-$
$\frac{dr}{db^*}$	$-$	$+$
$\frac{de}{db^*}$	$+$	$-$
$\frac{dp}{db^*}$	$+$	$-$

the rebellion (that is, increase in b^*) increases the army's probability of winning the contest if the rate of arrests fall faster than the rate of participation.

Let E_{1-p,b^*} be the elasticity of a rebel victory with respect to the participation rate in the insurgency. It is defined as follows:

$$E_{1-p,b^*} = \frac{b^*}{(1-p(e,r))} \frac{d(1-p(\cdot))}{db^*}. \tag{18}$$

It follows from the discussion above that the sign of E_{1-p,b^*} can go either way. In particular, $E_{1-p,b^*} < 0$ if $E_{1-\alpha_0,b^*} < \left|E_{1-F(b^*),b^*}\right|$ and $E_{1-p,b^*} > 0$ if $E_{1-\alpha_0,b^*} > \left|E_{1-F(b^*),b^*}\right|$. We summarize the main results of this section in Table 2.

4.4 Period 1

In this period, the government maximizes social welfare which is a weighted sum of the payoffs of the army and loyalists. Let λ be the weight on the payoff of army and $(1-\lambda)$ be the weight on the payoff of loyalists; $\lambda \in [0,1]$.[4] A lower weight on λ indicates a stronger preference for human rights. Therefore the welfare function is as follows:

$$\Psi = \lambda V(e, \alpha_0, \alpha_1) + (1-\lambda)\Pr(\theta = 0)[1 - \Pr(s = 1|\theta = 0)\alpha_0]w \tag{19}$$

where $V(e, \alpha_0, \alpha_1)$ is the payoff of the army and is given by (8). By substituting (1) and (16) into (19), we obtain the following:

$$\Psi = \lambda V(e, \alpha_0, \alpha_1) + (1-\lambda)[1-\alpha_0]F(b^*)w. \tag{20}$$

There are two ways in which c affects the endogenous variables e, r and α_0. One effect is the direct effect and this is the effect of c on these variables keeping b^* constant. The second effect is the indirect effect and this is the effect of c on these variables through its effect on b^*. Let us consider the direct effects first.

[4] The government comprises of several departments, such as the army, justice department, etc. The role of the army is to provide national security. The government certainly cares for security but it also keeps in mind other considerations, such as the administration of justice (which is primarily the domain of the justice department). Hence, the objectives of the government and the army need not coincide.

Proposition 2 *Keeping b^* constant, a change in c affects α_0, r and e in the following way:*

$$\frac{\partial \alpha_0}{\partial c} = -\frac{\Pi_{00}}{\frac{\partial^2 p(e_A, e_R)}{\partial e_R^2} \Pi_{01}^2} < 0$$

$$\frac{\partial r}{\partial c} = -\Pi_{01} \frac{\partial \alpha_0}{\partial c} > 0$$

$$\frac{\partial e}{\partial c} = -\frac{\frac{\partial^2 p(e,r)}{\partial e \partial r}}{\frac{\partial^2 p(e,r)}{\partial e^2}} \frac{\partial r}{\partial c} < 0.$$

The above results imply that

$$\frac{\partial p(\cdot)}{\partial c} < 0. \tag{21}$$

Proof. See the Appendix. ■

The above proposition implies that keeping the rate of participation fixed, the army's probability of winning the contest is higher if the government lowers the standard of human rights. This result is along expected lines. However, as we show below, such a result is significantly weakened when we consider changes in the participation rate in the insurgency in response to a change in the standard of human rights.

4.5 Impact of a change in c on b^*

It was mentioned earlier that a general concern with human rights violation is that it may encourage more people to participate in the insurgency. Below, we examine the validity of such a concern.

Proposition 3 *A reduction in c affects b^* in the following way:*

$$\frac{db^*}{dc} = \frac{\frac{\partial p(\cdot)}{\partial c} b^*}{(1 - p(e,r))\left(1 + E_{1-p,b^*}\right)}. \tag{22}$$

Proof. See the Appendix. ■

Suppose $E_{1-p,b^*} \geq -1$. In this case it follows from (21) and (22) that $\frac{db^*}{dc} < 0$. In such a situation, a reduction of the human rights standard (that is, a decrease of c) leads to less participation in the insurgency. This is the experience of several autocratic countries such as Russia (Zhukov 2012). However, if $E_{1-p,b^*} < -1$, then $\frac{db^*}{dc} > 0$. In such a case, a reduction of the human rights standard leads to more participation in the insurgency. This is the viewpoint of human rights advocates (Human Rights Watch 2008, Ramachandran 2015).

4.6 Impact of a change in c on other endogenous variables

A change in the human rights standard also results in changes in the other endogenous variables in our model - α_0, r and e. In each case, there are both direct and indirect effects that must be accounted for. For example, when c changes, there is a direct effect on α_0 because of a change in the penalty of an arrest on a

Table 3: Impact of a change in c under Scenario 1

	$E_{1-p,b^*} < -1$	$-1 \leq E_{1-p,b^*} < 0$	$E_{1-p,b^*} \geq 0$
$\frac{db^*}{dc}$	$+$	$-$	$-$
$\frac{d\alpha_0}{dc}$	$-$	?	?
$\frac{dr}{dc}$	?	?	?
$\frac{de}{dc}$	?	?	?
$\frac{dp}{dc}$	?	$-$	?

loyalist. However, there is also an indirect effect because a change in c changes b^* which in turn changes α_0. The aggregate change in α_0 is the sum of these direct and indirect effects. The impact of a change in c on the above-mentioned endogenous variables is summarized in Table 3.[5]

4.7 Optimal c

Let us now determine the optimal c that the government chooses in period 1. For this, first consider $\frac{dV}{dc}$, that is the effect of a change in the standard of human rights on the payoff of the army. Notice that

$$\frac{dV}{dc} = \frac{\partial V}{\partial c} + \frac{\partial V}{\partial e}\frac{\partial e}{\partial c} + \frac{\partial V}{\partial \alpha_0}\frac{\partial \alpha_0}{\partial c} + \frac{\partial V}{\partial b^*}\frac{\partial b^*}{\partial c}.$$

Using the first order conditions, the above expression can be written as follows:

$$\frac{dV}{dc} = -\alpha_0 F(b^*) - \frac{\partial p(e,r)}{\partial r}[1-\alpha_0]\Pr(s=0|\theta=1) f(b^*)\frac{db^*}{dc}$$

where the second expression follows from (8) and (13).

Using (20), the first order condition for welfare maximization is as follows:

$$\begin{aligned}\frac{d\Psi}{dc} &= -\lambda\alpha_0 F(b^*) - (1-\lambda)F(b^*)w\frac{\partial \alpha_0}{\partial c} - \frac{db^*}{dc}\times\{(1-\lambda)F(b^*)w\frac{\partial \alpha_0}{\partial b^*} \\ &\quad +\lambda\frac{\partial p(e,r)}{\partial r}[1-\alpha_0]\Pr(s=0|\theta=1)f(b^*) - (1-\lambda)[1-\alpha_0]f(b^*)w\}. \end{aligned} \quad (23)$$

It is instructive to examine the above first order condition for the two extreme values of λ. Suppose the government is completely biased towards the interests of the army. In that case, one would expect that the government would choose the lowest possible standard of human rights, that is, it would set $c = \underline{c}$. We show below that this is not necessarily true for this equilibrium. To see this, first note that in this case, $\lambda = 1$ and

[5] The term '?' in Table 3 means that the sign is indeterminate.

(23) reduces to the following:

$$\frac{d\Psi}{dc} = -\alpha_0 F(b^*) - \frac{\partial p(e,r)}{\partial r}[1-\alpha_0]\Pr(s=0|\theta=1) f(b^*) \times \frac{db^*}{dc}.$$

The first term is negative while the sign of the second term is same as the sign of $\frac{db^*}{dc}$. Suppose $E_{1-p,b^*} \geq -1$. In this case it follows from (21) and (22) that $\frac{db^*}{dc} < 0$ and hence the optimum value of c is indeed $\underline{c}$ as expected. However, if $E_{1-p,b^*} < -1$, then $\frac{db^*}{dc} > 0$ and it is possible in such cases for the optimum value of c to be greater than $\underline{c}$. If the government feels that a tough policy will ultimately lead to a major surge in the number of insurgents, it will choose to impose some restraints on the army.

Now consider the other extreme in which the the government is completely biased towards the protection of human rights. In that case, one would expect that the government would choose the highest possible standard of human rights, that is, it would set $c = \bar{c}$. We show below that this intuition is also incorrect. To see this, first note that in this case, $\lambda = 0$ and (23) reduces to the following:

$$\frac{d\Psi}{dc} = -F(b^*) w \frac{\partial\alpha_0}{\partial c} - \{F(b^*)\frac{\partial\alpha_0}{\partial b^*} - [1-\alpha_0] f(b^*)\} w \times \frac{db^*}{dc}.$$

The first term is positive. Since each of the terms in the braces is negative, the sign of the second term is same as the sign of $\frac{db^*}{dc}$. Suppose $E_{1-p,b^*} \geq -1$. In this case it follows from (21) and (22) that $\frac{db^*}{dc} < 0$ and it is possible for the optimum value of c to be less than $\bar{c}$. If the government feels that a lenient policy will be misused and will ultimately lead to a major surge in the number of insurgents, it will choose to lower the standard of human rights from its maximum level.

The scenario of false alarm is largely similar and has been discussed in the Appendix.

4.8 Equilibrium with perfect intelligence

In order to demonstrate the role of imperfect intelligence in human rights violations, we consider an extension of Scenario 1 in which there is neither any problem of missed alarm nor of false alarm. In particular, let us consider the equilbrium when

$$\Pi_{10} = \Pi_{01} = 0.$$

In this case, it follows from (10) that $\frac{dV}{d\alpha_0} < 0$ and hence, $\alpha_0 = 0$. However, α_1 is still equal to 1, as in Scenario 1. It can also be shown from (13) that $r = 0$.

Let us now consider period 2. In this case, the expected payoff of an individual from remaining a loyalist is w while the expected payoff from being an insurgent is 0. Hence, everyone chooses to be a loyalist, that is $b^* = \overline{b}$ and $F(b^*) = 1$. The probability of human rights violations of loyalists is $\sum_{s=0}^{1} \Pr(s|\theta = 0)\alpha_s = 0$ because $\alpha_0 = 0$ and $\Pr(s = 1|\theta = 0) = 0$. Therefore, when intelligence is so precise that a loyalist can be perfectly distinguished from an insurgent, there are no human rights violations in this model. Also, in this case, the insurgency is quelled because everyone chooses to be a loyalist.

In the Appendix, we show the results of a simulation in which we allow for imerfect intelligence. We then discuss how the endogenous variables change in response to varying degrees of the missed alarm and false alarm rates.

5 Discussion of theoretical results

In general, intelligence inputs will be imperfect in most situations. Such imperfections can give rise to two kinds of problems- missed alarm and false alarm. In the analytical discussion, we consider them separately because it helps to isolate the impact of each of these errors. Also, such an approach greatly simplifies the analysis. Below, we discuss some of the major insights from our analysis of the two scenarios.

First, consider the strategy of the army in arresting people. When the missed alarm problem is the major issue (Scenario 1), the army arrests everyone with an adverse intelligence report but only a fraction of the people with a favorable intelligence report, that is, $\alpha_0 \in (0, 1)$ but $\alpha_1 = 1$. It is therefore possible that a loyalist may have a favorable intelligence report, but may still be arrested. Such an instance may create an impression of malafide intentions of the army, when in fact it is a result of the army's response to faulty intelligence. When the major issue is false alarm (discussed in the Appendix), the army lets off everyone with a favorable report and arrests a fraction of the people with an unfavorable report. In other words, in such a case, $\alpha_0 = 0$ but $\alpha_1 \in (0, 1)$. In this case also, a loyalist's human rights may be violated if there is an adverse report against him. Again, the blame for this lies with faulty intelligence.

Next, consider the impact of increased participation in the insurgency for a fixed standard of human rights. The results are remarkably similar across the two scenarios. When the participation rate increases, the rate of arrests also increases under both scenarios. The net number of rebels depends positively on the participation rate and negatively on the rate of arrests. Hence, the net number of rebels increases if the rate of arrests increases slowly but it decreases if the rate of arrests increases too rapidly. When the net number of rebels increases (resp., decreases), the probability of the government winning the contest goes down (resp., up) for a fixed standard of human rights.

Finally consider the impact of a decrease in the standard of human rights. The standard of human rights affects the equilibrium through two different channels. On the one hand, a decrease in the standard of human rights provides a stronger incentive to the army to pre-emptively arrest people, and this tends to decrease the net number of rebels. On the other hand, a decrease in the standard of human rights leads to a change in the participation rate and this in turn leads to a further change in the rate of arrests. These two effects go in the same direction under some circumstances, but they also counteract each other under different circumstances. As a result, the impact of a decrease in the human rights standard on the number of rebels is indeterminate under most circumstances. There is one situation however ($-1 \leq E_{1-p,b^*} < 0$) in which there is a clear prediction that a decrease in the standard of human rights leads to an increase in the probability of a government victory.

Since the relationship between standard of human rights and the chance of quelling the rebellion cannot be easily determined from our theoretical analysis, there is a need to investigate this issue empirically. In the real world, we do not observe the chance of quelling the rebellion directly. However, the magnitude of violence can be taken to be an indicator of the chance of quelling the rebellion. If the goverment gains the upper hand, there should be a reduction in violence. Therefore, we examine the relationship between a lowering of the human rights standard in some rebellious provinces of India and the magnitude of violence there.

6 Background of AFSPA

The Armed Forces Special Powers Act (AFSPA) is essentially a set of three very similar laws that have been applied in three different regions in India. These are the states of Punjab and Jammu & Kashmir and the Northeastern region (comprising of the states of Arunachal Pradesh, Nagaland, Manipur, Mizoram, Meghalaya, Assam, and Tripura). Each of these states has either been plagued by an insurgency or borders a state that has this problem. The purpose of AFSPA is to create an enabling environment for the armed forces during a major internal disturbance.

AFSPA is derived from some British-era laws that were used against Indian freedom fighters. Ironically, after Independence, the Indian government had no hesitation in using these laws in provinces that tried to secede from the Indian union. Immediately after independence, the Nagas (an ethnic group that resides in the Eastern part of the country along the border with Myanmar) held a referendum in 1951 and asserted their independence from India. The provincial government failed to contain the rebellion and therefore decided to induct the army to aid the civil administration. Since the role of the army is to fight external wars and not internal security, the government realized that it needed a legal framework to enable the army to play an effective role. Indeed, the army had several legitimate concerns about playing a role in internal security. One concern is that there are bound to be mistakes in properly identifying an insurgent, which can then be exploited by insurgent groups or their proxies to file lawsuits against soldiers. Consequently, there is a risk that fear of such lawsuits would create hesitation in soldiers which would hamper the army's effectiveness (Jha 2015, pp. 71-75).

To preclude such occurrences, the Indian government passed the Armed Forces Special Powers Act on September 11,1958 (Government of India 1958). The law is operational in the Northeastern region. Later on, similar versions of the act were passed for the states of Punjab (Government of India 1983) and Jammu and Kashmir (Government of India 1990). There are three sections of the act that are of special interest from an analytical point of view and we discuss them below.

Under Section 3 of this act, the government (either of the state or the federal government) has the power to declare a state or a part of the state as 'disturbed' after which the armed forces can be inducted in that state to aid the civil administration . This means that inducting the army in any state must be preceded by a notification declaring the state or the relevant part of the state as a disturbed area. Hence, there can be two ways of viewing the duration of the law in a particular state. One way is to consider the date of passage of the law as the starting date for the law in a state since from this date the government has the option of implementing the act. The second way is to view the date of notification as a 'disturbed' area as the starting date since on this date the government exercises the option to implement the law. We consider both of these approaches when measuring the duration of the law.

Section 4 of the act permits a soldier to fire upon a person, even causing death if the situation requires. The army is also allowed to search or destroy property and arrest a person without a warrant. This is the most controversial part of the law and is the primary reason why it is criticized so often. According to Amnesty International (2013), this section violates international law such as article 6 of the International Covenant on Civil and Political Rights, UN Code of Conduct for Law Enforcement Officials and the UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials. It is alleged that this section provides an incentive to soldiers to use excessive force. Examples of such egregious behavior of soldiers include torture, enforced disappearences, sexual violence including rape and extrajudicial killings in fake encounters (Jha 2015, Chapters 3 and 4).

Finally, according to Section 6 of the act, a soldier who is discharging his duty in a disturbed area can be prosecuted only with the approval of the Federal government. In practice, it is remarkably difficult to obtain the Federal government's permission to prosecute a soldier. The Ministry of Defence while responding to a question in the Indian parliament (Unstarred question no. 1767, answered on March 13, 2013) stated that there were 127 complaints against soldiers throughout the country between $2010-12$, out of which 80 were from the Northeastern states. In March 2013, only 7 of these cases were under judicial consideration. Later, in response to a different question in the Indian parliament in 2018 (Unstarred question no. 1463, answered on January 1, 2018), the Ministry of Defence also stated that there were 50 requests to prosecute soldiers in Jammu & Kashmir from 2001 to 2016, out of which 47 were denied and 3 are pending (Ministry of Defence 2018). The combined effect of Sections 4 and 6 are that they reduce the penalty to the soldiers of violating human rights, exactly as specified in our theoretical model.

7 Data

We want to measure the impact of AFSPA on the magnitude of violence. This is measured in two ways- the number of incidents of terrorist attacks and the number of deaths due to terrorist attacks in in a state in a particular year. The primary source of this information is Global Terrorism Database (GTD). Our period of study is 1981 to 2013. Summary information on violence per state is presented in Table A.3. Polo and Gleditsch (2016) point out that during armed civil conflicts, insurgent groups resort to terrorist tactics if they are weak. They also find that such groups have a tendency to attack civilians if they have sectarian audiences. This indeed seems to be the case in India. Therefore, we have often used the terms 'insurgent' and 'terrorist' interchangeably.

Let us now consider the independent variables. The primary focus of our empirical analysis is to find out the impact of AFSPA in mitigating violence in a state. There are two different measures of AFSPA that we use. The first one is a binary variable that takes a value of 1 when the AFSPA is in place in a state in a particular year (and is 0 otherwise). The second control is the duration of AFSPA, which is the difference between the year in which AFSPA is repealed in a state (if at all) and the initial year. If the law is in place in a state in 2013, we treat that as the last year of the law since our analysis extends only upto 2013.

As we discussed above, there are two viewpoints of how to measure if AFSPA is in operation in a state. Therefore we have two measures of the AFSPA dummy and duration. The first measure considers the period between the enactment of the law and its repeal as the duration of the law since the government has the option to implement the law during this period. The other method considers the period in which the government

Table 4: Terrorism data for Indian states (1981 – 2013)

No.	State	Number of Incidents	Number Killed
1	Andhra Pradesh	431	190
2	Arunachal Pradesh	1	8
3	Assam	1987	883
4	Bihar	612	437
5	Chandigarh	2	2
6	Chhattisgarh	789	324
7	Goa	4	4
8	Gujarat	130	75
9	Haryana	176	40
10	Himachal Pradesh	115	19
11	Jammu and Kashmir	48560	14672
12	Jharkhand	627	504
13	Karnataka	147	111
14	Kerala	42	37
15	Madhya Pradesh	166	48
16	Maharashtra	1005	220
17	Manipur	584	644
18	Meghalaya	102	127
19	Mizoram	17	10
20	Nagaland	171	72
21	Odisha	332	425
22	Punjab	3098	1014
23	Rajasthan	140	46
24	Sikkim	0	5
25	Tamil Nadu	259	102
26	Tripura	421	102
27	Uttar Pradesh	516	157
28	Uttarakhand	78	15
29	West Bengal	694	500
	Grand Total	61210	20799

exercises its option of implementing the law by declaring an area as 'disturbed.'[6] Information on duration is presented in Table 5.[7] The geographical location of these states is shown in Figure 2.

The impact of AFSPA on the magnitude of violence is mostly ambiguous, as we showed in our theoretical analysis. Hence, there is no clear basis to expect a particular sign of the coefficient of AFSPA or of its duration in our regression. Supporters of this law would expect a negative sign of AFSPA's coefficient while its critics would expect a positive sign.

Below, we introduce other independent variables because they can be confounding factors.

Motivation: The first such factor is the primary motivation of each terrorist organization operating in India.We classify them into four different types according to their motivation (leftist, separatist, purely religious and others) and then allocate a share of terrorism to each of these types. The description of each type is as follows:

(i) Leftist: A group is included in this category if they believe in the lesser power of the state and in establishing a 'people's government' through 'people's war'. Many of these groups aim to overthrow the Indian government.

(ii) Separatist: If a group wants to secede from the country, it is counted as Separatist. Those who want to secede from a state but stay within the country are included under Others.

(iii) Purely Religious: A group is included in this category only if its objective is to fight for the rights of religious groups within India. Many secessionist movements such as in Punjab and J&K are both separatist and religious in character. If a terrorist group wants to secede from the country and create a nation for a religious group, it is counted as Separatist.

(iv) Others: This category is dominated by groups that want to secede from a state or expel people from other parts of the country from a region. There are a few groups whose objectives are not clear and they are also included in this category. We also include those that are not a terrorist organization within this group. This includes attacks by political parties, gangs or foreign terrorist groups that have no issues with the Indian government.

State-specific Characteristics: Following extant literature such as Piazza (2010), we include indicators for certain states that might be uniquely associated with terrorism. Specifically, there are certain particularly acute terrorist campaigns, all of which have deep roots but are largely confined to specific geographic areas: the state of Jammu and Kashmir, which contains a host of Kashmiri separatist terrorist groups; the 'Seven Sister' states (Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland and Tripura, see Figure 2) in Northeast India, which are plagued by ethnic separatist and nationalist groups; and the 'Naxalite Belt' states (Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand and West Bengal, see Figure 2) which are a collection of several states in Southern and Eastern India afflicted by the Communist terrorist movements. These states are potential outliers that might affect the results of the analytical models, so three dichotomous variables,

[6]Mizoram has still not been de-notified as a 'disturbed' area and therefore the law is technically in place in that state. However, after the signing of the Mizo accord in 1986, this law has not been enforced and therefore it is practically a dormant law. Hence, we consider 1986 as the last year of the law in Mizoram.

[7]Information on the first measure of duration can be found in the text of the three AFSPA laws or in Das (2013) or in Jha (2015). Regarding the second measure, we found information on the duration of the law by consulting news reports. The law was repealed in 2015 in Tripura and 2018 in Meghalaya which are after 2013- the end of our study period. Hence, the status of the law has been reported as 'current.'

coded 1 for all states affected by each of these three campaigns are inserted into all of the models as a control. In a similar vein, we include a control variable for states that share a border with a foreign country.

Politics: We control for the effect of a political party in each state. We do so through a binary variable for two major political parties: BJP and Indian National Congress. These variables take a value of 1 if the chief minister of the state is affiliated with that party.

Degree of Fractionalization: The extent of diversity in a country can lead to friction between different social groups and this may ultimately result in terrorism. To control for the extent of diversity, we develop indices of linguistic and religious fractionalization following Alesina et al. (2003). A higher value reflects the probability that two randomly chosen individuals from the same country belong to two different groups. Such measures have been used in Tavares (2004), Abadie (2006) and Bandyopadhyay and Younas (2011).

Geographical Variables: Everything else remaining constant, a region will be more vulnerable to terrorist attacks if it has the characteristics of a suitable target. Some of these characteristics, in turn, depend upon geography. Therefore, we consider geographical variables such as land area and fraction of the country that is forested. A large state is more vulnerable to attacks because it provides more targets. Also, a state with a large forest cover is harder to police and consequently may be more suitable for extremist groups.

Minority Discrimination: We control for political and economic discrimination against minorities in each state using the MAR dataset developed as an outcome of the Minorities at Risk Project at the University of Maryland.

Female Literacy Rate: We control for the effect of female literacy rate as it has been shown to negatively affect terrorism. For example, Hansen (2011) show that that as female education attainment levels increase in a country, the probability of at least one terrorist incident being committed by the citizens of that country decreases.

Youth Unemployment: Youth unemployment has been shown to positively affect terrorism in the extant literature. For example, Bagchi and Paul (2018) find that youth unemployment tends to increase domestic terrorism in the Middle Eastern and North African (MENAP) countries.

Other Independent Variables: The above independent variables were all motivated by the literature on determinants of terrorism. Apart from these, we also include some other variables that can be confounding factors. These include other acts of violence committed in the state such as number of murders, rapes, riots, violent acts not amounting to murder. The rationale is that a state with higher violence might be forced to divert more resources to fight crime leaving less resources to fight terrorism. We also control for the actual strength of armed police because it measures the defensive capability of a state.

To the best of our knowledge, there is no single data set that includes all of the variables required for our analysis. Therefore, it was required that the information on these variables were collected from a variety of sources as indicated in Table A.2 in the Appendix. We lost observations due to missing data on variables used in our study including linguistic fractionalization (loss of 18 observations), economic discrimination (loss of 13 observations), political discrimination (loss of 54 observations), political and economic discrimination (loss of 104 observations), type of organization (loss of 36 observations), political party (loss of 68 observations), percentage forested area (loss of 26 observations), unemployed youth (loss of 18 observations), actual strength of armed police (loss of 8 observations), number of incidents and number killed (loss

Table 5: Duration of AFSPA in different states

State	Duration Measure 1 Option to implement AFSPA	Duration Measure 2 Actual implementation of AFSPA
Arunachal Pradesh	1958 to Current	1991 to Current
Assam	1958 to Current	1990 to Current
Jammu and Kashmir	1990 to Current	1990 to Current
Manipur	1958 to Current	1980 to Current
Meghalaya	1958 to Current	1991 to Current
Mizoram	1958 to Current	1967 to 1986
Nagaland	1958 to Current	1958 to Current
Punjab	1983 to 1987	1983 to 1987
Tripura	1958 to Current	1997 to Current

Table 6: Evidence of overdispersion

Variables	**Mean**	**Std. Dev**	**Skewness**	**Kurtosis**	**Min**	**Max**
Number of Incidents	67.3943	(440.51)	8.633	79.46	0	4971
Number Killed	22.6718	(117.97)	7.643	64.393	0	1333

of 23 observations), murder, not amounting to murder, rape and riots (21 observations), etc. Various combination of five or more variables resulted in an additional loss of 161 observations. The surviving sample with no missing values for any of the variables has 407 observations with no obvious pattern or bias in the observations removed to raise concerns about the resulting sample. Table A.3 in the Appendix provides the summary statistics for this sample.

8 Modeling Specification

In this study, we examine the impact of AFSPA on terrorism in India. We used Stata 15 for all the statistical analysis performed in this study (Stata, 2018). In this paper, since our dependent variable is a count variable, therefore we consider using either Poisson Regression or Negative Binomial Regression. The Poisson model has the strong restriction that mean and variance are equal. However, this assumption is often violated in real world count datasets i.e. the data is overdispersed. Overdispersion occurs when the conditional variance is greater than the conditional mean. This may be caused by unobserved individual heterogeneity or excessive zeros in the count data which is quite common in real-world datasets. As can be noted from our examination of summary statistics associated with our dependent variables, there is significant overdispersion with the distribution skewed to the left with a long right tail. Given this, Poisson is not appropriate as results from such model might lead to overly optimistic conclusions about the statistical significance of the regressors. Therefore we focus on the use of negative binomial regression for our study which wherein the above mentioned restriction is relaxed.

Further, there is also a need to consider between Negative Binomial Regression or Zero-inflated Negative Binomial Regression. Zero-inflated Binomial Regression is the appropriate method if there are reasons to

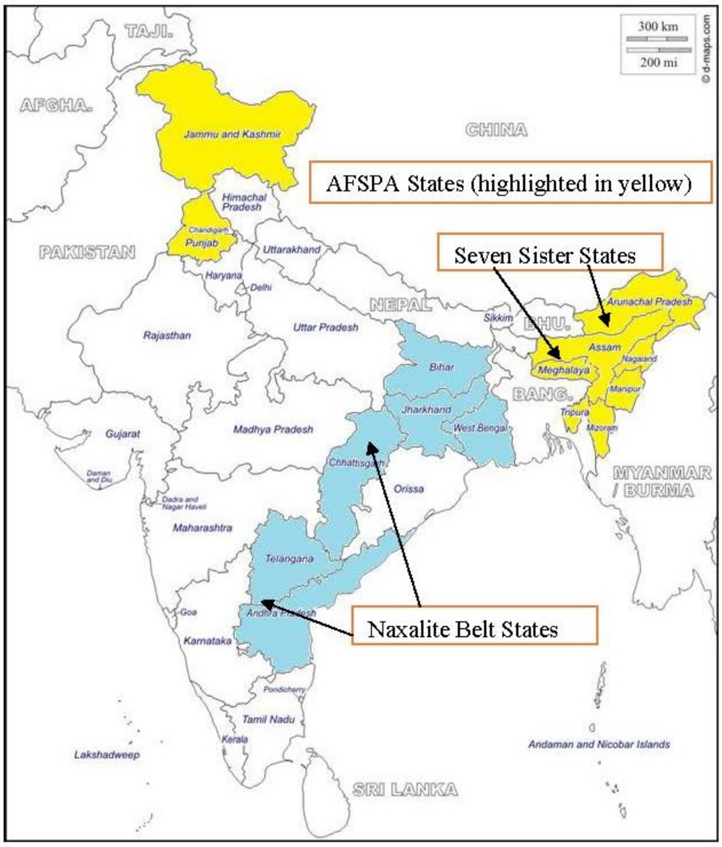

Figure 2: Indian states affected by political violence

believe that there are two groups of states - in the first group, terrorist incidents never take place, and in the other group, terrorist incidents can take place but there may be years with 0 incidents. In India, there are some states such as Kerala and Goa that are remarkably terror free, while there are other states such as Jammu and Kashmir and Punjab that account for most of the terrorist attacks. Therefore, it is plausible that there are two types of states, and the large number of 0s occurs partly because one group is generally terror-free. Using the Vuong test, we find that Negative Binomial Regression is the more appropriate method in this case. The modeling specification we employ following Hilbe (2011) and Cameron and Trivedi (2013) is given below:

$$\mathcal{L} = \sum_{i=1}^{n} \left\{ \begin{array}{c} y_i \ln\left(\frac{\alpha \ \exp\left(X_i{}'\beta_1 + AFSPA\ Indicator\ \beta_2 + AFSPA\ Duration\ \beta_3\right)}{1+\alpha\ \exp\left(X_i{}'\beta_1 + AFSPA\ Indicator\ \beta_2 + AFSPA\ Duration\ \beta_3\right)} \right) \\ -\frac{1}{\alpha}\ln\left(1+\alpha\exp\left(X_i{}'\beta_1 + AFSPA\ Indicator\ \beta_2 + AFSPA\ Duration\ \beta_3\right)\right) + \ln\Gamma\left(y_i + \frac{1}{\alpha}\right) \\ -\ln\Gamma\left(y_i+1\right) \ -\ln\Gamma\left(\frac{1}{\alpha}\right) \end{array} \right\} \tag{24}$$

with the density function given as follows:

$$f\left(y \,\middle|\, \exp\left(X_i{}'\beta\right),\ \alpha\right) = \frac{\Gamma(y+\alpha^{-1})}{\Gamma(y+1)\Gamma(\alpha^{-1})}\left(\frac{\alpha^{-1}}{\exp\left(X_i{}'\beta\right)}\right)^{\alpha^{-1}},\ f(y|\exp\left(X_i{}'\beta\right),\ \alpha \geq 0, y = 0,1,2,\ldots$$

Equation (24) is expressed as log-likelihood function, a typical representation in a count model. In the above equation, y_i represents the response variable measured by count a of terrorism incidents. The vector X includes other potential predictors of terrorism such as measures of politics, discrimination, country geography, etc. These variables are listed in Tables 7 and 8 and are motivated by the literature.

In order to tackle the existence of unobserved state heterogeneity, we extend our study by taking advantage of the panel setting of our data. The negative binomial model allows each state's Poisson parameter to have a random distribution. When state-specific effects are added to the negative binomial model we get:

$$f\left(y_{it}\right) = \frac{\Gamma\left(y_{it} + \exp\left(X_{it}{}'\beta\right)\right)}{\Gamma\left(y_{it}+1\right)\Gamma\left(\exp\left(X_{it}{}'\beta\right)\right)}\left(\frac{1}{1+\Theta_i}\right)^{\exp\left(X_{it}{}'\beta\right)}\left(\frac{\Theta_i}{1+\Theta_i}\right)^{y_{it}} \tag{25}$$

where

$$E(y_{it}|\Theta_i) = \exp\left(X_{it}{}'\beta\right)\Theta_i\ ,$$

$$Var(y_{it}|\Theta_i) = \exp\left(X_{it}{}'\beta\right)(\Theta_i + \Theta_i{}^2)\ ,$$

$$\text{and} \quad \Theta_i = \frac{\propto_i}{\emptyset_i}.$$

Also, $\propto_i$ is the state specific fixed effect and $\emptyset_i$ is the Negative binomial overdispersion parameter that is permitted to vary across individuals

Building on (25), we get the conditional density function as follows:

$$f\left(y_{it},\ldots,y_{iT}|\sum_{i=1}^{t} y_{it}\right) = \left(\prod_t \frac{\Gamma\left(y_{it} + \exp\left(X_{it}{}'\beta\right)\right)}{\Gamma\left(y_{it}+1\right)\Gamma\left(\exp\left(X_{it}{}'\beta\right)\right)}\right)\frac{\Gamma(\sum_t \exp\left(X_{it}{}'\beta\right)\ \Gamma(\sum_t y_{it}+1)}{\Gamma(\sum_t \exp\left(X_{it}{}'\beta + \sum_t y_{it}\right)} \tag{26}$$

The fixed effects model discussed above while allowing for the existence of an arbitrary relationship between state-specific effects and the observables does not allow for use of time-invariant variables. This can be resolved via the use of a random effects model that is more efficient if correctly specified. The only limitation is that it assumes there is no relationship between state-specific effects and the observables. The random effects model can be arrived at building on Equation (26) by assuming $1/(1+\theta_i)$ is distributed as beta (a, b) as follows:

$$f(y_{i1},\ldots,y_{iT}|) = \left(\prod_t \frac{\Gamma\left(y_{it} + \exp\left(X_{it}{}'\beta\right)\right)}{\Gamma(y_{it}+1)\Gamma\left(\exp\left(X_{it}{}'\beta\right)\right)}\right) \frac{\Gamma(\mathrm{a}+\mathrm{b})\Gamma(\mathrm{a}+\sum_t \exp\left(X_{it}{}'\beta\right)\ \Gamma(\mathrm{b}+\sum_t y_{it})}{\Gamma(\mathrm{a})\Gamma(\mathrm{b})\Gamma(a+b+\sum_t \exp\left(X_{it}{}'\beta + \sum_t y_{it}\right)}$$

Although the random effects model can include time-invariant variables and is more efficient when compared to the fixed effects model, it is consistent only when correctly specified. We use a Hausman type of test to compare the estimation results from our RE and FE models. To be more specific, the Hausman test sets its null hypothesis as "there is no correlation between the unobserved and observables (RE is the preferred model)", see chapter 9 in Greene (2008). Finally, while AFSPA can lead to increased terrorism, it is also plausible that the reverse is true (that is, increased terrorism could cause a state to have AFSPA). To control for endogeneity (or reverse causality) we use lagged values of independent variables. This is because the lagged values can be considered to be instruments of contemporaneous values and it is reasonable to assume that AFSPA may lead to increased terrorism only with a lag. In line with the extant literature, we use a one year lag.

9 Results

Tables 7 and 8 present results for number of incidents and number killed respectively. We discuss the results pertaining to the number of incidents first and then turn to the number killed.

9.1 Number of terrorist attacks

The results of the Hausman test (p-value >0.1) do not reject the null hypothesis and shows lack of evidence of the existence of a correlation between observed and unobserved heterogeneity. This means that the random effects model provides consistent estimates and therefore is our preferred specification for number of incidents.

We present results of the random effects model using both methods of measuring these variables- the first method considers the entire period in which the government has the option to implement AFSPA (duration measure 1) and the second method considers the period in which the government exercises this option (duration measure 2). In both cases, the coefficient of the AFSPA dummy is positive and statistically significant at the 99% level of confidence. Duration is statistically significant at the 95% level of confidence using the first measure but is not significant using the second measure.

Using the first measure of duration, our results indicate that the number of incidents in AFSPA states is approximately 20 times that of non-AFSPA states and each additional year of the law increases the number of incidents by 3.7%. Using the second measure, it follows that the incident rate in AFSPA states is around

11 times of non-AFSPA states and each additional year of the law increases the number of incidents by 1%. [8], [9] [10]

Regarding the other independent variables, we find that prevalence of leftist groups in a state is associated with more incidents and this effect is statistically significant. We also find a positive relationship between the number of incidents and linguistic fractionalization. Further, we find that everything else remaining constant, the number of attacks tend to be more in the Naxalite belt while it tends to be less in the seven sister states in Northeast India.

We also find that the number of attacks is higher in larger states. This is because larger states offer more targets. Interestingly, the number of incidents tends to have a negative association with political discrimina-

[8] Duration Measure 1:Using a treatment effect model, we find that if all states in India had AFSPA, the number of incidents will increase by an average of 114.502 from the average of 13.011 if all states in India did not have AFSPA. This increase was found to be statistically significant (p-value<0.05).

[9] Duration Measure 2: Using a treatment effect model, we find that if all states in India had AFSPA, the number of incidents will increase by an average of 120.259 from the average of 11.226 if all states in India did not have AFSPA. This increase was found to be statistically significant (p-value<0.05).

[10] Given concerns that AFSPA can influence the activity of terrorist groups, we check the statistical significance of interaction between AFSPA and the separatist group on number of terrorist attacks. Our analysis indicates while the coefficient of separatist variable on its own is positive and that of the interaction is negative which is in line with intuition, their coefficients are not statistically significant. Further, the marginal effect of these variables are found to be statistically insignificant.

tion.

Table 7: Effect of AFSPA on number of incidents

	AFSPA Measure 1		AFSPA Measure 2	
Variables	**Coef.**	**Std. Error**	**Coef.**	**Std. Error**
AFSPA	3.013***	(0.481)	2.511***	(0.416)
Duration of AFSPA	0.036**	(0.017)	0.01	(0.015)
Leftist	0.593**	(0.239)	0.547**	(0.241)
Separatist	0.076	(0.282)	0.056	(0.285)
Purely Religious	-2.288	(1.747)	-2.034	(1.733)
Foreign Border	-0.338	(0.306)	-0.255	(0.296)
Naxalite Belt	1.679***	(0.405)	1.773***	(0.407)
Seven Sisters	-1.282*	(0.658)	0.114	(0.575)
Congress	1.110**	(0.429)	1.312***	(0.443)
BJP	0.086	(0.235)	-0.08	(0.218)
ln(Population Density)	0.412	(0.259)	0.049	(0.226)
ln(Unemployed Youth)	0.038	(0.101)	0.083	(0.101)
Female Literacy Rate	0.024*	(0.014)	0.016	(0.014)
Mean Political Discrimination	-0.437***	(0.166)	-0.515***	(0.176)
Mean Economic Discrimination	-0.544	(0.518)	-0.273	(0.547)
Linguistic Fractionalization	1.377**	(0.643)	1.603**	(0.651)
Religious Fractionalization	1.546*	(0.892)	-0.118	(0.857)
ln(Geographical Area)	0.438**	(0.204)	0.27	(0.193)
Percentage of Forested Area	-0.019***	(0.007)	-0.019***	(0.007)
Murder Incidents	0.0003***	(0.0001)	0.0004***	(0.0001)
Not Amounting to Murder	-0.001	(0.0004)	-0.001**	(0.0004)
Rape	-0.0001*	(0.0002)	-0.0001	(0.0002)
Riots	0.0001	(0.00003)	0.00004	(0.00003)
Actual Strength Of Armed Police	-0.00001	(0.00002)	0.000004	(0.00002)
Constant	-10.58	(3.826)	-5.849	(3.489)
Year Dummies	Yes		Yes	
N	407		407	

*Significance level at 10%.
** Significance level at 5%.
*** Significance level at 1%.

9.2 Number of deaths due to terrorist attacks

The results of the Hausman test (p-value >0.1) do not reject the null hypothesis and show lack of evidence of the existence of a correlation between observed and unobserved heterogeneity. This means that the random effects model provides consistent estimates and therefore is our preferred specification for number of killings.

We present results of the random effects model using both methods of measuring these variables mentioned above. In both cases, the coefficient of the AFSPA dummy is positive and statistically significant at the 99% level of confidence. Duration is also statistically significant at the 95% level of confidence.

Using the first measure of duration, our results indicate that the number of killings in AFSPA states is approximately 21 times that of non-AFSPA states and each additional year of the law increases the number of killings by 3.7%. Using the second measure, it follows that the death rate in AFSPA states is around 10 times that of non-AFSPA states and each additional year of the law increases the number of killings by 3%.

[11,12] [13]

We find that the number of killings due to terrorist attacks tend to increases with the prevalence of left-wing terrorist groups in a state (captured by the variable 'Leftist'), location of a state in the Naxalite belt, and area of the state. Also, the number of killings due to terrorist attacks tends to decrease with the location of a state in Northeastern India (captured by the variable 'Seven Sisters' and political discrimination. These results are similar to our findings in the previous subsection.

Table 8: Effect of AFSPA on number killed

	AFSPA Measure 1		AFSPA Measure 2	
Variables	Coef.	Std. Err.	Coef.	Std. Err.
AFSPA	3.082***	(0.526)	2.367***	(0.517)
Duration of AFSPA	0.036**	(0.017)	0.030**	(0.016)
Leftist	0.424**	(0.187)	0.413**	(0.189)
Separatist	-0.212	(0.24)	-0.247	(0.245)
Purely Religious	-0.062	(0.697)	-0.005	(0.701)
Foreign Border	-0.680**	(0.326)	-0.674**	(0.331)
Naxalite Belt	1.500***	(0.429)	1.599***	(0.43)
Seven Sisters	-1.825***	(0.699)	-0.299	(0.597)
Congress	1.021**	(0.425)	1.163**	(0.442)
BJP	-0.059	(0.203)	-0.189	(0.189)
ln(Population Density)	0.378	(0.269)	-0.015	(0.257)
ln(Unemployed Youth)	0.015	(0.12)	0.088	(0.12)
Female Literacy Rate	0.056***	(0.017)	0.048***	(0.017)
Mean Political Discrimination	-0.270*	(0.162)	-0.419**	(0.188)
Mean Economic Discrimination	-0.01	(0.546)	0.459	(0.569)
Linguistic Fractionalization	0.696	(0.696)	1.441*	(0.76)
Religious Fractionalization	1.905**	(0.897)	0.128	(0.876)
ln(Geographical Area)	0.582**	(0.178)	0.482**	(0.184)
Percentage of Forested Area	-0.008*	(0.004)	-0.008*	(0.004)
Murder Incidents	0.0003***	(0.0001)	0.0003***	(0.0001)
Not Amounting to Murder	-0.0001	(0.0004)	-0.0003	(0.0004)
Rape	-0.0001	(0.0002)	-0.00004	(0.0002)
Riots	0.0001***	(0.00003)	0.0001	(0.00003)
Actual Strength Of Armed Police	0.00001	(0.00002)	0.00002	(0.00002)
Constant	-14.201	(3.701)	-11.009	(3.472)
Year Dummies	Yes		Yes	
N	407		407	

*Significance level at 10%.
** Significance level at 5%.
*** Significance level at 1%.

[11] Duration Measure 1: Using a treatment effect model, we find that if all states in India had AFSPA, the number killed will increase by an average of 15.677 from the average of 5.386 if all states in India did not have AFSPA. This increase however is not statistically significant.

[12] Duration Measure 2: Using a treatment effect model, we find that if all states in India had AFSPA, the number killed will increase by an average of 75.900 from the average of 6.613 if all states in India did not have AFSPA. This increase contrary to footnote 5 was found to be statistically significant (p-value<0.01).

[13] Given concerns that AFSPA can influence the activity of terrorist groups, we check the statistical significance of interaction between AFSPA and the separatist group on number of fatalities from terrorist attacks. As noted earlier, while our analysis indicates that the coefficient of separatist variable on its own is positive and that of the interaction is negative which is in line with intuition, their coefficients are not statistically significant. Further, the marginal effect of these variables are found to be statistically insignificant.

10 Conclusion and Extensions

In this paper, we consider both the cause and effect of human rights violations by a government facing a major problem of national security, such as an insurgency. We find that human rights violations are not at all necessary if intelligence is perfect. In the absence of that, there are several factors to consider in determining the optimal human rights standard captured in the first order conditions for welfare maximization (23) and (A.12). Such factors induce a government to reduce the standard of human rights for its armed forces below its peacetime level. We also highlight two reasons that explain why poor quality intelligence leads to human rights violation. The first reason is that sometimes the intelligence agency wrongly classifies a person as an insurgent when he is actually a loyalist. The second and more interesting reason is that even if the intelligence agency correctly classifies a person as a loyalist, the army may not completely believe the intelligence report and wrongly arrests him. The former occurs due to the false alarm problem (discussed in detail in the Appendix) and the latter occurs due to the missed alarm problem.

We also consider the effect of a reduction of the human rights standard on the magnitude of violence. There are two channels through which the human rights standard affects the magnitude of violence. On the one hand, it induces the army to preemptively arrest more people and this effect tends to reduce violence. On the other hand, more people can participate in the insurgency in response to more repression and this can increase violence. The net effect of the human rights standard on violence cannot be determined theoretically. Therefore, we adopt two approaches. One approach is to use a simulation and show that the relationship between the human rights standard and probability of quelling the rebellion is non-monotonic. This means that an increase in the standard of human rights results in a reduction in violence under some circumstances and an increase in violence under other circumstances. The simulation results are in the Appendix. The other approach is to econometrically estimate this effect using real-world data. Therefore, we study the effect of AFSPA in India. Our results show that a lowering of the human rights standard has resulted in more violence in India.

There are a few other issues that we address in the Appendix using the simulation. First, we show that welfare is highly sensitive to the quality of intelligence and that in many circumstances having even moderate quality intelligence is not substantially different from having no intelligence. We also find that the missed alarm rate has a much higher impact on welfare than the false alarm rate.

One limitation of our work is regarding the measurement of parameters in the real world. As an example, consider the parameter c that captures the human rights standard. In the simulation, we find that it has a non-monotonic relationship with the army's chance of winning. In the real world, a government will have to measure human rights reasonably accurately so that it knows whether to raise the standard or to reduce it. This can be a challenge. There are some commonly available measures of human standard such as Freedom House's index of political rights and civil liberties, Physical Integrity Rights Index of the CIRI human rights dataset, etc. All of these indicators provide systematic information about human rights in different years across different countries and can be used for empirical work. However, given the difficulty of measuring human rights, there is a vast scope for improvement. There are some other limitations of our work. We discuss them in the Appendix because they are related to the simulation.

Below, we mention a few interesting extensions of our work. In this paper, the government chooses its human rights standard just once. In practice, governments may have to adjust this standard over time. An interesting research question is therefore to determine the optimal time path of sticks vs. carrots. There is also a case for studying certain dynamics beyond what has been done in this model. For example, it is possible to envision situations in which some insurgents provoke a government crackdown which then induces more people to join the insurgency, which in turn forces the government to crackdown even harder, and so on. Second, it is possible that insurgents may take actions that reduce the accuracy of the government's signal. Examples of such actions are disguising themselves, detecting and punishing informants etc. It will also be interesting to see how the government's optimal policy changes in response to such actions.

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Appendix

A Proof of Proposition 1

First consider α_0. The first order condition that determines α_0 is given by (10) and can be re-written as follows:

$$\frac{dV}{d\alpha_0} = -\frac{\partial p(e,r)}{\partial r} \Pr(s=0|\theta=1)\left[1-F(b^*)\right] - cF(b^*).$$

Using the implicit function theorem, it follows that

$$sign\left(\frac{d\alpha_0}{db^*}\right) = sign\left(\left(\frac{\partial p(e,r)}{\partial r} \Pr(s=0|\theta=1) - c\right) f(b^*)\right) < 0.$$

Next consider r. It follows from (13) that

$$\begin{aligned}
\frac{dr}{db^*} &= -\frac{d\alpha_0}{db^*} \Pr(s=0|\theta=1)\left[1-F(b^*)\right] - \left[1-\alpha_0\right]\Pr(s=0|\theta=1) f(b^*) \\
&= -\Pr(s=0|\theta=1)\left[1-F(b^*)\right]\left[1-\alpha_0\right]\frac{1}{b^*}\left\{-\frac{d\left[1-\alpha_0\right]}{db^*}\frac{b^*}{1-\alpha_0} + \frac{f(b^*)}{1-F(b^*)}b^*\right\} \\
&= -\Pr(s=0|\theta=1)\left[1-F(b^*)\right]\left[1-\alpha_0\right]\frac{1}{b^*}\left\{-\frac{d\left[1-\alpha_0\right]}{db^*}\frac{b^*}{1-\alpha_0} - \frac{d\left[1-F(b^*)\right]}{b^*}\frac{b^*}{1-F(b^*)}\right\} \\
&= \Pr(s=0|\theta=1)\left[1-F(b^*)\right]\left[1-\alpha_0\right]\frac{1}{b^*}\left\{E_{1-\alpha_0,b^*} + E_{1-F(b^*),b^*}\right\}.
\end{aligned}$$

Hence,

$$sign\left(\frac{dr}{db^*}\right) = sign\left(E_{1-\alpha_0,b^*} - \left|E_{1-F(b^*),b^*}\right|\right).$$

Finally, consider e. Totally differentiating (9) with respect to b^*, it follows that

$$\frac{de}{db^*} = -\frac{\frac{\partial^2 p(\cdot)}{\partial e \partial r}\frac{dr}{db^*}}{\frac{\partial^2 p(\cdot)}{\partial e^2}}.$$

Hence,

$$sign\left(\frac{de}{db^*}\right) = -sign\left(\frac{dr}{db^*}\right).$$

B Proof of Proposition 2

The expression for $\frac{\partial \alpha_0}{\partial c}$ follows from (10).

Next, notice from (13) that

$$\frac{\partial r}{\partial c} = -\Pi_{01} \frac{\partial \alpha_0}{\partial c} > 0.$$

Next, notice from (9) and (6) that

$$\frac{\partial e}{\partial c} = -\frac{\frac{\partial^2 p(e,r)}{\partial e \partial r}}{\frac{\partial^2 p(e,r)}{\partial e^2}} \frac{\partial r}{\partial c} < 0.$$

Finally, notice that

$$\frac{\partial p(e,r)}{\partial c} = \frac{\partial p(e,r)}{\partial e} \frac{\partial e}{\partial c} + \frac{\partial p(e,r)}{\partial r} \frac{\partial r}{\partial c}.$$

Using (4) and the results above, it follows that

$$\frac{\partial p(e,r)}{\partial c} < 0.$$

C Proof of Proposition 3

Let

$$\Omega_1 = [1 - p(e,r)] \Pr(s = 0 | \theta = 1) b^* - w.$$

Notice that Ω_1 is the expression in the left hand side of (15). Hence, in equilibrium, $\Omega_1 = 0$. Using the implicit function theorem, it follows that

$$\frac{db^*}{dc} = -\frac{\frac{\partial \Omega_1}{\partial c}}{\frac{\partial \Omega_1}{\partial b^*}}.$$

First, let us evaluate $\frac{\partial \Omega_1}{\partial c}$. Notice that

$$\frac{\partial \Omega_1}{\partial c} = -\frac{\partial p(\cdot)}{\partial c} \Pr(s = 0 | \theta = 1) b^* > 0$$

because of (21).

Next, let us evaluate $\frac{\partial \Omega_1}{\partial b^*}$. It can be shown that

$$\begin{aligned}\frac{\partial \Omega_1}{\partial b^*} &= -\frac{\partial p(\cdot)}{\partial b^*}\Pr(s=0|\theta=1)\,b^* \\ &\quad +(1-p(e,r))\Pr(s=0|\theta=1) \\ &= \Pr(s=0|\theta=1)\left[-\frac{\partial p(\cdot)}{\partial b^*}b^*+(1-p(e,r))\right] \\ &= \Pr(s=0|\theta=1)(1-p(e,r))\left(1+E_{1-p,b^*}\right)\end{aligned}$$

Combining the results above, it can be shown that

$$\frac{db^*}{dc}=\frac{\frac{\partial p(\cdot)}{\partial c}b^*}{(1-p(e,r))\left(1+E_{1-p,b^*}\right)}.$$

D Scenario 2: Problem of false alarm

In this section, we assume that (2) holds, that is, the miss rate is 0. This implies that a signal of 0 is extremely reliable and it can originate only from a loyalist. However, a signal of 1 is not reliable since it can originate from either a rebel or a loyalist. Everything else is similar to Scenario 1.[14]

First consider period 4 in which the army determines e. The equilibrium value of e even in this scenario is determined by (9). Hence, there is no change in the analysis of period 4.

D.1 Period 3

Next, consider period 3. In this period, the army chooses α_s for $s=0,1$. It follows from (7) that

$$\frac{dV}{d\alpha_0}=\frac{\partial V}{\partial e}\frac{\partial e}{\partial \alpha_0}+\frac{\partial V}{\partial r}\frac{\partial r}{\partial \alpha_0}+\frac{\partial V}{\partial \alpha_0}.$$

However, $\frac{\partial V}{\partial e}=0$ because of (9) and $\frac{\partial r}{\partial \alpha_0}=0$ because of (2). Hence,

$$\frac{dV}{d\alpha_0}=\frac{\partial V}{\partial \alpha_0}=-c\Pi_{00}<0$$

[14]There are two reasons why we study the problems of false alarm and missed alarm separately. First, we want to isolate their individual effects. Second, there are no closed form solutions of some expressions (such as the rate of arrests) when those two problems are analyzed together.

Table A.1: Variable description

Variable Notations	Definitions	Type	Numeric Interpretation
Number of Incidents	Total terrorist incidents	Dependent	
Number Killed	Total fatalities	Dependent	
AFSPA	Whether a state has AFSPA or not	Independent	
Duration of AFSPA	The duration for which AFSPA has been in effect in a state	Independent	
Leftist	Share of terrorism (incidents/fatalities) by leftist organization	Independent	
Separatist	Share of terrorism (incidents/fatalities) by separatist organization	Independent	
Purely Religious	Share of terrorism (incidents/fatalities) by purely religious organization	Independent	
Others	Share of terrorism (incidents/fatalities) by other groups	Independent	
Foreign Border	Whether a state shares a border with a foreign country	Independent	
Jammu and Kashmir	Binary variable for Jammu and Kashmir	Independent	
Naxalite Belt	Binary variable for states in the Naxalite belt (Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand and West Bengal)	Independent	
Seven Sisters	Binary variable for seven sister states (Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland, and Tripura)	Independent	
Congress	Whether the Indian National Congress party was in power or not	Independent	
BJP	Whether BJP was in power or not	Independent	
ln(Population Density)	Natural log of population density	Independent	
ln(Unemployed Youth)	Natural log of unemployed youth	Independent	
Female Literacy Rate	Percentage of female population aged 7 years and above that are literate	Independent	
Mean Political Discrimination	Index that captures political discrimination against minorities	Independent	Higher values represent greater discrimination
Mean Economic Discrimination	Index that captures economic discrimination against minorities	Independent	Higher values represent higher discrimination
Linguistic Fractionalization	Index that captures linguistic diversity within the population	Independent	Higher values represent higher linguistic diversity
Religious Fractionalization	Index that captures religious diversity within the population	Independent	Higher values represent higher religious diversity
ln(Geographical Area)	Natural log of land area (km2)	Independent	
Percentage of Forested Area	Self-explanatory	Independent	
Murder Incidents	Number of murder incidents	Independent	
Not Amounting to Murder	Number of incidents not amounting to murder	Independent	
Rape	Number of rapes	Independent	
Riots	Number of riots	Independent	
Actual Strength Of Armed Police	Self-explanatory	Independent	

Table A.2: Variable data sources

No.	Variables	Data Source
1	Number of Incidents, Number Killed	Global Terrorism Database
2	AFSPA	Jha (2016), Das (2013), IDSA Monograph Series No.7 (2012) and various news reports
3	Type of Organization (Separatist, Leftist, Purely Religious, etc.)	South Asia Terrorism Portal
4	Indicator Variables: (Foreign Border, Jammu and Kashmir, Naxalite Belt, Seven Sisters)	Indiastat and Piazza (2010)
5	Socioeconomic Variables (ln(Population Density), ln(Unemployed Youth), Female Literacy Rate)	Indiastat
6	Discrimination (Political and Economic)	MAR dataset, Minorities at Risk Project at the University of Maryland
7	Fractionalization (Linguistic and Religious)	Indiastat building on the methodology used in Alesina et al. (2003)
8	Geographical Variables (ln(Geographical Area), Percentage of Forested Area)	Indiastat
9	Crime data (Murder Incidents, Riots, etc.) and Strength of Armed Police	data.gov.in

and this implies that

$$\alpha_0 = 0. \tag{A.1}$$

In Scenario 2, a signal of 0 can only originate from a loyalist and knowing this the army has no incentive of arresting a person with a favorable intelligence assessment. In contrast, in Scenario 1, the optimum value of α_0 is positive because in that case a signal of 0 is not very reliable and can originate either from a rebel or a loyalist.

Finally, it can be shown that

$$\frac{dV}{d\alpha_1} = -\frac{\partial p(e,r)}{\partial r}\Pi_{11} - c\Pi_{10} \tag{A.2}$$

and

$$\frac{d^2V}{d\alpha_1^2} = -\frac{\partial^2 p(e,r)}{\partial r}\Pi_{11}^2 < 0.$$

Hence, the optimum value of α_1 is determined by the following condition:

$$-\frac{\partial p(e,r)}{\partial r} = c\frac{\Pi_{10}}{\Pi_{11}}.$$

Table A.3: Summary statistics for Variables (N = 407)

Variables	Mean	Std. Dev.	Min	Max
Number of Incident	67.394	440.51	0	4971
Number Killed	22.672	117.969	0	1333
AFSPA (Measure 1)	0.273	0.446	0	1
AFSPA (Measure 2)	0.248	0.432	0	1
Duration of AFSPA (Measure 1)	12.305	19.782	0	54
Duration of AFSPA (Measure 2)	5.322	10.932	0	54
Leftist	0.169	0.333	0	1
Separatist	0.128	0.279	0	1
Purely Religious	0.011	0.08	0	1
Others	0.364	0.429	0	1
Foreign Border	0.56	0.497	0	1
Jammu and Kashmir	0.029	0.169	0	1
Naxalite Belt	0.123	0.329	0	1
Seven Sisters	0.177	0.382	0	1
Congress	0.012	0.11	0	1
BJP	0.179	0.384	0	1
ln(Population Density)	5.522	0.904	2.282	7.005
ln(Unemployed Youth)	6.081	1.452	3.227	8.345
Female Literacy Rate	61.321	11.404	33.12	92.07
Mean Political Discrimination	2.539	0.818	1.25	4
Mean Economic Discrimination	2.31	0.491	1.333	3
Linguistic Fractionalization	0.675	0.238	0.235	0.951
Religious Fractionalization	0.666	0.177	0.259	0.916
ln(Geographical Area)	11.209	1.176	8.217	12.743
Percentage of Forested Area	45.959	188.568	0	3776
Murder Incidents	1356.4	1562.853	30	10776
Not Amounting to Murder	142.12	318.671	0	2213
Rape	695.73	749.653	5	3737
Riots	2906.37	3589.025	0	21565
Actual Strength Of Armed Police	11071.7	8053.74	387	36112

For an interior solution, the optimum value of α_1 is less than 1 in this case, whereas it is 1 in Scenario 1. In Scenario 1, a signal of 1 is extremely reliable and can never originate from a loyalist. In such a case, the army can arrest anyone without having to worry about any human rights violation. In contrast, in Scenario 2, a signal of 1 is not reliable and the army can only arrest a subset of people with such a signal in order to lessen concerns of human rights violations.

Using (A.1), we can re-write (3) as follows:

$$r = \Pr(\theta = 1)[1 - \alpha_1]. \tag{A.3}$$

D.2 Period 2

In period 2, we consider the decision of an individual to participate in the insurgency. The expected payoff of an individual from being a loyalist is

$$[1 - \alpha_1 \Pr(s = 1|\theta = 0)]\, w,$$

while the expected payoff from being a rebel is given by the following:

$$\begin{aligned} & [1 - p(e, r)]\left[1 - \sum_{s=0}^{1} \Pr(s|\theta = 1)\, \alpha_s\right] b \\ = \; & [1 - p(e, r)][1 - \alpha_1]\, b \end{aligned}$$

Hence, the type of the marginal rebel is determined by the following condition:

$$[1 - p(e, r)][1 - \alpha_1]\, b^* - [1 - \alpha_1 \Pr(s = 1|\theta = 0)]\, w = 0. \tag{A.4}$$

The following proposition shows the impact of a change in the marginal rebel type b^* on α_1, r and e:

Proposition 4 *A change in b^* affects α_1, r and e as follows:*

$$\frac{d\alpha_1}{db^*} < 0,$$

$$sign\left(\frac{dr}{db^*}\right) = sign\left(E_{1-\alpha_1, b^*} - \left|E_{1-F(b^*), b^*}\right|\right) \tag{A.5}$$

and

$$sign\left(\frac{de}{db^*}\right) = -sign\left(\frac{dr}{db^*}\right).$$

Proof. First consider α_1. The first order condition that determines α_1 is given by (A.2) and can be re-written as follows:

$$\frac{\partial V}{\partial \alpha_1} = -\frac{\partial p(e,r)}{\partial r}[1 - F(b^*)] - c\Pr(s = 1|\theta = 0)F(b^*) = 0.$$

Using the implicit function theorem, it follows that

$$sign\left(\frac{\partial \alpha_1}{\partial b^*}\right) = sign\left(\left(\frac{\partial p(e,r)}{\partial r} - c\Pr(s = 1|\theta = 0)\right)f(b^*)\right) < 0.$$

Next, notice from (A.3) that

$$\begin{aligned} r &= [1-\alpha_1]\Pi_{11} \\ &= [1-\alpha_1]\Pr(\theta = 1) \\ &= [1-\alpha_1][1-F(b^*)]. \end{aligned}$$

Therefore,

$$\begin{aligned} \frac{\partial r}{\partial b^*} &= -\frac{\partial \alpha_1}{\partial b^*}[1-F(b^*)] - [1-\alpha_1]f(b^*) \\ &= [1-F(b^*)][1-\alpha_1]\frac{1}{b^*}\left\{\frac{\partial[1-\alpha_1]}{\partial b^*}\frac{b^*}{1-\alpha_1} + \frac{\partial[1-F(b^*)]}{\partial b^*}\frac{b^*}{1-F(b^*)}\right\} \\ &= [1-F(b^*)][1-\alpha_1]\frac{1}{b^*}\left\{E_{1-\alpha_1,b^*} - \left|E_{1-F(b^*),b^*}\right|\right\}. \end{aligned}$$

Hence, we obtain (A.5).

Finally, the sign of $\frac{\partial e}{\partial b^*}$ can be derived following similar steps as in the last part of Proposition 1.

■

These results are similar to those in Proposition 1 and hence are same as those given in Table 2.

D.3 Period 1

Finally consider period 1. In this period, the government maximizes social welfare which is as follows:

$$\begin{aligned}\Psi &= \lambda V(e,\alpha_0,\alpha_1)+(1-\lambda)\Pr(\theta=0)\left[1-\sum_{s=0}^{1}\Pr(s|\theta=0)\alpha_s\right]w \\ &= \lambda V(e,\alpha_0,\alpha_1)+(1-\lambda)F(b^*)\left[1-\alpha_1\Pr(s=1|\theta=0)\right]w.\end{aligned}$$

In the above expression, $V(e,\alpha_0,\alpha_1)$ is the payoff of the army and can be derived from (7) as follows:

$$\begin{aligned}V(e,\alpha_0,\alpha_1) &= p(e,r)-e-c\alpha_1\Pi_{10} \\ &= p(e,r)-e-c\alpha_1\Pr(s=1|\theta=0)F(b^*).\end{aligned}$$

Let us consider the direct effects of c first. It follows from (A.2) that

$$\frac{\partial\alpha_1}{\partial c}<0,$$

that is, if the government raises the standard of human rights, the army arrests less people with an adverse intelligence assessment, as long as the participation rate in the insurgency remains unchanged. In the proposition below, we describe the impact of a change in c on the effort levels of the army and the net number of rebels, keeping b^* constant.

Proposition 5 *Keeping b^* constant, a change in c affects e and r in the following way:*

$$\frac{\partial r}{\partial c}=-\Pi_{11}\frac{\partial\alpha_1}{\partial c}>0$$

$$\frac{\partial e}{\partial c}=-\frac{\frac{\partial^2 p(e,r)}{\partial e\partial r}}{\frac{\partial^2 p(e,r)}{\partial e^2}}\frac{\partial r}{\partial c}<0.$$

The above results imply that

$$\frac{\partial p(\cdot)}{\partial c}<0.$$

Proof. Similar to the proof of Proposition 2. ■

The above proposition shows that when the government raises the standard of human rights, its direct effect (that is, the effect keeping b^* constant) results in a decrease in the probability of the army winning the contest. This is also same as our finding in Scenario 1.

Below, we examine how b^* is affected when there is a change in c.

Proposition 6 *A reduction in c affects b^* in the following way:*

$$\frac{db^*}{dc} = \frac{\frac{\partial p(\cdot)}{\partial c}\left[1-\alpha_1\right]b^* + \frac{\partial \alpha_1}{\partial c}\frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]}}{(1-p(e,r))(1-\alpha_1)\left(1+E_{1-p,b^*}\right) - \frac{\partial \alpha_1}{\partial b^*}\frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]}}. \tag{A.6}$$

Hence,

$$\frac{db^*}{dc} < 0$$

if $E_{1-p,b^*} \geq -1$ and has an ambiguous sign otherwise.

Proof. Let

$$\Omega_2 = [1-p(e,r)][1-\alpha_1]b^* - [1-\alpha_1 \Pr(s=1|\theta=0)]w.$$

Notice that Ω_2 is the expression in the left hand side of (A.4). Hence, in equilibrium, $\Omega_2 = 0$. Using the implicit function theorem, it follows that

$$\frac{\partial b^*}{\partial c} = -\frac{\frac{\partial \Omega_2}{\partial c}}{\frac{\partial \Omega_2}{\partial b^*}}.$$

First, let us evaluate $\frac{\partial \Omega_2}{\partial c}$. Notice that

$$\frac{\partial \Omega_2}{\partial c} = -\frac{\partial p(\cdot)}{\partial c}[1-\alpha_1]b^* - \frac{\partial \alpha_1}{\partial c}\left[(1-p(e,r))b^* - \Pr(s=1|\theta=0)w\right]. \tag{A.7}$$

It follows from (A.4) that

$$[1-p(e,r)]b^* = \frac{[1-\alpha_1 \Pr(s=1|\theta=0)]w}{[1-\alpha_1]}.$$

Hence,

$$\begin{aligned} & [1-p(e,r)]b^* - \Pr(s=1|\theta=0)w \\ = \quad & \frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]} > 0. \end{aligned} \tag{A.8}$$

Using (A.8), the expression in (A.7) can be re-written as follows:

$$\frac{\partial \Omega_2}{\partial c} = -\frac{\partial p(\cdot)}{\partial c}[1-\alpha_1]b^* - \frac{\partial \alpha_1}{\partial c}\frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]}$$

Next, let us evaluate $\frac{\partial \Omega_2}{\partial b^*}$. It can be shown that

$$\begin{aligned}\frac{\partial \Omega_2}{\partial b^*} &= -\frac{\partial p(\cdot)}{\partial b^*}(1-\alpha_1)b^* - \frac{\partial \alpha_1}{\partial b^*}(1-p(e,r))b^* \\ &\quad +(1-p(e,r))(1-\alpha_1) + \frac{\partial \alpha_1}{\partial b^*}\Pr(s=1|\theta=0)w \\ &= -\frac{\partial p(\cdot)}{\partial b^*}(1-\alpha_1)b^* \\ &\quad -\frac{\partial \alpha_1}{\partial b^*}[(1-p(e,r))b^* - \Pr(s=1|\theta=0)w] \\ &\quad +(1-p(e,r))(1-\alpha_1). \end{aligned} \tag{A.9}$$

Notice that

$$\begin{aligned} & -\frac{\partial p(\cdot)}{\partial b^*}(1-\alpha_1)b^* + (1-p(e,r))(1-\alpha_1) \\ = \;& (1-p(e,r))(1-\alpha_1)\left[\frac{\partial[1-p(e,r)]}{\partial b^*}\frac{b^*}{(1-p(e,r))}+1\right] \\ = \;& (1-p(e,r))(1-\alpha_1)\left(1+E_{1-p,b^*}\right). \end{aligned} \tag{A.10}$$

Substituting (A.8) and (A.10) into (A.9), it follows that

$$\begin{aligned}\frac{\partial \Omega_2}{\partial b^*} &= (1-p(e,r))(1-\alpha_1)\left(1+E_{1-p,b^*}\right) \\ &\quad -\frac{\partial \alpha_1}{\partial b^*}\frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]}. \end{aligned}$$

Combining the results above, it can be shown that

$$\frac{\partial b^*}{\partial c} = \frac{\frac{\partial p(\cdot)}{\partial c}[1-\alpha_1]b^* + \frac{\partial \alpha_1}{\partial c}\frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]}}{(1-p(e,r))(1-\alpha_1)\left(1+E_{1-p,b^*}\right) - \frac{\partial \alpha_1}{\partial b^*}\frac{[1-\Pr(s=1|\theta=0)]w}{[1-\alpha_1]}}.$$

■

The aggregate impact of c on the other endogenous variables are summarized in Table A.4.

Let us now determine the optimal c that the government chooses in period 1. For this, first consider

Table A.4: Impact of a change in c under Scenario 2

	$E_{1-p,b^*} < -1$	$-1 \leq E_{1-p,b^*} < 0$	$E_{1-p,b^*} \geq 0$
$\frac{db^*}{dc}$	?	$-$	$-$
$\frac{d\alpha_1}{dc}$	?	?	?
$\frac{dr}{dc}$	?	?	?
$\frac{de}{dc}$	?	?	?
$\frac{dp}{dc}$	?	$-$	?

$\frac{\partial V}{\partial c}$, that is the effect of a change in the standard of human rights on the payoff of the army. Using a similar method as in the analysis of Scenario 1, it can be shown that

$$\begin{aligned}\frac{dV}{dc} &= \frac{\partial V}{\partial c} + \frac{\partial V}{\partial r}\frac{\partial r}{\partial b^*}\frac{\partial b^*}{\partial c} \\ &= -\alpha_1 \Pr(s=1|\theta=0)F(b^*) - \frac{\partial p(e,r)}{\partial r}[1-\alpha_1]f(b^*)\frac{\partial b^*}{\partial c}.\end{aligned}$$

Hence, the first order condition for welfare maximization is as follows:

$$\begin{aligned}\frac{d\Psi}{dc} = \; & -\lambda\alpha_1 \Pr(s=1|\theta=0)F(b^*) \\ & -(1-\lambda)\frac{d\alpha_1}{dc}F(b^*)\Pr(s=1|\theta=0)w \\ & -\lambda\frac{\partial p(e,r)}{\partial r}[1-\alpha_1]f(b^*)\frac{\partial b^*}{\partial c} \\ & +(1-\lambda)f(b^*)[1-\alpha_1\Pr(s=1|\theta=0)]w\frac{\partial b^*}{\partial c}. \qquad \text{(A.11)}\end{aligned}$$

Since

$$\frac{d\alpha_1}{dc} = \frac{\partial \alpha_1}{\partial c} + \frac{\partial \alpha_1}{\partial b^*}\frac{db^*}{dc},$$

we can re-write (A.11) as follows:

$$\begin{aligned}\frac{d\Psi}{dc} \quad = \quad & -\lambda\alpha_1 \Pr(s=1|\theta=0) F(b^*) \\ & -(1-\lambda)\frac{\partial\alpha_1}{\partial c} F(b^*) \Pr(s=1|\theta=0) w \\ & -\frac{\partial b^*}{\partial c} \times \{(1-\lambda)\frac{\partial\alpha_1}{\partial b^*} F(b^*) \Pr(s=1|\theta=0) w \\ & +\lambda\frac{\partial p(e,r)}{\partial r}[1-\alpha_1] f(b^*) \\ & -(1-\lambda) f(b^*)[1-\alpha_1 \Pr(s=1|\theta=0)] w\}. \end{aligned} \tag{A.12}$$

As in the analysis of Scenario 1, the government considers five factors in determining the optimal human rights standard. Since these factors have the same interpretation as in Scenario 1, we do not discuss them in detail again. The first term is negative and the second term is positive. The last three factors capture the effect of a change in the participation rate in the insurgency. Each of the terms in the braces is negative. Therefore if $E_{1-p,b^*} \geq -1$, then $\frac{\partial b^*}{\partial c} < 0$ and consequently the third, fourth and fifth factors all tend to increase the optimal standard of human rights. Conversely, if $E_{1-p,b^*} < -1$, the effect of these three factors on the optimal standard of human rights is ambiguous.

Since the first term of (A.11) is negative, the second term is positive, and the last three terms are ambiguous, an interior solution is possible.

E How sensitive is welfare to intelligence quality?

Below, we use a simulation to show that welfare can be quite sensitive and that in some circumstances having moderate quality intelligence is not much different than having no intelligence.

Since this is a numerical example, we relax two assumptions made in the analytical discussion. First, we considered either the missed alarm rate or false alarm rate, but not both. Second, we assumed that (6) holds in equilibrium. Both of these assumptions were made for the ease of exposition and are relaxed in the numerical example. Consequently, in this section, we allow for both types of intelligence errors to occur.

All parameter values are specified in Table A.5. Two of these- μ and Γ require some discussion here since they have not been used above. In this example, we assume that b follows the exponential distribution with parameter μ . Also Γ is the army's ex post value of winning. (In the analytical discussion, this was assumed to be 1 since Γ had no major role to play in the exposition). The contest success function is assumed to be

Table A.5: Parametric values

Parameter	Value
λ	0.5
w	50
Γ	10
μ	50
$\overline{c}$	50
$\underline{c}$	30

$p = \frac{e}{e+r}$. This is a standard contest success function commonly used in the literature.

The quality of intelligence depends upon the missed alarm rate and the false alarm rate. Based upon the Terrorist Trial Report card (2010) from New York University School of Law and Crenshaw et al. (2017), we estimate that the false alarm rate for the USA is around 0.12 and the missed alarm rate for USA is around 0.16. Our values are also supported by extant literature such as Virta et al. (2003) and Jacobson et al. (2006). We use these values as the baseline quality of intelligence. We multiply these rates by a scale factor k and determine how the endogenous variables change in response. We allow k to vary between 0.5 to 3 with a step size of 0.5. A value of $k < 1$ indicates better quality intelligence than the baseline and a value of $k > 1$ indicates inferior intelligence than the baseline. In general, k can be viewed as an index of the quality of intelligence with a higher value of k indicating lower quality intelligence. Notice from Panel 1 of Figure A.1 that welfare drops sharply when k increases from 1 to 1.5. When $k = 1.5$, the missed alarm rate is 0.24 and the false alarm rate is 0.18. Clearly, intelligence has some information content at this level, and yet it is not enough to prevent the steep welfare loss. It follows from Panel 2 and Panel 3 that the drop in welfare is primarily accounted for by the reduction in payoff of the loyalists, although there is a reduction in the army's payoff as well.

As far as the army is concerned, the chance that it wins the contest reduces from around 90% to around 70% when k increases from 1 to 1.5. Also, such a change forces the army to increase its effort from 0.56 to 2. The net effect of of a higher effort and lower win probability is that the army's payoff goes down from 8.8 to 4.8. As far as the residents of the province are concerned, there is a steep jump in their participation in the insurgency when k increases from 1 to 1.5. As a result, the net proportion of insurgents in the population jumps from 4% to 75%, which in turn forces the army to treble its effort. Note from Panel 4 that the human rights standard is relaxed (meaning that c is reduced) when k increases from 1 to 1.5. However, the human rights standard has a non-monotonic relationship with the quality of intelligence.

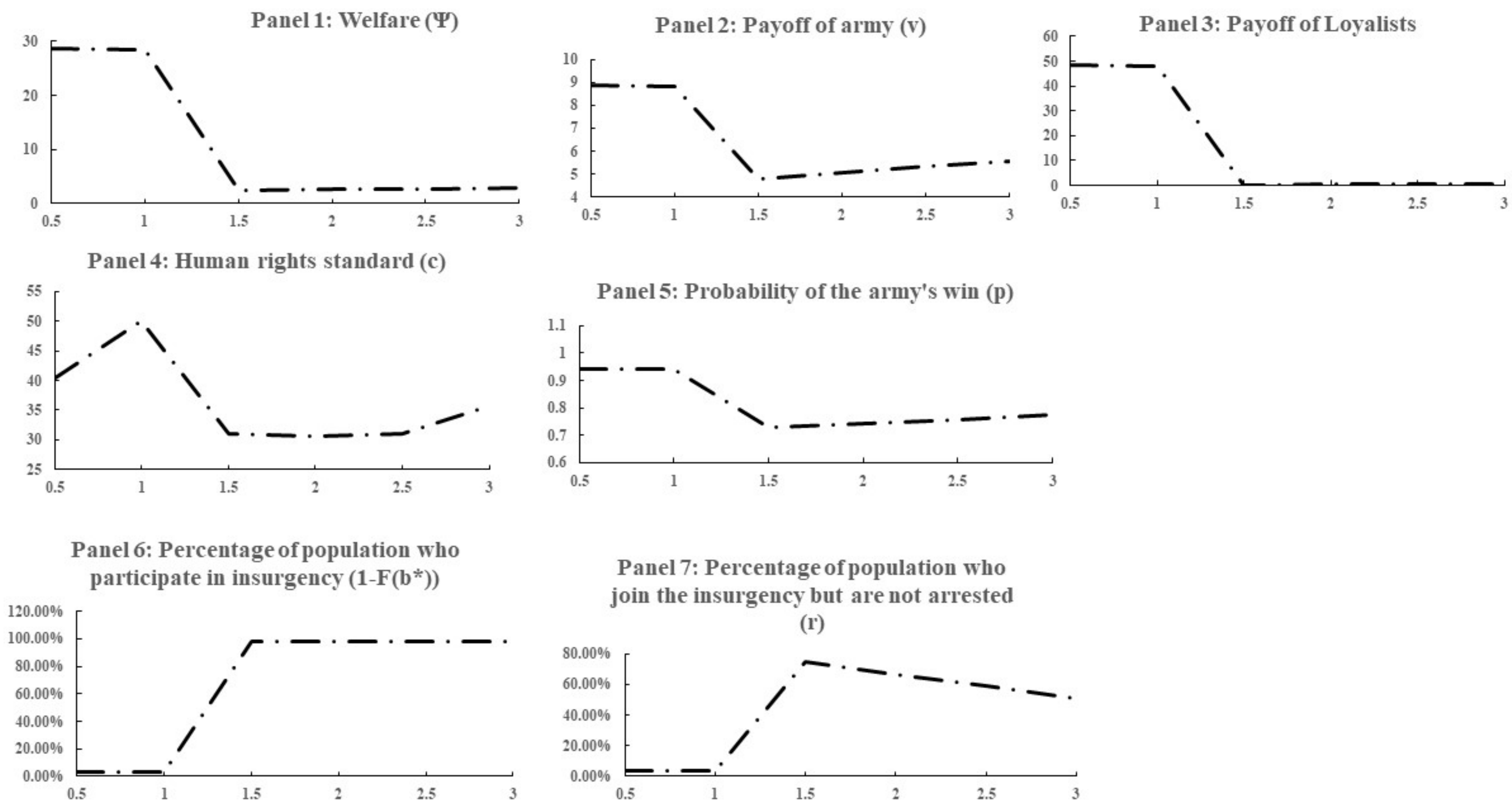

Figure A.1: Endogenous variables as a function of the quality of intelligence.

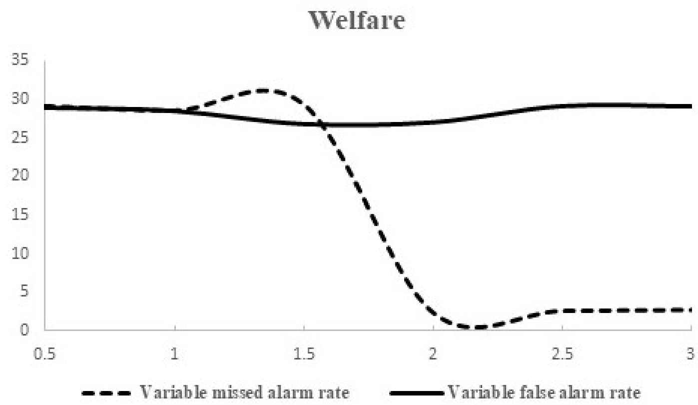

Figure A.2: Welfare as a function of one intelligence error, holding the other error at its baseline level.

It is demonstrated above that a lower quality of intelligence relative to the baseline leads to a sharp drop in welfare. It is natural to ask if both types of intelligence errors contribute equally to this reduction, or if one of them is more important than the other one. In order to investigate this, we compute welfare by varying only one of the intelligence errors, keeping the other error fixed at its baseline level. The results are presented in Figure A.2. The solid line is welfare when the false alarm rate is multiplied by the scale factor k holding the missed alarm rate equal to its baseline value of 0.16, while the dashed line is welfare when the missed alarm rate is varied holding the false alarm rate equal to its baseline value of 0.12. It can be seen that welfare does not change much when only the false alarm rate varies. In contrast, there is a steep drop in welfare when only the missed alarm rate increases. Hence we conclude that the reduction in welfare in Figure A.2 is primarily because of the missed alarm rate. This means that if intelligence quality is low in a country (and the parameters are same as in this example), it should prioritize improving the missed alarm rate.

We can also use this example to determine the effect of the human rights standard on the incentive to participate in the insurgency. The relationship between $1 - F(b^{\star})$ (which is the proportion of population that participate in the insurgency) and c (holding the missed alarm and false alarm rates at their baseline levels) is shown in the left panel of Figure A.3. Notice that there is a non-monotonic relationship between these two varables. A lower c induces the army to arrest more people. As long as only insurgents are arrested, this acts as a deterrent. However the problem is that intelligence errors lead to arrests of loyalists as well. Consequently the incentive to remain a loyalist goes down as well. Hence a lower c will result in lower participation in the insurgency if the deterrence effect dominates. It also means that a lower c will result

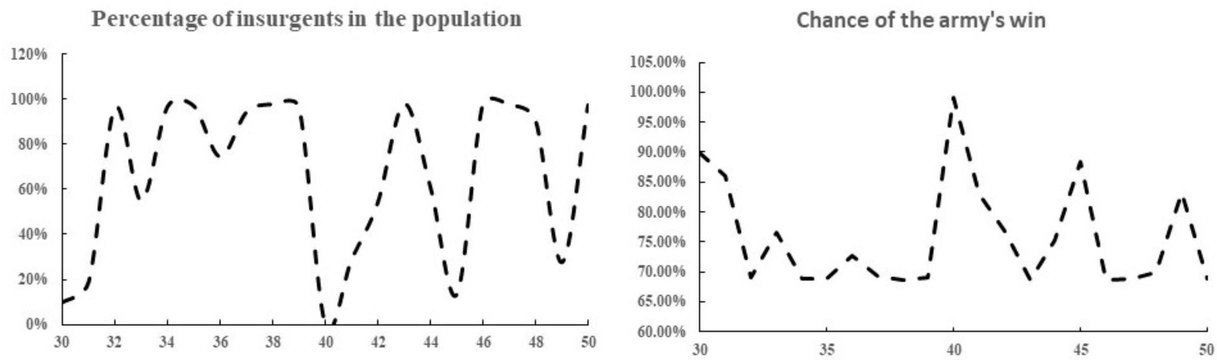

Figure A.3: The percentage of insurgents in the population and the probability of the army's win as a function of the human rights standard.

in higher participation in the insurgency if the deterrence effect is small. This explains the non-monotonic relationship in the left panel of Figure A.3. A consequence of this result is that the probability of the army's win also has a non-monotonic relationship with the human rights standard. This is shown in the right panel of Figure A.3.

F Limitations of the simulation

In the concluding section of the paper, we pointed out one limitation of the paper, which is the issue that the parameters are hard to measure accurately in the real world. We now point out two other limitations related to the simulations.

The first point is related to the functional forms we chose for the simulations. For example, we chose the contest success function $p = \frac{e}{e+r}$. The main reason we chose this is because this is a simple form and has been widely used in the literature. We are not aware of papers that empirically show whether this form is a good approximation to reality or whether a different form is superior. We can add however that if such insights are known in future, the simulations can be modified accordingly.

Another concern is that the results change quite significantly when k increases from 1 to 1.5 and as a result the simulation model seems to be hypersensitive. Indeed for such a change, welfare drops from around 28.5 to 2.5, the proportion of insurgents in the population changes from 3% to 98% and the probability of the army's win drops from 94% to 73%. The simple explanation is that a 50% drop in the accuracy of intelligence (that occurs when k changes from 1 to 1.5) is a substantial change and can plausibly have a major impact, which is what we have. We have checked that the impact of small changes in k are quite modest. For example, when k increases from 1 to 1.05, welfare drops froms from 28.5 to 27.4, the proportion of insurgents in the population increases from 3% to 7% and the probability of the army's win drops from 94% to 91.5%. Overall, the results change quite smoothly when we consider finer grids.