CIVIL CONFLICT: ROLE OF GRIEVANCE AND TERRORISM

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ABSTRACT

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Keywords: game theory, conflict, t errorism, e thnic g rievance, d uration, forecast.

In order to understand the role of grievance and terrorism in state-rebel conflicts, as an extension to Gibilisco's (2016) manuscript, a two stage sequential game between two players is designed. Addition to having explained late separations of rebel groups and separations of all groups with varying initial grievance levels, equilibria of this game produced 2 testable hypotheses: First, use of terrorism enhances the chances of getting a concession or negotiation. Second, the conflicts i n w hich more terrorist attacks are conducted are likely to finish e a rlier. H aving t ested t he latter one, I finished my thesis by attempting to forecast the durations of ongoing conflicts, making use of contemporary machine learning algorithms.

ÖZET

İÇ ÇATIŞMA: TERÖRİZM VE KİNİN ROLÜ

OLGAHAN ÇAT

EKONOMİ YÜKSEK LİSANS TEZİ, TEMMUZ 2019

Tez Danışmanı: Prof. Dr. ÖZGÜR KIBRIS

Anahtar Kelimeler: oyun teorisi, çatışma, terörizm, etnik kin, süre, tahmin

Kin ve terörizmin devlet-isyancı grup çatışmalarındaki rolünü daha iyi anlamak için, Gibilisco'nun çalışmasına bir tevsi olarak, 2 oyuncudan oluşan 2 kısımlı bir oyun dizayn edildi. Geç gerçekleşen ayrılışlar ve her seviyeden başlangıç kinini kapsayan ayrılışlara ek olarak, bu oyunun dengeleri bize test edilebilir 2 hipotez verdi: İlki, terörist ataklar ayrılıkçı grup için müzakereye oturma veya imtiyaz edinme şansını arttırıyor. İkincisi, daha fazla terörist atak gözlemlediğimiz çatışmalar daha erken sonuçlanıyor. İkincisini kendim test etmekle beraber, tezimi çağdaş makine öğrenmesi algoritmalarını kullanarak süregelen iç çatışmaların sürelerini tahmin ederek tamamladım.

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Lastly, I thank my mother for her lifetime support.

In memory of my grandfather

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1. INTRODUCTION

Terrorism has been a tool that is widely used by many groups and comes in many forms. Terrorism, in this paper, is defined as deliberately attacking civilians with violent means to attain political goals. Many groups find it effective to achieve their process goals and outcome goals, as defined by Abrahms (2012). To achieve such goals, Kydd and Walter (2006) enumerate the 5 strategies of terrorism as attrition, intimidation, provocation, spoiling, and outbidding. Groups use it to bear high costs on governments while incurring very less logistical costs. We even see forms of terrorism where a terrorist just rents a van and crashes into civilians, imposing such high damages while incurring almost no logistical cost. Although these attacks galvanize extremists to join the rebel group (Mishal and Sela 2006), targeting civilians comes at another cost which risks the losing the moderate base of supporters (Pape 2003) (Bueno de Mesquita and Dickson 2007). Usually, it is harder for people to legitimize the indiscriminate killing of civilians unless there is a strong hatred between communities of each side (Merari 1993). Due to the reasons I mentioned above, terrorism has not only been the tool of very weak groups that are at the rudimentary stages of becoming matured ones; but also, well-structured, largely organized groups that are capable of sustaining an armed conflict with states on the battlefield also commit to terrorism (Carter 2016) (Thomas 2014). Studies show that countries already experiencing conflict are susceptible to a lot more terrorism-caused deaths than the ones without civil conflict (Findley and Young 2012). Although this is directly related to the weakness of such governments under conflict conditions, which favors a habitat for early-stage armed groups to flourish, weak states are vulnerable to guerrilla attacks as well. Moreover, it can even be argued that the power asymmetry between a "powerful" state and a rebel group favors terrorism choice much more than a situation where the state is weaker. To mitigate terrorism, governments adopt security and intelligence measures. Not only these proactive measures are very costly in monetary terms, but also, they don't come as clean as it was desired to do. Given that there is an audience that terrorist groups try to provoke/galvanize, such proactive measures have the risk of mobilizing terror group sympathizers. Governments' accuracy in weakening the rebels are not always at its

best; measures almost always come with collateral damage to the civilians. Beyond the accuracy of these measures, violence can easily get out of hand due to its nature. Given that these counter-insurgency activities are conducted by certain individuals, negative externalities are just a matter of decision-making of that agent. These measures may harm economic activity in general, which lowers the opportunity cost of committing terror for sympathizers and they join the group. Another reason might be mainly ideological; these policies might increase grievance and supporters might join the group as fighters to get ideological satisfaction. Let me share some statistics to show the importance of ethnic grievances on public opinion about terrorism, although not from civil conflict. According to a PEW survey Perrin (2014), 46 percent of Palestinians think that suicide bombing, the cruelest form of terrorism, can be often/sometimes justified. We also see a large gap between the tendencies of respondents from Gaza and West Bank, 62 percent of the former think it's legitimate while 36 percent of the latter. It bolsters our argument given that Gaza has usually been the target of Israeli operations, compared to West Bank. Respondents from Lebanon comes at second, with 29 percent of them finding suicide attacks legitimate. We see a large difference in shares between respondents of Shia and Sunni, 37 percent of Shia can legitimize suicide attacks while only 21 of Sunni. It is interesting that 96 percent of Lebanese find Al-Qaeda's actions unfavorable while 29 of them can legitimize suicide bombing. Admittedly, intents/agendas behind these attacks are politically and religiously not necessarily the same even though both argue that they fight the enemies of Islam, however, this does not suffice to explain drastic difference in views in my opinion. I argue that grievance caused by state actions plays a huge role in the formation of these opinions. Although these grievances emerge over a long span of time, every single action taken by state actors is another contribution in this historical context, therefore, should not be overlooked. Also, there is a phenomenon called "recency effect", which people are affected more by recent developments rather than the former ones, even though they are of the same weight/magnitude. The statistics show that opinion on suicide terrorism shows great variance over time. (Perrin 2014). We see drops up to 16 percentage in people who think that a suicide attack can be legitimized, in just one year in a country like Palestine where ethnic grievances are thought to be very strong. Even though state actions are not the sole reason for these fluctuations, the absence of a steady level of support shows the ability of current actions to shape people's view. This paper analyzes the strategic interaction between a government and a rebel group where the government chooses either to repress the group, to give independence or a hands-off strategy, and the group responds it with either a terrorist attack, a war attempt (which is aimed directly at the outcome goal, either via a series of guerrilla attacks, or a conventional war, or a large protest), or nothing, which keeps the peaceful

status-quo. In this paper's context, 2 of these terrorist strategies, provocation, and attrition are thought to help rebel groups. I want to understand the use of terrorist attacks by a rebel group in a civil war with a game theoretical model which includes 2 players; center (government) and the periphery (rebel group). To do so, I did an extension to Gibilisco (2016) paper. Before defining the original model and my extension on it, I want to have a look at what the related literature says about the topic, both mentioning empirical and formal studies.

1.1 Literature

1.1.1 Empirical Studies

Use of terrorism in the context of a civil war was analyzed by Fortna (2015) where she compares the outcomes of civil wars whether there was terrorism used or not. She concludes that terrorism helps these wars last longer however groups committing terrorism are less likely to achieve their goals. Another work related to the capability of rebel forces in civil wars is Hultman (2007), where she argues that rebel groups tend to attack civilians more when they lose on the battlefields, which is parallel to the mainstream view. Some other papers related to the effectiveness of terrorism are Thomas (2014) where she concludes groups that use terrorist violence do better at getting governments into negotiations and forcing them to make concessions, analyzing the data from conflicts Africa. Pape (2003), although not necessarily a civil war context, argues suicide bombings force governments to make concessions in the 11 of 12 cases, except Turkey-PKK conflict. On the contrary, Abrahms (2012) empirical study has shown that terrorism is not as effective as guerrilla warfare against state forces at inducing concessions by governments.

1.1.1.1 Studies with Formal Models

Berman and Laitin (2017) ask the question on the theoretical basis that when do groups commit suicide and find out that it is a viable option when the targets are hard. He also empirically tests his hypotheses and concludes rich countries are more susceptible to suicide attacks since they have better military protection. Carter (2016)) constructs a perfect information game where rebel chooses either a terror attack or a guerrilla attack with the hope of a provocative response. They look for imprecise targeting from the government so that potential supporters would lean more to the terror group. While choosing so, they should also consider the fact that they could bear that forceful response. After testing his hypotheses empirically, he concludes that groups choose guerrilla attacks to provoke forceful responses while they choose terror attacks to avoid them. Rosendorff and Sandler (2010), constructed a formal model consisting of 3 players; Government, Rebel Leader, and the potential supporters. In this game, Rebel leader chooses a portion of suicide attacks to maximize his benefit and government chooses a preemptive action to weaken the enemy, at the expense of damaging economic activities which would mobilize rebel group supporters. Bueno de Mesquita and Dickson (2007) again constructs a 3 players game where the players are the government, extremist faction, and aggrieved population. He tries to find out under which circumstances terrorism is an effective tool to mobilize support for the rebel group. Again, Rosendorff and Sandler (2004) formed a model, one that is similar to ours, where the government chooses a proactive action to hinder potential terror attacks, which are to be committed after observing government's decision, either of a spectacular or a normal attack.

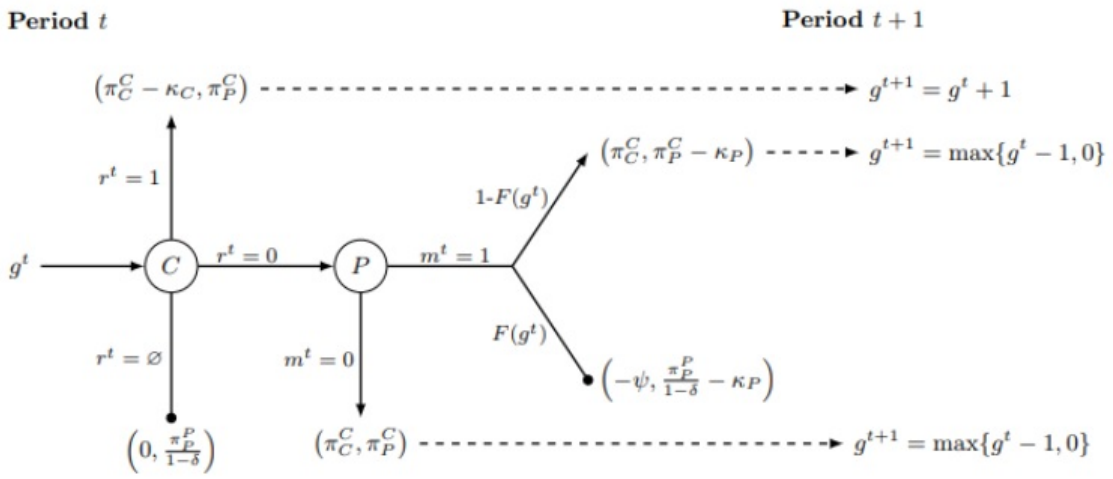
2. GAME

Gibilisco is one of the very few who treats grievance as a seperate parameter in a conflict game. In this section, I will explain Gibilisco's game and his results, and then motivation of my extension and how my game plays out.

2.1 Gibilisco's Game

Gibilisco's game consists of 2 actors; Center and Periphery. It is an infinitely-staged repeated game. In each stage, center starts the game by either repressing the periphery, giving independence or pursuing a hands-off strategy. In case of an independence, there are no interaction between the actors anymore and they get their corresponding payoffs for each stage. In case of a repression, periphery cannot take an action, and game moves to the next stage. In cas of a hands-off strategy, periphery can respond with either a war (can be a terrorist attack, guerrilla warfare, protest etc.) or nothing, and game moves to the next stage. Here's the representation of the game:

Figure 2.1 Gibilisco's Game



Here are the payoffs:

π_C^C: Center's utility when territory belongs to Center
π_P^C: Periphery's utility when territory belongs to Center
π_P^P: Periphery's utility when territory belongs to Periphery
$-\kappa_C$: Cost of Repression for Center
$-$: Center's loss at a lost war
g: Level of grievance at the beginning
T: Loss of terror to both sides
$2T$: Loss of repression to Periphery
$F(g)$: Periphery's probability of winning a war, increasing in g

$g^{t+1} = \max\left\{g^t - 1, 0\right\}$

Future is discounted by δ.

2.2 Gibilisco's Results

Gibilisco's results are highly path-dependent. The game has 2 cut-off points for initial grievance level. Levels below the area between these two points, mobilization is tolerable for center, which eliminates future grievances. Levels above this area are

way higher than what center can tolerate, hence, they either repress the periphery, or grants independence instantly. As a result, periphery finds it desirable and feasible to mobilize only for levels between these cutoff points. Another interesting result of his game is about the timing, which suggests that decentralization cannot occur at later stages of the game. To show how his mechanism reflect onto an example, he gives Spain-Basque conflict illustration. Even though his game maps nicely upon this example (and possibly some other historical examples), it fails to capture why some other cases occuring such as Scotland and Wales's decentralization after decades of stalemate.

2.3 My Extension

In this section, I will explain why my extension is a valuable attempt and how I motivate the parameters in my mechanism. My main contribution is, due to the reasons I explained in detail in the previous section, treating terrorism as a different form of war, , unlike Gibilisco's game, in which all attacks/protests are represented as a single strategy. Also, as opposed to the whole terrorism formal model literature, treating grievance as a seperate parameter allows me to reflect use of terrorism in a conflict better. In vast majority of terrorism work, terrorist group gets the benefit immediately at that stage, although most of the time they aim for future mobilization and get benefit for that. Having a grievance parameter makes it easier differentiate between these two, therefore, have a more accurate representation of a conflict between a state and a terrorist group.

My game consists of 2 stages, between a Center and a Periphery. Center starts the game either repressing, granting independence or pursuing hands-off strategy. Similar to what Gibilisco defines, in case of a repression, game moves to the second stage, in case of an independence, the game ends and in case of a hands-off strategy, periphery responds with either a terrorist attack, a war or nothing. Then we move to the second round, where center starts with same strategies, and this time in case of a hands-off strategy, periphery responds with only a war or nothing, since this is the last stage of the game and there's no future that the periphery can realize the utility of a terrorist attack.

Strategies for Center in both stages are $\{I, R, H\}$ where I stands for Independence, R stands of Repression and H stands for Hands-Off

Strategies for Periphery in the first stage are $\{NW, T, W\}$ and in the second stage are $\{NW, W\}$ where NW stands for No-War, T stands for a terrorist attack and W stands for War. Payoffs for each stage are similar with Gibilisco's game except:
Grievance level increases by 1 after a repression, and 1/2 after a terrorist attack. I assume that the terrorist attack is responded by a backlash from center, therefore, it increases the grievance next period, however, not as much as what repression does. I just assigned it as 1/2 to keep things simple.
When periphery conducts a terrorist attack, both sides incur a cost of T. In case of a repression, periphery incurs a repression cost of 2T. The second premise follows from the assumption that repression's cost to periphery is more than backlash's cost. Again, I kept things simple and assigned them as T and 2T. The first premise, where both parties incur a cost after a terrorist attack, follows from the fact that center gets damaged after a terrorist attack, in terms of both materiality and reputation, while periphery suffers from a backlash of the center. It is important to note that repression and this backlash are different, repression is an act where periphery, or minority people/geography is isolated in a way that they cannot take any action. However, backlash's can be thought of local counter-operations, mostly just after the terrorist attacks, or center's people's social backlash against periphery people. This one is nicely addressed by Gould and Klor (2016); they show that 9/11 attacks made it harder to assimilate for Muslims in USA due to the reactions they get afterwards. Also, Benmelech and Klor (2016) show that lack of assimilation is one of the main drivers of flow of foreign fighters to ISIS. These are two empirical works which affirm the motivations behind my mechanism.
To keep things simple, I do not have a discount factor for the second stage.
Lastly, I assumed that cost of repression is never equal to a payoff Center gets by holding the territory. This is a borderline case and has no value in our story, so I made this assumption in order to present one of my equilibra more smoothly.

2.3.1 Results

- IWIW is an equilibrium if
  - $\pi_c^c < K_c$
  - $F(g) \cdot \pi p^p - (1 - F(g)) \cdot (K_c - \pi_p^c) > \pi_p^c$
  - $0 > (1 - F(g)) \cdot \pi_c^c - \psi \cdot F(g)$

- RWRW is an equilibrium if
  - $\pi_c^c > K_c$
  - $F(g) \cdot \pi p^p - (1 - F(g)) \cdot (K_c - \pi_p^c) > \pi_p^c$
  - $\pi_c^c - K_c > (1 - F(g)) \cdot \pi_c^c - \psi \cdot F(g)$
  - and number of innocents killed and wounded.
- HNHN is an equilibrium if
  - $\pi_p^c > F(g)\pi_p^p + (1 - F(g)) \left(\pi_p^c - K_p\right)$
  - $2\pi_p^c > \pi_p^c + F(g-1) \left(\pi_\rho^p - K_p\right) + (1 - F(g-1)) \left(\pi_p^c - K_p\right)$
- HTIW is an equilibrium if
  - $\pi_p^c - T + f(g+1/2) \left(\pi_p^p - k_p\right) + (1 - f(g+1/2)) \left(\pi_p^c - k_p\right) > 2\pi_p^c$ - T
  - $\pi_c^c - T + f(g+1/2) \cdot (-\psi) + (1 - f(g+1/2)) (\pi_c^c) < \pi_c^c - T$
  - $\pi_p^c + f(g-1)(\pi_p^p - k_p) + (1 - f(g-1)) \left(\pi_p^c - k_p\right) > 2\pi_p^c$
  - $\pi_c^c + f(g-1) \cdot (-\psi) + (1 - f(g-1)) (\pi_c^c) > \pi_c^c$
  - $\pi_p^c + f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2)) \left(\pi_p^c - k_p\right) - T >$
    $\pi_p^c + f(g-1)(\pi_p^p - k_p) + (1 - f(g-1)) \left(\pi_p^c - k_p\right)$
  - This suggests that, rebel groups rely heavily on targeting civilians without committing other forms of war are still likely to get independence, concessions etc.
  - Hypothesis 1: Groups conduct mostly terrorist attacks can force their opponents into concessions.
- HTHW is an equilibrium if
  - $\pi_p^c - T + F\left(g + \frac{1}{2}\right) \left(\pi_p^p - k_p\right) + \left(1 - F\left(g + \frac{1}{2}\right)\right) (\pi_p^c - K_p) > 2\pi_p^c - T$
  - $\pi_p^c - T + F\left(g + \frac{1}{2}\right) \left(\pi_p^p - k_p\right) + \left(1 - F\left(g + \frac{1}{2}\right)\right) (\pi_p^c - K_p) >$2F(g)$\pi_p^p - (1 - F(g))(K_p - \pi_p^c)$
  - $\pi_p^c - T + F\left(g + \frac{1}{2}\right) \left(\pi_p^p - k_p\right) + \left(1 - F\left(g + \frac{1}{2}\right)\right) (\pi_p^c - K_p) > 2\pi_p^c$
  - $\pi_c^c - T + f\left(g + \frac{1}{2}\right) \cdot (-\psi) + + \left(1 - F\left(g + \frac{1}{2}\right)\right) \pi_c^c > 2\pi_c^c - k_c - T$

- $\pi_c^c - T + f\left(g+\frac{1}{2}\right)\cdot(-\psi) + +\left(1-F\left(g+\frac{1}{2}\right)\right)\pi_c^c > 0$
- $\pi_c^c - T + f\left(g+\frac{1}{2}\right)\cdot(-\psi) + +\left(1-F\left(g+\frac{1}{2}\right)\right) > 2\pi_c^c > 2(\pi_c^c - k_c)$
- $\pi_c^c - T + f\left(g+\frac{1}{2}\right)\cdot(-\psi) + +\left(1-F\left(g+\frac{1}{2}\right)\right) > \pi_c^c - T$
- $\pi_c^c - T + f\left(g+\frac{1}{2}\right)\cdot(-\psi) + +\left(1-F\left(g+\frac{1}{2}\right)\right) > 2(\pi_c^c - k_c)$
- Hypothesis 2: The only equilibria including terrorist attacks is which the periphery follows up with a war, or Center granting independence. so terrorist attacks shorten the duration of conflicts.

Before going into the empirical tests, I want to discuss what this extension brings to the literature. Firstly, in this model, seperation can occur in both stages, which shows how both early and later seperations occur. Secondly, we see that terrorist attacks are conduct only when they're followed by a war attempt, which ends the conflict in favour of either side. This suggests that use of terrorism shortens the duration of conflicts, and I will test it empirically. Lastly, we see that there is an equilibrium in which periphery conducts a terrorist attack and gets independence afterwards, without a war attempt. This suggests that groups relying heavily/solely on terrorism can still pose a credible threat to their opponents in order to get independence. These two results are in line with a good number of extant literature in terrorism, both theoretically and empirically.

3. EMPIRICAL TESTS

3.1 Hypothesis 1

Hypothesis 1: The only equilibrium including terrorist attacks is which the periphery follows up with a war, so terrorist attacks shorten the duration of conflicts.

To test this hypothesis, I make use of Acosta (2016) and Benjamin (2016) replication data . Since suicide attacks are a strong form of terrorism, it is reasonable to disaggregate terrorist attacks in this way. Suicide Attack Network Database consists of variables such as target type which can be combatant, political and civilian, location of target and organizaton which can be foreign, domestic or mixed, and specific conflict and conflict types. Duration is the dependent variable in this analysis. Main explanatory variable is a dummy variable which indicates whether that particular group has ever conducted a suicide attack or not, in its entire lifetime, and its network ties. Addition to them, some other variables are used as control such as organization size (whether it is more than one thousand or ten thousand), dummy variables for organization ideology (islamist or leftist), whether the purpose of the organization is self-determination or not, number of states which sponsors the organization, the number of Safe havens utilized by the group, the number of total Attacks conducted by the group, the total number of Kills incurred by the organization, GDP per capita and Polity score as development proxy variables of enemy, whether the group has held Hegemonic status over its rivals, and lastly, a Unified Front is marked by the group, which means all alliances of that group striving for a specific outcome goal or not.
To test his hypothesis, he makes use of the Cox proportional-hazards model (Cox 1972). This model is mostly used by medical statisticians to analyze the relation between survival time of patients and explanatory variables, which can be genotype,

sex, drugs that are used by patients. It became a common tool in modern conflict literature, in which conflicts can be analogous to patients in the sense that they both have a lifetime and some of them die/end.

In his paper, Acosta's main finding suggests the opposite: He claims that suicide attacks increase rebel groups' longevity, and hence, duration of civil conflicts. However, his results may be flawed. The reason is; he assigns a dummy variable for each group which indicates whether this group has conducted a suicide attack or not, during its whole lifetime. I claim this is not an accurate way of reflecting the effect of suicide attacks. As I mentioned in the introduction, terrorist attacks are conducted to attract people and people's tendencies vary a lot even year by year, which implies that impact of terrorist attacks tend to vanish over time. As a result, using the same dataset, I created dummy variables for whether that group did a suicide attack or not in last 1,2,3,4 and 5 years. I also adjusted some other variables in the same way (for example, to control for strength of the group, I used number of killings in 1,2,3,4 and 5 years for each dummy variable). Here's the table showing my results:

Table 3.1 Regression Summaries

	Dependent variable:				
	age.x				
	(1)	(2)	(3)	(4)	(5)
Observations	143	102	86	68	61
R^2	0.321	0.263	0.209	0.236	0.275
Max. Possible R^2	0.986	0.958	0.930	0.913	0.883
Log Likelihood	−276.236	−146.256	−104.447	−74.010	−55.766
Wald Test (df = 15)	46.760***	42.880***	22.940*	35.030***	14.030
LR Test (df = 15)	55.409***	31.182***	20.185	18.336	19.594
Score (Logrank) Test (df = 15)	43.120***	25.828**	17.170	17.894	17.122
Note:					*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:				
	age.x				
	(1)	(2)	(3)	(4)	(5)
onethousand1	−0.926**	−0.660	−0.620	−0.383	−1.628*
	(0.483)	(0.537)	(0.552)	(0.661)	(0.900)
tenthousand1	0.323	0.045	0.256	−0.457	−0.248
	(0.680)	(0.742)	(0.747)	(0.885)	(0.876)
islamist1	−0.448	−0.569	−0.450	−0.284	−0.244
	(0.390)	(0.567)	(0.659)	(0.823)	(0.956)
leftist1	−0.338	−0.272	0.038	0.107	0.479
	(0.381)	(0.511)	(0.595)	(0.685)	(0.756)
nsd1	−0.472	−0.261	−0.156	0.084	0.873
	(0.304)	(0.387)	(0.460)	(0.591)	(0.760)
as1	−0.041				
	(0.028)				
ks1	0.002				
	(0.008)				
as2		−0.025*			
		(0.017)			
ks2		0.003*			
		(0.003)			
as3			−0.010		
			(0.009)		
ks3			0.002		
			(0.001)		
as4				−0.003	
				(0.003)	
ks4				0.001*	
				(0.001)	
as5					−0.002
					(0.003)
ks5					0.0004
					(0.001)
safe	0.212	0.185	0.638	−0.203	0.229
	(0.430)	(0.528)	(0.585)	(0.915)	(0.872)
sponsors	−0.109	0.008	−0.026	0.264	0.245
	(0.128)	(0.152)	(0.162)	(0.211)	(0.225)
ties.x	−0.140*	−0.135	−0.217**	−0.281**	−0.282**
	(0.069)	(0.082)	(0.097)	(0.118)	(0.136)
polity.x	0.019	0.032	0.036	0.012	−0.016
	(0.020)	(0.030)	(0.038)	(0.049)	(0.057)
gdp	−0.007	−0.004	−0.008	−0.018	−0.049*
	(0.009)	(0.012)	(0.015)	(0.020)	(0.030)
uf1	−0.314	−0.077	0.026	−0.739	−0.380
	(0.516)	(0.595)	(0.616)	(0.771)	(0.814)
hegemonic1	−0.376	−0.538	−0.234	0.040	1.550
	(0.356)	(0.448)	(0.521)	(0.706)	(1.031)
dummy1	1.236**	1.166**	1.462*	0.849	0.993
	(0.586)	(0.655)	(0.824)	(0.798)	(1.004)
Note:					*p<0.1; **p<0.05; ***p<0.01

As can be seen in summary statistics, Wald Test gives significant values in each of the regressions except the one with 5 years. When we look at the regression table, for the regressions with 1, 2 and 3 years dummy variables, suicide attack dummy variables reduces the duration of conflict and the coefficients are significant. For 4 and 5 years, it still reduces the duration however the coefficients are not statistically significant. This may be due to the vanishing tendency of suicide attacks over time, or small number observations for 4 and 5 years. It is also important to note that Wald Statistics was not significant for 5 years regression, which makes it harder to rely on that model.

Although these results support my hypothesis, even though suicide attacks can be a good measure of terrorism, these impacts may be restricted to suicide attacks, hence, may not be generalisable for all terrorist attacks.

3.2 Hypothesis 2

Hypothesis 2: Groups conduct mostly terrorist attacks can achieve their outcome goals.
Although I did not test this hyptohesis myself, there's a vast extant literature in line with this view. In a highly-cited paper, using evidence from 11 conflicts, Pape (2003) has shown that suicide attacks are useful to push states to make concessions. All of these 11 examples except one (between Turkey-PKK) ended up in favour of the rebel group, after the use of suicide attacks. In a recent paper, using a monthly data including African Civil Wars between 1989-2010, Thomas (2014) has empirically shown that use of terrorism resulted in more concessions and negotiations between states and rebel groups.

4. CONFLICT DURATION FORECASTING

4.1 Literature

Forecasting has been becoming more popular in social sciences, especially in conflict literature. More and more statistical methods are employed by conflict scholars. Some of the recent conflict forecasting work worth mentioning are the following: Using a 1970-2009 cross-sectional dataset, Hegre et al. (2013) predict conflicts between 2010-2050 using core exogenous predictors as population size, infant mortality rates, demographic composition, education levels, oil dependence, ethnic cleavages, and neighborhood characteristics. Weidmann and Ward (2010) incorporate geolocated data on conflict events in Bosnia between 1992-1995 to predict future conflict, using simulation approach. While Cederman, Gleditsch, and Buhaug (2013) built a forecast model of civil war that relies on relatively static measures of horizontal inequality, using this model, Chiba and Gleditsch (2017) explore whether dynamic information about mobilization and the behavior of actors from event data can increase forecast accuracy.

4.2 Strategy

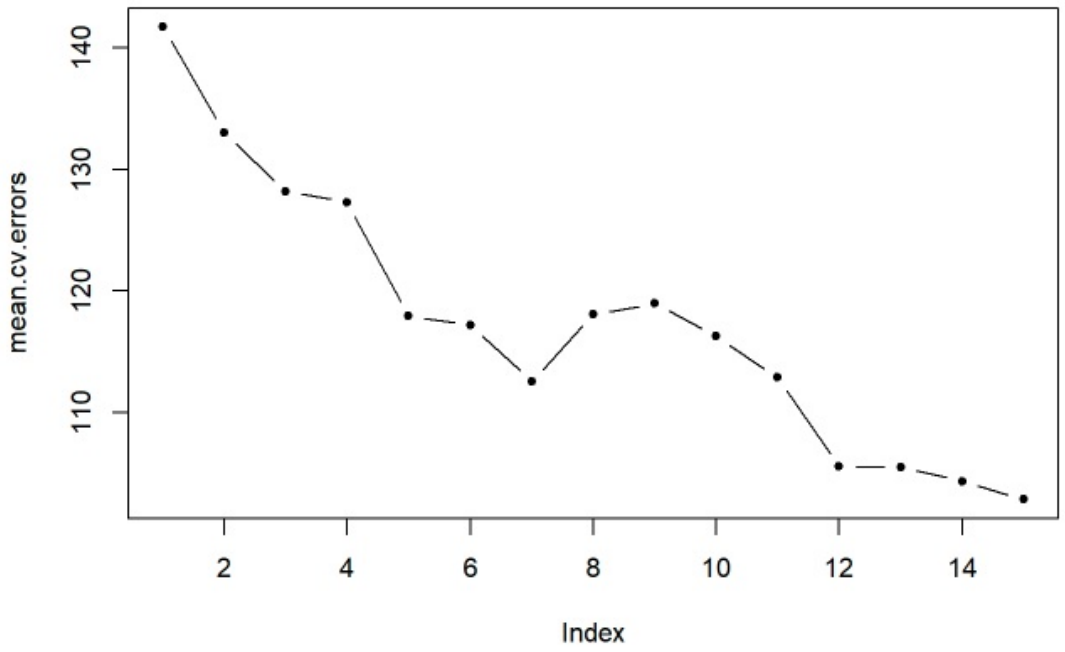
My research question is, can we forecast the lifetime of ongoing conflicts? To answer this question, I replicated the work of Benjamin (2016), which tries to see the impacts suicide attacks have, and concludes that they increase longevity of rebel

groups. In this article, he makes use of the Acosta (2016), which was created by himself. Covering suicide attacks between 1980-2017 SAND lists date of attack, sponsoring organization/s, location and target of attack, and number of innocents killed and wounded. In addition, the database categorizes suicide attacks by target type (combatant, political, and/or civilian), target location (foreign, domestic, or mixed), organization location (foreign, domestic, or mixed), specific conflict and conflict type. By replicating this paper, I was able to use 300+ conflicts, almost half of them had already finished, while the remaining are still ongoing. All variables he included, and so I included, are: whether an organization Conducts suicide attacks, organization age (dependent variable), the organization size variables of 1,000-plus members and 10,000-plus members, the organization ideology variables of political islam and leftist, the nationalist goal variable of self-determination, an organization's number of state sponsors, the number of safe havens an organization has utilized, the number of attacks an organization has carried out, the number of kills an organization has inflicted, the primary enemy development variables of GDP per capita and polity, whether an organization has held hegemonic status over its rivals, and whether an organization is of a unified front, that is, an alliance of all groups seeking a particular outcome goal. To determine the duration of ongoing conflicts, I employed the following strategy: training prediction models on conflicts that already ended, I predicted the lifetime of ongoing conflicts by using these trained models. I used KNN, Lasso, Ridge and Random Forest algorithms. I did not use Logit because my outcome variable is of continuous nature. The reason I did not employ a count model is, they're used for data for certain time periods, however, my outcome variable itself is time.

4.3 Methods

First, I checked for correlation between variables. Only as and ks variables had correlation over 0.75, and since they're categorical variables, I eliminated them only for KNN prediction. As the next step, I divided my sample into two; dead and ongoing conflicts. Next, using regsubsets function and doing cross-validation, I found the best number of predictors to work with for Ridge and Lasso.

Figure 4.1 Mean of CV errors



As shown in the graph, 15 variables give us the minimum mean error, after cross-validation is done.

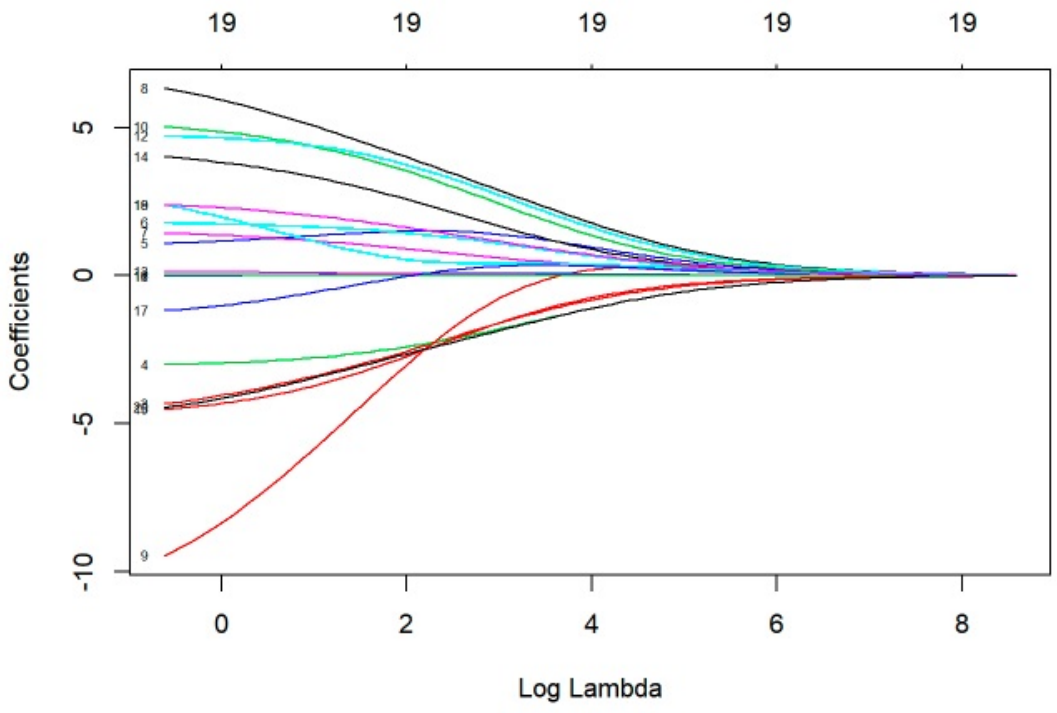
After finding the number of variables, I need to find optimum lambda level for ridge and lasso separately. Lambda is the level of penalty for each coefficient; we want to get rid of the effects of unimportant variables and we do it by penalizing them by lambda.

$$\min_{\beta_0,\beta} \frac{1}{N} \sum_{i=1}^{N} w_i l(y_i, \beta_0 + \beta^T x_i) + \lambda \left[(1-\alpha)||\beta||_2^2/2 + \alpha||\beta||_1 \right]$$

This is the minimization formula. For Ridge, we set alpha as 0 and for Lasso, we set alpha as 1.

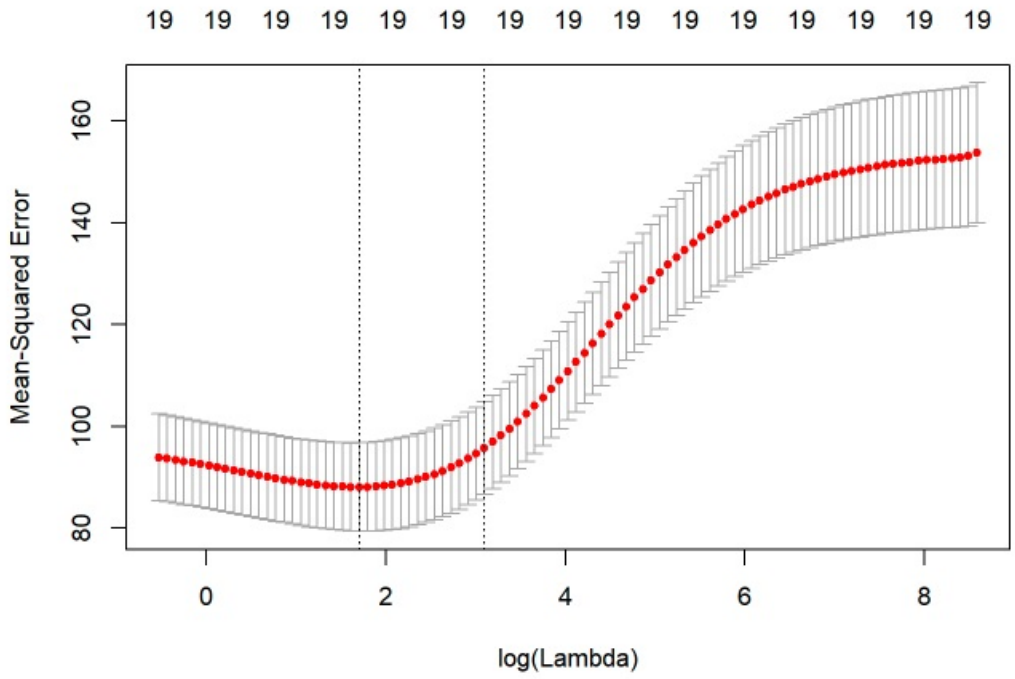
Here is the coefficient penalties for Ridge:

Figure 4.2 Ridge Log Lambda Coefficients



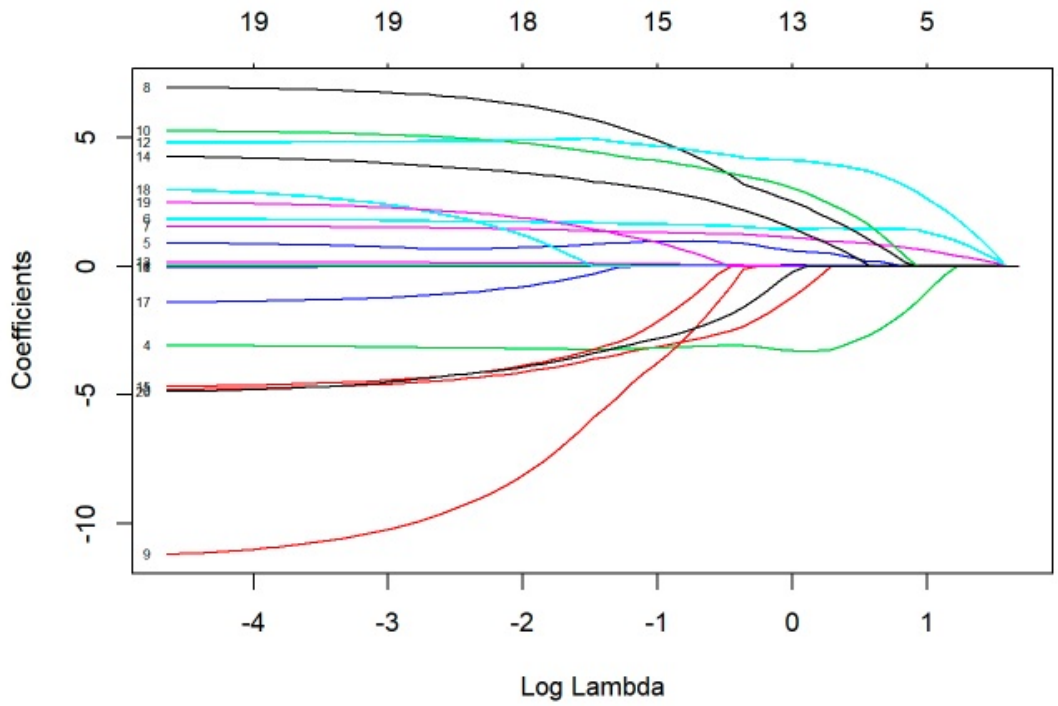
Here is the graph showing the lambda level which gives the minimum error in prediction, which is 5.491599:

Figure 4.3 MSEs for Ridge Log Lambdas



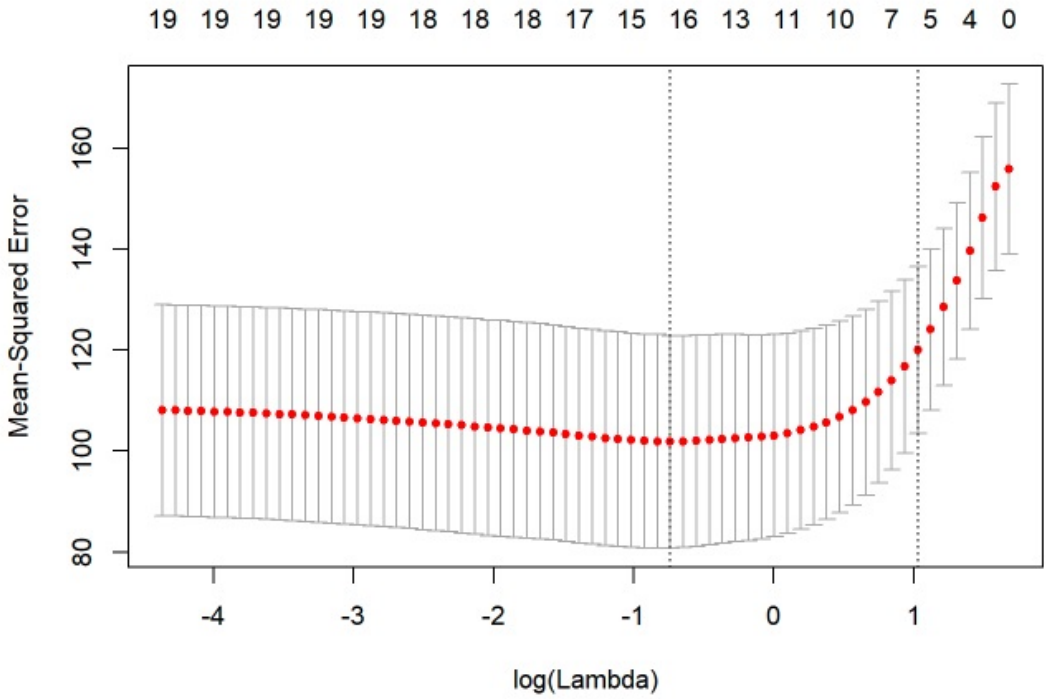
Here is the coefficient penalties for Lasso:

Figure 4.4 Lasso Log Lambda Coefficients



Here is the graph showing the lambda level which gives the minimum error in prediction, which is 0.4776313:

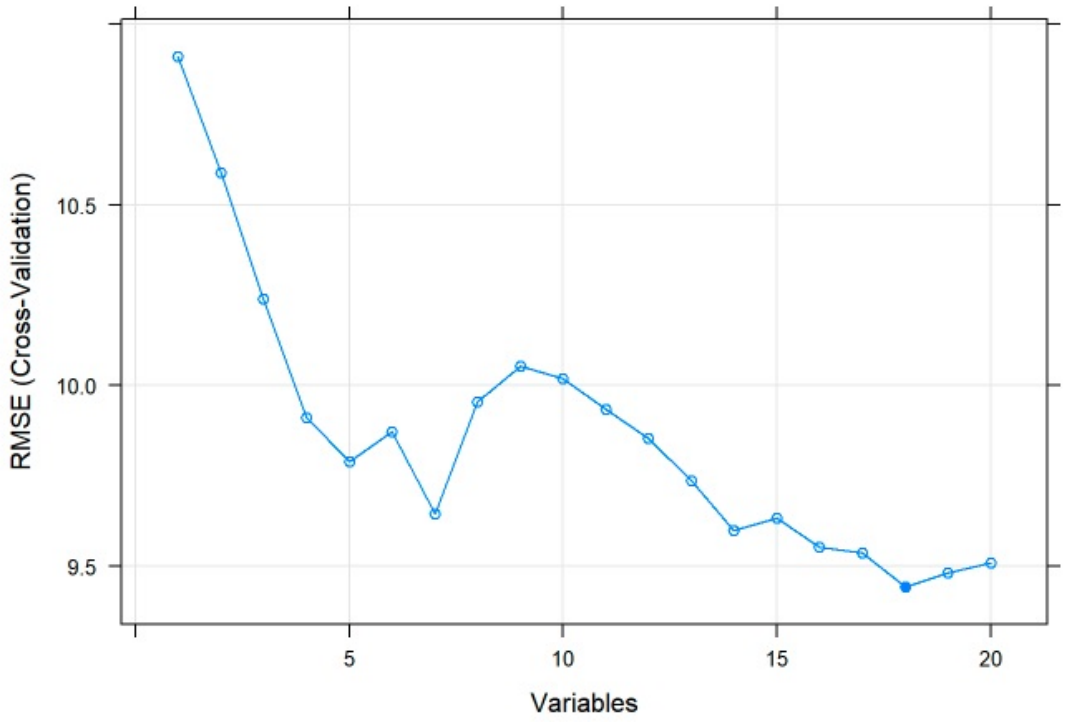
Figure 4.5 MSEs for Lasso Log Lambdas



After I predicted ongoing conflicts using both models with parameters above, prediction MSE's for Ridge and Lasso are 76.28729 and 76.05304 respectively. Since they're very close to each other, I decided to make use of both models.

To do a Random Forest prediction, first I needed to how many and which variables to include in my model. To do so, I did RFE (Recursive Feature Elimination). The graph shows that I should include 18 variables in my model:

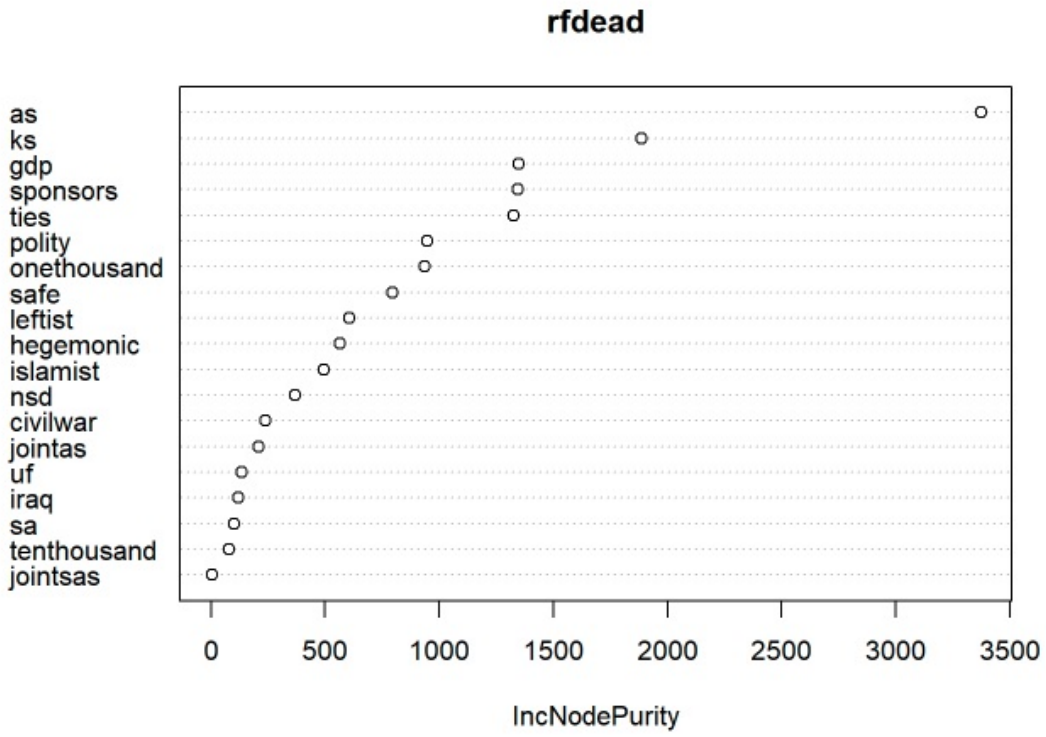
Figure 4.6 MSEs for Variables



These 18 variables are "as" "hegemonic" "ties" "islamist" "sponsors" "polity" "ks" "gdp" "leftist" "sa" "civilwar" "safe" "iraq" "onethousand" "jointas" "nsd" "tenthousand" and "afghan". "as", "hegemonic", "ties", "islamist", "sponsors" are the best 5 predictor.

Here is the graph showing node purity values for each variable:

Figure 4.7 Node purity values



Lastly, I did KNN prediction. Before doing so, stored all variables as numeric, normalized them excluded "ks" variable and did cross-validation to find optimum k, which minimizes the error for 18-variable prediction. Note that I used the variables suggested by RFE. Optimum k turns out to be 8, and I complete all of my predictions.

There are 147 conflicts that I predicted and it is not convenient to list durations of all of them. Instead, I can share summary statistics for each prediction:

Table 4.1 Summary of Predictions

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
knnyear	147	1,994.320	19.993	1,880.009	1,983.278	2,008.250	2,030.000
ridgeyear	147	1,997.985	21.352	1,877.646	1,985.815	2,011.298	2,051.842
lassoyear	147	1,999.004	21.629	1,880.619	1,987.284	2,011.885	2,063.812
rfmbyear	147	1,998.810	19.719	1,883.685	1,988.420	2,012.505	2,028.302

Although each prediction was carried out meticulously, results seem to have failed since majority of the predicted years have already past. One reason might be very small number of observation. To deal with that, future research might incorporate more small-size specific techniques, or make use of AI. Another reason could be the

outliers; for example, Ku Klux Klan was established in 1866 and is still alive. Arguably, its characteristics as an organization, both in terms of use of violence and type of clash especially in modern era, diverges dramatically from other conflicts. Inclusion of organizations as KKK and alike could mess up the prediction, especially when they have been alive for over a century. Not random elimination but a systematic classification of these conflicts could preculde potential prediction biases. Other reason might be simply the lack of variables, inclusion of possible key variables for duration might alleviate the issue.

5. CONCLUSION

Lack of focus on the ethnic/religious grievance in terrorism literature caused me to ask the following research question: How does the existence of ethnic/religious grievance impact rebel strategies, mainly terrorism? To answer this question I decided to make usef of applied game theory. I extended Michael Gibilisco' (2016) manuscript which employs grievance as a separate parameter in a repeated game, without differentiating between forms of war. By simplifying into a 2-stage game, I extended this model by employing terrorism as a different strategy for rebel group, or as used in this paper, Periphery. Doing this extension allowed me to have a two-sided trade-off, whereas the original paper had one by Center's side. Also, inclusion of grievance parameter served a better purpose to reflect terrorism's use in a formal model, especially regarding time related consequences. As a result, my extension was able to produce equilibria in which not only moderately aggrieved groups were able to separate from centers, as it was suggested in the original paper, but also less and much aggrieved peripheries were capable as well, former being able to make use of terrorism to aggrieve their people. My extension has also produced equilibria in which periphery could separate not only during earlier stages, but also later in the conflict. Addition to them, my model produced 2 testable hypotheses: Use of terrorism shortens the duration of conflicts and can make opponents offer concessions/negotiations. While the second one is already parallel to a number of studies, including empirical ones and case studies, I myself tested the first hypothesis. Using Suicide Attack Network Database (SAND) and replicating Acosta's paper, I have shown that suicide attacks indeed shorten the duration of conflicts. Lastly, as a unique attempt in conflict forecasting literature, using the same dataset and making use of machine learning algorithms, I predicted the durations of ongoing conflicts, with the models I trained in conflicts that have already ended.

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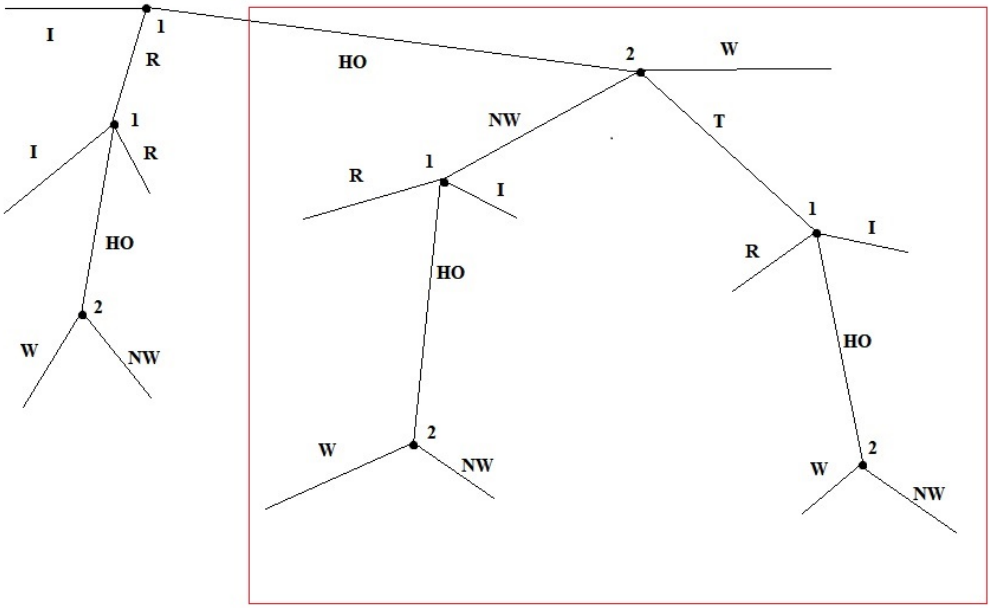
APPENDIX A

Proofs of Equilibria

Before starting to prove each equilibrium, I want to prove impossibility of some strategies in the subgame after Center chooses HO in stage 1. This will help me sketch my proofs more easily. The subgame is drawn below:



In this game tree, 1 stands for Center and 2 stands for Periphery. Under the assumption that both agents play rationally, I will show the outcomes that do not survive. To ensure sequential rationality, I will apply backward induction in all of my proofs.

HNRW is never an equilibrium

Proof: Starting by Periphery's action in Stage 2. HNRW brings Periphery a payoff of $2\pi_p^c - 2T$. Choosing W in Stage 2 means that W brings a better payoff than H for Periphery, which is:
$\pi_p^c + f(g-1)\left(\pi_p^p - k_p\right) + (1 - f(g-1))\left(\pi_p^c - k_p\ \right) > 2\pi_p^c$
Implied by this inequality, choosing W in the first stage should bring Perihery a

payoff of:
$2\Big(f(g)\pi_p^p - (1-f(g))(k_p - \pi_p^c)) > 2\pi_p^c - 2T$
While left hand side increases by the increase in f() function, right hand side decreases by 2T. Hence, Periphery would deviate to W in the first stage.

HNRN is never an equilibrium

Proof: This outcome brings Center a payoff of $2\pi_c^c - k_c$. If Center deviates to HO in the second stage, HNHN brings Center $2\pi_c^c > 2\pi_c^c - k_c$.

HNIN is never an equilibrium

Proof: This outcome brings Center a payoff of $2\pi_c^c$. If Center deviates to HO in the second stage, HNHN brings Center $2\pi_c^c > 2\pi_c^c$.

HNHW is never an equilibrium

Proof: Very similar to first proof. This outcome means Periphery prefers W to N in stage 2. Which is:
$\pi_p^c + f(g-1)\left(\pi_p^p - k_p\right) + (1-f(g-1))\left(\pi_p^c - k_p\ \right) > 2\pi_p^c$
This purifies to:
$f(g-1)\left(\pi_p^p - k_p\right) + (1-f(g-1))\left(\pi_p^c - k_p\ \right) > \pi_p^c$
So the total payoff is certainly smaller than:
$2(f(g-1)\left(\pi_p^p - k_p\right) + (1-f(g-1))\left(\pi_p^c - k_p\right))$
Let's call the total payoff as:
$2(f(g-1)\left(\pi_p^p - k_p\right) + (1-f(g-1))\left(\pi_p^c - k_p\right)) - \epsilon$
A deviation to W in the first stage brings Periphery a payoff of:
$2\Big(f(g)(\pi_p^p - k_p) - (1-f(g))(k_p - \pi_p^c))$
Comparing these two:

$2\Big(f(g)(\pi_p^p - k_p) - (1 - f(g))(k_p - \pi_p^c)) >$
$2(f(g-1)\left(\pi_p^p - k_p\right) + (1 - f(g-1))\left(\pi_p^c - k_p\right)) - \epsilon$
Without needing the ϵ, the former is larger than the latter since f() function is an increasing function and f(g)>f(g-1).

HTRW is never an equilibrium

Proof: This brings Periphery a payoff of:
$2\pi_p^c - 3T$
If Periphery deviates to N in the first stage, as I eliminated the others above, there are 2 possible equilibriums: HNIW, which brings $\pi_p^c + \pi_p^p$ and HNHN, which brings $2\pi_p^c$.
Both are larger than $2\pi_p^c - 3T$, hence, Periphery would deviate to N in the first stage.

HTRN is never an equilibrium

Proof: This brings Center a utility of:
$2\pi_c^c - k_c - T$.
If center deviates to HO in the second stage as well, the resulting strategy HTHN would bring Center:
$2\pi_c^c - T > 2\pi_c^c - k_c - T$

HTIN is never an equilibrium

Proof: This brings Center a payoff of:
$\pi_c^c - T$
If Center deviates to Hands Off in second stage, it gains:

$2\pi_c^c - T > \pi_c^c - T$

The outcomes that are never equilibrium after Center chooses R in the first stage

RNHN is never an equilibrium

Proof: Periphery choosing N in the second stage means that it prefers N over W, which is mathematically:
$2\pi_p^c - 2T > \pi_p^c - 2T + (1 - f(g+1))(\pi_p^p - k_p) + f(g+1)\left(\pi_p^p - k_p\right)$
which purifies to:
$\pi_p^c > (1 - f(g+1))(\pi_p^p - k_p) + f(g+1)\left(\pi_p^p - k_p\right)$
This implies that in case of Center chooses H in the first stage, the Periphery would choose N, which results in HNHN. This gives Center a payoff of:
$2\pi_c^c > 2\left(\pi_c^c - k_c\right)$
Which is larger than what Center gets under RNHN. Hence, Center would deviate to H in the first stage.

RWIW is never an equilibrium

Proof: The payoff Center gets is:
$\pi_c^c - k_c$
If $\pi_c^c - k_c > 0$, Center would deviate from I to R in the second stage since
$2\pi_c^c - k_c > \pi_c^c - k_c$ If $\pi_c^c - k_c < 0$, Center would deviate from R to I in the first stage since
$0 > \pi_c^c - k_c$
The only condition that makes RWIW an equilibrium is $\pi_c^c = k_c$. Since this does not contribute a novelty to our story, I simply make the assumption that this equality

never holds, to simplify solutions.

RNIN is never an equilibrium

Proof: Very similar to RNHN. Periphery choosing N in the second stage means that it prefers N over W, which is mathematically:
$2\pi_p^c - 2T > \pi_p^c - 2T + (1 - f(g+1))(\pi_p^p - k_p) + f(g+1)\left(\pi_p^p - k_p\right)$
which purifies to:
$\pi_p^c > (1 - f(g+1))(\pi_p^p - k_p) + f(g+1)\left(\pi_p^p - k_p\right)$
This implies that in case of Center chooses H in the first stage, the Periphery would choose N, which results in HNHN. This gives Center a payoff of:
$2\pi_c^c > \pi_c^c$
Which is larger than what Center gets under RNHN. Hence, Center would deviate to H in the first stage.

Proofs of each equilibrium

Proof of RWRW

Proof: Doing backward induction, I start by the last node. In order Center to choose Repression in both stages, Periphery should choose W in second stage rather than N, otherwise Center would deviate to H in the second stage. The condition for Periphery to choose W over N is:
$2\pi_p^c - 2T < \pi_p^c - 2T + (1 - f(g+1))(\pi_p^p - k_p) + f(g+1)\left(\pi_p^p - k_p\right)$
In the upper node, Center should find it more enjoyable to Repress rather than Hands-Off. Condition is:
$2\pi_c^c - 2k_c > \pi_c^c - k_c + (1 - f(g+1))\pi_c^c - f(g+1)$
In the upper node, in case of Center chooses Hands Off, $\pi_c^c > k_c$ implies that Center would not choose I in second stage, hence, the only outcome that is left is HNHN,

which Center would certainly deviate to. The condition to eliminate this outcome is when Periphery chooses War in the first stage, which is satisfied by :
$2\Big(f(g)(\pi_p^p - k_p) - (1-f(g))(k_p - \pi_p^c)) > 2\pi_p^c$
and Center should prefer to repress both stages over RWHW, which depends on the condition:
$2\left(\pi_c^c - k_c\right) > 2((1-f(g)\pi_c^c - f(g)\psi)$
Also Center should not deviate to I, which is satisfied by:
$2\left(\pi_c^c - k_c\right) > 0$
Under HT, $\pi_c^c > k_c$ implies Center never prefers HTIW over RWRW. The only equilibrium under HT remains as HTHW. In order Center not to deviate to Hands Off in the first stage, the condition is:
$\pi_c^c - T + F(g+1/2)\cdot(-\psi) + (1-f(g+1/2))\pi_c^c < 2(\pi_c^c - k_c)$

Proof of IWIW

Proof: Since choosing I immediately ends the game in the first stage, I will check deviations to possible equilibriums under when Repression or Hands-Off are chosen in the first stage. In case Center chooses Hands Off in the first stage, in case Periphery chooses either N or T, Center can continue with choosing I in the second stage, which gives him payoffs respectively:
π_c^c,$\pi_c^c - T > 0$ with the help of the assumption that a terror attack could never damage more than the enjoyment Center gets when it controls territory. Since both of them brings a higher utility than 0, Periphery should not choose T or N under HO, which means it should prefer W in the first stage. This is satisfied by:
$2(f(g)\pi_p^p - (1-f(g))\Big(k_p - \pi_p^c\Big)) > \pi_p^c + \pi_p^p$

The condition that makes I more preferable than Hands Off for Center is:
$0 > 2((1-f(g))\left(\pi_c^c\right) - f(g)$
I should be more profitable for C than R in the first stage. 2 possible equilibriums under R are RWRW and RWHW. The conditions are:
$0 > \pi_c^c - k_c$ for RWRW,
$0 > \pi_c^c - k_c + (1-f(g+1))\pi_c^c - f(g+1)\psi$ for RWHW.

Proof of HTHW

Proof: In stage 2, Periphery chooses W over N:
$\pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) > 2\pi_p^c - T$
Under T, Center should not deviate to I, which is another possible equilibrium. To ensure this:
$\pi_c^c - T + f(g+1/2)\cdot(-\psi) + (1 - f(g+1/2))\,(\pi_c^c) > \pi_c^c - T$ should hold. This condition also implies that, in case of Periphery chooses N under H, Center does not choose I after N. So the only possible equilibrium left under HN is HNHN. Hence, choosing T should be preferable to N and W in first stage, for Periphery. Conditions for that are as follows:

$\pi_p^c - T + f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2))(\pi_p^c - k_p) >$
$2((F(g)\pi_p^p - (1 - f(g)).(k_p - \pi_\rho^c)$

$\pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) > 2\pi_p^c$

First equilibrium implies that Under RH, Periphery would prefer W over N. Hence, I should characterize the conditions under which Center chooses H over R and I in the first stage:
$\pi_c^c - T + f(g+1/2)\cdot(-\psi) + (1 - f(g+1/2))\,(\pi_c^c) >$
$\pi_c^c - k_c + f(g+1)\cdot(-\psi) + (1 - f(g+1))\,(\pi_c^c)$ (over RWHW)

$\pi_c^c - T + f(g+1/2)\cdot(-\psi) + (1 - f(g+1/2))\,(\pi_c^c) > 2(\pi_c^c - k_c)$ (over RWRW)

$\pi_c^c - T + f(g+1/2)\cdot(-\psi) + (1 - f(g+1/2))\,(\pi_c^c) > 0$ (over IWIW)

Proof of HTIW

Proof: Starting from the last node. Since HTHN obviously and undeniably brings a higher utility to Center, in order for him not to deviate to H in second stage, HTHW should be more preferable than HTHN for Periphery. This is satisfied by:

$$\pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) > 2\pi_p^c \text{ - T}$$

HTHW should be less desirable for Center than HTIW, which is satisfied by:

$$\pi_c^c - T + f(g+1/2)\cdot(-\psi) + (1 - f(g+1/2))\,(\pi_c^c) < \pi_c^c - T$$

Now I should show Periphery does not deviate to N or W in the first stage. Under N, 2 possible equilibriums are HNIW and HNHN which bring Center higher utility than HTIW. It is important to note that HNIW also brings Periphery higher utility. Possibility of HTIW being an equilibrium strictly depends on the following conditions:
Under HNH, Periphery chooses HNHW over HNHN
Under HN, Center prefers HNHW over HNI
Periphery finds HTIW more desirable than HNHW.
The following equations represent these preferences:

$$\pi_p^c + f(g-1)(\pi_p^p - k_p) + (1 - f(g-1))\left(\pi_p^c - k_p\right) > 2\pi_p^c$$

$$\pi_c^c + f(g-1)\cdot(-\psi) + (1 - f(g-1))\,(\pi_c^c) > \pi_c^c$$

$$\pi_p^c + f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) - T >$$
$$\pi_p^c + f(g-1)(\pi_p^p - k_p) + (1 - f(g-1))\left(\pi_p^c - k_p\right)$$

Now we can get back to first stage. For Periphery, HTIW should be more desirable than other possible equilibrium, which is HWHW. To ensure this:

$$\pi_p^c + f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) - T >$$
$2(f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right))$ should hold.

For Center not to deviate to I or R in the first stage, HTIW should bring more utility than IWIW, RWRW and RWHW, which are the other possible equilibria. The conditions are:

$$\pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) > 0$$

$$\pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) > 2(\pi_c^c - k_c)$$

$$\pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) >$$
$$\pi_p^c + f(g+1)\left(\pi_p^p - k_p\right) + (1 - f(g+1))\left(\pi_p^c - k_p\right)$$

Proof of HNHN

Proof: Note that this is the outcome that Center finds most profitable in entire game. Hence, I just need to ensure that HNHN is more desirable for Periphery in every sequence as well. Starting by the last node, under HNH, N should be more preferable to Periphery than W:
$\pi_p^c + f(g-1)(\pi_p^p - k_p) + (1 - f(g-1))\left(\pi_p^c - k_p\right) < 2\pi_p^c$
Among N, T and W, in the first stage, Periphery should find HNHN more enjoyable than the other possible equilibria under HT (HTIW and HTHW) and HW. Conditions satisfying them, respectively:

$$2\pi_p^c > \pi_p^c + f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right) - T$$

$$2\pi_p^c > \pi_p^c - T + f(g+1/2)\left(\pi_p^p - k_p\right) + (1 - f(g+1/2))\left(\pi_p^c - k_p\right)$$

$$2\pi_p^c > 2(f(g)\pi_p^p - (1 - f(g))\left(k_p - \pi_p^c\right))$$

Proof of HW

Proof: Starting from the last node, I need to show choosing W in the first stage is more desirable for Periphery than choosing T and N. Hence, it should bring more utility than the possible equilibria under HT (HTIN and HTHW) and HN (HNHN and HNIW). Note that HTHW brings more utility than HNHW and HNIW brings more utility than HTIW, hence, only 2 inequalities are enough to prove our premise:

$$2(f(g)\pi_p^p - (1 - f(g))(k_p - \pi_p^c)) >$$
$$\pi_p^c - T + f(g+1/2)(\pi_p^p - k_p) + (1 - f(g+1/2))(\pi_p^c - k_p)$$

$$2(f(g)\pi_p^p - (1-f(g))\Big(k_p - \pi_p^c\Big)) > \pi_p^p + \pi_p^c$$

Now, I should show that choosing H (and ending up at HW) brings more utility than R (RWRW and RWHW) and IWIW. The following equations characterize my final equilibrium, respectively:

$$2(\pi_c^c - k_c) < 2((1-f(g))\,(\pi_c^c) - f(g)$$

$$\pi_c^c + (1-f(g+1))\,(\pi_c^c) - f(g+1)\psi < 2((1-f(g))\,(\pi_c^c) - f(g)$$

$$0 < 2((1-f(g))\,(\pi_c^c) - f(g)$$