

On Terrorist Strategy in Domestic Conflicts

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By

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Abstract:

This thesis contains three papers on the economic study of domestic terrorism. Domestic terrorism is the most prevalent form of terrorism, yet, when compared to transnational terrorism, is understudied in the literature. This thesis makes two game theoretic and one econometric contribution to this literature. Chapter 3 presents a model of how a revolutionary terrorist interacts with both governments and members of society. This model shows that societies adverse to violence can incentivise reductions in terrorism but can also induce escalations of violence and lax government responses. Chapter 4 contributes to the signalling literature, by painting a revolutionary terrorist that has both political and militant wings. The leadership of this organisation favours one wing over the other and attempts to signal this preference to its rivals. This model shows that terrorist organisations are more likely to signal their true type to adversaries who have access to similar levels of resources. Finally, Chapter 5 uses duration modelling to test the interaction of rival terrorist organisations operating during The Troubles in Northern Ireland in the late-20th century, showing that both the main Republican and Loyalist players deviated from their local and temporal strategies to interact with each other.

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Chapter 1: Introduction

The literature in the field of the economics of terrorism has a long and impressive history that stretches as far back as the seminal work presented in Schelling's "The Strategy of Conflict" in 1960, with other early theoretical contributions sketched as an adaptation of Becker's (1968) "Crime and Punishment" theory. Landes (1978) builds on this theoretical framework and introduces a statistical analysis of US skyjackings, for example. Despite the length of this history, however, even the quickest glance at the literature reveals that a disproportionately large majority of this work has been carried out in the last ten years.

In a comprehensive review of the literature by Schneider, Brück and Meierrieks (2010), for example, only 10% of in excess of 250 cited papers were written before 2000. Whilst impossible to suggest this review is a perfect barometer of the distribution of the literature, it is revealing to see that such a significant proportion of the cited literature is comparatively recent.

This is not to say that valuable contributions were not made before the millennium. Sandler, Tschirhart and Cauley (1983) present a rational actor model of the negotiation process between the government and terrorists in hostage situations for example. Other important contributions include; Atkinson, Sandler and Tschirhart (1987), Rappoport (1992) and Hoffman (1998) but the degree and scope of the literature has changed significantly in recent years. The literature has matured from early attempts to rationalise terrorist action to a wide array of related topics.

To the casual observer, this recent and rapid expansion of the literature may not be surprising. In recent years a spate of large-scale attacks has occurred that have, no doubt, heightened the awareness of terrorism and raised the profile of such events in the media. Whilst the attacks in New York, Pennsylvania and Washington D.C. on September 11, 2001 tend to provide an accepted reference point in the literature, such attacks can better be traced back to the attacks against American embassies in Nairobi, Kenya and Dar es Salaam, Tanzania, which killed 223 people in 1998.

Within ten years of these attacks, transnational organisations were responsible for

further high-profile, high-casualty incidents in Bali (2002), Madrid (2004) and London (2007) in addition to the 9/11 attacks. This is not to mention a number of extensively reported but largely failed attacks, including further attacks on London and Glasgow in 2007 and attempted attacks on aircraft with bombs hidden in shoes (Richard Reid, 2001) and underpants (Umar Abdulmutallab, 2009).

Indeed, even as I write these overtures, a number of conflicts and terrorist threats are regular features in the international news sections of many popular press publications. Boko Haram has perpetrated a number of domestic terrorist attacks in Nigeria in recent months, whilst concern continues to grow over the operation of al-Shabaab in Somalia. When coupled with the insurgencies and conflicts in Afghanistan and Iraq, the return of low-intensity conflict in Northern Ireland, the 2011 attacks in Norway and 2012 attacks in France, a casual observer could be forgiven for believing that terrorism, or action rationalised as such, has never posed such an extreme threat.

Despite this media coverage, a quick search of data stored on the Global Terrorism Database (GTD), START (2011) reveals that significantly more terrorist incidents occurred between 1980 & 1989 and 1990 & 1999 than have occurred since 2000. Whilst some of this increased profile can be explained by the increased risk of injury and fatality from terrorist incidents – another quick search of the GTD shows a notably higher proportion of attacks result in injury or death in recent times – the attention terrorism currently receives and the fears and costs associated with it are not matched by the intensity of violence. Whilst some have suggested this is a result of the changing nature of the threat, even the concept of a terrorist organisation based in one country perpetrating attacks in another is not a new phenomenon. The 1972 'Munich Massacre' and the 1988 bombing of Pan Am flight 103 are notable pre-9/11 examples.

This, of course, is to ignore the singular, psychological, effect of the 9/11 attacks. In terms of sheer scale and the technology of attack, this incident is unprecedented. The death toll from these attacks was greater than the sum of deaths from all transnational attacks in the previous decade (Sandler, 2003), for example. The use of civilian airliners and the iconic images of the Twin Towers themselves, no doubt further raised the profile of transnational terrorism and individuals' perceptions of the risk that it poses.

This significantly increased profile is the context in which the literature base has expanded extensively. In recent years, work has focused on a wide array of topics including; the long- and short-term effects of terrorism on macro- and micro-level economic indicators; impacts on tourism, investment, education and employment; target selection and response to government counter-terror measures; the impact of terrorists' funding; effects on the structure of the economy and the impact on stock and bond markets.

Schneider, Brück and Meierrieks (2010) split the literature into four main areas; causes of terrorism, economic effects of terrorism, economic effects of counter-terrorism policies and the interaction of actors of security and insecurity. For the research presented in this thesis, the last area is the most immediately relevant as it deals with, amongst other things, the strategic interaction between terrorists' decision-making and the counter-terrorism policies of governments.

Despite not, initially, seemingly like an economic problem, many of the questions associated with terrorism can be discussed in simple economic terms. Like many studies in economics, it begins with the assumption that terrorists are rational actors. Whilst this thought may not sit comfortably with those who view terrorists as amoral, murderous monsters, it provides a solid base from which to build a theory on the causes of terrorism and the activities of terrorists. In this respect, the study of terrorism begins much like the study of any other field in economics. Terrorists have some goal they wish to achieve and choose activities they believe will bring about attainment of this goal.

What do terrorists wish to achieve? I begin with the assumption that they have some kind of political goal – regime change, secession or repatriation, for example. In this, however, I defer to the definition provided by Enders and Sandler (2006): “*Terrorism is the premeditated use or threat to use violence by individuals or subnational groups in order to gain a political or social objective through intimidation of a large audience beyond that of the immediate victims.*” This definition enables a differentiation of terrorism from more general forms of crime. Throughout the work presented in this thesis, the potential to use violence as a tool to attain political goals is of paramount importance to the analysis.

By carrying out attacks, terrorists hope to generate 'utility' by making the attainment of these political goals more likely. Incidents may, for example, weaken the resolve of an incumbent government and result in political concessions. Terrorists are also subjected to direct and opportunity costs, however. In order to carry out an attack, resources must be spent on weapons, for example. This can result in, say, foregone non-terrorist consumption, whilst terrorists themselves may have to forego non-terrorism related income streams, due to training times and so on.

Using basic economic intuition, it can then be stated that terrorists will 'produce' terrorism up to the point where the marginal cost and marginal benefit of engaging in these violent acts are the same. Thus, should something happen to materially change the costs, opportunity costs or returns from engagement in terrorism, it would be expected that optimal devotion of resources to terrorism would change accordingly. Should a government increase counter-terrorism, for example, the costs of engaging in terrorism may increase, which should result in a reduction in terrorism. A sharp increase in the availability of weapons, on the other hand, should have the effect of reducing the costs of terrorism and should induce an upsurge in violence.

Taking this as the 'original' frame of reference, it is possible to see adaptations of this simple logic, even in recent literature; Berman and Laitin (2005) use a club-goods model to discuss group outcomes, in the context of suicide attacks, for example. Arce and Sandler (2007) use a signalling model to overcome implicit information asymmetry under a terrorist threat. Whilst these developments provide a much more accurate portrayal of the nature of terrorism than the simple model shown above, this "Crime and Punishment" based modelling still has important implications for the work in this thesis and in the literature, more broadly.

Adverse economic conditions, for example, may decrease opportunity costs of potential terrorists due to reduced non-terrorist employment or income. Despite this suggestion, however, some countries in the world are exceptionally poor and have not suffered a terrorist threat, whilst Northern Ireland and Spain are comparatively wealthy and have suffered endemic terrorism throughout the latter half of the 20th Century. "Relative Deprivation" aims to explain this phenomenon; it is not the existence of poverty, per se, that can cause terrorism but when one section of society is, or at least perceives itself, to be unfairly worse off than another. These feelings can relate to feelings of economic,

political or social marginalisation, all of which are of paramount importance for this work.

This notion stretches back to the work of Gurr (1970) but empirical findings have been mixed and heavily debated; Kruger and Maleckova (2003) dispute the findings, showing that individuals who engaged in terrorism in the Israeli-Palestinian conflict were more likely to come from higher income backgrounds. Bueno de Mesquita (2005) corroborates this finding but points to the selection of well-educated individuals to carry out attacks. Burgoon (2006), however, shows that strong social welfare programmes significantly reduce terrorism, via a reduction of inequality. In the specific context of Northern Ireland, Thompson (1989) and White (1993) show no significant relationship between unemployment and terrorism yet Honaker (2010) shows a significant relationship with the expected signs, by decomposing unemployment and violence by religion.

In opposition to the suggestion that the economic situation of a country can facilitate terrorism, recent work has shown that political variables tend to be more important. Abadie (2006) shows that when political variables are accounted for, economic variables tend to become a less significant driver of terrorism. Krueger and Laitin (2008) and Feldman and Perälä (2004) also support this claim. As such, whilst the simple model provides a naïve basis for the economic study of terrorism, it is already immediately obvious that the empirical literature shows a much more complex picture that suggests a requirement for further development of these models. The three substantive chapters of this thesis aim to answer some of these outstanding questions. Firstly, the analyses presented here differentiates between terrorist typologies and secondly, it introduces the potential for new strategic choice and interactions that have, hitherto, not been considered in the literature. Such differentiations are further considered in the next section.

Chapter 2: Domestic Terrorism

In this chapter, I aim to discuss differences in types of terrorism. The research presented in Chapters 3, 4 and 5 focuses, specifically on a kind of terrorism I refer to as 'domestic terrorism'. I fully define domestic terrorism later in this chapter but it can be broadly considered as terrorism carried out in order to affect material change to policies or regimes within a country or some sub-region of that country. Throughout this chapter, I aim to discuss the application, or lack of, of economic methods to the understanding of domestic terrorism.

I begin this section with a brief overview of domestic terrorism, including some background statistics about the prevalence of domestic terrorism and its relative anonymity in the literature and then provide a formal definition of the phenomenon. Following this, I describe the features that I believe uniquely define domestic terrorism from other forms of terrorist threat and discuss the current shortcomings of the background literature in respect to accounting for these features. In this section, I also compare different kinds of domestic terrorist threats; nominally, 'unitary', 'binary' and 'triangular' threats, all of which I define later in this chapter.

I then intuitively augment the simple economic model discussed in Chapter 1 to account for some of the unique features of domestic terrorism and conclude with an overview of the relevant literature, including a brief discussion on its potential application to domestic terrorism. I close this chapter with three sub-sections that provide a brief overview of each of the substantive chapters of this thesis.

Domestic terrorism affects, or has affected, a significant number of countries at different stages of development throughout the world and is responsible for a large majority of terrorist attacks (Enders and Sandler, 2008). Despite this, when compared with transnational terrorism, it has been relatively understudied in a literature that stretches back for in excess of half a century. As such, the study of domestic terrorist threats, due to their notable structural differences from transnational terrorism, provides a rich theoretical and empirical background that, hitherto, has not been fully studied or exploited.

Domestic terrorism, typically, arises when an organisation has some strategic goal to

materially affect the economic, political or social status quo of a country, or some sub-region of a country. Euskadi Ta Askatasuna (ETA), for example, holds a long-term strategic aim of an independent Basque state, whilst Fuerzas Armadas Revolucionarias de Colombia (FARC) aims for the implementation of a Marxist-Leninist state in Colombia.

A particularly pertinent and common feature of such terrorist activity is that such organisations are, or at least perceive themselves to be, marginalised from normal democratic or political processes. UMKHONTO WE SIZWE came to prominence as a military representative organisation of Black South Africans who faced political exclusion due to Apartheid. A first-past-the-post and an, effectively, two-party electoral system had the result of excluding the large Catholic minority, nominally represented by the Provisional Irish Republican Army (PIRA), from the Executive of the 1921 – 1972 Parliament of Northern Ireland from the 1930s onwards. In both of these cases, decades of, largely peaceful opposition to the status quo eventually led to eruptions of terrorist violence.

In these situations, the use of violence is, therefore, more likely to be politically, rather than ideologically, motivated. Perhaps, a stronger statement would suggest that violence and political engagement are effectively tactical substitutes, or even tactical compliments, in many domestic terrorist conflicts. The choice of strategic action is therefore, based more in terms of expected political returns from action, rather than on a violent or peaceful ideology. Terrorism, therefore, is used as a means to achieve political objectives, or as a method to generate political recognition of a cause, especially when traditional political methods are deemed to be unavailable or to have failed.

The motivations and reasons for action, therefore, exhibit differences from those typically found in the literature of transnational terrorism. As such, many of the findings and policy recommendations of this literature may not be directly relevant to domestic threats. The common finding, for example, that a unilateral increase in counter-terrorism in one country can deflect terrorism to another doesn't seem directly applicable to domestic terrorism. Instead, given that the nature of terrorism is political, rather than ideological, the effect of changes in government strategies could change the incentives of a terrorist organisation to engage in peace-making, for example.

This suggestion, that terrorist organisations could devote resources to peace-making, represents a significant departure from a vast majority of the literature, yet should be seen as an intrinsic part of the process under domestic terrorist threats. Each of the four terrorist organisations mentioned above are, or were, linked with a nominally democratic political wing; ETA with Batasuna, FARC with Unión Patriótica, the PIRA with Sinn Féin and uMkhonto we Sizwe with the African National Congress (ANC).

Against the backdrop of increased media attention and perceptions of risk from transnational terrorism, it perhaps isn't too surprising that the literature predominantly looks at transnational terrorism. Despite this domination, nonetheless, both Rosendorff and Sandler (2005) and Enders and Sandler (2008) show that domestic terrorism is responsible for significantly more terrorist incidents than transnational terrorism. The latter present data showing that domestic terrorism is almost eight times more likely to occur than transnational terrorism.

Despite being responsible for almost 90% of terrorist incidents, a cursory glance at the large literature reviews of Sandler and Siqueira (2009) and Schneider, Bruck and Meierrieks (2010) reveals a significant limitation in research that looks directly at domestic terrorism. Of in excess of 250 citations in Schneider, Brück and Meierrieks, only ten pertain to domestic conflict, for example. Of these ten papers, only three deal with the strategies employed by terrorists in domestic conflict, such as their interactions with government. Rosendorff and Sandler (2005) suggest that this outcome has occurred under the assumption that governments are 'self-reliant' in dealing with domestic terrorists. This assumption implies that because government counter-terrorism under a domestic threat does not deflect attacks to other countries, for example, it does not merit direct modelling or analysis.

This thesis challenges this view and suggests that, hitherto, the chance to understand and use the very rich modelling background inherent in domestic terrorists has been spurned. Thus, the work presented here aims to rectify a large oversight in the literature by providing contributions on three important questions that relate, directly and uniquely, to the structure of domestic conflicts. Firstly, by which mechanisms do violent terrorists begin on the long road towards peace; secondly, on how rival organisations strategically interact with each other and, finally, by offering an empirical analysis of violent domestic conflict.

Further suggestions as to the predominance of transnational terrorism in the literature relate to media profile and data unavailability. The commonly used International Terrorism: Attributes of Terrorist Events (ITERATE) database, Mickolus *et al* (2008), for example, includes only data on transnational terrorism and whilst the GTD, START (2011) provides data on domestic incidents, it has only been available since 2006. Despite this, however, country-specific data has been available for a significantly longer period of time; “An Index of Deaths from the Conflict in Ireland”, Sutton (1994), which is used in Chapter 5, has been available for almost two decades, for example.

“The Troubles” was largely a domestic conflict with goals that directly related to the status of Northern Ireland. The Sutton database shows that approximately 95% of the deaths directly related to the conflict occurred in Northern Ireland. Despite this, the Provisional Irish Republican Army (PIRA) perpetrated attacks in Belgium, England, (West) Germany and the Netherlands. Similarly, Loyalist terrorist organisations perpetrated attacks in the Republic of Ireland.

Under some assumptions, this could be regarded as transnational terrorism; indeed, ITERATE (Mickolus *et al*, 2008), codes them as such. Despite claiming responsibility for deaths in other sovereign states, however, the PIRA exclusively attacked British targets. These do not appear to be the strategic actions of an organisation seeking to escalate a conflict beyond its domestic strategic aims. It would, therefore, be a mistake to regard The Troubles as a transnational conflict. Although the differentiation may be obvious in the case of Northern Ireland, it is less clear cut when, for example, The Taliban attack American soldiers based in Afghanistan.

Despite such potential grey areas, formally identifying what constitutes domestic terrorism is important for the work presented in this thesis. Therefore, I draw what may seem like a subtle differentiation between what defines 'domestic' from 'transnational' terrorists. Rather than being based on whether an organisation attacks inside or outside its country of origin, it is based on that organisation's strategic aims. In other words, what defines a domestic terrorist is the goals of that organisation, not the locations of its attacks.

On this basis, the likes of the PIRA, ETA and FARC are regarded as 'domestic' terrorists, despite perpetrating attacks outside of their country of origin. The Taliban,

whilst attacking 'foreign' targets, is also regarded as domestic, therefore, as their principle aim is based on seizing local political control. Similarly, however, the British-born extremists who attacked the London Underground in 2005 are regarded as transnational terrorists, despite carrying out attacks in their country of origin.

More formally, I define a domestic terrorist organisation as: *An organisation willing to engage in acts of terrorism in order to affect material change to economic or political policy or regime within its country, or region, of origin.* By taking this definition, it is easy to see that in recent years, sub-national paramilitaries operating in domestic conflicts have been a common feature of the political landscape. Whether regarded as insurgents (Afghanistan, Iraq) or terrorists (Colombia, Nigeria, Northern Ireland, Spain), it is a pattern of conflict that occurs regularly and results in high casualties and a high frequency of incidents.

It would not be a stretch to state that there is a significant paucity of evidence on the causes and consequences of domestic terrorism, with empirical work particularly rare. Burgoon (2006) and Krieger and Meierrieks (2009) both show that strong social welfare infrastructure significantly reduces domestic terrorism, fitting with opportunity cost based modelling. Bloomberg and Hess (2008b) also show that higher domestic output significantly reduces the prevalence of terrorism. Sambanis (2008) does not significantly find this link, however. To this author's knowledge, there is currently no work that would allow inference of the effects of non-economic variables.

In this mismatch of the threat of domestic terrorism to its coverage in the literature and its perception amongst wider society, I find my motivations for this thesis. Whilst there may be some credence to a suggestion that, 'terrorism is terrorism is terrorism,' domestic terrorist conflicts tend to exhibit features that define them from transnational threats, specifically from a research perspective.

They tend to display high-frequency, low-intensity violence, which is divergent to the infrequent 'spectacular' attacks of transnational organisations, for example. The largest single attack during The Troubles in Northern Ireland, for example, occurred in Omagh in 1998 and led to the deaths of 29 individuals, whilst the largest single attack due to ETA killed 21 in Barcelona in 1987. To put this in context, the Northern Ireland conflict itself resulted in in excess of 3,500 deaths and was built against a background of some

2,000 fatal incidents and many thousands more incidents that resulted in injury and or destruction. Similarly, Basque separatists are responsible for almost 850 deaths and countless other violent incidents. Technology of attack also tends to be low in domestic conflicts, relying on homemade explosives and small arms, which helps to explain the low intensity, high frequency of violence. Another outcome of such low technologies is that the scale of fatalities and injuries cannot often be accurately predicted.

Whilst the above examples may provide stark empirical and methodological concerns, one must also be careful in attempting to draw policy inference for domestic terrorism from the wider literature. Perhaps the single largest defining feature of domestic terrorism is that it facilitates a situation in which terrorist organisations can have both political and military wings. ETA had strong ties to Batasuna; FARC to Unión Patriótica and the African National Congress to uMkhonto we Sizwe. In Northern Ireland, the PIRA had strong ties to Sinn Fein but these ties also existed between Loyalist paramilitaries and political parties; the most obvious example being the Progressive Unionist Party (PUP) and the Ulster Volunteer Force (UVF).

The failure of the literature, hitherto, to account for the potential arising of this situation is, perhaps, the single biggest weakness of the wider terrorism literature. By ignoring the potential for a terrorist organisation to devote some proportion of its resources to a political wing, the literature essentially removes a strategic choice that is fundamental to domestic terrorists.

Various theoretical works have discussed the impact of government counter-terrorism policy on terrorist strategy, for example but this work has rarely, if ever, accounted for peace-making as a strategic choice. When peace-making is included as a strategic choice, government action can lead to substitution of resources and new strategic mixes from terrorist organisations, rather than changes in devotion of resources to behaviour designed to achieve strategic aims.

Thus, in comparison to the traditional modelling set up where terrorists face a choice between actions aimed at achieving their goals (violence) and some non-goal based consumption, this work allows terrorists to choose between two behaviours designed to bring about their aims. It is my belief that this innovation is both more realistic as a modelling technique and as a rational framework for the study of domestic conflict –

not least because it reflects both of the potential avenues through which terrorists can attempt to achieve their goals. Rather than spending money on terrorism or consuming some other good that is unrelated to the attainment of strategic goals, terrorists devote all of their resources to achieving their political goals.

Further defining features of domestic conflict are; firstly, that paramilitary organisations have a legitimate claim of representing society, or some portion of the society in which they operate. Loyalists and Republicans in Northern Ireland claimed to represent the Protestant and Catholic communities, respectively, whilst ETA claims to represent the Basque peoples, FARC the rural poor in Colombia, uMkhonto we Sizwe black South Africans and so on... Secondly, domestic conflicts have a tendency towards peaceful outcomes in the long-term, with the political wings of paramilitary organisations playing active and important roles in democratic parliaments. It is accepted that recent work has shown that transnational organisations also tend towards non-violence in the long-run (Blomberg, Engel and Sawyer, 2010), but this work suggests that these organisations tend to disappear entirely, rather than to evolve into democratic political actors.

Whilst ETA calling an end to its armed struggle within the last six months is a very recent example of the potential to transition from violence to peace, uMkhonto we Sizwe laid down arms in 1990, leading to Nelson Mandela's election as president of South Africa in 1994. The PIRA called a ceasefire in 1994, leading to the 1998 Belfast (Good Friday) Agreement. While transnational terrorist organisations also have a tendency to decrease their violence in the long-term, the feature of paramilitaries actively engaging in democratic politics seems unique to domestic terrorism.

As such, two primary concerns are already raised as to the application of transnational research, or what I denote as 'catch-all' terrorism research, which follows the 'terrorism is terrorism is terrorism' dictum. The first is that suitable policies for dealing with domestic terrorism have yet to be actively considered in the literature. This is particularly relevant in the case of interactions between governments and terrorists as governments' actions can deter or encourage peaceful engagement by the terrorist organisation's political wing; this is a phenomenon not explicitly touched on in the wider literature.

Secondly, there is significant suggestion that the theoretical and empirical frameworks used in the economics of terrorism literature may not be well-suited to the study of domestic conflict. Due to the low-intensity, long-duration of domestic conflicts, data variation issues are likely to be prevalent, suggesting that typical time-series and panel formations may be unsuitable. This is especially pertinent when dealing with the emergence of rival terrorist organisations and the potential for rapid-retaliation tit-for-tat violence. Similarly, the roles of voters and of domestic terrorists ability to devote resources to their political wings is typically ignored in the theoretical literature, yet provides important contexts for the strategic interactions in domestic conflicts.

Whilst the differentiations may seem subtle, they provide extremely important information, both in determining appropriate policies to deal with domestic terrorists and in the discussion of likely perpetrators of particular incidents. Typically, much can be deduced about the nature of an attack from the technologies used, for example. Despite this potential for reasonable deduction, there have been cases of high profile individuals 'calling it wrong'.

In 2004, for example, ten bombs exploded on commuter trains in Madrid and resulted in a death toll of 191 individuals. In the immediate aftermath, all of the major political players in Spain laid the blame at the feet of ETA. The combined death toll of all ETA attacks in almost 50 years of armed struggle amounts to approximately 850 deaths, with the single largest attack killing 21 individuals. It seems incredible that an organisation engaged in a low-level war of attrition with the Spanish and French governments could pull off an attack of this scale.

Of greatest note in this episode, perhaps, was the response of the then Spanish Prime Minister, José María Aznar, who maintained ETA's guilt even when evidence that it had been the work of Islamic extremists became available. Aznar's response to the Madrid bombings is frequently cited as an important factor in his surprise election defeat later that same week, as were the attacks themselves.

The 2011 attacks in Oslo and Utøya in Norway also provided a stark illustration of public misconception. Whilst resulting in a comparatively high death toll, the attacks involved low technologies of attack and bore hallmarks of domestic terrorism. Many politicians and commentators immediately concluded that the attacks were the work of

transnational terrorists, however. Speculation surrounded a reproduction of supposedly offensive cartoons of the Prophet Mohammad as a motive. In the aftermath, some discussion was given to how the misperception of the initial attack in Norway facilitated the more deadly attacks at an Arbeiderpartiet (Labour Party) youth camp, due to the delay in the deployment of police and army forces, who had suspected a further attack in Oslo.

In the United Kingdom, Labour Member of Parliament for Glasgow South, Tom Harris used social-networking website Twitter to announce his suspicions. He wrote, “We'll still have the apologists for terrorism saying it was caused by 'foreign policy' or by 'disrespect to the Prophet.” Perhaps unwisely, Harris later defended his stance as being a valid assumption to have made in the context, due to the predominance of Islamic terrorism, even when further details emerged and it became obvious that the attacks were not the work of a transnational organisation. Mr Harris is, perhaps unfairly, condemned by his profile as a member of the British parliament. His views, which assumed that only a transnational organisation could be behind a terrorist attack in Western Europe, were reflected by certain sections of the media and in wider society.

From these two examples, however, it is easy to see a stark illustration of the dangers of a relatively singularly focused literature and of the biased view many people hold about the nature of terrorist threats. The danger of the direction of popular concerns and of a research base that is dominated by one particular form of terrorism is that it can engender a feeling that domestic terrorism no longer poses the real, immediate or significant threat that it does.

Whilst some authors have attempted to bridge this gap, the lack of a defined methodology for the study of domestic terrorism and the dearth of specific policy suggestions remain significant concerns. In this respect, the findings presented in this thesis are important, not only in their conclusions and associated policy implications but in providing a significant contribution to the methodology of the study of domestic conflicts. Chapters 3 and 4 show the validity and outcomes of including peace-making in theoretical models, whilst Chapter 5 shows that duration analysis is a valid econometric method for the study of low-intensity conflicts.

Despite the short-comings of the literature discussed, however, the simple economic

model of terrorism discussed in Chapter 1 can easily be extended to account for action and reaction in domestic conflicts. This model still implies that any increase in counter-terrorism should, *ceteris paribus*, reduce the level of terrorism. I postulate that it is the mechanism that differs between domestic and transnational terrorism. In the domestic context, the substitution away from violence still sees resources devoted to other behaviours designed to achieve the long-term goals of an organisation, rather than to some unrelated form of consumption, as is typical in the transnational literature.

This, of course, is still excessively simplistic. Significant work has shown, for example, that counter-terror polices have a habit of 'deflecting' rather than preventing terrorism. Following the examples of Sandler and Enders (2004), the introduction of metal detectors in airports reduced terrorist action against aircraft but led to a substitution towards attacks on other targets, such as trains. Similarly, one country with high counter-terrorism may deter attacks against that country at the expense of attacks in other countries.

This type of logic can be extended to domestic conflicts. Early in its campaign in Northern Ireland the IRA, for example, made a strategic decision to target civilians as well as security forces. This occurred in response to increased troop numbers, which presumably had the effect of increasing the costs of attacking the British army. This deflection of attacks towards civilian populations was instrumental in the rise of Loyalist paramilitaries, which this thesis suggests increased the duration of that conflict.

Other work, notably Enders and Sandler (2006) shows that security measures can actually increase terrorist actions; whilst immediately appearing to be counter-intuitive, this can be explained in a rational framework. A government attempting to appear tough on terrorism, for example, may engender community support for this organisation¹, or increase terrorists' incentives and returns from an attack.

Any increase in what the literature deems 'aggression' can reduce the outcomes from

¹ A pertinent example occurred in Dublin in the aftermath of the Easter Rising in 1916. Although frequently forgotten, the rebellion was unpopular in Dublin, not least because it resulted in the destruction of much of the city. Following the failure of the uprising, many leaders were executed, including James Connolly. Connolly had been seriously injured during the rebellion and was tied to a chair in front of the firing post as he was unable to support himself. The image of British troops executing a man so seriously injured that he couldn't stand to face the firing squad, designed to show toughness in the face of the Nationalist threat, led to a significant change in attitudes in and around Dublin and acted as a huge fillip to the cause of Irish independence.

non-terrorism related activity, also increasing the incentive to attack. Frey (2004) notes this effect, with its transmission via gained political legitimacy; in the context of Northern Ireland, the introduction of internment and diplock courts, not to mention perceptions of the treatment of the Hunger Strikers all conferred political legitimacy on Republican aims.

Frey and Luechinger (2003) and Frey (2004) also show the potentially negative effects of offering 'carrots' rather than 'sticks' to terrorists. Whilst they note the impact of inviting Sinn Féin into political talks in Northern Ireland, a suggestion is made that terrorists could exploit these steps. Terrorists could, for example, pretend to be peaceful, only to unleash a wave of further violence against an unsuspecting or unprepared government, such as the ETA attack on Barajas Airport in Madrid in 2006. This notion provides some of the background to the signalling model presented in Chapter 4. This notion is further developed by Addison and Murshed (2005), who show that groups with varying degrees of militancy will respond differently to different incentives.

Arce and Sandler (2007) have used signalling models to overcome inherent informational asymmetries in terrorist threats. This model introduces both 'peaceful' and 'militant' terrorist types, which provides an important context and notation for the work in Chapter 4. Outcomes show that peaceful types may mimic violent types by launching large attacks in the first period, in order to induce government concessions. Similarly, however, militant types may limit the scale of their first period attacks, in order to trick the government into reducing counter-terrorism measures.

This branch of the literature stretches back to Sandler, Tschirhart and Cauley (1983), who proposed a model of the negotiation process between terrorists and government. Sandler and Lapan (1988) proposed the first model to look at the effects of defence allocation. A major limitation of Sandler and Lapan (1988) is that it treats the terrorist as a non-strategic player, however. Powell (2007a, 2007b, 2007c) provides an important contribution, accordingly, by introducing both terrorists and governments as strategic players who respond to each other. This interdependency of choice variables has been expanded by the likes of Bier, Oliveros and Samuelson (2007) and Zhuang and Bier (2007). Chapters 3 and 4 of this thesis build on these notions.

These models, too, support what may seem like counter-intuitive outcomes. For

example, it is shown that increased counter-terrorism can result in increased terrorism but also that decreased terrorism can actually increase counter-terrorism, although these results are explained in the context of mixed strategies. Other interesting outcomes show that governments have an incentive to move first, such as making their counter-measures public information and that it may actually be optimal to leave some targets undefended, due to the low cost of attacks focused on these targets. This is typified by the work of Farrow (2007).

Siquiera and Sandler (2007) and Bueno de Mesquita and Dickson (2007) both introduce the influence of domestic politics on government counter-terror measures; this work provides an important context for the model presented in Chapter 3, where I allow society to influence the actions of both terrorists and governments. Another important notion for this work is introduced by Epstein and Gang (2007), who show rent-seeking terrorist leaders who maximise outcomes through the attraction of followers. Although the focus of this work is on different terrorist factions, the notion of popularity and competition as a driver of outcomes is still important. Crenshaw (2001) models competition amongst groups and shows that it can lead to an escalation of violence, although this work is disputed by Siquiera (2005).

Signalling models have intermittently appeared in the literature and are intrinsically important to the work presented in Chapter 4. This work can be traced back to Lapan and Sandler (1993) and Overgaard (1994). In these models, small terrorist organisations may have an incentive to engage in large, spectacular attacks, in order to convince a government to make political concessions, whilst large organisations may attempt to avoid government wrath by pretending to be small. The aim of these signalling models is to overcome the implicit informational asymmetry that arises in the models by the likes of Shapiro and Siegal (2007), which follow principle-agent problems. Perhaps the most relevant signalling model, however, is Arce and Sandler (2007), who enable two different kinds of terrorist organisation – nominally, a peaceful organisation who uses violence to raise awareness of a cause and a violent organisation that believes only in destruction.

Early major empirical contributions come from Brophy-Baermann and Conybeare (1994), who apply rational expectations in the Israeli-Palestine conflict and Lee (1988) who looks at the interactions between terrorists and government counter-terrorism.

Most pertinently for Chapter 5 of this thesis, Jaeger and Paserman (2006) examine the dynamic relationship between violence committed by Israel and Palestinian factions during the Second Intifada. Although this work uses incidence rather than duration, it stands as a precedent study into the spatial and temporal interaction of rival organisations in violent conflicts.

Other empirical studies of terrorist strategy can be found in the work of the likes of Barros, Gil-Alana and Passos (2006), who study the timing of ETA attacks, Berribe and Lakadawalla (2007) who look at the location of terrorist attacks in Israel and Blomberg, Engel and Sawyer (2010), who look at the life-span of terrorist organisations. A common feature of these three final papers is that they all use duration modelling techniques, which are also applied in the work presented in Chapter 5.

Despite the earliest use of duration techniques in the literature being Atkinson, Sandler and Tschirhart (1987), at the time of writing, this author is aware of approximately ten papers in the terrorism literature which adopt this technique. This is despite the fact that duration analysis is singularly well suited to the study of a number of forms of terrorist threat, particularly domestic terrorism. In this respect, this work represents a significant contribution to the literature, not only in the sense of the use of a relatively uncommon modelling technique but as the first to apply this technique to the interaction of rival organisations.

The final consideration of this introduction is to note that not all domestic conflicts follow the same pattern of conflict. Whilst accepting that such definitions rely on general assumptions, domestic threats can, broadly, be split into three main categories. The first grouping I refer to as 'unitary conflict' and involve attacks that are carried out by individuals or small-cells; typically, these are one-time only attacks, such as those in Norway in 2011 or the Oklahoma City bombing in 1995. Motives in these situations tend to be disparate and due to the one-time-only nature of attack, strategy and engagement with security forces are impossible to study. Accordingly, the work presented here lies in two further subdivisions of domestic terrorism conflict, which I henceforth call 'binary conflict' and 'triangular conflict'.

In these forms conflicts, the motives of the terrorist organisations tend to be similar and involve some change or other to the status quo; nationalism (PIRA in Northern Ireland),

secession (ETA in Spain), equality (uMkhonto we Sizwe in South Africa) or political / economic regime change (FARC in Columbia). The differentiation between 'binary' and 'triangular' relies only on whether or not some rival paramilitary organisation to the revolutionary arises; for example, Loyalist paramilitaries in Northern Ireland.²

As such, I define binary conflict as a conflict that occurs between the incumbent government and some revolutionary domestic terrorist. I define triangular conflict as a situation involving two rival paramilitaries and government security forces. A notable outcome commonly observed in the qualitative literature of triangular conflicts is the suggestion that paramilitary organisations engage in conflict with each other³, as well as engaging the security forces, which is the context of the model presented in Chapter 4.

The first of these subdivisions more readily fits with the general and even transnational literature in the sense that it pits a violent armed force against a government adversary. That said, the literature does not provide a notion as to how these conflicts tend towards peace in the long-term and any interactions with support bases tends to focus on the funding of the organisation, not, explicitly, the local popularity of the campaign (Siquiera and Sandler, 2006). The implicit outcome of Siquiera and Sandler is that community support can sustain, rather than end, a conflict. Triangular conflict is more complex, however, as one must account, not only for the actions of terrorists and governments but also the potential interaction between the terrorist organisations.

Thus, this thesis makes three particularly important and relevant contributions to the literature in the growing field of the economics of security and terrorism. Firstly, as discussed at length throughout these introductory chapters, this is the first major body of work that facilitates the devotion of all of terrorists' resources towards goal-achievement, by introducing peace-making as a strategic choice. The most notable impact of such an innovation is that it changes, slightly, the nature of the research question traditionally asked in the literature.

² A recent suggestion is that, in fact, the Northern Ireland conflict isn't so much 'triangular' conflict as two 'binary' conflicts; one fought between Loyalists and Republicans and one fought between Republicans and Security Forces. This is based on the relative lack of interaction between Loyalists and Security Forces and suggestions of collusion between the British Army and Loyalist paramilitaries. Despite this suggestion, I maintain the 'triangular' nomenclature throughout this thesis.

³ This engagement can take the form of direct engagement, where members of one organisation kill members of another or the form of a 'proxy' conflict, where members of one organisation attack the civilian population that supports its rival.

By including non-goal related consumption alternatives, the literature has essentially asked the question, "Why do people become terrorists." The work presented here, by assuming political, rather than ideological goals, asks, "How do terrorists act optimally, in order to achieve their goals." This innovation represents one of the most important aspects of domestic conflicts and suggests that violence and peace-making are essentially substitutes, or perhaps even compliments, in the struggle to achieve long-term strategic goals.

Secondly, and in addition to the novel introduction of peace-making, the game theory models in Chapters 3 and 4 aim to exploit some of the other defining features of domestic violence. These innovations help to explain interactions that have, hitherto, been under-discussed or ignored entirely, in the literature. Chapter 3, for example, builds on notions of terrorist popularity introduced by the likes of Siqueira and Sandler (2006) and Epstein and Gang (2007). By interacting the notion of popularity with a suggestion that domestic terrorists represent sub-sections of the society in which they operate, I provide the first contribution on how communities can affect terrorists' strategic choices and the first suggestions for the process by which domestic terrorist threats have a tendency to end peacefully.

Similarly, in Chapter 4, I advance the signalling frameworks used by the likes of Lapan and Sandler (1993), Overgaard (1994) and Arce and Sandler (2007). This builds upon the notion of direct interaction between rival terrorist organisations in domestic threats but also exhibits some technical innovations, when compared with other terrorism-related models. Specifically, I introduce simultaneous interaction between strategic players in a Bayes-Nash extensive form game that follows the signalling phase. This stands in contrast to the sequential models previously presented in the terrorism literature, in which the third period action is essentially a non-strategic and pre-stated response to the government's interpretation to the signal.

Finally, the empirical work presented in Chapter 5 overcomes some of the inherent difficulties in the study of terrorist strategy in domestic conflict, particularly those relating to the scale and timing of attacks, the low-intensity of violence and the nature of strategic interaction amongst rival organisations and security forces. These results are also of intrinsic interest. Specifically relating to the conflict in Northern Ireland, it is

the first work to confirm the qualitative writings about Loyalist and Republican strategies. More generally, it provides evidence that terrorist organisations deviate from their underlying strategies to engage with rival organisations, which is an important finding that could, potentially, be applied to continuing conflicts in Colombia or Iraq, for example. More so, however, these results also show the validity of the methodology itself, which extends the scope of the literature by effectively introducing a method seldom used in the economics of terrorism literature and by being the first paper to apply such methods to terrorist strategy and interaction.

The structure of the remainder of this thesis is as follows; in the next part of this chapter, I provide a synopsis of each of the three papers that make up the research component of this work. In Chapters 3, 4 and 5, I present the background, methodology and findings of these papers. Finally, in Chapter 6, I present my conclusions and suggestions for further research. Following the main chapters, I include a full bibliography and appendices.

2.1 Synopsis of Chapter 3: On the Impact of Voters under Violent Domestic Threat

A major limitation of the research in the field of terrorism is that it has offered no real explanations as to why domestic terrorist conflicts have tended towards peaceful resolutions. Northern Ireland and South Africa are obvious and pertinent examples⁴ of domestic conflicts that have come to peaceful resolution. 2011 also saw ETA, an organisation with links to the currently banned Batasuna political party, call a 'definitive cessation of its armed activity'. The number of terrorist organisations which have, or have had, political wings are too numerous to list, yet frequently, the literature has ignored the potential for terrorist organisations to devote resources to their political wings, as well as, or even rather than, their military wings.

This work, therefore, makes a novel contribution by introducing 'peace-making' into a terrorist's utility function. This is intuitively understandable in the context of an organisation with some strategic aim of changing the status quo; whilst terrorist

⁴ Of interest in both Northern Ireland and South Africa is that the political wings of militant organisations, Sinn Féin and the African National Congress (ANC) respectively, became major players in the assemblies and parliaments of these countries, following cessation of violence. The ANC has provided the last four presidents of South Africa, whilst Sinn Féin is the single largest Northern Irish party, by the popular vote, in the Westminster Parliament and the second largest party by votes and seats in the Northern Ireland Assembly.

organisations obviously believe these goals can be achieved through violence, history also provides examples of organisations whose aims have been achieved through peace, such as the ANC / uMkhonto we Sizwe in South Africa. These interactions are governed by terrorists' preferences, however; in a situation where the existing democratic arrangements would prevent their participation in a political process, terrorists' returns are obviously such that they will not act peacefully.

I build on the assertion that domestic terrorists believe they represent the society, or some sub-section of the society, in which they operate. Thus, the political support society shows for the terrorist's campaign, proxied by the vote-share of the terrorist's political wing, directly affects the terrorists' outcomes. I also show that Voters' outcomes are related to the interaction between the terrorist organisation and the incumbent government in the region. This builds on the work of Siquiera and Sandler (2006), who show how terrorist organisations can rely, financially, on support from their community but also that support from their community is contingent on strategic choice. In their model, the greater the support a terrorist garners, the greater the level of resources upon which it can draw. Siquiera and Sandler (2006), however, do not include the possibility for peace, *per se*, but instead allows for consumption of some non-terrorism good that also adds positively to utility. The novelty of this work, therefore, is to generate a relationship between the resources terrorists expend on peace and the returns from this choice, in the face of an interested public.

To this end, I present a two-stage model in this chapter that aims to show the impact of Voters' preferences on the outcomes and strategic interaction of a Revolutionary terrorist organisation and an Incumbent government. I show Voters who are averse to violence but who may broadly support the Revolutionary's aims. Both the Revolutionary and Incumbent concern themselves with their popularity amongst Voters.

The Revolutionary is not, intrinsically, a vote maximiser. Instead, *ceteris paribus*, the Revolutionary is better off for each strategic choice combination, the more votes it receives. The Revolutionary, therefore, concerns itself with the preferences of Voters and with its own outcomes from engagement in acts of violence and peace-making, which it uses to achieve its long-term goal. An Incumbent government aims to end terrorist violence in the location and optimally chooses peace-making and counter-terror spending, whilst also accounting for its own popularity amongst the population. The

Incumbent, again, does not explicitly aim to maximise votes but is better off for each combination of resource spend the more votes it receives. Voters are shown to broadly support the Revolutionary's aims but are shown to be averse to terrorism, due to the high associated social and economic costs.

The outcomes of this model show that the presence of Voters changes the equilibrium choices of both Revolutionary and Incumbents but does not significantly change the nature of their strategic interaction. Furthermore, it supports conditions that show Voters have the expected result of decreasing equilibrium spending on both terrorism and counter-terrorism.

Voters, however, can also have the impact of increasing terrorism in equilibrium. Although this may seem, initially, counter-intuitive, the model shows self-interested voters who gain through the strategic interactions of both Revolutionary and Incumbents.

2.2 Synopsis of Chapter 4: A Signalling Model of the Terrorist Interaction in Triangular Conflict

This paper further builds on the introduction of peace-making into terrorist's utility but introduces the interaction of two rival organisations in order to overcome another of the limitations of the background literature – that this kind of interaction can have profound effects on the duration and outcomes of a conflict. Whilst signalling models have been employed before in the literature - Lapan and Sandler (1993), Overgaard (1994) and Arce and Sandler (2007) - the nature of these models does not explicitly overcome the nature of informational asymmetry that can occur in triangular conflict.

The formation of triangular conflicts is not uniform; the nature of 'rivals' can be unique to the conflict but the defining features of triangular conflict remain the same across all major examples. The explicit defining features of triangular conflicts are that there are at least two terrorist organisations that have motives that are, somehow, divergent.⁵ The third player is a set of government security forces, who seek to end the conflict through counter-terrorism action.

⁵ In this case, I define 'motive' broadly, such that even organisations with approximately convergent goals, such as anti-Israeli organisations in the Middle East or FARC and ELN in Colombia, can be rivals. In the case of FARC and ELN, for example, whilst both organisations are broadly socialist, their theological background diverges.

Present examples include the conflicts in Colombia, Iraq and Northern Ireland, as well as occasional anti-Israeli rivalries in the Middle East. In this particular case, I look at the interaction of two terrorist organisations, one designated the Revolutionary and one designated the Vigilante. This special case of triangular conflict provides the most intuitive background to the use of signalling models but the outcomes are more generally applicable to conflicts that include two revolutionary forces.

I present a Revolutionary organisation with some long-standing strategic goal; although I do not explicitly define what this goal is, typical goals in triangular conflict include nationalism, secession and political/economic regime change. The Vigilante is depicted as a pro-status quo organisation that aims to prevent the attainment of the Revolutionary's goal. Whilst this may not be the explicit aim of rival organisations in every triangular conflict, the nature of interaction remains similar – insurgents in Iraq, for example, aim both for their own strategic goals and to prevent rivals achieving theirs.

The Vigilante in this model has a pre-stated aim that is known to the Revolutionary; to meet Revolutionary violence with violence but to engage peacefully with a Revolutionary, should the Revolutionary be willing to do so. The nature of asymmetry is defined by the fact that the Revolutionary can have a dichotomous leadership type; nominally, Peaceful (P-Type) and Militant (M-Type). A peaceful Revolutionary believes its goals can be achieved through the use of both peace and violence. A militant Revolutionary believes that its goals can only be achieved through armed struggle. The Vigilante does not observe the Revolutionary's type.

The Revolutionary uses a peaceful overture in period one of the game, such as supporting a parliamentary candidate, calling a ceasefire or decommissioning, to send a signal to the Vigilante as to the nature of their leadership. The Vigilante, as a reactionary force, attempts to interpret this overture and respond according to its pre-stated strategy. In period two of the model, the Revolutionary and the Vigilante act simultaneously, choosing to act peacefully or violently towards its opponent. Thus, in period two, a second informational asymmetry is introduced as neither group knows how its rival will act. These simultaneous-move interactions, following the signalling phase, represent the second major departure of this model from the previous literature.

The literature, hitherto, has tended to three-period, sequential games, which does not tally closely with the nature of triangular conflict.

This model sets out conditions that support pooling equilibria in which the signalling phase is ineffective and a separating equilibrium in which the structure of the Vigilante's beliefs leads to differences in the equilibrium behaviour of the Revolutionary. This model has the expected finding that, when a very strong signal is required, the Revolutionary is likely to support violence even where it is not committed to it.

This point shows that a nominally peaceful Revolutionary can be induced to devote all resources to violence, due to the involvement of the Vigilante. This offers some explanation of the duration of triangular conflicts; the Troubles in Northern Ireland lasted for almost thirty years, the Colombian armed conflict has continued for almost fifty years and the Iraqi insurgency is approaching its tenth year, for example.

The most pertinent finding of this model, however, shows that the major driving force of the decision to signal is in the relative scales of the terrorist organisations. Should the Revolutionary dwarf the Vigilante, any incentive to interact is removed and the signal will not be sent; the action of Hamas towards rivals, for example, fits with this description.

Alternatively, however, if the Vigilante is a dominant organisation, a militant Revolutionary is incentivised to pretend it is peaceful due to the scale of the threat of violent Vigilante action. Although not necessarily fitting the nature of triangular conflict, the interaction of ETA with the French and Spanish governments can be understood in this manner, with ETA calling a number of ceasefires that were subsequently broken, in 1989, 1996, 1998 and 2006.

When neither case is true, however, separation is facilitated; in Northern Ireland, for example, Republican organisations had greater access to resources and weapons than their Loyalist counterparts but Loyalists still provided a significant enough threat for Republicans to, eventually, interact in a peace process that led to the signing of the Good Friday Agreement in 1998.

2.3 Synopsis of Chapter 5: A Duration Analysis of The Troubles in Northern Ireland

The work in this chapter aims to apply empirical analysis to some of the results of the signalling model presented in Chapter 4. That said, this chapter should not be considered as a direct implementation of this model, but more as an empirical analysis of the concepts introduced by interactions that occur following the signalling phase. Specifically, it aims to determine if rival organisations 'match' their strategies; acting violently when their rival is in a high period of militancy and acting peacefully when their rival is doing so. More explicitly, this chapter asks the question; “do terrorist organisations deviate from their local and temporal strategies to engage with rivals?”

To this end, I employ a dataset from “The Troubles” in Northern Ireland, a conflict that began with street riots in the late-60s and eventually ended with Republican and Loyalist ceasefires in 1994 and the signing of the Belfast (Good Friday) Agreement in 1998. The Troubles displayed nearly all of the features I discuss in Chapter 2 as defining characteristics of domestic conflict; the violence was low intensity - approximately 3,500 deaths in almost 30 years; appears to display a rapid tit-for-tat retaliation structure that necessitates a daily time-series; suffers from low technology of attack, such that death tolls tend to be fairly unpredictable in scale, and was, at least partly, organised on a local, rather than national level.

This caused substantial data concerns for the study. The Troubles resulted in 3,500 deaths decomposed into approximately 2,000 events that matched the time-series and geographical requirements. Due to the rapid retaliation, the local organisation of the Loyalist forces and the three main 'sides' of the conflict (Republicans, Loyalists and Security Forces), there are almost 500,000 potential date, location and perpetrator spaces per equation to fill with approximately 1,300 and 600 incidents, respectively.

To overcome this data sparsity, I employ duration analysis, which allows each attack pair, or more correctly the duration between each pair of attacks, to act as a single observation. I use the average violence perpetrated by the rival organisation and security forces in each region, and violence by all players in contiguous regions as covariates. I use the Cox Proportional Hazards model for the baseline analysis, as neither economic theory nor qualitative writings on The Troubles provide justification

for underlying distribution of terrorist violence. As robustness checks, I employ other duration and control specifications.

I use these techniques to specifically test the suggestion that Loyalists acted as a reactive force, aiming to deter Republican attacks on Northern Ireland's Protestant community. Republicans are claimed to have operated a broader strategy, aimed at imposing maximum physical and psychological damage and may or may not have interacted with Loyalists. The results presented in this chapter provide evidence of the theoretical outcomes, whilst showing that organisations operated different strategies in different locations and at different times. The most interesting findings of this work, however, are in the spatial nature of the retaliation and of the targets of retaliation.

I show that retaliation tends to be localised; violence by Loyalists in a location appears to cause violence by Republicans in that location and vice versa; neither are shown to be caused by violence from outside this region, however. This strongly reflects the relatively 'local' organisation of Loyalist organisations. The Ulster Defence Association (UDA), for example, operated as an umbrella leadership for a loose band of vigilantes, known as 'defence associations' when it first formed. That Republicans also appear to retaliate locally is an interesting finding, not least because the qualitative literature suggests a wider, national Republican strategy. This validates the 'matching' of strategies shown in the signalling model in Chapter 4 – organisations deviate from their local and temporal strategies and are more likely to engage in militant behaviour when their rivals are in a period of high militancy.

The results also show that retaliation takes place, entirely, within the civilian population. Republican attacks on security forces, for example, do not induce Loyalist retaliation. Loyalists appear to retaliate when Republicans perpetrate an attack against civilians, whilst Republicans are shown to attack civilians when Loyalists are engaging in violence. Most interestingly, Loyalist attacks have no significant impact on Republican attacks against security forces, suggesting that retaliation escalates the conflict, with Republicans attacking more frequently, rather than substituting between targets. This fits with the suggestions made in Chapter 4 that the Vigilante can perpetuate a conflict it seeks to end, whilst also suggesting the potential for conflict escalation.

Chapter 3: On the Impact of Voters in Domestic Conflicts

3.1 Introduction

At Sinn Féin's 1981 *Ard Fheis* (party conference), the Republican political writer and member of the Provisional Irish Republican Army (PIRA), Danny Morrison is widely reported to have said, “Who here really believes that we can win the war through the ballot box? But will anyone here object if, with a ballot paper in this hand and an Armalite in the other, we take power in Ireland?”

This speech is widely suggested to have been the genesis of a Republican strategy that mixed continued violent acts of terrorism with engagement in democratic politics. Taking its name from the content of Morrison's speech, this “Ballot Box and Armalite” strategy saw Sinn Féin, nominally the political wing of the PIRA, stand candidates to the Westminster elections in 1983 and the Dáil Éireann elections in 1986.

By 1994, the PIRA had called a ceasefire that eventually led to Sinn Féin becoming a major player at the multi-party talks that resulted in the signing of the Belfast (Good Friday) Agreement in 1998. Today, Sinn Féin is the largest Northern Ireland-based party in the Westminster parliament by the popular vote and the second largest party in the Northern Irish assembly.

In 1961, the African National Congress (ANC) abandoned a 49 year long non-violent campaign and formed a military wing, uMkhonto we Sizwe, following the Sharpsville Massacre. This change in approach was described by Nelson Mandela as a 'defensive move'. This move from peaceful action towards violence is strategically interesting; not least because it is suggestive of the role that political marginalisation can play in the strategic choices of organisations with largely political motives. After almost 40 years of violence, uMkhonto we Sizwe put their arms aside in 1990 to facilitate political talks that eventually led to Nelson Mandela's election as president of South Africa in 1994.

The reasons for these changes in strategic approach may, *prima facie*, seem obvious. In 1994 and 1998 in Northern Ireland, the PIRA had failed to attain their end goals, despite engaging in almost thirty years of open conflict with Loyalist paramilitaries and British security forces. Indeed, the PIRA were only the latest in a long line to have engaged in

such 'wars' since the inception of the Northern Irish state 75 years earlier. The ANC had been engaged in 'passive' activism for almost half a century without materially changing the apartheid status quo in South Africa. Whilst it should not be surprising that an unsuccessful campaign is likely to result in strategic changes, that a campaign fails to achieve its goals in a given time frame should not be deemed a solitary reason.

Neither uMkhonto we Sizwe, nor the PIRA, for example, should be considered as isolationist organisations acting, solely, in their own interest. The PIRA held strong claims to representing the Catholic Nationalist, or at least Republican, minority in Northern Ireland, from whom they drew their support and amongst whom they operated. uMkhonto we Sizwe, similarly, held claims of representation of the black South African population who had been politically and socially marginalised by Apartheid.

In other words, it is highly likely that the strategic goals of domestic terrorist organisations will closely reflect the desires of the societies from which they draw their support. The model presented in this chapter aims to draw upon this relationship in order to discuss the impact that society can have on terrorist strategy and on the engagement of terrorists and governments under a domestic terrorist threat. This diverges from the literature which, hitherto, has predominantly looked at the impacts of society's desires upon government strategy. This chapter extends this notion by also allowing these desires to affect terrorist strategy.

A terrorist organisation acting contrary to the wishes of the society that they purport to represent is unlikely to achieve their long-term, strategic aims, due to a lack of public support for their aims. Alternatively, however, a terrorist organisation that pays strong attention the wishes of that society is likely to have a stronger claim for affecting material change.

In recent times, the economics of terrorism literature has expanded rapidly. Amongst the plethora of questions now considered are three topics that seem particularly pertinent for this study. Firstly, attention has turned to the impact of terrorist activity on electoral outcomes. Secondly, the impact of the desires of voters on government counter-terrorism responses has also produced interesting and relevant results.

The link between voting behaviour and terrorist incidents has become well established in the economics of conflict literature. Montalvo (2006) and Michavila (2005) both use a macabre natural experiment created by the Madrid bombings to show terrorism to have had a significant impact on the outcome on an election that took place three days later. Berri and Klor (2006, 2008a) show theoretical and empirical evidence that high incidence of terrorism increases vote share of right wing blocs in Israel, whilst Indridason (2008) shows that terrorism alters voters' priorities and has an effect on how governments are formed.

There is significant debate in the literature over the extent to which voters' preferences can affect the outcomes of terrorist operations. Pape (2003, 2005) argues that voters' reaction to terrorism can actually lead to politicians offering concessions to terrorist organisations. The focus of this work, however, relates to the use of suicide attacks and its results are disputed by the likes of Moghadam (2006). That said, this notion of the interaction between voters' preferences and the strategic actions of government, provides the essential outline of the model displayed here, as it provides a potential mechanism by which terrorists can achieve their political goals through the use of violence.

The third relevant topic looks at the interaction between terrorists and their support bases. In this respect, this work most closely resembles the work of Siqueria and Sandler (2006), who show how both government and terrorist choices can affect their public support, although they show support through donations to terrorists and not electoral outcomes. The key deviation this model makes from Siqueria and Sandler (2006) is that I aim to discuss the mechanism by which terrorist organisations become peaceful, rather than explaining how terrorist threats are sustained, which seems to be the implication of Siqueria and Sandler.

A fourth, inchoate, strand of the literature is also pertinent for this work and discusses the impact of government counter-terrorism on support for terrorism. Most work in this area focuses on the breaking of fundamental human rights (Pape, 2005) but Choi (2010) has also shown that, by closing the door on terrorist engagement in a political process, legitimacy can be conferred upon their cause. This result is tempered by the warnings from Frey (2004), who shows the potential pitfalls that can occur by inviting terrorists into a political process if those terrorists are dedicated to violence.

The aim of this chapter is to bring together some of the notions of these pertinent strands of the literature, in order to understand how societies can affect the equilibrium interactions of terrorist organisations and governments who are subject to the preferences of that society. This model begins by exploiting the notion that domestic terrorist organisations share the goals of the society in which they operate and therefore have some legitimate claim to being a representative of that society.

A second key deviation made in this chapter is that previous work in this area tends to treat terrorist strategy as exogenous to the political process that it is supposedly affecting. I augment this notion by endogenising strategy; thus, the success of the political process is affected, in part, by the terrorist's willingness to take part and to devote resources to peace, as well as by the actions of the government.

To this, I add an assumption that society is averse to terrorism, as it imposes well-documented social and economic costs. The effect here is that, whilst individuals in society may be supportive of a terrorist's political aims, they do not intrinsically support the use of violence in order to achieve these goals. Accordingly, society may turn its support away from an organisation it deems to be too violent. It seems logical that a terrorist organisation who claims to act as a military and or political representative of this community is concerned with its popularity amongst that support base.

The outcomes of this terrorist organisation are therefore related, in part, to their strategic choices in the face of a government 'enemy', which can lead to the achievements of their goals and in part by society's aversion to violence, which impacts on the terrorist's popularity. Society's view of violence, therefore, acts as an important driver of the strategic choices of the terrorist organisation and could facilitate a diversion of resources towards peace-making. Enabling terrorist organisations to devote resources directly to peace-making represents the second major departure that this model makes from the background literature in this field, where typically, terrorists can devote resources to violence or some other consumption not designed to achieve end goals.

This model, therefore, offers three augmentations to the game theory of terrorism literature. First, it is the first model that looks directly at the interactions of domestic terrorist organisations and governments. This facilitates the second augmentation of the

literature, which is the introduction of peace-making into terrorists' utility functions. In the transnational literature, such a development seems implausible as it would require a peaceful coordination across a number of governments, with different priorities and different approaches to counter-terrorism. In the domestic case, these conflicts typically involve only one government, which can then choose a unilateral response to the terrorist threat.

Finally, this model is the first to look, directly, at how terrorist organisations' outcomes are affected by their popularity. Whilst the role of society is not a new development in this literature, previous literature (Siquiera and Sandler, (2006), for example) measures this impact through the level of resources a terrorist organisation has at its disposal. I model the impact more directly, with a terrorist organisation linking the success of its campaign, in part, to its popularity in the society it claims to represent.

Accordingly, I build on the work carried out by the likes of Siquiera and Sandler (2006). I introduce a one-shot, simultaneous game as the baseline model presented in this chapter. It is accepted that, in reality, prolonged conflict could more accurately be modelled using models of repeated interactions. The aim of the work, however, is to isolate the key interactions, specifically the influence of society, on the optimal strategic choices of the involved players. A one-shot game, therefore, is the most appropriate method of modelling this influence, particularly as it more easily isolates the role society plays, in comparison to a baseline model.

The rest of this paper is split into five sections: In the next section, I introduce the background discussion of the model and the assumptions made about the interactions of the strategic players. In Section 3.3, I introduce a special case of a baseline model, which deals with the interaction between terrorists and a government. In this special case, I linearise the peacemaking component of both players' utility functions, in order to facilitate an explicit and exact solution of the model and of the equilibria that it supports.

In Section 3.4, I introduce a more general case of this model, where I adopt a Cobb-Douglas presentation of the peacemaking component, under an assumption of diminishing returns to scale. In Section 3.5, I extend the model, by introducing the role of society. In this extension, both the government and the terrorist organisation interest

themselves with their popularity amongst the society over which they hold rival claims of representation. Finally, in Section 3.6 I discuss the conclusions of this model and offer suggestions for further research in this area.

3.2 Developing the Model

In this section, I introduce a one-shot simultaneous game between a government and a terrorist organisation. A Revolutionary terrorist organization exists in a location and has some political goal, such as secession, nationalism or economic / political regime change within that region. This organization can attempt to achieve its long-run strategic aims through interaction with an Incumbent government in a peace process, by unilateral acts of violence or by some optimal mixture of the two. The Incumbent government of the region under threat aims to interact with the Revolutionary in order to minimise terrorist violence and the impact of this violence, both of which impose well-documented economic, political and social costs.

The Revolutionary uses violence and peace, aiming to maximise political concessions from the Incumbent by using some optimal mix of its strategic choices. To this end, I show a Revolutionary with both political and military wings. The ability to devote resources to both wings deviates from a majority of the economics of terrorism literature but commonly occurs in domestic conflicts.⁶

A key motivation in the use of terrorism is a belief that violence can garner political concessions from a government. This may seem all the more pertinent when a group is, or at least perceives itself to be, unfairly economically, politically or socially marginalised. Thus, the greater this perception of marginalisation, the higher relative returns to violence are likely to be. A Revolutionary that has fully integrated into domestic politics, on the other hand, is likely to have relatively higher returns from peace.

The Incumbent favours the status quo but has a strategic aim of minimising the economic and social costs associated with terrorist violence. It aims to avoid violence

⁶ An example of this kind of behaviour can be observed in the strategies employed by the PIRA in Northern Ireland, who operated a solely violent strategy from 1969 until 1983. From 1983 until a ceasefire in 1994, it operated a strategy called “The Armalite and Ballot Box”, which mixed terrorism and political activity. From 1994, the PIRA’s official strategic stance is to engage only in democratic politics.

either by engaging with the Revolutionary in a political peace process or by engaging in counter-terrorism measures. Broadly speaking, counter-terrorism measures are assumed to be, “appropriately violent.” This may include, for example, the deployment of peacekeeping troops or the collection of intelligence.

The peace process is shown to be interactive; this means that for a Revolutionary to gain from investment in peace-making, they require that Incumbents also engage in the process. In this model, terrorism is assumed to be a violent response to real or perceived political and social inequality, such as Apartheid in South Africa or the horizontal inequalities generated by the Parliament of Northern Ireland. As such, a Revolutionary who unilaterally engages in peace-making fears looking weak in front of the community it represents and does not gain from such an expenditure of resources. Incumbents are shown to gain only interactively from peace-making, as non-engagement by Revolutionary indicates a devotion of resources towards terrorism, suggesting peace is an ineffective way of ending the threat. Returns to violence are shown to be private.

At the beginning of the game, the Revolutionary receives a non-stochastic endowment from some non-strategic benefactor. The Incumbent government exogenously earmarks a binding budget, which it devotes to dealing with the Revolutionary. In both cases, these budgets are normalised to 1. This game is set up as a one-shot, simultaneous move game with full information and full employment of resources.

The Revolutionary concerns itself with the strategic actions of the Incumbent, specifically the Incumbent’s counter-terrorism action, as this reduces the potency of terrorist violence. I argue that, subject to some “effectiveness factor”, each unit of spending by the Incumbent on counter-terrorism reduces the potency of militant action by the Revolutionary. Spending on anti-terror intelligence, for example, could reduce the probability of success of an attack; deployment of peacekeepers could reduce available targets or destroy resources and so on. The only assumption made about the effectiveness factor is that it is greater than or equal to zero. Incumbents are shown to be concerned with their strategic interactions with the Revolutionary, which are aimed at reducing the incidence and effectiveness of terrorism and, therefore, the associated social deadweight losses of terrorism.

The model shows a Revolutionary organisation that can achieve its long-run strategic goals through the use of terrorism, from interaction in a political process or some combination of the two. Returns to violence are tempered by the effectiveness of the Incumbent government's counter-terrorism devotion but are private. Returns to peace-making are reliant on joint engagement by the Incumbent. Thus, the Revolutionary is more willing to engage in violence when it does not believe that the Incumbent will commit strongly to peace. That said, *ceteris paribus*, the Revolutionary gains more for each unit it devotes to peace-making when the Incumbent increases its peaceful activities, suggesting a positive externality of peace-making.

This effect, however, is reinforced by the motives behind Revolutionary action. In essence, this model assumes that the Revolutionary believes that both violence and peace-making can bring about some political concessions from the Incumbent. This is based on a belief that violence will weaken the resolve of the Incumbent. The gains from violence, therefore, are from its impact on political outcomes, not from the enjoyment of violence, itself. Engagement in the peace process has a more obvious and direct impact on potential political outcomes.

The Incumbent's gains are based on the minimisation of the impact of Revolutionary violence. Counter-terrorism is shown to generate positive utility for the Incumbent only in terms of its impact on the potency of Revolutionary violence. Accordingly, at the marginal level, the Incumbent's returns are increasing in devotion to counter-terrorism but decreasing in realised terrorism. A further feature of this function is that the Incumbent only gains from counter-terrorism in situations when there is a realised terrorist threat. Spending to reduce a threat that does not materialise is regarded as a waste of resources. The Incumbent does not support the strategic goals of the Revolutionary but also gains from joint interaction in a peace process, as this represents a substitution of Revolutionary resources away from violence.

3.3 Solving the Model: The Special Case

In this section, I introduce a special case of the model discussed above. I assume diminishing returns to scale from the private investment in terrorism and counter-terrorism but constant returns from peace-making. This assumption of linear returns to peace-making is made to facilitate an explicit simulation of the model and of the

equilibria that are supported. In Section 3.4, this assumption is relaxed and the model is generalised.

Given this assumption, the payoffs of this game are defined:

$$\Pi_R = \frac{r^\alpha}{\eta^i} + P_R P_I \quad (1)$$

$$\Pi_I = \frac{(\eta^i)^Y}{r} + P_R P_I \quad (2)$$

Where; r denotes Revolutionary terrorism and i denotes Incumbent counter-terrorism. P_R and P_I denote the respective devotions of the Revolutionary and the Incumbent to peace-making. η is the effectiveness parameter of counter-terrorism spending.

The assumption here is that terrorism and counter-terrorism both suffer diminishing returns to scale. In the case of terrorism, this is most easily justified. Taking the examples of the Omagh bombing in Northern Ireland in 1998, it is difficult to suggest that it would have received significantly less media coverage had it killed 28 individuals, rather than 29. At the same time, it is also noticeable that it received significantly more coverage than an incident that would kill one individual. At the same time, an incident that kills one individual, such as the murder of P.C. Ronan Kerr in Northern Ireland in 2011 received significantly more coverage than the multitude of incidents that result in no deaths. Indeed, it received significantly more attention than the many incidents in Northern Ireland in the 1970s and 1980s, which also resulted in only one fatality. Accordingly, it seems likely that the impact of terrorism is decreasing in both the number of fatalities and the number of events.

In terms of counter-terrorism, the assumption made is more in terms of each unit of currency spent on counter-terrorism. At the lowest end of the spending spectrum, spending has a high impact as low-level threats are readily deterred. As spending increases, however, there are likely to be fewer outstanding threats and those that do remain are likely to be well planned and thus, more difficult to avoid or deter. Accordingly, whilst the first units of currency are likely to have high marginal returns, in terms of avoided attacks, increasing spending at the top end of the spending spectrum

is unlikely to be so effective. For now, no assumptions are made about the returns of peace.

The resources available to both players in this model are normalised to one. Furthermore, for both players, the cost of terrorism / counter-terrorism is also normalised to one, with the cost of peace-making depicted as a relative cost. I denote these costs c_R and c_I , for the Revolutionary and the Incumbent respectively. The nature of this game, which occurs in a single time period, supports a full-employment of resources assumption. All resources available to both the Revolutionary and the Incumbent are spent within the game. Furthermore, in this situation, these resources can only be spent on terrorism / counter-terrorism and on peace-making. Accordingly, both the budget constraints and the utility functions depicted in Equations (1) and (2) can be written entirely in terms of one strategic choice for each player, as P_R and P_I can be rewritten in terms of spending on (counter-)terrorism, such that:

$$P_R = \frac{1-r}{c_R} \quad (3)$$

$$P_I = \frac{1-i}{c_I} \quad (4)$$

Thus, by combining the information in Equations (3) and (4) with the utility functions, I can redefine Equations (1) and (2) solely in terms of devotion to (counter-)terrorism, such that:

$$\Pi_R = \frac{r^\alpha}{\eta^i} + \left(\frac{1-r}{c_R}\right) \left(\frac{1-i}{c_I}\right) \quad (5)$$

$$\Pi_I = \frac{(\eta i)^Y}{r} + \left(\frac{1-r}{c_R}\right) \left(\frac{1-i}{c_I}\right) \quad (6)$$

By taking the first order conditions of Equations (5) and (6) with respect to terrorism and counter-terrorism, respectively, I can then define the optimal choices of the strategic players. The first order maximisations of Equations (5) and (6) yield:

$$\frac{\partial \Pi_R}{\partial r} = \frac{\alpha r^{\alpha-1}}{\eta i} - \left(\frac{1}{c_R}\right) \left(\frac{1-i}{c_I}\right) = 0 \quad (7)$$

$$\frac{\partial \Pi_I}{\partial i} = \frac{\gamma \eta^\gamma i^{\gamma-1}}{r} - \left(\frac{1}{c_I}\right) \left(\frac{1-r}{c_R}\right) = 0 \quad (8)$$

The second order derivatives of Equations (7) and (8) confirm that these values are maxima.⁷

The nature of strategic interaction is easy to see in the maximisations depicted in Equations (7) and (8). The Incumbent's optimal choice of devotion to counter-terrorism obviously has some impact on the Revolutionary's choice and vice versa. This relationship is formalised by rearranging Equations (7) and (8) for r and i , respectively and using these outcomes to simulate the best responses of the strategic players. These rearrangements yield:

$$r = \left(\frac{\alpha c_R c_I}{\eta(i-i^2)}\right)^{\frac{1}{1-\alpha}} \quad (9)$$

$$i = \left(\frac{\gamma \eta^\gamma c_R c_I}{r-r^2}\right)^{\frac{1}{1-\gamma}} \quad (10)$$

A quick review of Equations (9) and (10) provides some insight into the workings of this model, as well as revealing sensible comparative statics. Whilst obvious that desire to engage in (counter-)terrorism would be increasing in the elasticities of these strategic choices, the price of peace-making of both a player and its opponent also increase the desire to opt for (counter-) terrorism. Perhaps the most interesting comparative statics, however, is the non-linear response of a player's strategic choice to that of its opponent.

This outcome suggests that, when the level of counter-terrorism is initially low, the Revolutionary will, *ceteris paribus*, decrease terrorism in response to an increase in counter-terrorism. At high initial levels, however, the Revolutionary increases terrorism in response to increased counter-terrorism. This response is still quite intuitive; at low levels of counter-terrorism, the Revolutionary feels the impact as a direct reduction in its returns from terrorism. Thus, this finding fits with the early theory literature,

⁷ Taking the second order partial of Equation (7) with respect to r yields: $\frac{\partial^2 \Pi_R}{\partial r^2} = \frac{(\alpha^2 - \alpha)r^{\alpha-2}}{\eta i}$, which is negative under the diminishing marginal returns to terrorism assumption ($\alpha < 1$). The second order partial of Equation (8) with respect to counter-terrorism yields: $\frac{\partial^2 \Pi_I}{\partial i^2} = \frac{(\gamma^2 - \gamma)\eta^\gamma i^{\gamma-2}}{r}$, which is also negative under the diminishing marginal returns to counter-terrorism assumption, $\gamma < 1$.

suggesting that terrorists reduce their militant activity should the costs of engaging in that activity increase. At the upper end, however, the impact is felt through the peace process. As this process is interactive, the large-scale devotion of resources to counter-terrorism significantly reduces the Revolutionary's returns from peace-making, rendering terrorism the more attractive option. Similar intuition can be applied to the Incumbent's response.

These responses are characterised in Figure 1, below. As can be seen, both best-response curves exhibit a u-shape, which follows the discussion above. Given the shape of these curves, it is also immediately obvious that a number of permutations are feasible for the characterisation and discussion of the equilibrium outcomes of this model.⁸ This text presents a calibration of this model which supports two interior solutions.^{9,10}

These results represent an advance on a literature that, hitherto, has offered results that suggest that increased counter-terrorism can either reduce the incidence of terrorism, through the reduction of potency of terrorism or increases in costs of engaging in terrorism or can increase the incidence of terrorism, due to a backlash against perceptions of "heavy-handed" government responses. This result brings together these two notions, suggesting that excessive government responses can lead to an escalation of a conflict it seeks to end, supporting the findings of Enders and Sandler (2006) and Frey and Leuchinger (2002), whilst also suggesting that counter-terrorism can be an effective anti-terrorist deterrent at low initial levels.

Figure 1 characterises two interior Nash equilibria, as well as the corner-solution noted in Footnote 9. This corner solution occurs in two situations; the first where the initial levels of terrorism and counter-terrorism are low and the second when these initial levels are exceptionally high. Whilst the first of these results is, no doubt, intuitive and requires little explanation, the intuition of the second situation, where incredibly high

⁸ In fact, broadly speaking, there are four outcomes of interest supported by this model; a situation in which there is no interior solution, a situation with one interior solution, a situation with two interior solutions and a situation with four interior solutions.

⁹ An important note should be made about the corner solutions of this model, however. By looking at Equations (7) and (8), the best response of terrorism to counter-terrorism when counter-terrorism is equal to one or zero is zero and the same for the response of counter-terrorism to terrorism. Accordingly, the only corner solution supported by this model is an "all-peace" scenario. Therefore, when no interior solution prevails, all resources in this model will be devoted to peace.

¹⁰ The parameterisation that supports the outcome depicted here shows the relative price of peaceful activity to be relatively low (0.5), whilst the elasticities of terrorism and counter-terrorism are also fairly low (0.6 and 0.5 respectively). Finally, this calibration shows a reasonably effective counter-terrorism spend (1.2).

violence leads to an “all-peace” outcome is not so obvious.

In such a violent situation, however, both groups are likely to wish a political process, with the Revolutionary and Incumbent, respectively, fearing an ineffective campaign and massive losses. Therefore, rather than an incredibly violent and short-lived conflict, this result suggests that in such situations, conflict will simply never arise as the costs of such extreme violence are too great to both parties.

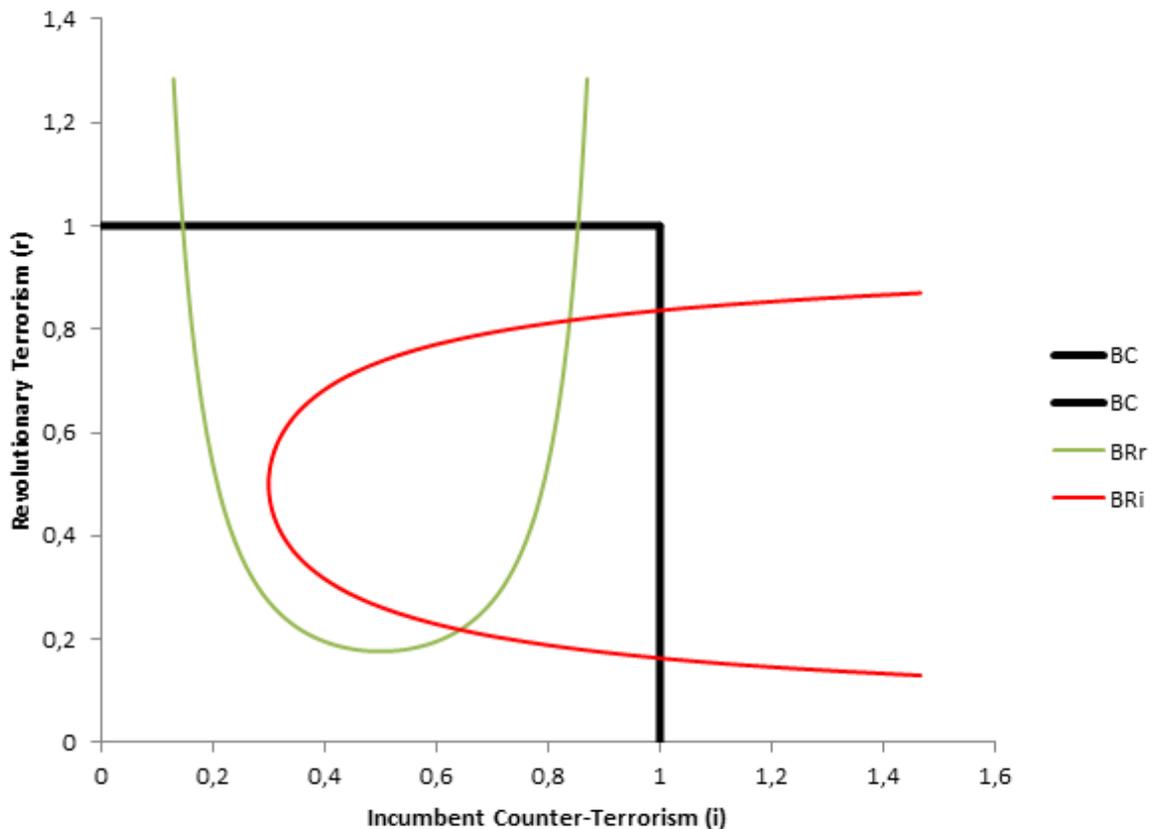


Figure 1: Best responses of terrorism and counter-terrorism.

Both interior solutions presented in Figure 1 suggest a relatively high devotion of Incumbent resources to counter-terrorism. At low levels of terrorism, counter-terrorism is an effective deterrent and so is likely to be relatively high, as it minimises losses from terrorist activity. At high levels of terrorism, however, there is little incentive for the Incumbent to engage politically with a violent adversary, and so is also likely to result in high levels of counter-terrorism. These outcomes are a product of the relatively high effectiveness of counter-terrorism spending in that parameterisation, however. In situations where counter-terrorism is less effective, it can be shown that when the level of terrorism is low, counter-terrorism is also likely to be low, although, of course, this

also has impacts on the Revolutionary's response, as depicted in Figure 2¹¹.

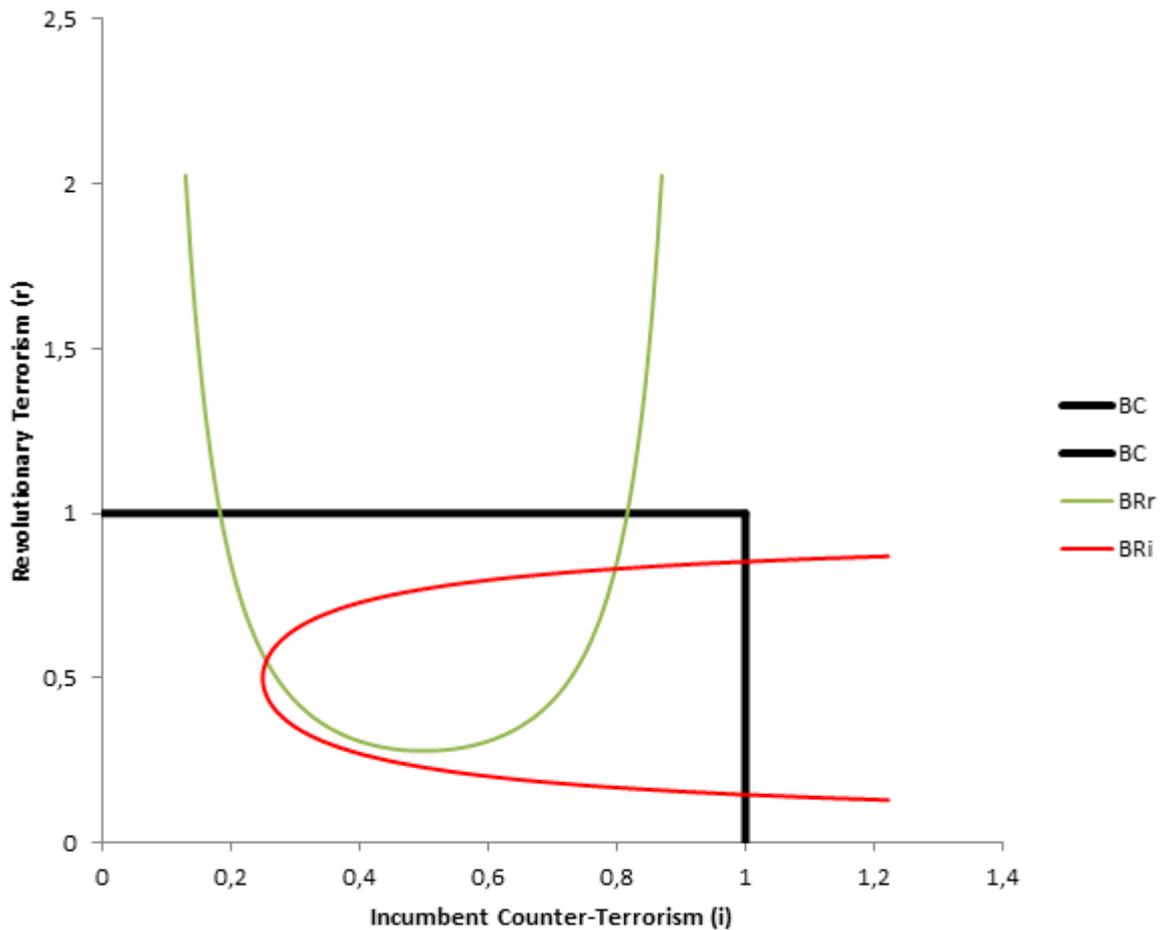


Figure 2: Best responses of terrorism and counter-terrorism when counter-terrorism spending is less effective.

In Figures 1 and 2, only the “lower” of the two equilibria depicted is stable. This suggests that situations of “all-peace” are unlikely in low-intensity conflicts but that both the Incumbent and the Revolutionary can be incentivised to engage, predominantly, in peaceful action. In Northern Ireland, for example, violence has decreased markedly in the time since the Good Friday Agreement in 1998. Despite this period of relative peace, however, low-level counter-terrorism remains an important policy, whilst self-styled “dissident Republicans” have engaged in a number of small terrorists attacks in recent years.

The assumption that leads to the outcomes characterised here, specifically that returns to peace-making are constant in scale, is a strong assumption to make, however.

¹¹ The parameterization here is identical as in Figure 1, except that the effectiveness parameter has been reduced from 1.2 to 0.9

Accordingly, in the next section, I aim to relax this assumption and to generalise this model.

3.4 Solving the Model: The General Case

In this section, I present the general case of this model and qualitatively discuss the implications of these outcomes. As with terrorism, I make an assumption that returns to peace-making are also diminishing in return. To elucidate this assumption, I consider the devotion of resources to contesting an election. At the lowest levels of spending, the resulting publicity may sway the most marginal or indifferent voters. At higher levels of spending, however, the easiest voters to sway have already changed allegiance. Accordingly, each pound spent contesting the election is likely to sway fewer voters as the spend increases. In the discussion that follows, I parameterise the returns to peace-making, denoted β and ρ , for Revolutionary and Incumbent peace-making respectively and assume that $\beta < 1$ and $\rho < 1$. Thus, the utility functions depicted in Equations (5) and (6) are rewritten:

$$\Pi_R = \frac{r^\alpha}{\eta i} + \left(\frac{1-r}{c_R}\right)^\beta \left(\frac{1-i}{c_I}\right)^\rho \quad (11)$$

$$\Pi_I = \frac{(\eta i)^\gamma}{r} + \left(\frac{1-r}{c_R}\right)^\beta \left(\frac{1-i}{c_I}\right)^\rho \quad (12)$$

As before, partially differentiating Equations (11) and (12) with respect to r and i , respectively now yields:

$$\frac{\partial \Pi_R}{\partial r} = \frac{\alpha r^{\alpha-1}}{\eta i} - \beta \left(\frac{1}{c_R}\right) \left(\frac{1-r}{c_R}\right)^{\beta-1} \left(\frac{1-i}{c_I}\right)^\rho = 0 \quad (13)$$

$$\frac{\partial \Pi_I}{\partial i} = \frac{\gamma \eta^\gamma i^{\gamma-1}}{r} - \rho \left(\frac{1}{c_I}\right) \left(\frac{1-i}{c_I}\right)^{\rho-1} \left(\frac{1-r}{c_R}\right)^\beta = 0 \quad (14)$$

In this instance, the model cannot be explicitly solved as it could be in the special case. Accordingly, I characterise the outcomes qualitatively, by implicitly differentiating Equation (13) with respect to counter-terrorism and Equation (14) with respect to terrorism, which yields the rather unattractive outcomes:

$$\frac{\partial r}{\partial i} = \frac{\left[\frac{\alpha r^{\alpha-1}}{(\eta i)^2} - \rho \beta \left(\frac{1}{c_R c_I} \right) \left(\frac{1-i}{c_I} \right)^{p-1} \left(\frac{1-r}{c_R} \right)^{\beta-1} \right]}{\left[\frac{(\alpha^2 - \alpha) r^{\alpha-2}}{\eta i} - (\beta^2 - \beta) \left(\frac{1}{c_R} \right)^2 \left(\frac{1-i}{c_I} \right)^p \left(\frac{1-r}{c_R} \right)^{\beta-2} \right]} \quad (15)$$

$$\frac{\partial i}{\partial r} = \frac{\left[\gamma \eta^\gamma i^{\gamma-1} - \rho \beta \left(\frac{1}{c_R c_I} \right) \left(\frac{1-i}{c_I} \right)^{p-1} \left(\frac{1-r}{c_R} \right)^{\beta-1} \right]}{\left[\frac{(\gamma^2 - \gamma) \eta^\gamma i^{\gamma-2}}{r} - (\rho^2 - \rho) \left(\frac{1}{c_I} \right)^2 \left(\frac{1-i}{c_I} \right)^{p-2} \left(\frac{1-r}{c_R} \right)^\beta \right]} \quad (16)$$

Whilst attempting to interpret these equations may seem unappealing, they still provide intuition of significant interest – the denominator of both Equations (15) and (16) is the second order partial differentiation of the utility functions introduced in Equations (11) and (12). Under the maximisation condition, this second order partial should be negative. Accordingly, following this logic, the denominators of Equations (15) and (16) will also both be negative, so long as Equations (13) and (14) depict local maxima.

In order to characterise the best-response function, attention therefore turns to the numerators of Equations (15) and (16), which are non-linear. The first argument in Equation (15) is the same as the first argument in Equation (13), suggesting that a comparison of the second arguments in Equations (13) and (15) can reveal the nature of interaction that results. In Equation (13), the optimisation condition ensures that the outcome must equal zero. Therefore, when the second argument in Equation (15) is greater than that in Equation (13), the numerator of Equation (15) will be less than zero. This occurs when the Incumbent's devotion to counter-terrorism, i , is high. Similarly, however, when i is low, the numerator of Equation (15) is greater than zero, supporting the non-linearity depicted in the special case.

Combined with the negative denominator of Equation (15), these outcomes suggest that, when i is low, the Revolutionary's best-response is negative. When i is high, the best-response is positive. Thus, when counter-terrorism is low, the best-response of the Revolutionary is to switch away from terrorism towards peace-making, with the opposite being true when counter-terrorism is high. This supports the findings of the special case and suggests validation of that modelling approach. Similar logic shows that the outcome of the special-case is also supported when we look at the incentives of

the Incumbent and its best-response to changes in the Revolutionary's behaviour depicted in Equation (16). The outcome is, again, non-linear with devotion of counter-terrorism decreasing when terrorism is low and increasing when it is high.

A final outcome of the simple models relates to the Cobb-Douglas nature of peace-making. As Revolutionary peace-making appears positively in the utility function of the Incumbent and vice-versa, there is a suggestion of positive externalities from peace-making. Following externality theory, this suggests that there will be a socially sub-optimal devotion of resources to peace-making. Similarly, however, that counter-terrorism appears negatively in the utility function of the Revolutionary and terrorism negatively in that of the Incumbent suggests an over-investment in non-peaceful means.

In the situation depicted in this model, it is difficult to elucidate, however, why the Incumbent would be concerned about the outcomes of the Revolutionary or vice-versa. After all, the “society” affected by these socially suboptimal devotions consists only of two rivals who are unconcerned about the outcomes of the other player. In a situation where more considerations are introduced, however, such as the idea of a civilian population, these socially inefficient outcomes become more problematic. Whilst neither player, in isolation, would be concerned about making their rival better off, the obvious negative impact of suboptimal peace-making for the individuals who live in a society is concerning.

As such, in the next section, I further extend this model, in an attempt to understand the role society can play in the determination of both peaceful and violent outcomes.

3.5 Solving the Model: The Extended Case

In this section, the model presented in Section 3.3 is extended by introducing the impact of individuals who live in this conflict affected region. To this end, society, characterised as Voters, may broadly support the strategic goals of the Revolutionary but also oppose terrorism, due to its economic and social costs. This notion hinges on the assumption that terrorists in domestic conflicts claim to represent and therefore draw their support from some section of the society in which it operates.¹² As before, the

¹² This portion could represent the whole of society or some majority or minority within it. Republicans in Northern Ireland, for example, claimed to represent the Catholic community who desired a United Ireland, ETA claims to represent the Basque peoples who desire an independent state, and so on.

Revolutionary can attempt to achieve its strategic aims by using violence, politics or some mixture of the two.

Voters gain from any action that may bring about the goals of the Revolutionary but their returns from terrorism are discounted, due to the social and economic costs that it imposes. This means that an individual in society can broadly agree with the strategic goals of the Revolutionary and even accept the possibility that these aims may, or can only, be brought about through terrorism, whilst still opposing the externalities imposed by violence. Support for the Revolutionary, therefore, is based on agreement with its goals but not, intrinsically, with its methods.

Each individual in society is shown to have a personal aversion to violence that reflects his or her feelings towards terrorism. I derive an “aversion factor”, denoted δ , which is defined as one minus the degree of aversion that individual holds. For simplicity, I assume that aversion is uniformly distributed on the interval $\in [0, 1]$, although any distribution would yield similar intuition from this model.

Given this modelling set up, an aversion factor of zero shows complete opposition to acts of violence by the Revolutionary; an aversion factor of one shows complete support. To elucidate this, discounting returns to terrorist violence by a factor of zero means that this individual gains nothing from that violence. Apart from this personal discount factor, I show a society with homogeneous preferences that are exogenously determined.

The Revolutionary now acts as a political and military representative of the society it claims to represent, as well as a self-interested body. It may face opposition from Incumbent governments or other organisations within that society with whom it must interact. The Incumbent also draws its support from Voters and concerns itself with popularity, as well as its own outcomes. As before, the Incumbent favours the status quo but also garners support from society as it aims to minimise the negative externalities associated with terrorist violence.

Voters may broadly support the strategic aims of the Revolutionary but are opposed to violence, as defined by their personal discount factor. Voters gain from violent terrorist action as they believe this can bring about the strategic goals of the organisation. As with the Revolutionary, the more marginalised society feels from the democratic

process, the higher their relative returns to violence, as they believe political engagement to be futile. Voters also gain through the Revolutionary's interaction in a peace process, as they believe direct political talks can also result in concessions, subject to the bilateral engagement of the Incumbent.

Incumbent counter-terrorism measures also positively impact on Voters' utility, subject to its effectiveness. Society is averse to terrorist violence and so supports any efforts focused on reducing violence. Finally, as the Incumbent's engagement in the peace process can also lead to concessions, Voters support these peace-making efforts. Peace-making is also governed by a subjective discount factor as an individual who strongly favours violence is unlikely to support peace and vice versa. Voters are unconcerned about the proportion of resources each player devotes to peace but, instead, gain from the whole process, which they view as a kind of "social good".

As would be expected, the relative returns for Voters to terrorism and counter-terrorism depend on society's "closeness" to each of these organisations. This closeness is measured using two exogenous factors that are common to society, denoted θ and ϕ for the Revolutionary and the Incumbent, respectively. Voters are self-interested and concern themselves with maximising their own outcomes, given the equilibrium outcomes in the first stage of this game.

Therefore, the Revolutionary is now depicted as facing two primary concerns; the first is in selecting its optimal mix of peaceful and violence action, with which to achieve its strategic goals. The second is in the garnering of support for its campaign from those it claims to represent. I proxy this effect through the proportion of votes the Revolutionary's political wing receives in an election that occurs in the second period of the game. *Ceteris paribus*, the more votes the political wing receives, the better off the Revolutionary is shown to be. That said, the Revolutionary does not necessarily seek to maximise popularity but instead opts for an optimal strategic mix, given its own preferences and the response of Voters in the second period. A better strategic mix and lower vote share could, therefore, still maximise the Revolutionary's outcomes.

As before, the Revolutionary and the Incumbent engage in a simultaneous move game, this time in the first stage. In the second period, society goes to the polls and votes in an election, where Voters face a dichotomous choice between the Incumbent and the Revolutionary. Voters choose who to support based on their preferences and aversion to

violence. I use the earlier distributional assumption of this aversion factor to define a “marginal voter” who is indifferent between the Revolutionary and the Incumbent.

As society, otherwise, has homogeneous preferences, the marginal voter is characterised by his or her personal aversion factor, denoted δ^* , where $0 < \delta^* < 1$. All individuals with an aversion factor between δ^* and 1 will vote for the Incumbent. Revolutionary, therefore, receive a share of the vote $1 - \delta^*$, whilst the Incumbent receives δ^* . Apart from the impact of Voters’ choice, I assume the utility functions of the Incumbent and the Revolutionary unchanged.

This game is solved using backwards induction. Accordingly, I first look at the Voters’ problem. Voters take as given the outcomes of the first period and vote to maximise their outcomes. Voters are shown to gain equally from peace-making, regardless of which side instigates the process and gain from the whole process, rather than from the individual contributions of the Revolutionary and the Incumbent. Peace-making is governed by a discount factor, $\varepsilon \in [0, 1]$, as those who strongly support violence are unlikely to support peace. That said, as shown below, ε is trivial to this analysis and so, no specific assumptions are made on its distribution. The final feature of Voters’ utility is that they are only shown to gain from counter-terrorism spending when a terrorist threat is realised, otherwise they deem it as a waste of resources but they also gain more from counter-terrorism, the greater is the level of realised threat. Therefore, Voters’ preferences are defined:

$$\Pi_{V|R} = \delta\theta r + \varepsilon P_R P_I \quad (17)$$

$$\Pi_{V|I} = \phi r \eta i + \varepsilon P_R P_I \quad (18)$$

Where; δ and ε are the discount factors of terrorist violence and politics, respectively and θ and ϕ are the “closeness” factors to Revolutionary and Incumbents, respectively. Equations (17) and (18) are solved for the marginal voter’s discount factor, which generates the popularity of Revolutionary and Incumbents in the first stage of this game. Voters choose to vote for the Revolutionary if their return to Equation (17) is greater than from Equation (18). This information can be used to then generate an inequality, which can be considered the threshold of aversion at which an individual will vote for

the Revolutionary:

$$\delta \theta r \geq \phi r \eta i \quad (19)$$

Solving Equation (19) for δ , the minimum level of aversion that will ensure an individual will vote for the Revolutionary is generated:

$$\delta \geq \frac{\phi \eta i}{\theta} \quad (20)$$

Thus, all of those in society for whom Equation (20) is not satisfied will choose to vote for the Incumbent; those for whom it is satisfied will vote for the Revolutionary. The marginal voter is found at the point where Equation (20) is just binding. This individual is said to have a discount factor δ^* , which is used in the generation of the new utility functions for the first stage of this game.

Apart from the impact of Voters' preferences, I assume that the utility functions of the Incumbent and the Revolutionary are unchanged. As popularity is determined on Voters' opposition to terrorist violence, the Revolutionary takes the election outcome as a judgement on its violent strategy - returns from the peace-process are unaffected by their popularity. Similarly, as counter-terrorism has the express aim of reducing violence, the Incumbent takes the election results to be an indication of the popularity of its counter-terrorism programmes. Accordingly, the peace process in this model essentially acts as a "social good" for all three strategic players. Therefore, the utility functions of the Revolutionary and the Incumbent for this model can now be written:

$$\Pi_R = (1 - \delta^*) \frac{r^\alpha}{\eta i} + \left(\frac{1-r}{c_R} \right)^\beta \left(\frac{1-i}{c_I} \right)^\rho \quad (21)$$

$$\Pi_I = \delta^* \frac{(\eta i)^\gamma}{r} + \left(\frac{1-r}{c_R} \right)^\beta \left(\frac{1-i}{c_I} \right)^\rho \quad (22)$$

As interest here is on the impact of society on the equilibrium devotions to terrorism and counter-terrorism, I explore the special case, with β and ρ both set equal to one, in order to facilitate an explicit solution of the model. Accordingly, plugging δ into Equations (21) and (22), the first order conditions are generated as in the simple model and solved, such that:

$$r = \left(\frac{\alpha c_R c_I \left(1 - \frac{\phi}{\theta}\right)}{\eta (i - i^2)} \right)^{\frac{1}{1-\alpha}} \quad (23)$$

$$i = \left[\frac{(1+\gamma)\phi\eta^{1+\gamma} c_I c_R}{\theta (r - r^2)} \right]^{-\frac{1}{\gamma}} \quad (24)$$

Again, the nature of the strategic interaction can be seen from the inspection of Equations (23) and (24). In Equation (23), we see that the impacts on the Revolutionary's best responses are derived from the "closeness" factors. Thus, in situations where society feels very "close" to the Incumbent, society has the expected role of decreasing terrorist violence in response to increased counter-terrorism. At the same time, however, the non-linear relationship from the simple model is maintained when society feels "closer" to the Revolutionary.

Equation (24), however, depicts a marked change in the Incumbent's best response. As Voters favour counter-terrorism and reward the Incumbent for increasing counter-terrorism, there is now an incentive for the Incumbent to change its counter-terrorism strategy positively in response to increased terrorism, when the initial level of terrorism is low. As the level of terrorism increases, however, the incentive to increase counter-terrorism is tempered by declining returns from peaceful engagement and from the costs that the high-level of terrorism impose on society and the Incumbent seeks to reduce its counter-terrorism spending.

As in section 3.3, Equations (23) and (24) are simulated, with the results shown in Figure 3. The results presented here use the same parameterisation that generated the results depicted in Figure 1 for easy comparison. The only assumption made in the analysis that follows is that society feels closer to the Revolutionary than to the Incumbent. This assumption is made under the notion that terrorist organisations are unlikely to be popular or successful in scenarios where the Incumbent is popular and where society feels very close to its aims. Terrorism is more likely to arise in scenarios where society feels dissatisfied with or marginalised by the Incumbent.

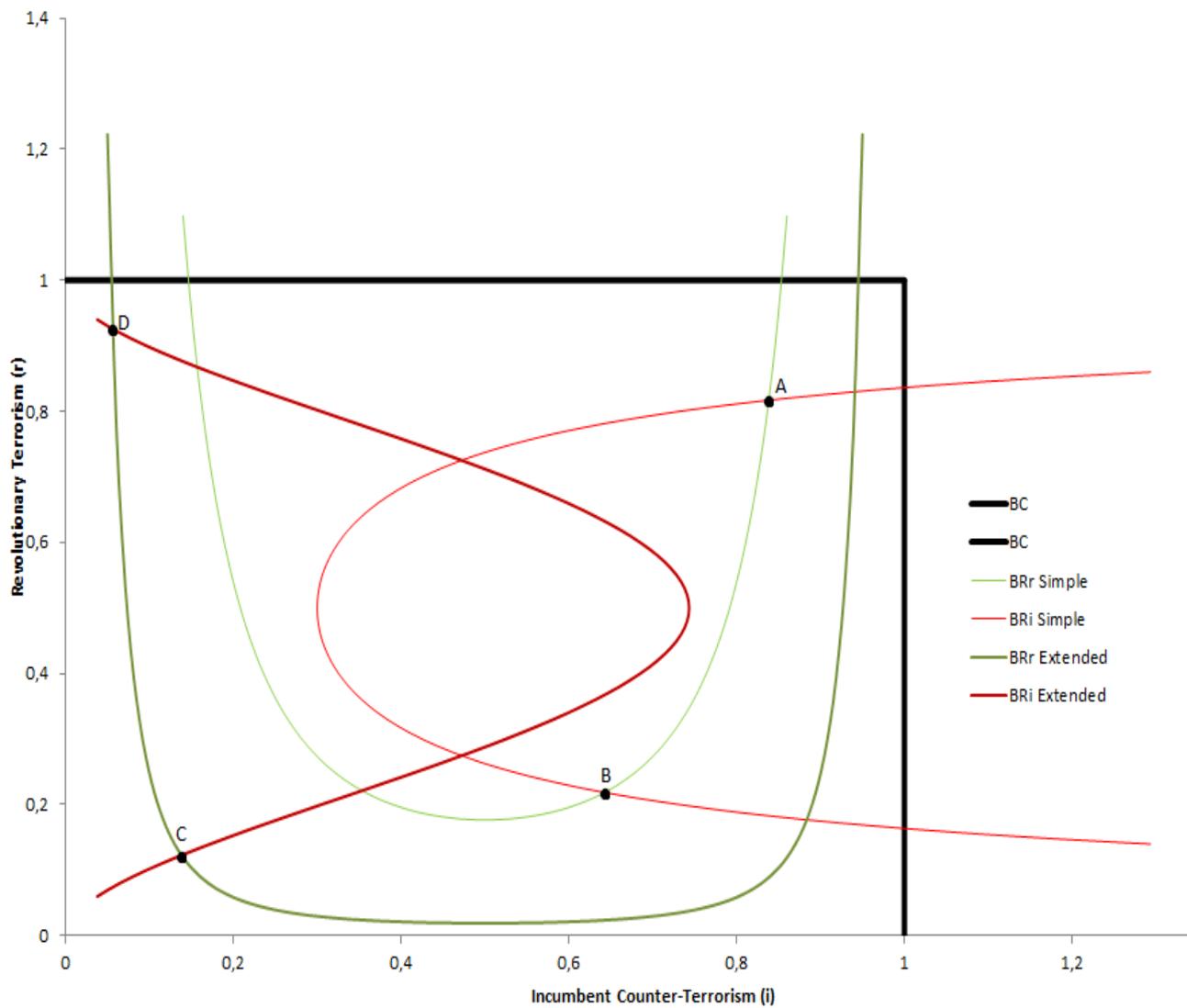


Figure 3: Best Responses of Terrorism and Counter Terrorism in the Extended Case

As discussed in the previous section, the simple model exhibits two internal equilibria, which are now denoted as A and B in Figure 3. Following the introduction of Voters, who are shown to oppose terrorism, two new equilibria are formed at C and D. The feasibility and intuition of the equilibrium depicted at C is unsurprising; as Voters oppose terrorism, the Revolutionary's incentive to engage in violence activity is decreased. In response to such a decrease in terrorism, the Incumbent is also better off devoting resources to the peace process. Accordingly, in equilibrium, fewer resources are spent on terrorism and counter-terrorism, with the peace process taking precedent.

The equilibrium depicted at D is, however, less intuitive. Under public scrutiny, the government chooses to respond to large levels of terrorist threat with a low level of counter-terrorism spending. Whilst this might seem like a bizarre suggestion that a

rational government matches high threat with low protection, this follows the precise logic of so-called “failed states”, where governments may make early attempts to accommodate a large terrorist threat, potentially due to that government's own lack of legitimacy.

Whilst this seems like a bizarre scenario, it is explained in the confines of this model – the non-linear impact of terrorism remains but this non-linear impact has a secondary impact, becoming more pronounced the more popular a political party is. The level of terrorism directly reduces returns from both counter-terrorism and peace-making. Popularity, however, only impacts on returns to counter-terrorism, making it a less desirable choice when terrorism is high.

Whilst this may seem like a strange concept, the British government in Northern Ireland actively increased their dedication to peaceful politics in Northern Ireland following the Omagh bombing in 1998 and continued to scale down military operations there, supporting the principle of this outline. Similarly, despite ETA's engagement in arms procurement in France during their ceasefire in 2006, the Spanish government responded by continuing open political dialogue with the organisation, rather than by responding with increased counter-terrorism. In the game theory of terrorism literature, such notions are also not unheard of. Pape (2003, 2005), for example, shows that Voters' fear of conflict can lead to politicians offering concessions to terrorist organisations when threat is high.

Whilst depicted as a one-shot game, it may also be important to note that the equilibria depicted at points C and D in Figure 3 are unstable and remain so in all parameterisations of this model. Accordingly, one may not need to suspend too much belief to suggest that the all-peace Nash equilibrium corner solution is the outcome most likely to prevail in this scenario, which fits with the impact of popular opposition to terrorism, which prevailed in South Africa in the early-1990s and in Northern Ireland in the mid-1990s.

3.6 Concluding Remarks

In the last twenty years, a number of terrorist threats, particular those associated with domestic or ethnic conflicts, have found their way to peaceful, or at least relatively

peaceful, resolutions. This model looks at the role that the societies affected by these conflicts can have in achieving these peaceful outcomes. By using voting outcomes as a proxy for public support of a campaign, I show how the incidence of violence can be reduced and how terrorists and governments can be encouraged to engage in a political peace process. This finding fits with the background to a number of conflicts, including the Troubles in Northern Ireland and the end of Apartheid in South Africa.

Despite this intuitive outcome, however, I also show the distorting effect that a society opposed to terrorism can have, both in terms of increasing terrorists' devotion to violence and inducing, *prima facie*, counter-intuitive government responses. The increase in terrorism is a logical response for terrorists faced with a government that decreases its devotion to counter-terrorism in the face of increased terrorism, as happened at different times in both Northern Ireland and Spain.

Therefore, whilst I show the important and positive role that society can play in the resolutions of domestic conflicts, I also show a danger in the feedbacks between public support of governments' counter-terrorism measures and the impact this can have on the optimal response of terrorists.

The work depicted in this model could be advanced with the introduction of a non-strategic third political party, nominally The Opposition, who rivals both the Incumbent and the political wing of the Revolutionary. Thus, Voters may be enabled to jointly oppose, and personally discount, both terrorism and counter-terrorism, as it could be argued that both impose costs on society. This is beyond the scope of the work presented here, however, which aims to sketch the main interactions of society, governments and politically motivated terrorists in domestic conflict and to understand the role of society in deriving the outcomes of these conflicts.

Chapter 4: A Signalling Model of Triangular Conflict

4.1 Introduction

Whilst there is a long historical time series of the application of economic thought to terrorism, including the seminal work of Schelling (1958) and Becker (1968) as adapted by Landes (1978), Sandler, Tschirhart and Cauley (1983) and Rapoport (1992) it is really only since the September 2001 attacks that researchers in economics have turned their attention to the strategies employed by terrorists, specifically to the choice of targets and their strategic interactions with governments and the public.

It should, perhaps, be unsurprising that a significant proportion of the post-9/11 literature, at least implicitly, focuses on the actions of international terrorists and religious extremists. Berman and Laitin (2005) use a rational choice model of terrorism and club goods to explain militant terrorist action, even when there is no individual gain from violence. Bueno de Mesquita (2005) models the interactions between voters, government and a terrorist organisation. Perhaps the most opaque reference in the nature of conflict considered in the literature comes from Behrens et al (2006), however, who model a game between “The West” and an international terrorist organisation.

Important work has taken place that holds applications to domestic terrorism, however Siqueira and Sandler (2005, 2007) look at the interactions of terrorist organisations, governments and grassroots support. Still; work that focuses specifically and directly on domestic terrorist strategy is still comparatively rare, yet these conflicts often show features that do not appear in the transnational terror literature, such as interaction in political peace-processes and interaction with rival terrorist organisations. I introduce both effects into this model.

Despite its relative scarcity in the literature, domestic incidents continue to occur throughout the world. Norway and Germany both experienced events in 2011, whilst violence has continued in Columbia, Iraq, Spain and Northern Ireland in recent years. These experiences show the threat that domestic terrorists and extremists still pose. Despite this threat, the study of the actions and strategies of domestic terrorists does not match the transnational terrorist literature. Indeed, despite pertaining to numerous conflicts in the Middle East, Western Europe and South America, study of triangular

conflict, in particular, has almost disappeared from the radar in recent years.

I define triangular conflict as a conflict involving two rival terrorist organisations and a set of government security forces. More specifically, in this formation, I show rival terrorist organisations to have divergent motives – one seeking a change to the status quo, one seeking to maintain it. This need not necessarily be the case; anti-Israeli rivalries in the Middle East, for example, pitted groups against each other despite a common ‘enemy’.

An earlier formation of this model introduced security forces as a non-strategic third player, acting with a certain probability in each game to reduce terrorists’ expected resources. The only effect of this addition, however, was to add an extra factor into the analysis, which slightly convoluted the main analysis. As such, I ignore the role of security forces for notational neatness and intuitive ease, in order to focus on the interaction between terrorist organisations.

This paper attempts to provide a theoretical outline of the interaction of terrorist organisations within triangular conflicts. I draw on the work of Lapan and Sandler (1993), Overgaard (1994) and Arce and Sandler (2007), who use signalling models to overcome informational asymmetry under terrorist threat. This paper, however, presents two new contributions to the literature; both in its direct application to domestic and triangular conflicts and with the inclusion of imperfect information in the context of an extensive form game, which contrasts with the sequential move signalling games hitherto seen.

4.2 Introducing the Model

In this section, I introduce a signalling model of triangular conflict between a pro-status quo vigilante (The Vigilante) and a terrorist organisation with some revolutionary motives (The Revolutionary). The Revolutionary leadership can believe that their long-term aims can be achieved only through violence, or through the use of both peace-making and violence. The Vigilante aims to deter attacks against civilian targets by imposing costs on the Revolutionary through violent retaliation. The Vigilante has incomplete information about the type of Revolutionary that it confronts. The asymmetry occurs as the Revolutionary is aware of the Vigilante’s stated strategy; when the Vigilante believes

that the Revolutionary will act violently, it will act violently. When the Vigilante believes that the Revolutionary will act peacefully, the Vigilante will follow suit.

I consider a two-period model with dichotomous Revolutionary type set. The first period of this model is the signalling phase, where the Revolutionary attempts to signal its type. The second stage is a simultaneous game between the Revolutionary and the Vigilante. In keeping with the nomenclature of Arce and Sandler (2007), I designate Revolutionary leadership types $\{P, M\}$, where P refers to Peaceful-Types and M to Militant-Types.

Typical goals in triangular conflicts include secession, independence, nationalism, equality, and the changing of economic / political regime. M-Types believe these changes can only be brought about through the use of violence. P-Types believe that both peace and violence can be used. For M-Types, any engagement in peace - be it through a signal or by devotion of resources to peace-making in the second stage - acts as a pure cost. Alternatively, P-Types are politically motivated in the sense that they believe that their long-term strategy can be brought about via peaceful means, as well as through the attempt to gain political concessions through violence.

The informational asymmetry provides an obvious incentive for M-Types to mimic P-Types by signalling in the first period, in the hope of convincing the Vigilante to respond peacefully in the second period. P-Types, however, may also have an incentive to mimic M-Types by not signalling. If P-Types believe that they cannot hope to induce a peaceful response from the Vigilante in period two, regardless of how strong the signal, then they are likely to save the resources they would devote to signalling for the battle in the second period.

In period two, the Vigilante and the Revolutionary engage in a simultaneous move game. Upon observing the Revolutionary's first period action, the Vigilante must decide whether to devote its resources to peaceful or violent action. Simultaneously, the Revolutionary must also choose its strategic action in the second period, devoting its remaining resources to either peace or violence. Any devotion of resources to peace acts as a pure cost for M-Types. P-Types, on the other hand, gain from both peace and violence and their decisions will be based on the Vigilante's interpretation of the first period signal.

The terrorist organisations receive an endowment at the start of the game, denoted R for Revolutionary and V for Vigilante. In the first period, the Revolutionary chooses its signal, S , from the continuous set, $[0, 1]$, where this set represents some proportion of resources, R . As the signal is assumed costly but does not directly contribute to utility, this then facilitates the postulation; $0 \leq S < R$. Thus, S is some proportion of resources that is devoted to the signal.

The game is illustrated in Figure 4 and the decision set is shown below:

1. Nature (N) selects the Revolutionary's type from the set $\{P, M\}$
2. In the first period, the Revolutionary selects its signal from the set $[0, 1]$
3. Following the signal, the (Revolutionary) Vigilante devotes all (remaining) resources to either peaceful or violent action.

Payoffs to action profiles in this model are expressed as Π_P and Π_M for P-Types and M-Types respectively and as Π_V for Vigilante. Payoffs are calculated as follows:

1. The Revolutionary and the Vigilante receive endowments, R and V respectively, at the start of the game.
2. The Revolutionary face the cost of sending a signal in the first period and chooses either a signal of 0 or S , where $S \in [0, 1]$ and is some proportion of Revolutionary's resources, R . Signalling, therefore, depletes the Revolutionary's resources in a linear manner, with remaining resources equalling δR , where $\delta = 1 - S$. Thus, when the Revolutionary does not signal, $\delta = 1$.
3. Payoffs follow a generic pattern, with outcomes contingent on Vigilante action and the action and type of the Revolutionary. As in Chapter 3, peace-making is shown as an interactive process. For one side to gain from its investment in peace, it requires participation in the process from the other but always gains from its rival's engagement, as this represents a substitution away from violence. Violence generates positive outcomes from unilateral action but this is tempered by negative outcomes from violence by a rival.

- a. P-Types gain a payoff that is a factor of remaining resources and their choice to act peacefully ($\gamma\delta R$), which is subject to peaceful action from Vigilante, or violently ($\alpha\delta R$). They gain from Vigilante engagement in peace-making (βV) and lose out due to Vigilante violence (vV).
- b. M-Types gain a payoff from peace that relates only to the action of the Vigilante (βV), as their own peace-making acts as a pure cost. Like P-Types, M-Types gain from unilateral engagement in violence ($\alpha\delta R$) and lose from Vigilante violence (vV).
- c. A Vigilante facing a P-Type opponent gains from its own peace-making (βV), subject to the participation in that process of its rival, from which it also gains ($\gamma\delta R$). The Vigilante also gains from unilateral violence, (vV), tempered by any Revolutionary violence, ($\alpha\delta R$).
- d. A Vigilante facing an M-Type opponent make no direct gains from its own peace-making, as it faces a rival committed only to violence. Accordingly, in this scenario, gains are only made from unilateral engagement in violence (vV), again tempered by any Revolutionary violence, ($\alpha\delta R$).

This payoff structure is formalised in Equations (25), (26) and (27):

$$\Pi_P = \lambda_R \lambda_V (\gamma\delta R) + \lambda_V (\beta V) + (1 - \lambda_R) \alpha\delta R - (1 - \lambda_V) vV \quad (25)$$

$$\Pi_M = \lambda_V (\beta V) + (1 - \lambda_R) \alpha\delta R - (1 - \lambda_V) vV \quad (26)$$

$$\Pi_V = \lambda_V \lambda_R (\beta V) + \lambda_R (\gamma\delta R) + (1 - \lambda_V) vV - (1 - \lambda_R) \alpha\delta R \quad (27)$$

Where: λ_R and λ_V take the value of 1 when the Revolutionary and the Vigilante, respectively, act peacefully and 0 when they act violently. δ takes the value of 1 when a signal is not sent and the value 1-S when it is. From these Equations, the essential structure of the game is shown; the returns from peace-making are entirely contingent on interaction in that process by the rival organisation, whilst returns to violence are private.

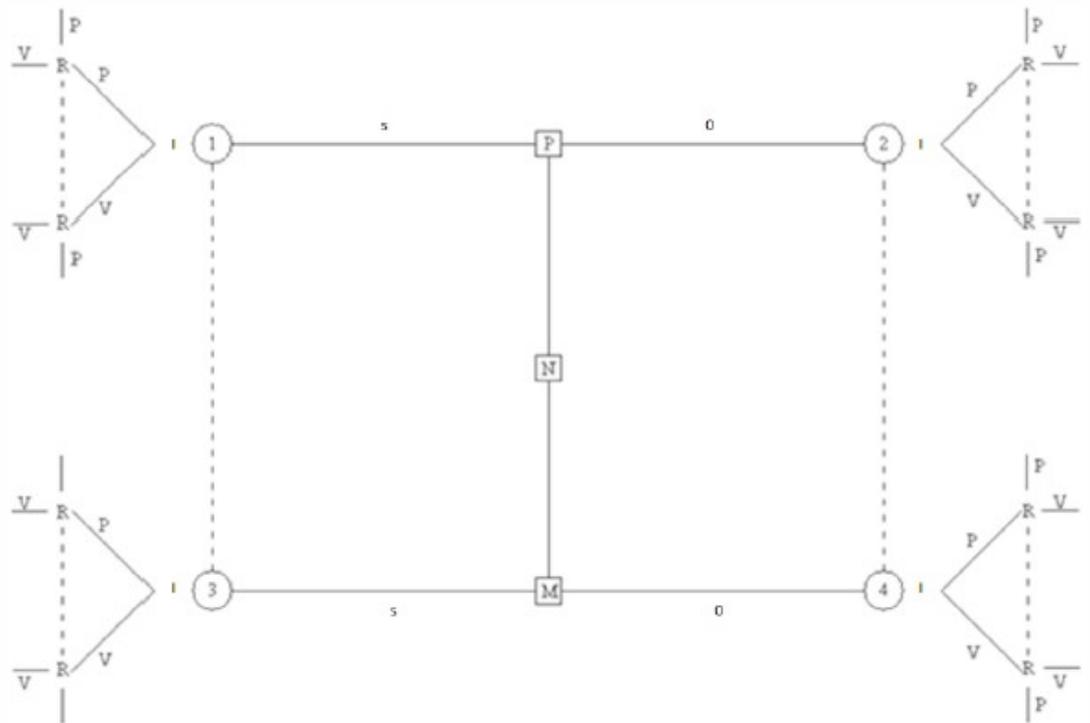


Figure 4: Incomplete information about Revolutionary preferences

Despite this, the model also shows that both the Vigilante and P-Types are best off when they jointly engage in a peace process. This hinges on the sensible assumption that P-Types prefer to act peacefully than violently when the Vigilante acts peacefully ($\gamma > \alpha$). As terrorism imposes well documented economic and social costs, I also assume that the Vigilante is better off acting peacefully, rather than violently, when P-Types act peacefully ($\beta > \nu$). When your adversary chooses violence, you are best of choosing violence, regardless of type. These outcomes show the importance of belief in this model. Payoffs to action profiles are documented in their familiar form in Tables 2 and 3.

In triangular conflicts, reputation is important. The combatants declare themselves as the representatives of the warring communities. Against this backdrop of reputation, the assumptions imposed on utility are eminently sensible - a unilateral decision to engage in peace against a violent adversary leaves the peaceful organisation looking weak in front of the community from which it draws its support. This provides an incentive, even for peaceful organisations, to behave violently unless they have strong reasons to believe that the rival organisation will act peacefully.

		Vigilante	
		Peace	Violence
Revolutionary	Peace	$\Pi_P = \gamma\delta R + \beta V$ $\Pi_V = \beta V + \gamma\delta R$	$\Pi_P = -vV$ $\Pi_V = vV + \gamma\delta R$
	Violence	$\Pi_P = \alpha\delta R + \beta V$ $\Pi_V = -\alpha\delta R$	$\Pi_P = \alpha\delta R - vV$ $\Pi_V = vV - \alpha\delta R$

Table 1: Revolutionary and Vigilante payoffs when Nature selects P-Type Revolutionary

		Vigilante	
		Peace	Violence
Revolutionary	Peace	$\Pi_M = \beta V$ $\Pi_V = \gamma\delta R$	$\Pi_M = -vV$ $\Pi_V = vV + \gamma\delta R$
	Violence	$\Pi_M = \alpha\delta R + \beta V$ $\Pi_V = -\alpha\delta R$	$\Pi_M = \alpha\delta R - vV$ $\Pi_V = vV - \alpha\delta R$

Table 2: Revolutionary and Vigilante payoffs when Nature selects M-Type Revolutionary

The set of critical beliefs in this model refers to the conditional probabilities, such that the Vigilante will act as if they are at node 1 or 3 following a first period signal of S, or if they are at node 2 or 4 following a signal of 0. Nature selects the type of Revolutionary with some probability at the start of the game. The Vigilante attaches a belief, μ , to Nature having selected a P-Type Revolutionary and $1-\mu$ that she selects an M-Type. The Vigilante additionally believes that the Revolutionary will choose to signal with probability θ_P if they are P-Type and θ_M if they are M-Type. I refer to each of these conditional probabilities as χ_i at nodes $i \in [1, 2, 3, 4]$. As can be seen from Equations (28) – (31) below, $\chi_1 + \chi_3 = \chi_2 + \chi_4 = 1$.

Following Bayes' Rule, it can be shown that, given the signal S, the Vigilante believes that it is at node 1 with the probability:

$$P[P\text{-Type} | S] = \chi_1 = \frac{\mu\theta_P}{\mu\theta_P + (1-\mu)\theta_M} \quad (28)$$

And at each subsequent node:

$$P[P\text{-Type} | 0] = \chi_2 = \frac{\mu(1-\theta_P)}{\mu(1-\theta_P) + (1-\mu)(1-\theta_M)} \quad (29)$$

$$P[V\text{-Type} | S] = \chi_3 = \frac{(1-\mu)\theta_M}{\mu\theta_P + (1-\mu)\theta_M} \quad (30)$$

$$P[V\text{-Type} | 0] = \chi_4 = \frac{(1-\mu)(1-\theta_M)}{\mu(1-\theta_P) + (1-\mu)(1-\theta_M)} \quad (31)$$

4.3 Signalling Equilibria

This model supports four potential equilibrium outcomes: a separating equilibrium in which P-Types signal and M-Types do not (denoted 0, S); two pooling equilibria, in which both players follow the same course of action in the signalling phase (S, S when both signal and 0, 0 when neither signals) and, finally, a separating equilibrium in which P-Types do not signal, but M-Types do (0, S).¹³

In these potential outcomes, we see the source of informational asymmetry. Given the prior assumptions on the Vigilante's beliefs, incomplete information raises a concern that M-Types may pose as P-Types, in order to induce a peaceful response from the Vigilante in the second period, with the S, S pooling equilibrium ensuing.

A second concern is that P-Types, anticipating post-signalling violence from the Vigilante, mimic M-Types by not signalling and using all resources for violence in the second period. Thus, the outcome is a 0, 0 pooling equilibrium. In principle, a scenario also arises in which P-Types do not signal and M-Types do. This outcome seems

¹³ This notation is used throughout the rest of the text and follows the convention that P-Types' choice in the signalling phase is listed first and that of M-Types second.

counter-intuitive, however and is not supported by the model, as will be shown below.

In the sections below, I discuss each of these potential equilibria and the conditions that are required in order for them to ensue in this model. In this discussion, I deal only with pure strategies following the signalling phase¹⁴ in order to clarify the discussion of the results. When mixed strategies are allowed, the number of potential equilibria grows significantly and convolutes the discussion of results.

4.3.1. *S, 0 Separating Equilibrium*

In this situation, the Vigilante set its belief that the Revolutionary is P-Type equal to 1 if the Revolutionary sends a signal of at least $S^* > 0$. It then follows that the Vigilante will always interpret a decision not to signal as the action of an M-Type. As violence is the dominant strategy in subgames involving M-Types, Vigilante then always respond violently when a signal is not sent.

Formally, this implies that, in all cases, $\chi_2 = 0$ and $\chi_4 = 1$ whilst $\chi_1 = 1$ and $\chi_3 = 0$ for any $S \geq S^*$. For the version of the model presented here, I make the assumption that Vigilante and Revolutionary always act peacefully at Node 1.¹⁵

In discussing this outcome, I first derive the conditions under which signalling will occur. Firstly, therefore, I define δ^* , which is the proportion of resources left following a signal of S^* , such that $\delta^* = 1 - S^*$. S^* is defined as an optimal signal – that is, the minimum signal that supports a P-Type signal but also ensures that M-Types will not signal. It is considered that any $S > S^*$ represents an inefficient excess spent on the signal.

P-Types then choose to send a signal, S^* , if their outcome from signalling at this level and inducing peace, given the expense of inducing it, is greater than the outcome from saving these resources and interacting violently with the Vigilante in the subgame. This occurs when: $\gamma\delta^*R + \beta V \geq \alpha R - \nu V$, which simplifies to:

¹⁴ In order to properly facilitate this as a valid method of discussion, I assume that the best response of Player A to a mixed strategy from Player B is to respond with violence. It should be noted that mixing is only a valid potential strategy in the portion of the game that deals with P-Types, as violence is a dominant strategy in the subgames that deal with M-Types.

¹⁵ This is intuitively understandable. If Vigilante knew they were at node 1 and dealing with a P-Type Revolutionary, they would wish for a peaceful outcome. The same goes for Revolutionary.

$$\frac{R}{V} \leq \frac{(\beta + \nu)}{(\alpha - \gamma\delta^*)} \quad (\text{Condition 1})$$

Similarly, M-Types will choose to signal when: $\alpha\delta^*R + \beta V \geq \alpha R - \nu V$, which can be simplified to:

$$\frac{R}{V} \leq \frac{(\beta + \nu)}{\alpha(1 - \delta^*)} \quad (\text{Condition 2})$$

Thus, this separating equilibrium occurs when P-Types send a signal of S^* and M-Types do not signal. Accordingly, this occurs under Conditions 1, ~ 2 , where \sim denotes that a condition does not hold. The condition for separation is, thus:

$$\frac{(\beta + \nu)}{(\alpha - \gamma\delta^*)} \leq \frac{R}{V} \leq \frac{(\beta + \nu)}{\alpha(1 - \delta^*)} \quad (\text{Condition 3})$$

As I have already shown the relationship between δ^* and S^* , I can rewrite Condition 3 in terms of a condition on the range in which the scale of the signal must lie to ensure separation, such that:

$$1 - \frac{\left[\alpha + \frac{V(\beta + \nu)}{R} \right]}{\gamma} \leq S^* \leq \frac{V(\beta + \nu)}{\alpha R} \quad (\text{Condition 4})$$

4.3.2. 0, S Separating Equilibrium

I now, briefly, turn attention to the case of separation in which M-Types signal and P-Types do not. It is easy to note that such an outcome is immediately counter-intuitive in this model as it requires the Vigilante to interpret the sending of a signal as an act of war and the choice not to send a peaceful signal as one of peace. It is included here for completeness of discussion. In this situation, the Vigilante sets its belief that Revolutionary is M-Type equal to 1 if the Revolutionary sends the signal of at least S^* . It then follows that the Vigilante will always interpret a decision not to signal as the action of a P-Type. As violence is the dominant strategy in subgames involving M-Types, Vigilante then always respond violently when a signal is sent.

Formally, this implies that, in all cases, $\chi_1 = 0$ and $\chi_3 = 1$ whilst $\chi_2 = 0$ and $\chi_4 = 1$ for any $S \geq S^*$. In this case, I again look only at the peace-peace and pure strategy outcomes, where P-Types and the Vigilante both act peacefully following the signalling phase. As before, I first look at the incentives for a P-Type to signal. A P-Type will signal when: $\alpha\delta^* R - vV \geq \gamma R + \beta V$. As neither vV or βV are trivial and as $\delta^* < 1$, this condition never holds. Accordingly, P-Types will never signal in this scenario.

M-Types will choose to signal when: $\alpha\delta^* R - vV \geq \alpha R + \beta V$. Following the logic in the previous paragraph, it is also easy to see that this condition will never hold and M-Types will also choose never to signal in this scenario. Accordingly, a 0, S separating equilibrium is infeasible in this model.

4.3.3. Pooling Equilibria

Attention now turns to the case in which both Revolutionary types choose the same signal in the first period. It should be noted that in either pooling equilibrium, the post-signalling phases are representative of the incomplete information version of the battle of the sexes game. Accordingly, a similar solution concept can be employed, in order to solve the outcomes of the game in the pooling equilibria. The subgames that ensue at nodes 1 and 2 have two pure Nash equilibria; the case in which both P-Types and the Vigilante act peacefully and the case where both act violently. As before, the subgames at nodes 3 and 4 exhibit an all-violence dominant strategy.

This discussion then begins with a discussion of P-Type strategy at node 1, which is reached with a probability of χ_1 in this model. Should P-Types choose peace at node 1, then the pure strategy Nash equilibrium best response of the Vigilante is to respond with peace at this node. However, as the signal now contains no new information, node 3 is also reached with a positive probability, $\chi_3 = (1 - \chi_1)$, where violence ensues. Accordingly, in the S, S pooling equilibrium, given a P-Type strategy of peace at node 1, the Vigilante will choose to act peacefully if expected returns from doing so are such that: $\chi_1(\beta V + \gamma\delta^* R) + (1 - \chi_1)(-\alpha\delta^* R) \geq \chi_1(vV + \gamma\delta^* R) + (1 - \chi_1)(vV - \alpha\delta^* R)$, which can be rewritten:

$$x_1 \geq \frac{v}{\beta} \quad (\text{Condition 5})$$

In exactly the same manner, the condition for Vigilante peace at node 2 can be written:

$$x_2 \geq \frac{v}{\beta} \quad (\text{Condition 6})$$

As all beliefs in this model are common knowledge, in the situations where Conditions 5 or 6 fail, the P-Types' best response is to act violently. In either equilibrium, the best response of the Vigilante to a P-Type strategy of violence is always to act violently. Given these conditions, there are four permutations that can occur in this model; where both hold, when both fail and when Condition 5 holds, whilst Condition 6 fails.¹⁶

Accordingly, under Conditions 5, 6, P-Types act peacefully at nodes 1 and 2, M-Types act violently at nodes 3 and 4 and the Vigilante responds peacefully to both S and 0. Under Conditions ~ 5 , ~ 6 , the opposite outcome ensues, with both P-Types and M-Types acting violently in the subgames and Vigilante responding violently to both S and 0. Finally, under Conditions 5, ~ 6 , M-Types still respond violently following either signal. P-Types, however, respond peacefully at node 1 and violently at node 2. Finally, the Vigilante responds peacefully following S and violently following 0.

Conditions:	Type:	Payoff:	
		Signal: S	Signal: 0
5, 6	P-Type	$\gamma\delta^*R + \beta V$	$\gamma R + \beta V$
	M-Type	$\alpha\delta^*R + \beta V$	$\alpha R + \beta V$
5, ~ 6	P-Type	$\gamma\delta^*R + \beta V$	$\alpha R - vV$
	M-Type	$\alpha\delta^*R + \beta V$	$\alpha R - vV$
~ 5 , ~ 6	P-Type	$\alpha\delta R^* - vV$	$\alpha R - vV$
	M-Type	$\alpha\delta R^* - vV$	$\alpha R - vV$

Table 3: Revolutionary payoffs in pooling equilibria

Having discussed the solution to the subgames, attention now turns to the feasibility of each of these equilibria. Accordingly, in Table 3, the returns to each type of Revolutionary are displayed for the three feasible strategic mixes discussed in the

¹⁶ The situation where Condition 5 fails and Condition 6 holds is not considered as this would require Vigilante to have stronger beliefs that Revolutionary are P-Type following no signal than following a signal; or in the context of the model, to assume an act of peace to be an act of war and vice versa.

previous paragraph. Outcomes to each type of Revolutionary are also split by the signal they send, which provides information on the incentives each type has to signal, given the subgame outcomes.

Accordingly, an S-Pooling equilibrium can only occur under Conditions 5, ~6, although it should be noted that a 0-Pooling equilibrium can also occur in this situation, as can a situation where neither of these equilibria is feasible. Under 5, ~6, an S-Pooling equilibrium occurs when the returns of both P-Types and M-Types are greater, having sent the signal than having not sent this signal. This requires; $\gamma\delta^*R + \beta V \geq \alpha R - vV$ and $\alpha\delta^*R + \beta V \geq \alpha R - vV$ for P-Types and M-Types respectively. These can be rearranged:

$$\frac{R}{V} \geq \frac{-v-\beta}{(\gamma\delta^*-\alpha)} \quad (\text{Condition 7})$$

$$\frac{R}{V} = \frac{\beta+v}{\alpha-\alpha\delta^*} \quad (\text{Condition 8})$$

Accordingly, an S-Pooling equilibrium only occurs under Conditions 5, ~6, 7, 8. In any situation where the discounted return of peace-making, ($\gamma\delta^*$) induced by the signal is greater than the return to violence (α) for P-Types, they will choose to signal as Condition 7 will always be negative in this scenario. Neither pooling equilibrium is infeasible under Conditions 5, ~6, 7, ~8, whilst the model exhibits three feasible 0-Pooling equilibria, which occur under; Conditions 5, 6; Conditions ~5, ~6 and Conditions 5, ~6, ~7, ~8.

This final result depicts a P-Type Revolutionary organisation that devotes all of its resources to acts of violence. Here, we witness the potentially destructive effect that a pro-status quo Vigilante can have in a conflict it wishes to end. When P-Types lose their belief that they can convince the Vigilante that they are peaceful, violence ensues. The principal effect here is that the Vigilante's beliefs and subsequent actions can actually perpetuate a conflict that it claims is seeks to end.

Ceteris paribus, the conditions discussed above show that, given a set of beliefs, it is the relative scale of the organisations involved that drives the outcomes of the model. The larger the Revolutionary organisation is, relative to the Vigilante organisation, the less

likely the Revolutionary is to signal. That said, if the relative scale is too low, there is an incentive for M-Types to signal. The implicit outcome here is that the Vigilante threat must be large enough to provide a significant deterrent to the Revolutionary for the Revolutionary to be willing to interact. If the Vigilante organisation is too large, however, it poses such a threat to the Revolutionary in the second period that M-Types will be willing to mimic P-Types by sending a signal and attempting to induce peace in the second period.

Superficially, this result is supported by data on paramilitary membership and weapons caches from the Northern Ireland conflict. The Republican organisations, jointly, were larger and had greater access to weaponry and expertise than their Loyalist counterparts but the Loyalist forces still provided a significant presence in the conflict. Contrarily, the enormous Hamas organisation has simply crushed a number of small rivals operating in the Middle East.

The conditions also show the role that the relative sizes of the parameters of peace and violence of the Revolutionary organisation play in the signalling decision. The larger the return to peace, γ , relative to the return to violence, α , the more likely a P-Type organisation is to signal, whilst a high return to violence reduces the likelihood of a signal.

4.4 Concluding Remarks

Due to the Bayes-Nash nature of the subgames in this model, we witness a large number of potential conclusions and outcomes. In the formation above, I show conditions that support pooling equilibria both on and off the signal and a separating equilibrium, where types signal their true nature. I show how the role of both beliefs and relative resources are important in the derivation of outcomes. This is most specifically poignant in outcomes where P-Types devote all resources to the pursuit of violence.

The three main results supported by the model presented here provide an interesting snapshot of triangular conflict. Under the conditions for pooling equilibrium, we see that Vigilante beliefs and actions can deter a nominally peaceful Revolutionary organisation from devoting any resources to peaceful action. This provides a notion of

how the presence of a pro-government Vigilante can perpetuate conflicts they are seeking to end. Despite this, I also show the conditions that support a peaceful resolution between the warring factions in triangular conflicts, which occurs when a P-Type leadership is present and separation possible.

We see these results illuminated in the context of Northern Ireland, for example. In 1986, Sinn Féin recognised the legitimacy of Dáil Éireann, the parliament of the Republic of Ireland and stood candidates for election to both the Irish and United Kingdom parliaments. This began the IRA strategy known as “the Armalite and the ballot box”, a strategy fought both on political and violent fronts. Despite these peaceful overtures, the IRA did not cease violence for another 8 years, suggesting that in these years, signalling took place but was ineffective.

Following the IRA ceasefire on 31 August 1994, however, the Combined Loyalist Military Command (CLMC) called their own ceasefire 43 days later, suggesting that the earlier ceasefire had differentiated P-Types and M-Types. These ceasefires led, ultimately, to the signing of the Good Friday Agreement in 1998, which serves as an illustration of how peace can be brought about, through the use of a signal of appropriate scale.

Most interestingly, this model shows that the incentives to signal and to separate are based on the relative scales of the organisations involved. If the Revolutionary is too forceful, the Vigilante cannot provide an effective deterrent, removing the Revolutionary’s incentive to interact in a peace process. If the Vigilante is too powerful, however, the deterrent it provides is great enough to incentivise an M-Type Revolutionary to act peacefully in the signalling phase.

It should be noted, however, that this is not a complete model of triangular conflict. This model focuses only on the interaction, within a triangular conflict, of the illegal paramilitary organisations. Further work could look at the role of government security forces as a strategic player in the conflict but this is beyond the scope of the work presented here.

The model could also be expanded to account for a continuum of Revolutionary types that can vary across time. This version works on an assumption that the Revolutionary

is either entirely P-Type or M-Type at any given time. This seems a poor reflection of reality, where the Revolutionary leadership would have some continuum of peacefulness, based on the internal wrangling of the organisation and the beliefs of those in the upper echelons of power. The degree of peacefulness at any time would be reflected by the scale of signal sent.

This would constitute a further major piece of work but would provide a more accurate portrayal of triangular conflict. This model still goes some way to capturing these effects, however. The Revolutionary's incentives to act peacefully or violently in the subgames and its incentive to signal is based, in part, on the relative scale of returns to peace, γ and violence, α . A Revolutionary with a strongly peaceful leadership would expect a higher return to peaceful action than violence, increasing both the likelihood of choosing to signal and of acting peacefully in the post-signalling phase.

Whilst more simplistic than explicitly focusing on the peacefulness of a Revolutionary leadership, the effect captured here is strong and provides an interesting rationale of the structure of the Revolutionary leadership. In this respect, this model provides a strong outline of the interaction between two of the major players in triangular conflicts, whilst offering explanations for the duration of these conflicts - almost thirty years in Northern Ireland and on-going in both Iraq and Columbia, for example - but also a suggestion as to how they can, end with a peaceful resolution.

Chapter 5: A Duration Analysis of The Troubles in Northern Ireland

5.1 Introduction

On 14 July 1969, Francis McCloskey, a Catholic civilian, died after being struck with batons by members of the Royal Ulster Constabulary (RUC) during street disturbances in Dungiven, County Derry, Northern Ireland. This death was a precursor to a low-intensity triangular conflict between Republican paramilitaries, Loyalist paramilitaries and British Security Forces. Colloquially known as “The Troubles”, this conflict claimed the lives of in excess of 3,500 people over almost thirty years.

The Troubles provide a rich background and a reliable source of data for the study of triangular conflict. Darby (1995) traces the conflict back to the plantation of Ulster in 1609 and concludes that the problems identified at this time were not only territorial but also cultural and religious, between the 'planted' Protestant landowners from England and Scotland and the Catholic Irish. These divisions remained prevalent up to and following the Anglo-Irish agreement that partitioned Ireland in 1921. Whilst the problem is initially described as English-Irish, in the context of the Northern Irish conflict, it came to be, broadly, a Protestant-Catholic problem.

Fitzduff and O’Hagan (2000) focus on a theme of inequality as a background to the conflict, noting the effects of discrimination against Catholics. This inequality led, first of all, to the non-violent Northern Ireland Civil Rights Movement. The Parliament of Northern Ireland, seeing this movement as a threat to the 'Protestant state', reacted aggressively. This “hostile response” led to an “eruption of violence on the streets”; it was this violence that ultimately led to the formation of vigilante organisations and the commencement of the paramilitary violence that characterised The Troubles.

Darby (2003) notes that during the Troubles, the model of violence changed – what began with rioting between the two main communities in the 1960s gradually moved towards a, “triangular, low intensity conflict,” between the British Army, Republican Paramilitaries and Loyalist Paramilitaries. The British Army entered Northern Ireland in 1969, with a brief to restore peace but quickly became a target for Republican terrorist attacks. During the early 1970s, a number of paramilitary organisations formed. The Ulster Defence Association (UDA) acted as an umbrella organisation for a

loose band of Loyalist vigilantes, whilst the Provisional Irish Republican Army (PIRA) began a series of bombing and shooting attacks.

Whilst the initial aim of the Civil Rights movement was equality, the Republican movement's long-term strategic goal was of the reunification of Ireland. Loyalists, on the other hand, wished to maintain the status quo of the union with the United Kingdom. Although often illegal, Loyalist paramilitaries acted as pro-government, or at least as pro-status quo, vigilantes and attempted to impose costs on Republican organisations through a series of retaliative attacks.

This strategy is discussed widely in qualitative literature with the likes of Taylor (1996), O'Brien (1995) and Dillon (1992) stating that the long-term aim of Loyalist terrorist forces was to protect the Protestant community in Northern Ireland from Republican attacks. O'Brien, in particular, claims that the stated political goal of the UDA was to stop Republican violence. Should Republicans cease to be violent, the UDA would lay down their arms. This suggestion is indicated by the Combined Loyalist Military Command (CLMC) ceasefire in October 1994, which came only 43 days after the IRA's ceasefire in August 1994.

The qualitative literature suggests a more varied Republican strategy, aiming to impose maximum physical and mental damage on 'the enemy'. It states that interaction with Loyalists was not an important part of overall strategy. Thus, whilst I still expect some 'matching' of strategy, Republican action should not necessarily directly correlate with Loyalist attacks in the way theory and qualitative literature suggests Loyalists will interact with Republicans.

In the theoretical setting, presented in Chapter 4, organisations' actions are related to the actions of the other organisation. For example, should Republicans engage in a long period of relative peacefulness, it would be expected that Loyalists, as self-styled reactionary forces, would also engage in a period of relative peacefulness. The transmission of this idea into reality makes duration analysis a particularly suitable method to study the interaction, as I look at the effect on the likelihood of an attack by one organisation, contingent on the level of action of its rival.

At times of high violence by an adversary, the duration between the attacks of a group

are likely to be considerably shorter than at times of relative peacefulness by the adversary. Thus, it allows modelling of both the overarching strategy and the interactive strategy. Furthermore, unlike probit / logit models, duration analysis allows direct interpretation of the marginal effects, rather than simply the direction of causality. I measure the relative peacefulness / violence of an organisation as the average level of violence perpetrated by that group between the pair of attacks of the other organisation that generates the duration variable.

In considering this question, I begin with a simple hypothesis; *ceteris paribus*, a high level of militancy by organisation A will decrease the duration between attacks perpetuated by organisation B. In keeping with the nomenclature of duration analysis, this translates to a higher conditional probability of organisation B attacking in any window of time when organisation A is in a period of militancy.

Duration dependence, therefore, should appear to be negative; the longer since an attack by an organisation, the less likely it is for that organisation to attack in the next period. This notion is intuitively tractable – if a proportion of the violence perpetrated by organisation A relates to the degree of militancy of organisation B, then the suggestion of a long duration is that organisation B is engaging in a period of relative peacefulness. As organisation B is engaging in a period of relative peacefulness, organisation A will not engage in retaliative attacks, which discourages organisation B from engaging in violence and so on...

To capture the organisational structure of paramilitary organisations, I introduce a naïve measure of spatial spillovers. Loyalist organisations, particularly, were organised at local level, forming into 'battalions' that were split closely along the borders of Northern Ireland's parliamentary constituencies¹⁷. Due to this organisational structure, the qualitative literature suggests that Loyalist groups' actions are likely to be more locally organised.

¹⁷ Whilst almost impossible to find a full list of Loyalist paramilitary battalions, I draw on the most violent UVF battalions during “The Troubles” to illuminate this suggestion. Four notable battalions exist in Belfast – East Belfast, North Belfast, South Belfast and West Belfast. Belfast’s electoral constituencies are split similarly. Londonderry (Foyle Constituency) and Mid-Ulster (Upper Bann constituency) were also prevalent.

5.2 Data

The data used in this work is sourced from Malcolm Sutton's "An Index of Deaths from the Conflict in Ireland", Sutton (1994), which documents each death directly linked to the conflict. Pertinent information includes the name of the organisation that perpetrated the attack and the status of the victim, for example, a Catholic civilian, Protestant civilian or a member of the security forces. Most importantly for this study, however, this data provides the exact date of each death and excellent geographic information on the location of each attack, which facilitates mapping of the conflict to Northern Ireland's eighteen Westminster parliamentary constituencies.

I use a restricted sample of this data running from 1st January 1971 until 31st August 1994. Although the common suggestion is that the first death directly related to The Troubles was that of Francis McClosky in July 1969, his death occurred during a street disturbance, the kind of which was common in the late-1960s. It was only in the early-1970s that the pattern of violence changed from this kind of communal rioting to the terrorist incidents that characterised the conflict until its end.

By the same token, the Ulster Defence Association (UDA) only commenced action in 1971. The beginning of UDA action closely defines the beginning of the triangular conflict in Northern Ireland, which this paper aims to study. The PIRA ceasefire of 31st August 1994 presents a logical end point. Violence dramatically declined on both sides of the conflict following this ceasefire, as shown below in Figure 5.

I look only at attacks that occurred between these dates and within the geographical boundaries of Northern Ireland. I also do not include incidents where the 'side' of the perpetrator organisation was not known or incidents that could not accurately be geographically mapped to a Westminster parliamentary constituency. My dataset includes some 2,900 deaths, which occurred across 9,009 days. I present a daily time-series due to the apparently rapid retaliation structures in place.¹⁸ Using the location data, I have been able to map each death from the conflict to latitudes and longitudes,

¹⁸ As an example of rapid retaliation, I consider the first attacks to occur in Portadown. Portadown is a town with a population of approximately 20,000 and is located in the Upper Bann constituency in County Armagh. The first attack there took place on 12 July 1972, over two and a half years into the conflict. A non-specific Republican organisation killed a Protestant civilian. The second attack in Portadown also took place on 12 July 1972, when the UDA killed a Catholic civilian and a Protestant civilian in a bar shooting.

postcodes and electoral constituencies. This has provided a panel formation of the information that is suited to duration analysis.

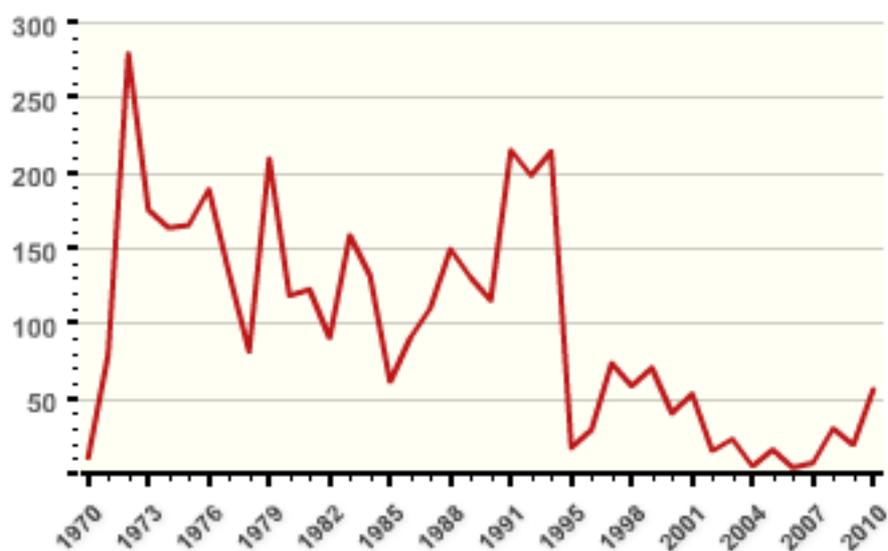


Figure 5: Terrorist incidents in Northern Ireland by year (Source: GTD, START (2011))

I construct the duration of 'peace' from Sutton's (1994) Index. 'Peace' is the time elapsed between each pair of attacks attributable to the paramilitaries on each 'side' of the conflict. For this study, I have broadly grouped 'sides' into "Loyalist" and "Republican".¹⁹ The main Republican organisations included in the data are the PIRA and the INLA. The main Loyalist organisations are the UDA, the UFF and the UVF. Data for the more minor groups is also available and is included in the analysis. Finally, I derive a series of ten covariates from the data included in Sutton, five for each of the two duration series. I fully define each of these covariates in Table 3 and include the summary statistics of these covariates in Table 4.

Data for economic and geographic controls, such as population, population split, unemployment, GDP and a series of location specific dummy variables are also used. To capture changing strategies throughout the conflict, I use a further series of dummy variables; the first accounts for the effects following the Sunningdale Agreement in 1973, the second for the election of Bobby Sands in May 1981 and the final one from 1986 onwards, which marks the beginning of the 'Ballot Box and Armalite' strategy. Finally, due to the changing nature of violence, which saw a rise in the early 1970s and

¹⁹ Data variation issues prevent further disaggregation of 'sides' into their constituent 'groups'.

a general decline through the late-70s and 1980s, I include a quadratic time trend.

Table 4: Definitions of main covariates included in analysis

Duration	Covariate	Definition
Republican	tlave	Average number of deaths caused by Loyalist paramilitaries, per day.
	tsave	Average number of deaths caused by British Security Forces, per day.
	trbave	Average number of deaths caused by Republican paramilitaries, per day, in contiguous regions.
	tlbave	Average number of deaths caused by Loyalist paramilitaries, per day, in contiguous regions.
	tsbave	Average number of deaths caused by British Security Forces, per day, in contiguous regions.
Loyalist	trave	Average number of deaths caused by Republican paramilitaries, per day.
	tsave	Average number of deaths caused by British Security Forces, per day.
	trbave	Average number of deaths caused by Republican paramilitaries, per day, in contiguous regions.
	tlbave	Average number of deaths caused by Loyalist paramilitaries, per day, in contiguous regions.
	tsbave	Average number of deaths caused by British Security Forces, per day, in contiguous regions.

5.3 Econometric Methodology

In this section, I apply duration modelling techniques to my panels. In the simplest sense, duration models look at the probability of changing state in some small window of time, contingent on having survived in the initial state up to the start of this window.

More formally, the length of a spell, in this case, the period without a violent attack, is the “realisation of a continuous random variable, T , with a cumulative distribution function (cdf) $F(t)$ and probability density function (pdf) $f(t)$.” (Jenkins, 2005). The cdf is also known as the failure function, with the survivor function defined: $S(t) = 1 - F(t)$; t is the time elapsed since entry into this state. Exit from this state is then defined by the timing the next violent attack.

Duration	Covariate	Obs.	Mean	Std. Dev.	Min	Max
Republicans		1261	127.549	419.453	1	9009
	tlave	1261	0.030	0.197	0	6
	tsave	1261	0.016	0.173	0	5
	trbave	1261	0.076	0.176	0	2.75
	tlbave	1261	0.050	0.135	0	1.364
	tsbave	1261	0.025	0.147	0	3
Loyalists		690	234.364	680.598	1	7108
	trave	690	0.050	0.160	0	2
	tsave	690	0.017	0.182	0	4
	trbave	690	0.100	0.230	0	3
	tlbave	690	0.091	0.163	0	1.33
	tsbave	690	0.028	0.110	0	1.33

Table 5: Summary Statistics for Duration Variables and Main Covariates

More formally, the failure and survivor functions are defined:

$$F(t) = \Pr(T \leq t) \quad (32)$$

$$S(t) = 1 - F(t) = \Pr(T > t) \quad (33)$$

The probability density function is then the slope of the failure function, which can be defined:

$$f(t) = \lim_{\Delta t \rightarrow 0} \frac{\Pr(t \leq T \leq t + \Delta t)}{\Delta t} = \frac{\partial F(t)}{\partial t} = -\frac{\partial S(t)}{\partial t} \quad (34)$$

As Δt is an infinitesimally small duration, Equation (34) is interpreted as the probability of exiting the current state in this tiny window of time. From this, the hazard rate is defined. The hazard rate is, in essence, the probability of a state change, contingent on the state having not changed up until that time. In other words, the hazard rate shows the ‘transition intensity’. The hazard rate is defined:

$$\theta(t) = \frac{f(t)}{1 - F(t)} = \frac{f(t)}{S(t)} \quad (35)$$

The baseline hazard gives the conditional probability of a state change in a particular window of time, when all covariates are set equal to zero. In this case, the baseline hazard essentially implies the underlying strategy of a terrorist organisation. The

introduction of covariates then allows us to examine their impact on the baseline hazard, or how the underlying terrorist strategy was affected by the covariates.

Furthermore, the baseline hazard also allows inspection of duration dependence. In the literature, a series is said to exhibit positive duration dependence if the probability of exiting a state increases with time. For example, a series would have positive duration dependence if the probability of failure at time $t+1$, conditional on having survived until time t is larger than the probability of failure at time $s+1$, conditional on having survived until time s for all $s < t$. A series exhibits negative duration dependence if the probability of failure decreases in time.

Neither economic theory, nor the qualitative literature, provides any strong justification for imposing the structure of duration dependence on this model. As stated before, the baseline hazard functions in this paper proxy terrorist strategy; this distribution of violence is not discussed in the qualitative literature. As such, I use the Cox Proportional Hazards (PH) Model to parametrically estimate duration dependence.

The PH specification is as follows:

$$\theta(t, X_i) = \theta_0(t) \exp(\beta' X_i) \quad (36)$$

In other words, the probability of exit at a particular time, conditional on having survived in a state until that time, is equal to a multiplicative relationship between the baseline hazard function and the covariates in the model. The advantage of the Cox model is that it allows one to estimate the relationship between the baseline hazard and covariates without making any assumption about the shape of the baseline hazard.

This is particularly important for this work as the interest is not in the shape of duration dependence itself but on the impact of the covariates. This makes the Cox PH model particularly suited to this study. I use the Breslow method for tied failures in the main analysis for computational ease and derivation of the Schoenfeld residuals, which allows testing of the proportional hazards assumption.

In interpreting the output of the Cox model, the hazard rate is compared to 1. If a

covariate has a hazard rate that is not significantly different to one, it is shown not to affect the baseline hazard. Looking at the PH specification in Equation (36), this is sensible – the 'transition intensity' is the same as in the baseline hazard if the hazard ratio of a covariate is 1. If it has a value greater than one, it increases the probability of exit, thus decreasing the duration of survival and if it has a value less than one, it has the effect of increasing the duration of survival.

I apply the Cox model to two series. The first series is the duration between each Republican attack and the previous Republican attack within a Westminster parliamentary constituency in Northern Ireland. The second is the duration between a Loyalist attack and the previous Loyalist attack within a constituency. I generate a series of five covariates of interest for each duration series. These covariates are the average level of violence by each of the involved groups between each pair of attacks in the location and in contiguous regions.

Thus, for Republicans, I test the impact of average Loyalist violence in the region ($tlave$), average Security Forces violence in the region ($tsave$), and average Republican ($trbave$), Loyalist ($tlbave$) and Security Forces ($tsbave$) in contiguous regions. For Loyalists, I replace average Loyalist violence with average Republican violence ($trave$) within the region and include the other four covariates. I define contiguity as having a land border with another constituency.

Given that the baseline hazard effectively measures the underlying strategies employed by the terrorist organisations, any deviation from the baseline is suggestive of how overall strategy is affected by the actions of rival and opposition groups. It should not be unreasonable to expect that the duration between Loyalist attacks, say, will decrease when average Republican violence is high given the theory and qualitative literature.

It is plausible to expect that some incidents will be correlated over space and time. As can be seen from Figure 5, deaths attributable to the conflict vary dramatically by year, whilst Figure 6 shows the number of deaths, per constituency, within my time-series, which also varies intensely.

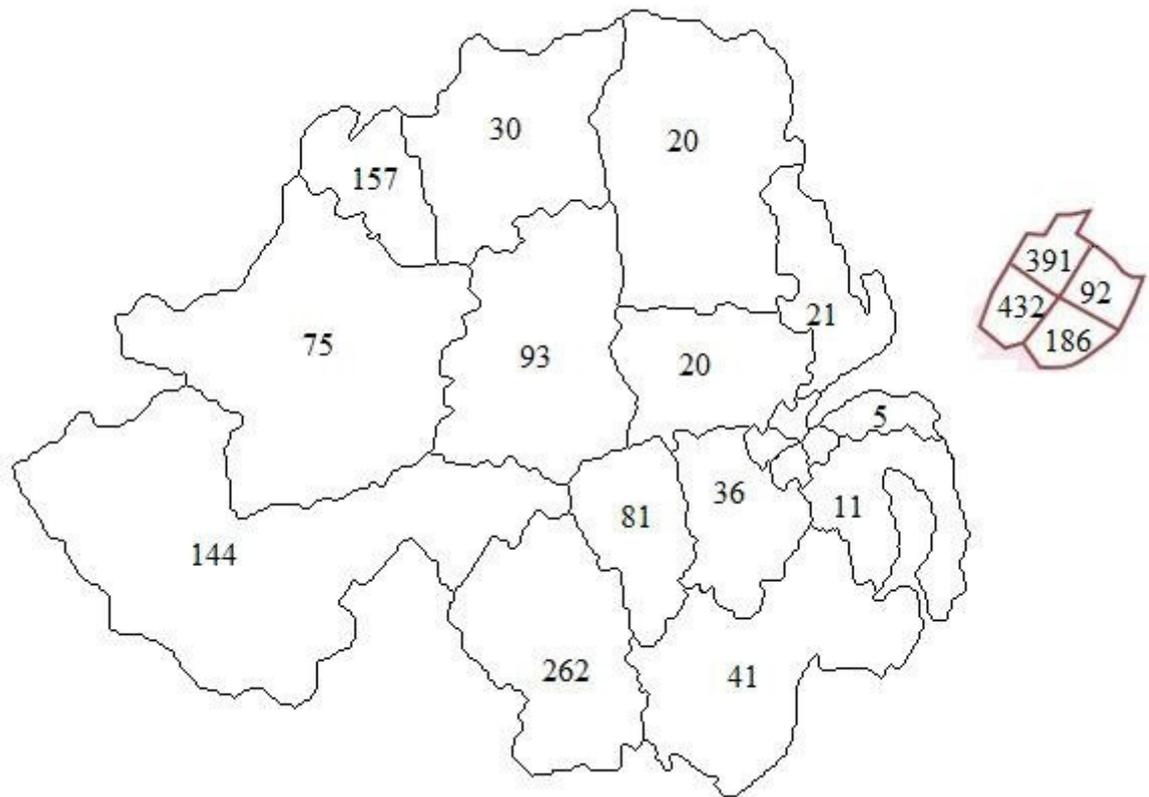


Figure 6: Deaths from the Conflict in Northern Ireland by Westminster Constituency

To overcome these variations, I work with four main models. Firstly, I look at a model where I introduce a series of year and location controls. In controlling for location, I include a dummy variable for each of my geographic units²⁰, population (pop) and the percentage of Catholics in the population (split). In controlling for year, I include the log of unemployment (lnunemppc) and the log of GDP per capita (lngdppc) as well as a quadratic time trend. Finally, I introduce dummy variables to account for potential structural breaks in Republican strategy (sunn, sands and dail), which represent the Sunningdale Agreement in 1973, Bobby Sands' election to the Westminster parliament in 1981 and Sinn Féin's recognition of the Dáil Éireann in 1986.

In the second model, I stratify by year and include the location controls. In the third, I stratify by location and include the economic year-controls. Finally, I stratify by both year and location, whilst excluding the location and year controls. Stratification allows a new baseline hazard for each stratum but imposes that the effect of the covariates remains the same on each baseline hazard. In effect, this allows terrorist organisations

²⁰ Abadie (2006) shows that geographic controls are important in terrorism studies and also suggests that they reduce the explanatory power of economic variables.

to adopt different strategies in different locations and / or in different years but that their interaction with rival organisations remains the same across space and time.

It should be noted that, using this modelling technique, the results presented here do not necessarily designate causality but rather, reflect a direct correlation of the activities of organisations. The Cox PH model does not readily facilitate a fuller discussion of causality using, for example, Granger Prediction. Accordingly, throughout this chapter, reference is made to qualitative literature, theory and, in the next section, more specific interactions, in order to infer the nature of the effects that I find.

I use Stata's inbuilt 'phtest' to test the proportional hazards assumption. The PH assumption that underpins the Cox model states that the hazard rate must stay constant over time. This means that the hazard ratio between a treated and a non-treated group remains constant over time. As the average level of violence changes for each new duration pair, graphical methods of testing this assumption are infeasible. The 'phtest' is, essentially, a test of a nonzero slope of the Schoenfeld residuals that are derived from the Cox model. The null hypothesis of a zero slope is tantamount to testing that the log hazard-ratio function is constant over time. A rejection of this null hypothesis suggests deviation from the PH assumption.²¹

5.4 Results

The output from the key variables in these models is documented in Tables 6 (duration between Republican attacks) and 7 (duration between Loyalists attacks). Full results are in Appendices 2 and 3. A hazard ratio of 1 suggests that the covariate has no effect on the duration being discussed. Thus, the test of the hazard ratio's significance is a test as to whether it is significantly different to 1.

These results use the Breslow method for tied failures for computation ease but these methods do not materially change the results presented here. Similarly, results are also robust when using a variance-covariance estimator clustered on year and constituency. Two further robustness checks also support these outcomes. In the first, I use an accelerated failure time model using a Weibull distribution (presented in Appendix 7)

²¹ A full discussion of the duration techniques discussed in this chapter and throughout this thesis can be found in Jenkins (2005)

and in the second, I introduce a quarterly dummy variable²² to account for annual intensity in the variation of violence (presented in Appendix 5). This is important as, typically, paramilitaries held a “Christmas Ceasefire” for two weeks each December, whilst there is also typically a peak in violence in the middle of the Orange Order marching season in July. Neither of these robustness checks materially changes the results.

	No strat. Year and loc controls	Strat by year & loc controls	Strat by loc and year controls	Strat by year and loc
tlave	1.977***	1.751***	2.1289***	1.758***
tsave	1.627***	1.579***	1.6729***	1.526**
trbave	1.486**	1.239	1.382*	1.081
tlbave	2.065**	1.8079**	1.974**	1.590
tsbave	2.243***	2.369***	2.239***	2.537***
log-likelihood	-7302.677	-3706.554	-4625.126	-1590.513

***, ** and * show significance at 1%, 5% and 10% respectively

Table 6: Results for Cox PH model on the duration between Republican attacks

A final robustness check seeks to test the dynamic nature of the conflict by introducing the lagged average value of violence by each of the three “groups” in the region and in neighbouring regions in the three months before each attack by Republicans and Loyalists. Full results from these analyses are found in Appendix 6. Whilst these results do not materially change the main findings of the models presented below²³, they show that these lagged variables are insignificant determinants of the timing of violence.²⁴ This suggests that the interaction of the organisations is very much

²² For Republicans, the only one of these dummies that is significant is the first quarter dummy, whilst none are significant for Loyalists. As they do not materially change the outcomes of interest in this model, I present these results in an appendix, only.

²³ In fact, the only change is that Loyalists are no longer shown to interact with Loyalist organisations in neighbouring regions.

²⁴ All of the lagged values in both duration series are shown to be insignificant drivers of the outcomes, with the exception of the lag of in-region violence by the security forces. Given the relative low-intensity of this violence and the excessive hazard ratio and standard error presented, this is assumed to be driven by multicollinearity with other variables in the model – as in-region security forces violence tends to be comparatively low, a significant number of three month periods exist with no security forces violence at all. Accordingly, it seems likely that these zeroes will be correlated with the zeroes in the other variables in the model. Accordingly, no inference is drawn on the significance of this variable.

immediate. Previous reputation of one organisation does not account for the strategic actions of another. Instead, responses seem to occur as a direct response of current and local violence.

	No strat. Year and loc controls	Strat by year & loc controls	Strat by loc and year controls	Strat by year and loc
trave	4.302***	4.051***	4.999***	3.868***
tsave	1.487*	1.377	1.566**	1.333
trbave	1.226	1.077	1.198	1.038
tlbave	4.402***	2.623**	4.159***	2.561**
tsbave	0.999	0.973	1.024	0.871
log-likelihood	-3464.351	-1690.007	-2180.681	-799.770

***, ** and * show significance at 1%, 5% and 10% respectively

Table 7: Results for Cox PH model on the duration between Republican attacks

The universal PH tests reject the null in both the Republican and Loyalist models when I use the single set up that does not involve any stratification. The PH tests do not reject the null in any of the three set ups using stratification. This suggests that stratification is an appropriate tool to use in this situation. Results from the PH tests can be seen in Appendix 4.

As discussed in Section 5.3, the interpretation of the hazard ratios from the Cox PH model should be tested as being significantly different from one. To interpret the marginal effects, we compare the hazard ratio to one. For example, taking the first result presented in Table 5, we can see that the hazard ratio for the average number of deaths attributable to Loyalists, on the duration between Republican attacks is 1.977 and is shown to be significant at the 1% level.

What this hazard ratio means is that, should the average number of deaths attributable to Loyalists increase by one, the conditional probability of Republicans shifting their ‘state’ from peace to violence changes by $1.977 - 1$, or 0.977. In other words, should the average number of deaths attributable to Loyalists increase by one; the probability of a Republican state-change is 97% higher. Whilst this is a startling statistic in itself,

the hazard ratio of 3.868 shown as Loyalists' response to Republican militancy in Table 7 is even stronger. This suggestion fits strongly with the qualitative literature, suggesting that Loyalists are much more responsive to Republican militancy than the other way around

Perhaps the most striking result is that I present evidence both of Loyalists interacting with Republicans and Republicans interacting with Loyalists. Given the scale of the hazard ratio, however, it appears that interaction plays a significantly larger role in Loyalist strategy than Republican strategy, supporting the qualitative literature that Republicans operated a much broader strategy. More importantly, it shows this interaction to be localised within constituencies, representing the local organisation of Loyalist paramilitaries. This notion is apparently confirmed by the fact that Republicans interact with security forces, both within and extra-region, whilst there are no significant findings which suggest Loyalists do the same. This suggests that Republicans react to Security Forces action across a broader geographic spectrum, reflecting their more national / centralised organisational structure.

Another interesting feature of these results is the cross-border spillover of Loyalist violence. Loyalists positively interact with Loyalist violence in contiguous regions. This is suggestive either of Loyalist infighting or rivalries, which are well documented in non-economic literature. This outcome fits with the theoretical outcomes from Gang and Epstein (2007), who discuss 'rent-seeking' leaders concerned with their popularity and may suggest that Loyalists engaged in intra-group action in order to garner support from their local communities. The dominant PIRA did not suffer the same issues in winning the hearts and minds of the Republican communities in which they operated, which explains why this result only pertains to Loyalist interaction.

Thus far, these results fail to show causality. In essence, they show that Republican and Loyalist violence are positively correlated within regions. In an attempt to shed light on the direction of causality, I introduce three 'sub-models' using restricted aspects of the dataset. For these purposes, I split Republican attacks into attacks against 'civilian' and 'military' targets. Due to the nature of the UDR as an amateur reserve force of the British army that was unique to Northern Ireland and the RUC as the civilian police service of Northern Ireland, I regard these, as well as the wider populace, as 'civilian' targets. British Army and Territorial Army targets make up the 'military' targets.

Given earlier discussion about the similarity of results across the four specifications of the baseline model, I run these new models only using the Cox PH model with stratification by region and year and using the Breslow method for tied failure times. The models are as follows:

- Duration between total Republican attacks on military targets, using in-region averages of total Republican attacks on civilian targets (trnonarmyave), total Loyalist attacks (tlave) and total Security Forces attacks (tsave) and bordering total Republican attacks on civilian and military targets (trarmybave & trnonarmybave), total Loyalist attacks (tlbave) and total Security Forces attacks (tsbave) as covariates.
- Duration between total Republican attacks on military targets, using in-region averages of total Republican attacks on civilian targets (trarmyave), total Loyalist attacks (tlave) and total Security Forces attacks (tsave) and bordering total Republican attacks on civilian and military targets (trarmybave & trnonarmybave), total Loyalist attacks (tlbave) and total Security Forces attacks (tsbave) as covariates.
- Duration between total Loyalist attacks, using in-region averages of total Republican attacks on civilian and military targets (trarmyave & trnonarmyave) and total Security Forces attacks (tsave) and bordering total Republican attacks on civilian and military targets (trarmybave & trnonarmybave), total Loyalist attacks (tlbave) and total Security Forces attacks (tsbave) as covariates.

These models are designed to pick up on the intuition of both the qualitative literature discussed earlier in this paper and that of the signalling model presented in Chapter 4. This application is particularly strong when dealing with Republican attacks against Security Forces. These attacks seem explicitly strategic, as they are aimed against the forces of the incumbent government. As such, there are few strong reasons to suspect that Loyalist violence affects the frequency of these attacks.

Indeed, the only economic reason to suggest why such an interaction may occur is if Loyalist violence imposes such significant costs on Republicans that they substitute from civilian targets to military ones, which makes the assumption that Loyalists only

respond to attacks against civilians and that Loyalist retaliation is a successful deterrent. Despite the results from the baseline models in Tables 6 and 7, there is also little in the qualitative literature to suggest that Republicans' attacks on civilians would be affected by Loyalist violence but the notion is more intuitively tractable, especially in the context of the theory presented in Chapter 4.

There is strong justification, however, to suggest that there should be definite causality between Republican attacks on civilians and Loyalist violence. The stated aim of Loyalists was to protect Northern Ireland's Protestant community from Republican attacks, which provides a logical and tractable suggestion of causality. Although Loyalists also desired to maintain the union with Great Britain, it is not explicitly clear if it would be expected that Loyalists' attacks should also be correlated with Republican violence against military targets. The results are shown below in Table 8.

	Republican Army Duration	Republican Civilian Duration	Loyalist Duration
trarmyave	-----	0.459 (0.336)	0.942 (0.716)
trnonarmyave	0.738 (0.950)	-----	4.899*** (1.930)
tlave	14.897* (19.901)	1.624** (0.309)	-----
tsave	0.481 (0.631)	2.156** (0.814)	1.354 (0.353)
trarmybave	0.368 (0.629)	1.001 (0.949)	0.457 (0.358)
trnonarmybave	1.075 (0.603)	1.224 (0.634)	1.326 (0.416)
tlbave	0.969 (0.806)	2.336* (1.139)	2.325** (1.044)
tsbave	8.520*** (6.467)	4.086 (2.863)	1.336 (0.812)

***, ** and * show significance at 1%, 5% and 10% respectively; S.E.'s in parentheses.

Table 8: Results from Cox PH Model on Restricted Data Subsets

The first result of note is the confirmation that Loyalists interact only with Republican attacks against civilians. This shows that Republicans can act without Loyalist retaliation, so long as they only attack the military. The findings of the baseline model of the duration between Loyalist violence are not violated here, suggesting that there is a definite causal relationship between Republican strategic action and Loyalist violence.

Republican strategy is more difficult to interpret. The first thing to note is that the coefficient on 'tlave' is apparently affecting Republican attacks on security forces. The size of the coefficient is extremely large, however, as is the standard error (19.901). This is the result of near multicollinearity relating particularly to the variable 'tsbave' but seems to occur between trarmybave, trnonarmybave and tsbave. Inspection of this data reveals that the collinear variables have a tendency to be zero at the same time.

Most typically and not unexpectedly, this occurs when the duration between attacks is low, meaning reduced time in which attacks to occur between the two attacks generating the duration variable. Given the nature of the data, I assume this is a random correlation. The easiest way to address this multicollinearity is to drop one of these three variables and discuss the impacts.

The result of dropping each of these variables is reported in Table 9. The results show that when this multicollinearity is accounted for, tlave presents a more sensible coefficient and standard error and is no longer significant. These results suggest that a majority of this effect comes from tsbave. It is worth noting, however, that when tlave is removed, tsbave remains strongly significant, suggesting it does play an important role in determining Republican action.

I also show that Loyalist violence is a significant driver of Republican attacks on civilians. It is harder, here, to discuss causality. Given the establishment of a definite underlying Republican strategy and using the suggestions of the qualitative literature, it appears that likely that both military targets and civilians were targeted by Republican strategy. It is the attacks on civilians from this underlying strategy that draws a definite response from Loyalists. Following this retaliation, Republicans may or may not continue to retaliate. Full results from these regressions can be found in Appendix 9.

Whilst the interpretation of this result is imperfect, it does seem to shed at least a little

more light on the direction of causality. The result from the Loyalist analysis, in particular, suggests that the relationship with Republican violence against civilian targets is more than a random correlation, given that Republican violence against the British Army does not appear to cause Loyalist violence. The sensible hazard ratio on Republican attacks against civilians, however, slightly convolutes this interpretation, as it suggests that causality runs in both directions. Full results from these analyses can be found in Appendix 10.

	Dropping trarmybave	Dropping trnonarmybave	Dropping tsbave	Dropping All	Dropping tlave
trnonarmybave	0.623 (0.784)	0.747 (0.956)	6.440* (6.979)	4.919 (5.301)	0.940 (1.158)
tlave	12.128* (15.776)	15.857** (19.715)	9.471* (12.367)	5.459 (5.960)	-----
tsbave	0.393 (0.505)	0.462 (0.589)	0.842 (0.999)	0.687 (0.799)	0.608 (0.795)
trarmybave	-----	0.389 (0.644)	0.209 (0.357)	-----	0.910 (1.450)
trnonarmybave	0.981 (0.538)	-----	1.009 (0.568)	-----	1.632 (0.891)
tlbave	0.842 (0.688)	0.957 (0.793)	1.267 (1.018)	1.066 (0.856)	1.205 (0.954)
tsbave	8.857*** (6.675)	8.441*** (6.346)	-----	-----	7.084*** (5.125)

***, ** and * show significance at 1%, 5% and 10% respectively; S.E.'s in parentheses.

Table 9: Results from Collinearity Explorations for the variable "Republican Army Duration".

That said, when coupled with qualitative writings and theory, it seems possible to suggest that the relationship between Republican violence against civilian targets could be an affectation of the data caused by the relationship between Loyalist violence and Republican violence against civilians; this suggests that both groups were most violent at the same times. That Loyalists only react to Republican attacks on civilians and not to attacks on military targets, however, provides some argument when coupled with qualitative writings and theory. This suggests that high Republican violence leads to the initial Loyalist retaliation, with a potential Republican response to Loyalist attacks.

5.5 Concluding Remarks

In this paper, I examine the claims of the significant qualitative literature in respect to the conflict in Northern Ireland. By employing models of duration and survival, I confirm that Republicans and Loyalists appear to match strategy. Should one group be engaged in a period of high militancy, this has the effect of reducing the duration between attacks by the other organisation. I show that the presence of significant action from rival organisations causes both Republicans and Loyalists to deviate from their underlying strategies and to attack more regularly than they otherwise would. More importantly, it is possible to interpret this deviation as a direct interaction between the groups.

I also uncover evidence of the interaction between rival Loyalist groups that spills over from neighbouring constituencies. Finally, we see a very strong interaction between Republican violence and action by British Security Forces that spills over borders. Coupled with the findings that Loyalists only retaliate locally, we see an indication of the organisational structure of the organisations involved reflected in their strategies. This seems to confirm the theoretical idea of the strategy ‘matching’ of involved organisations, introduced in Chapter 4.

Finally, I also show that the strategies employed by the organisations in Northern Ireland vary by both location and year. This means that, for example, Republicans operated a different strategy in Belfast West in 1972 and 1981 but also that they operated different strategies in Belfast West and Belfast North in 1972. This gives a confirmation of the changing pattern of violence as discussed by Darby.

Chapter 6: Conclusion

It has been more than half a century since Schelling first began sketching the strategies of conflict and over thirty years since the seminal work of Landes (1978) first began exploring terrorism within these frameworks. Throughout this long, expansive and impressive time series of research, the causes, impacts, interactions and strategies of terrorism have all be explored in considerable depth. Light has been shed on the economic and political conditions that can facilitate terrorism, on the consequences of terrorism and governments' counter-terrorism policies and, from a personal perspective most interestingly, on the interactions of strategic players.

Despite this bulk of literature, however, there are still major limitations throughout the literature. Not least in the preponderance of focus on transnational terrorism, despite domestic terrorism being the more prevalent form of violence. The three studies presented in this thesis aim to focus on different theoretical and empirical aspects of domestic terrorism, and as such represent a major contribution to this literature. This thesis is the first work, to the best of my knowledge to look at the interactions of rival terrorist organisations in domestic conflicts and the first to begin looking at how peace can be achieved under domestic terrorist threats. It is also one of only a handful of terrorism papers to employ duration analysis and one of the first to study the impact of covariates on the probability of violence, rather than to look simply at duration dependence.

In Chapter 3, I introduce peace-making directly into terrorists' utility function and build on the suggestions by Epstein and Gang (2007), and Siquiera and Sandler (2006), who note the impact of popularity on terrorists' outcomes. The results of this model show that, when terrorist organisations and governments account for their popularity amongst the society they claim to represent, violence can be reduced when society is opposed to violence. The strategic interaction between terrorists and governments are also shown to be interesting in this model; whilst governments can expectedly increase counter-terrorism in the face of a terrorist threat, they may be best off reducing counter-terrorism, in order to facilitate peace making. Terrorists respond changes in counter-terror, depending on the level of counter-terrorism. At high levels of counter-terrorism, terrorists can be induced to increase violence, due to tiny returns from peace-making.

As with much of the literature, however, this model also supports, *prima facie*, counter-intuitive outcomes. For example, a society that is opposed to violence can actually have the effect of increasing the equilibrium spending on terrorism. This occurs due to the self-interest of voters and governments; they are interested, only, in their own outcomes. By ignoring the incentives of terrorists and the strategic responses between players, they can bring about the outcomes they are most opposed to, as their preferences slightly change the nature of this interaction.

Whilst sketching out the role of voters in inducing peaceful outcomes under domestic terrorist threats, this work does not answer what is, perhaps, a more important question; why do domestic terrorists become peaceful in the first place? Whilst it may be easy to create 'folk tale' style answers – the PIRA in Northern Ireland waged a 'war' without success for fourteen years before the beginning of the 'Armalite and Ballot Box' strategy – there is significant scope for a rich modelling background to answering this question.

It is my belief that this, whilst representing a substantial body of work, is an important area of research and one of the most defining features of domestic conflicts. Similarly, whilst these theoretical outcomes are interesting, there is also scope for empirical work in this area; for example, interacting Sinn Féin's electoral outcomes in Northern Ireland with the degree of PIRA militancy.

Chapter 4 of this thesis seeks to understand how rival terrorist organisations operating in the same domestic conflict interact with each other. Building on the signalling models of the likes of Arce and Sandler (2007), I overcome the inherent informational asymmetry that occurs between rival terrorist organisations. I introduce an organisation with some revolutionary motive that can be achieved through either peace or violence, or violence only, depending on the nature of the leadership. This revolutionary is forced to interact with another terrorist organisation that emerges in this conflict.

The results of this model show that the presence of a second, rival, terrorist organisation has profound impacts on the modelling outcomes, not least because the rival can induce violence from a nominally peaceful revolutionary. This phenomenon has the effect of potentially increasing the duration of the conflict. This is particularly pertinent in cases such as Northern Ireland, where the rival was opposed to the aims of the revolutionary and sought to end the conflict.

Thus, this result shows that a rival can actually perpetuate a war that it seeks to end. Another interesting outcome is that what drives the incentives to signal relate to the relative scales of the organisations; a large revolutionary can simply crush emerging rivals, whilst a large rival poses such a threat that violent revolutionary may attempt to mimic peaceful ones, in order to avoid retaliation.

There are two major limitations that arise from this work, however; firstly, whilst the Bayes-Nash subgames in period two represent an advance on the literature's tendency towards three-stage, sequential games, the dichotomous choice does not reflect the array of strategies and responses available to terrorists. Similarly, the dichotomous leadership type of the revolutionary organisation betrays the dynamic nature of terrorist leadership.

Of these limitations, the second seems more important. Much can be inferred about the interaction of rivals in the subgames from the substantial literature that looks at the interaction between terrorists and governments. Recalibrating this model with a continuous leadership type, whilst relating the scale of the signal to peacefulness of the leadership would represent a significant piece of work but may provide a more interesting insight, not least because it may allow inference about how and why that organisation becomes 'peaceful'.

Chapter 5 seeks to study some of the outcomes discussed in the signalling model, although it should not be considered as an empirical implementation of Chapter 4. The scope here is slightly more limited but can, perhaps, be interpreted as an implementation of the suggestion of the subgames – namely, that rival terrorist organisations aim to 'match' their strategies. Although matching has other modelling connotations in economics, in this context it simply means that when one organisation is acting violently, the other will also act violently. When one organisation is acting peacefully, the other organisation should also act peacefully. In order to capture the true nature of triangular conflict, I also introduced violence related to the security forces into this work.

Data comes from The Troubles in Northern Ireland and the results support the suggestion that rivals match their strategies – in the context of Northern Ireland, this is interpreted as retaliation, given the context provided by a glut of qualitative literature. More specifically, this work shows that interaction and retaliation is related only to the

killing of civilians²⁵; Republican attacks against civilians induce Loyalist attacks against civilians and vice versa, suggesting a kind of 'proxy' war between rival paramilitaries. The results also show that Republicans interact with violence related to the British Army but that Loyalists do not, which should not be surprising to those familiar with the conflict. Finally, I show that interaction takes place at a 'local' level within Northern Ireland; attacks in a region induce retaliative attacks in the same region. Attacks in contiguous regions do not induce retaliation.

Although the outcomes here are interesting in themselves, data issues, as is common in the terrorism literature, limited the scope of the work somewhat. Duration analysis was employed as a means to overcome some of these issues and has been shown to be a suitable tool to overcome a number of other issues that arise in domestic conflicts, which were discussed in earlier sections. Another limitation is that the conflict in Northern Ireland pitted rival organisations with divergent goals against each other. Further work of interest would be similar applications to data from different conflicts; an application of data from Iraq, for example, could allow confirmation that this retaliation is not specific to Northern Ireland. Application to Colombia would allow study of the interaction of rival organisations with broadly similar goals.

Thus, in the three substantive chapters of this thesis, I have provided significant theoretical and empirical contributions to the domestic terrorism literature. Given that the literature in this area is relatively sparse, it has been impossible to close all of the information gaps that surround this kind of conflict. There is significant work that remains to be carried out in this area, for example, the role that political institutions play in fostering domestic terrorists and the causes of the peaceful outcomes witnessed in South Africa, Northern Ireland and, now, possibly even Spain.

²⁵ Although denoted as civilians, this term actually relates to non-British Army targets; this therefore includes members of the RUC and the UDR. The RUC was the civilian police force of Northern Ireland, whilst the UDR was a reserve force of the British Army, made up of part-timers exclusively from Northern Ireland.

Appendix 1: Full List of Baseline Regression Covariates

Covariate Name:	Definition:
tlave	Average deaths per day attributable to Loyalist within a region, between two Republican attacks
trave	Average deaths per day attributable to Republicans with a region, between two Loyalist attacks
tsave	Average deaths per day attributable to Security Forces within a region between two Republican or Loyalist attacks
trbave	Average deaths per day attributable to Republicans contiguous areas, between two Republican or Loyalist attacks
tlbave	Average deaths per day attributable to Loyalists in contiguous areas, between two Republican or Loyalist attacks
tsbave	Average number of deaths, per day, attributable to Security Forces in contiguous areas, between two Republican or Loyalist attacks
lngdppc	Natural logarithm of GDP, measured as Gross Value Added, per capita for the whole of Northern Ireland
lnunemp	Natural logarithm of unemployment for Northern Ireland
year	Annual time trend
year2	Annual time trend = $\text{year}^2/10$
year3	Annual time trend = $\text{year}^3/100$
year4	Annual time trend = $\text{year}^4/1000$
sunn	Dummy variable taking value of 1 for attacks that occurred before the Sunningdale Agreement was signed and zero otherwise
sands	Dummy variable taking value of 1 for attacks that occurred between the Sunningdale Agreement and Bobby Sands' election to Westminster and zero otherwise
dail	Dummy variable taking value of 1 for attacks that occurred between Bobby Sands' election and Sinn Fein's recognition of The Dail in 1986 and zero otherwise
pop	Population of electoral constituency
split	Percentage of Catholics in the population of the constituency
east	Regional dummy variable for the East Belfast constituency
north	Regional dummy variable for the North Belfast constituency
south	Regional dummy variable for the South Belfast constituency
west	Regional dummy variable for the West Belfast constituency
eantrim	Regional dummy variable for the East Antrim constituency
ederry	Regional dummy variable for the East Londonderry constituency
fst	Regional dummy variable for the Fermanagh and South Tyrone constituency
foyle	Regional dummy variable for the Foyle constituency
lagan	Regional dummy variable for the Lagan Valley constituency
midulster	Regional dummy variable for the Midulster constituency
newry	Regional dummy variable for the Newry and Armagh constituency
nantrim	Regional dummy variable for the North Antrim constituency
ndown	Regional dummy variable for the North Down constituency
santrim	Regional dummy variable for the South Antrim constituency
sdown	Regional dummy variable for the South Down constituency
strangford	Regional dummy variable for the Strangford constituency
tyrone	Regional dummy variable for the West Tyrone constituency

Appendix 2: Output from Cox Proportional Hazards Models with Duration between Republican Attacks as Duration Variable

Output from Cox proportional hazards model; Duration between Republican attacks; Breslow method for tied failures; Full year and location controls.

```

No. of subjects =          1261                Number of obs =
1261
No. of failures =          1243
Time at risk    =          160839
Log likelihood   =   -7302.6774
LR chi2(32)     =          745.46
Prob > chi2     =          0.0000
    
```

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
tlave	1.976532	.2308268	5.83	0.000	1.572163 2.484909
tsave	1.626694	.2524189	3.14	0.002	1.200114 2.204903
trbave	1.485565	.2837227	2.07	0.038	1.021701 2.160029
tlbave	2.065119	.6078143	2.46	0.014	1.159888 3.676836
tsbave	2.243208	.4546504	3.99	0.000	1.507818 3.337259
lngdppc	1.601091	.6525185	1.15	0.248	.7202979 3.558934
lnunemppc	2.301009	.9138572	2.10	0.036	1.056475 5.01161
year	3.071627	.810535	4.25	0.000	1.831281 5.152072
year2	.1516859	.0530652	-5.39	0.000	.0764125 .3011107
year3	2.729988	.5262519	5.21	0.000	1.871014 3.983312
year4	.8397612	.0300075	-4.89	0.000	.7829598 .9006834
sunn	1.20816	.4456102	0.51	0.608	.586371 2.489295
sands	.8155083	.2561354	-0.65	0.516	.4406386 1.509296
dail	1.021908	.2100074	0.11	0.916	.6831018 1.528756
pop	1.000005	1.91e-06	2.52	0.012	1.000001 1.000009
split	.9813163	.0115216	-1.61	0.108	.9589923 1.00416
east	.3764515	.1533939	-2.40	0.017	.169382 .8366635
north	2.382834	.4393664	4.71	0.000	1.660131 3.420151
south	1.467019	.2940548	1.91	0.056	.9904159 2.17297
west	5.585971	1.558272	6.17	0.000	3.2333 9.650534
eantrim	.0721786	.0495316	-3.83	0.000	.0188054 .2770344
ederry	.5235574	.1401539	-2.42	0.016	.3098144 .8847632
fst	2.573095	.6400469	3.80	0.000	1.58024 4.189756
foyle	4.227478	1.450943	4.20	0.000	2.157419 8.283775
lagan	.3764236	.123468	-2.98	0.003	.1979158 .7159345
midulster	1.848761	.4312168	2.63	0.008	1.170418 2.920253
newry	5.574305	1.394147	6.87	0.000	3.414313 9.100771
nantrim	1.199233	.0528756	4.12	0.000	1.099951 1.307477
ndown	4.64e-21
santrim	.1035239	.0597679	-3.93	0.000	.0333897 .3209731
sdown	1.040837	.3342477	0.12	0.901	.554668 1.953134
strangford	.0709002	.047205	-3.97	0.000	.0192275 .2614403
tyrone	1.936386	.580093	2.21	0.027	1.076448 3.483299

Appendix 3: Output from Cox Proportional Hazards Models with Duration between Loyalist Attacks as Duration Variable

Output from Cox proportional hazards model; Duration between Loyalist attacks; Breslow method for tied failures; Full year and location controls.

```
No. of subjects =          690                Number of obs =
683
No. of failures =          672
Time at risk    =          153097
Log likelihood  = -3464.3512                LR chi2(33)    =    528.01
                                                Prob > chi2    =    0.0000
```

	_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trave		4.30158	1.22299	5.13	0.000	2.463889 7.50991
tsave		1.487064	.3303192	1.79	0.074	.9621736 2.298294
trbave		1.226039	.2633451	0.95	0.343	.8047699 1.867828
tlbave		4.401734	1.773844	3.68	0.000	1.998021 9.697226
tsbave		.9986294	.5200663	-0.00	0.998	.3598451 2.771362
lngdppc		1.877729	.8755912	1.35	0.177	.7528613 4.68329
lnunemppc		2.997707	1.559425	2.11	0.035	1.081407 8.309774
year		7.96721	3.563899	4.64	0.000	3.315478 19.14549
year2		.0317646	.0196589	-5.57	0.000	.0094436 .1068432
year3		6.330666	2.155085	5.42	0.000	3.248505 12.33716
year4		.7266092	.045424	-5.11	0.000	.6428179 .8213226
sunn		.6136675	.3869361	-0.77	0.439	.1783301 2.111746
sands		.6269479	.3683509	-0.79	0.427	.1982096 1.983071
dail		1.10129	.412949	0.26	0.797	.5281146 2.296547
pop		.9999979	3.61e-06	-0.60	0.552	.9999908 1.000005
split		1.002683	.011966	0.22	0.822	.9795024 1.026412
east		1.674093	.6887527	1.25	0.210	.747446 3.749554
north		4.357684	.8941149	7.17	0.000	2.914776 6.514878
south		2.110602	.4731807	3.33	0.001	1.360108 3.27521
west		2.67864	.8678309	3.04	0.002	1.419516 5.054617
eantrim		.5665775	.2231391	-1.44	0.149	.2618332 1.22601
ederry		.3120892	.1277777	-2.84	0.004	.1398859 .6962794
fst		.7162925	.2491648	-0.96	0.337	.3622405 1.416393
foyle		.1444492	.1016339	-2.75	0.006	.0363759 .5736106
lagan		.6446846	.2325259	-1.22	0.224	.3179322 1.307254
midulster		.6667393	.2151946	-1.26	0.209	.3541808 1.255125
newry		.6551523	.2355251	-1.18	0.239	.3238457 1.325398
nantrim		.3879604	.1553496	-2.36	0.018	.176988 .8504154
ndown		.3078949	.2119579	-1.71	0.087	.0798779 1.186802
santrim		.5110949	.1963523	-1.75	0.081	.2407061 1.085215
sdown		.3472097	.1575372	-2.33	0.020	.1426861 .8448938
strangford		.2869535	.1336551	-2.68	0.007	.1151715 .714954
tyrone		.2759465	.1461464	-2.43	0.015	.0977266 .7791789

Appendix 4: PH Test Results for Cox Proportional Hazards Models for Both Republican and Loyalist Equations

Test of proportional hazards assumption; Duration between Republican attacks; Breslow method for tied failures; Full location and year controls..

```
. estat phtest
```

```
Test of proportional-hazards assumption
```

```
Time: Time
```

	chi2	df	Prob>chi2
global test	97.84	32	0.0000

```
. estat phtest, detail
```

```
Test of proportional-hazards assumption
```

```
Time: Time
```

	rho	chi2	df	Prob>chi2
tlave	0.00599	0.03	1	0.8678
tsave	0.00442	0.02	1	0.8842
trbave	0.01102	0.18	1	0.6744
tlbave	0.00326	0.02	1	0.8872
tsbave	0.00386	0.02	1	0.8918
lngdppc	0.05861	4.33	1	0.0375
lnunemppc	-0.02838	1.09	1	0.2966
year	-0.00154	0.00	1	0.9551
year2	-0.00916	0.11	1	0.7396
year3	0.00998	0.13	1	0.7181
year4	-0.00987	0.13	1	0.7217
sun	-0.00355	0.02	1	0.8945
sands	-0.01331	0.24	1	0.6225
dail	0.01774	0.41	1	0.5216
pop	0.02268	0.64	1	0.4226
split	0.03624	1.85	1	0.1732
east	0.06426	5.71	1	0.0169
north	0.02947	1.10	1	0.2953
south	0.04299	2.34	1	0.1261
west	-0.00847	0.10	1	0.7561
eantrim	0.04119	1.97	1	0.1601
ederry	0.07251	6.54	1	0.0106
fst	-0.00361	0.02	1	0.8952
foyle	-0.01234	0.21	1	0.6464
lagan	0.00026	0.00	1	0.9926
midulster	0.02705	0.96	1	0.3262
newry	-0.00209	0.01	1	0.9380
nantrim	-0.08958	9.73	1	0.0018
ndown	.	.	1	.
santrim	-0.02390	0.78	1	0.3759
sdown	-0.01822	0.46	1	0.4953
strangford	0.22675	56.14	1	0.0000
tyrone	0.00581	0.05	1	0.8286
global test		97.84	32	0.0000

**Test of proportional hazards assumption; Duration between Republican attacks;
Breslow method for tied failures; Stratification by year with location controls..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	22.12	23	0.5128

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
tlave	0.00313	0.01	1	0.9249
tsave	0.00137	0.00	1	0.9633
trbave	-0.00192	0.01	1	0.9349
tlbave	-0.00263	0.01	1	0.9113
tsbave	0.00222	0.01	1	0.9370
pop	0.01718	0.34	1	0.5576
split	0.01318	0.22	1	0.6423
east	0.02472	0.82	1	0.3642
north	0.01171	0.17	1	0.6838
south	0.02125	0.54	1	0.4620
west	-0.00356	0.02	1	0.8998
eantrim	0.00099	0.00	1	0.9711
ederry	0.03615	1.53	1	0.2164
fst	-0.00119	0.00	1	0.9661
foyle	-0.00628	0.05	1	0.8227
lagan	-0.03301	1.55	1	0.2130
midulster	0.00902	0.10	1	0.7479
newry	-0.00030	0.00	1	0.9915
nantrim	-0.03071	1.17	1	0.2793
ndown	.	.	1	.
santrim	0.00337	0.01	1	0.9077
sdown	-0.00244	0.01	1	0.9290
strangford	0.09151	8.91	1	0.0028
tyrone	0.00545	0.04	1	0.8440
global test		22.12	23	0.5128

**Test of proportional hazards assumption; Duration between Republican attacks;
Breslow method for tied failures; Stratification by location with year controls..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	7.64	14	0.9074

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
tlave	0.00241	0.01	1	0.9369
tsave	0.00303	0.01	1	0.9187
trbave	0.00700	0.07	1	0.7867
tlbave	0.00198	0.01	1	0.9325
tsbave	0.00193	0.00	1	0.9466
lngdppc	0.01611	0.32	1	0.5691
lnunemppc	-0.00968	0.12	1	0.7261
year	0.01087	0.16	1	0.6917
year2	-0.01754	0.40	1	0.5252
year3	0.01991	0.52	1	0.4715
year4	-0.02117	0.59	1	0.4438
sunn	-0.00473	0.03	1	0.8622
sands	-0.00653	0.06	1	0.8118
dail	0.01602	0.32	1	0.5693
global test		7.64	14	0.9074

**Test of proportional hazards assumption; Duration between Republican attacks;
Breslow method for tied failures; Stratification by year and location..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	0.01	5	1.0000

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
tlave	0.00043	0.00	1	0.9863
tsave	0.00024	0.00	1	0.9934
trbave	0.00084	0.00	1	0.9721
tlbave	0.00205	0.01	1	0.9311
tsbave	-0.00085	0.00	1	0.9751
global test		0.01	5	1.0000

**Test of proportional hazards assumption; Duration between Loyalist attacks;
Breslow method for tied failures; Full location and year controls..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	80.18	33	0.0000

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
trave	0.00614	0.03	1	0.8555
tsave	-0.00389	0.01	1	0.9182
trbave	-0.00324	0.01	1	0.9194
tlbave	0.01950	0.43	1	0.5113
tsbave	-0.01106	0.11	1	0.7398
lngdppc	0.08683	5.76	1	0.0164
lnunemppc	-0.02076	0.31	1	0.5768
year	-0.02838	0.54	1	0.4641
year2	0.01154	0.09	1	0.7636
year3	-0.00339	0.01	1	0.9294
year4	-0.00269	0.00	1	0.9441
sunn	0.04534	1.55	1	0.2127
sands	0.04418	1.43	1	0.2320
dail	0.06969	3.60	1	0.0579
pop	-0.04779	1.47	1	0.2255
split	0.07464	3.72	1	0.0539
east	0.05649	2.06	1	0.1510
north	0.02028	0.28	1	0.5951
south	0.02943	0.59	1	0.4420
west	-0.05307	1.92	1	0.1663
eantrim	0.00162	0.00	1	0.9655
ederry	0.02119	0.29	1	0.5909
fst	0.00050	0.00	1	0.9892
foyle	-0.06117	2.62	1	0.1054
lagan	0.05436	2.04	1	0.1527
midulster	-0.05354	1.89	1	0.1690
newry	-0.04045	1.13	1	0.2886
nantrim	0.09249	5.52	1	0.0188
ndown	0.05626	2.08	1	0.1496
santrim	-0.04911	1.73	1	0.1880
sdown	0.03224	0.68	1	0.4086
strangford	0.05513	2.09	1	0.1484
tyrone	0.05903	2.21	1	0.1372
global test		80.18	33	0.0000

**Test of proportional hazards assumption; Duration between Loyalist attacks;
Breslow method for tied failures; Stratification by year with location controls..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	12.88	24	0.9680

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
trave	0.00124	0.00	1	0.9685
tsave	0.00046	0.00	1	0.9899
trbave	0.00073	0.00	1	0.9804
tlbave	0.00088	0.00	1	0.9765
tsbave	-0.00015	0.00	1	0.9962
pop	-0.01011	0.06	1	0.8047
split	0.03474	0.74	1	0.3909
east	0.03473	0.76	1	0.3838
north	0.01427	0.15	1	0.7017
south	0.01627	0.19	1	0.6652
west	-0.02303	0.35	1	0.5565
eantrim	0.03152	0.67	1	0.4135
ederry	-0.02317	0.38	1	0.5359
fst	-0.01845	0.25	1	0.6167
foyle	-0.03804	0.80	1	0.3711
lagan	-0.00034	0.00	1	0.9927
midulster	-0.00405	0.01	1	0.9203
newry	0.00180	0.00	1	0.9626
nantrim	-0.01577	0.20	1	0.6552
ndown	-0.00768	0.04	1	0.8332
santrim	-0.02143	0.31	1	0.5786
sdown	-0.00584	0.02	1	0.8835
strangford	0.04158	1.03	1	0.3102
tyrone	0.05716	1.80	1	0.1792
global test		12.88	24	0.9680

**Test of proportional hazards assumption; Duration between Loyalist attacks;
Breslow method for tied failures; Stratification by location with year controls..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	0.70	14	1.0000

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
trave	0.00356	0.01	1	0.9159
tsave	0.00080	0.00	1	0.9831
trbave	0.00308	0.01	1	0.9222
tlbave	0.00503	0.03	1	0.8655
tsbave	-0.00034	0.00	1	0.9920
lngdppc	0.00904	0.05	1	0.8162
lnunemppc	-0.00531	0.02	1	0.8888
year	-0.00877	0.05	1	0.8230
year2	0.00914	0.06	1	0.8141
year3	-0.00903	0.05	1	0.8161
year4	0.00877	0.05	1	0.8215
sunn	-0.00028	0.00	1	0.9940
sands	0.00290	0.01	1	0.9380
dail	0.00480	0.02	1	0.8984
global test		0.70	14	1.0000

**Test of proportional hazards assumption; Duration between Loyalist attacks;
Breslow method for tied failures; Stratification by year and location..**

. estat phtest

Test of proportional-hazards assumption

Time: Time

	chi2	df	Prob>chi2
global test	0.00	5	1.0000

. estat phtest, detail

Test of proportional-hazards assumption

Time: Time

	rho	chi2	df	Prob>chi2
trave	0.00037	0.00	1	0.9908
tsave	0.00002	0.00	1	0.9995
trbave	0.00025	0.00	1	0.9930
tlbave	0.00003	0.00	1	0.9992
tsbave	0.00009	0.00	1	0.9978
global test		0.00	5	1.0000

Appendix 5: Output from Cox PH Model with Duration Between Republican and Loyalist Attacks as Duration Variable and Inclusion of Quarterly Dummies

Republicans:

No. of subjects =	1261	Number of obs =	1261
No. of failures =	1243		
Time at risk =	160839		
Log likelihood =	-1587.7521	LR chi2(8) =	36.34
		Prob > chi2 =	0.0000

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
tlave	1.729616	.3260179	2.91	0.004	1.195379 2.502615
tsave	1.558019	.2869837	2.41	0.016	1.085883 2.235436
trbave	1.067449	.2497367	0.28	0.780	.6748437 1.688462
tlbave	1.493061	.4884506	1.23	0.220	.7863386 2.834952
tsbave	2.586833	.6612258	3.72	0.000	1.56744 4.269193
q1	.7959992	.0811887	-2.24	0.025	.6517687 .9721465
q2	.9443482	.096093	-0.56	0.574	.7736017 1.152781
q3	.8922826	.090182	-1.13	0.259	.7319348 1.087758

Stratified by yearcon

Loyalists:

No. of subjects =	690	Number of obs =	690
No. of failures =	672		
Time at risk =	161711		
Log likelihood =	-798.2881	LR chi2(8) =	26.26
		Prob > chi2 =	0.0009

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trave	4.014722	1.427881	3.91	0.000	1.999476 8.06111
tsave	1.316952	.3485625	1.04	0.298	.7839335 2.212384
trbave	1.092247	.2774908	0.35	0.728	.6638487 1.797103
tlbave	2.527236	1.130583	2.07	0.038	1.051605 6.073496
tsbave	.8069217	.4754341	-0.36	0.716	.2542775 2.560678
q1	.8657535	.1299833	-0.96	0.337	.6450535 1.161964
q2	.7836148	.1164356	-1.64	0.101	.5856315 1.04853
q3	.8303115	.1195582	-1.29	0.197	.6261448 1.101051

Stratified by yearcon

Appendix 7: Output from Accelerated Failure Time Models with Duration between Republican and Loyalist Attacks as Duration Variable

Output from accelerated failure time models; Weibull distribution; Duration between Republican attacks; Full year and location controls..

```

No. of subjects =          1261                Number of obs   =
1261
No. of failures =          1243
Time at risk    =          160839
Log likelihood  = -2102.3675
LR chi2(24)     =          774.35
Prob > chi2     =          0.0000
  
```

_t	Haz.	Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
tlave	2.046252		.2292657	6.39	0.000	1.642816	2.548762
tsave	1.818652		.2669341	4.07	0.000	1.363998	2.424852
trbave	2.221495		.3266898	5.43	0.000	1.665209	2.963615
tlbave	4.16508		1.027768	5.78	0.000	2.567926	6.755606
tsbave	1.923038		.3680897	3.42	0.001	1.321475	2.798446
pop	1.000006		1.79e-06	3.19	0.001	1.000002	1.000009
split	.9748911		.0059294	-4.18	0.000	.9633388	.986582
east	.2992162		.0881906	-4.09	0.000	.1679202	.5331719
north	2.314247		.4003567	4.85	0.000	1.64875	3.248364
south	1.381719		.2565729	1.74	0.082	.9601944	1.988292
west	6.059752		1.223912	8.92	0.000	4.078818	9.002755
eantrim	.0622747		.0378998	-4.56	0.000	.018892	.2052795
ederry	.5146536		.1347894	-2.54	0.011	.3080226	.8598988
fst	2.589725		.5530184	4.46	0.000	1.704062	3.935701
foyle	4.95967		1.148789	6.91	0.000	3.149868	7.80932
lagan	.3232482		.0912937	-4.00	0.000	.1858381	.5622605
midulster	1.931198		.4006969	3.17	0.002	1.285921	2.900276
newry	6.030211		1.147386	9.44	0.000	4.153095	8.755747
nantrim	1.199098		.0495159	4.40	0.000	1.105872	1.300183
ndown	3.85e-08		.000028	-0.02	0.981	0	.
santrim	.0635395		.0337996	-5.18	0.000	.0224001	.1802343
sdown	1.042751		.2695161	0.16	0.871	.6283091	1.730563
strangford	.0441595		.0271205	-5.08	0.000	.0132513	.1471597
tyrone	2.141984		.4870239	3.35	0.001	1.37176	3.344678
_cons	.0026222		.0010743	-14.51	0.000	.0011747	.0058534

/ln_p	-.1288376		.0215249	-5.99	0.000	-.1710256	-.0866497

p	.8791167		.0189229			.8428	.9169983
1/p	1.137505		.0244846			1.090515	1.186521

Appendix 8: List of Extended Regression Covariates

Covariate Name:	Definition:
trarmyave	Average deaths of members of the British Army, per day, attributable to Republican organisations within a region, between two Republican or Loyalist attacks
tnonarmyave	Average deaths attributable to Republican organisations that were not members of the British Army, within a region, between two Republican or Loyalist attacks
trarmybave	Average deaths of members of the British Army, per day, attributable to Republican organisations in areas contiguous to a region, between two Republican or Loyalist attacks
tnonarmybave	Average deaths attributable to Republican organisations that were not members of the British Army, in areas contiguous to a region, between two Republican or Loyalist attacks

Appendix 9: Output from Cox Proportional Hazards Models with Duration between Republican Attacks against Army and Civilians as Duration Variable

Output from Cox proportional hazards model; Duration between Republican attacks against the Army as duration variable; Breslow method for tied failures; Stratified by year and location.

```

No. of subjects =          328                Number of obs   =          328
No. of failures =          314
Time at risk    =          126126
Log likelihood   = -300.66398                LR chi2(7)      =          17.37
                                                Prob > chi2     =          0.0152
    
```

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trnonarmyave	.737831	.9503601	-0.24	0.813	.0590977 9.211777
tlave	14.89698	19.90893	2.02	0.043	1.085221 204.493
tsave	.4809788	.6307266	-0.56	0.577	.0368054 6.285507
trarmybave	.3677372	.6294287	-0.58	0.559	.012841 10.53117
trnonarmybave	1.074545	.6028635	0.13	0.898	.3578211 3.226884
tlbave	.9689155	.8059009	-0.04	0.970	.1897991 4.946268
tsbave	8.520339	6.462695	2.82	0.005	1.926721 37.67863

Stratified by strat

Output from Cox proportional hazards model; Duration between Republican attacks against non-Army targets as duration variable; Breslow method for tied failures; Stratified by year and location.

```

No. of subjects =          966                Number of obs   =          966
No. of failures =          949
Time at risk    =          151830
Log likelihood   = -958.48256                LR chi2(7)      =          18.24
                                                Prob > chi2     =          0.0109
    
```

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trarmyave	.4587264	.3361429	-1.06	0.288	.1090976 1.928823
tlave	1.623664	.3094574	2.54	0.011	1.117543 2.359003
tsave	2.155905	.814262	2.03	0.042	1.028348 4.519801
trnonarmybave	1.223677	.6339871	0.39	0.697	.4432608 3.378114
trarmybave	1.005785	.9489379	0.01	0.995	.1582756 6.391408
tlbave	2.336071	1.139732	1.74	0.082	.897839 6.078182
tsbave	4.086393	2.862532	2.01	0.044	1.035311 16.12908

Stratified by strat

Appendix 10: Output from Cox Proportional Hazards Model; Accounting for Multicollinearity of ‘tlave’

Output from Cox Proportional hazards model; Duration between Republican attacks against the British Army as duration variable; Breslow method for tied failures; Stratified of year and location; Full model.

```

No. of subjects =          328                Number of obs =          328
No. of failures =          314
Time at risk   =          126126
Log likelihood = -300.66398
LR chi2(7)     =          17.37
Prob > chi2    =          0.0152
    
```

__t	Haz.	Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trnonarmyave	.737831		.9503601	-0.24	0.813	.0590977 9.211777
tlave	14.89698		19.90893	2.02	0.043	1.085221 204.493
tsave	.4809788		.6307266	-0.56	0.577	.0368054 6.285507
trarmybave	.3677372		.6294287	-0.58	0.559	.012841 10.53117
trnonarmybave	1.074545		.6028635	0.13	0.898	.3578211 3.226884
tlbave	.9689155		.8059009	-0.04	0.970	.1897991 4.946268
tsbave	8.520339		6.462695	2.82	0.005	1.926721 37.67863

Stratified by strat

Output from Cox Proportional hazards model; Duration between Republican attacks against the British Army as duration variable; Breslow method for tied failures; Stratified of year and location; ‘trnonarmyave’ dropped.

```

No. of subjects =          328                Number of obs =          328
No. of failures =          314
Time at risk   =          126126
Log likelihood = -300.69217
LR chi2(6)     =          17.31
Prob > chi2    =          0.0082
    
```

__t	Haz.	Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
tlave	14.41189		19.14514	2.01	0.045	1.066504 194.7509
tsave	.4739552		.6180908	-0.57	0.567	.0367854 6.106603
trarmybave	.3355473		.5605028	-0.65	0.513	.0127027 8.863646
trnonarmybave	1.066032		.598468	0.11	0.909	.3547376 3.20356
tlbave	.9828356		.8148804	-0.02	0.983	.1935263 4.991395
tsbave	7.551125		4.126249	3.70	0.000	2.587496 22.03655

Stratified by strat

Output from Cox Proportional hazards model; Duration between Republican attacks against the British Army as duration variable; Breslow method for tied failures; Stratified of year and location; ‘tsave’ dropped.

```

No. of subjects =          328                Number of obs =          328
No. of failures =          314
Time at risk   =          126126
Log likelihood = -300.82654
LR chi2(6)     =          17.04
Prob > chi2    =          0.0091
    
```

__t	Haz.	Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trnonarmyave	.7026537		.9168776	-0.27	0.787	.0544536 9.066838
tlave	13.88896		18.50435	1.97	0.048	1.020019 189.1172
trarmybave	.2873355		.4768034	-0.75	0.452	.011115 7.427965
trnonarmybave	1.163256		.6302725	0.28	0.780	.4022346 3.364118
tlbave	.9141369		.7597002	-0.11	0.914	.1793139 4.660243
tsbave	8.535328		6.62995	2.76	0.006	1.862242 39.1205

Stratified by strat

Output from Cox Proportional hazards model; Duration between Republican attacks against the British Army as duration variable; Breslow method for tied failures; Stratified of year and location; 'tsbave' dropped.

```
No. of subjects =          328                Number of obs   =          328
No. of failures =          314
Time at risk    =          126126
Log likelihood  = -305.90223                LR chi2(6)      =          6.89
                                                Prob > chi2    =          0.3311
```

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trnonarmyave	6.44039	6.978547	1.72	0.086	.7701663 53.85671
tlave	9.471095	12.36718	1.72	0.085	.7326849 122.4287
tsave	.8419986	.9997366	-0.14	0.885	.0821576 8.629288
trarmybave	.2085122	.3565635	-0.92	0.359	.0073037 5.952745
trnonarmybave	1.00997	.5678693	0.02	0.986	.3355128 3.040241
tlbave	1.267226	1.017451	0.29	0.768	.2626802 6.113371

Stratified by strat

Output from Cox Proportional hazards model; Duration between Republican attacks against the British Army as duration variable; Breslow method for tied failures; Stratified of year and location; 'trnonarmybave', 'trarmybave' and 'tsbave' dropped.

```
No. of subjects =          328                Number of obs   =          328
No. of failures =          314
Time at risk    =          126126
Log likelihood  = -306.36548                LR chi2(4)      =          5.96
                                                Prob > chi2    =          0.2019
```

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trnonarmyave	4.919119	5.301324	1.48	0.139	.595044 40.66544
tlave	5.45897	5.96023	1.55	0.120	.6423167 46.39512
tsave	.6874425	.7992695	-0.32	0.747	.0703994 6.7128
tlbave	1.066453	.8557393	0.08	0.936	.2212705 5.13996

Stratified by strat

Output from Cox Proportional hazards model; Duration between Republican attacks against the British Army as duration variable; Breslow method for tied failures; Stratified of year and location; 'tlave' dropped.

```
No. of subjects =          328                Number of obs   =          328
No. of failures =          314
Time at risk    =          126126
Log likelihood  = -302.57039                LR chi2(6)      =          13.55
                                                Prob > chi2    =          0.0350
```

_t	Haz. Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
trnonarmyave	.9401815	1.15824	-0.05	0.960	.0840599 10.51562
tsave	.6077827	.7952024	-0.38	0.704	.0467805 7.896446
trarmybave	.9103582	1.45001	-0.06	0.953	.040126 20.65372
trnonarmybave	1.632249	.8909828	0.90	0.369	.5599484 4.758006
tlbave	1.204446	.9536731	0.23	0.814	.2551591 5.685433
tsbave	7.083973	5.12548	2.71	0.007	1.715558 29.25151

Stratified by strat

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