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Terrorism From Within: An Economic Model of Terrorism

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Abstract

In this paper, we develop and explore the implications of an economic model that links the incidence of terrorism in a country to the economic circumstances facing that country. We briefly sketch out a theory, in the spirit of Tornell (1998), that describes terrorist activities as being initiated by groups that are unhappy with the current economic status quo, yet unable to bring about drastic political and institutional changes that can improve their situation. Such groups with limited access to opportunity may find it rational to engage in terrorist activities. The result is then a pattern of reduced economic activity and increased terrorism. In contrast, an alternative environment can emerge where access to economic resources is more abundant and terrorism is reduced. Our empirical results are consistent with the theory. We find that for democratic, high income countries, economic contractions (i.e. recessions) can provide the spark for increased probabilities of terrorist activities.

1 Introduction

The magnitude of the September 11th terrorism incident, whether measured in lives lost or economic activity disrupted, was substantial. One study by the World Travel & Tourism Council estimated the scale of the economic impact of the September 11 attacks to be in the tens of billions of dollars globally, even without including the economic impact of job losses. Despite the unprecedented scale of these attacks, it is important to keep in mind that terrorist attacks, albeit of a lower intensity, have been widespread in the United States and in many other countries for the last 35 years. These events, terrible as they are, serve as motivation for this research project. The goal of this project is to understand the extent to which economic variables are important in influencing terrorism. Even though we will never be able to fully explain the onset of an event like the attacks of September 11th, our study hopes to shed some new light on the links between economic developments and terrorist activities.

This paper makes two central contributions: First, we outline a simple model that provides some structure for thinking about the channels through which economic outcomes can influence terrorist activities. Second, we examine empirically the presence of these channels by constructing and employing a rich panel data set of 127 countries from 1968 to 1991. Our analysis investigates the importance of standard economic variables such as GDP growth per capita and investment in determining the onset and intensity of terrorist attacks. In doing so, we hope to provide a *systematic* account of how economic developments influence terrorism. We believe the implication of our research project is rather straight-forward: policy-makers should be aware of the extent to which economics influences the likelihood of terrorist activities.

The theoretical foundations of our paper are based on the model of Tornell (1998). In summary, a no-conflict *status quo* will eventually be disrupted by powerful groups who seek to increase their appropriation and agenda setting power in the economy. Negative shocks that diminish the growth of an economy's resource base hasten the incidence of conflict. These predictions are consistent with the empirical evidence in Hess and Orphanides (1995, 2001) and Blomberg and Hess (2002), among others, that finds links between adverse economic outcomes and conflict. We extend this work by breaking conflict down into two types: a "rebellion", in which a group seek-

ing to disrupt the *status quo* overthrows the government and takes over power, and a “terrorist attack”, a less institutionally disruptive conflict type in which a dissident group seeks to indulge in terrorist activities to increase their voice in the economy, yet are unable to take over power. The basic prediction of the model is that the choice between a “rebellion attack” and a “terrorist attack” is influenced by the country’s ability to not give in to the dissident groups. In particular, during bad economic times, economies with well-established institutions and defense capabilities are more likely to be affected by terrorism, whereas economies with weak institutions and defense capabilities are more likely to see civil wars, coups and other conflict types designed to overthrow the government.

While our theory provides some structure for the links between economic weakness and terrorism, we also examine the empirical linkages between the two. We construct a data set of economic and terrorism variables by linking the Summers and Heston (1995) data set to the ITERATE data set. The empirical work estimates and identifies the separate channels by which the economy and terrorism affect each other. We find that for democratic, high income countries economic contractions (i.e. recessions) can provide the spark for increased probabilities of terrorist activities, which in turn raise the probability of recessions in a “trap-like” environment.

The structure of this paper is as follows. Section 2 of the paper discusses the relevant literature and establishes the context for our paper. Section 3 presents the basic theory and its implications. Section 4 provides a description of the data, and preliminary analysis. Section 5 provides the results from our empirical model and we conclude with Section 6.

2 Literature Summary

In summarizing an entire journal issue devoted to the topic of economics and conflict, Sandler (2000) points out that “economists have increasingly turned their attention to the study of conflict and its resolution in the past four decades.” Accordingly, we first review the seminal research into the determinants of terrorism. Work by Grossman (1991) presents a general equilibrium model that treats insurrection and the suppression of insurrection as economic activities willingly undertaken

by the participants. The ruler has to trade off higher taxes not only with the lower tax revenue that comes about when people devote less time to productive activities but also with the added cost of having to hire soldiering services to suppress insurrection. Grossman finds that economies in which the soldiering technology is effective can move themselves to no-conflict equilibria by devoting some resources to soldiering and keeping tax rates low. Lapan and Sandler (1993) presents an analysis of terrorism as a signaling game in the face of incomplete information. Terrorist attacks are devices through which the two sides learn more about each others offensive and defensive capabilities. Lapan and Sandler (1988) examine the extent to which governments should pre-commit themselves to a strategy of never negotiating with terrorists. They show that such a strategy is not likely to work when terrorists have a high probability of success or when the cost of failure is low. Effective deterrence would then require taking steps to reduce the probability of success and to raise the cost of failure in addition to adopting otherwise time inconsistent strategies of non-negotiation.

On the empirical side, Enders, Sandler and Cauley (1990) have developed a model to assess the effectiveness of terrorist-thwarting policies on terrorism. Unfortunately, they find little evidence for legislative activity in preventing terrorism. They find that installing metal detectors in airports helped reduce the incidence of skyjackings while enhancing security in embassies helped increase the safety of U.S. diplomats albeit with the unintended consequence of decreasing the safety of non-diplomatic individuals. Atkinson, Sandler and Tschirhart (1987) examine the impact of changes in the negotiating environment (e.g. bargaining costs, bluffing) on the length and severity of terrorist attacks. They find, in general, that increases in bargaining costs lengthen the duration of a terrorist incident. O'Brien (1996) looks at whether terrorism is used as a foreign policy tool by international superpowers: he shows that authoritarian regimes are more likely to sponsor terrorist attacks following setbacks in the foreign policy arena. Finally, work by Enders, Sandler and Parise (1992) examine the impact of terrorism on the economy. Using an ARIMA model, the authors estimate that there are large and substantial losses to the tourism industry caused by terrorist incidents.

These papers provide, broadly speaking, the groundwork for analyzing terrorism within an economic framework. They do not, however, explicitly address how, or even whether, the onset of terrorist incidence is related to the economic situation of a country. There is, however, an existing literature that analyzes how economics influences conflict in general. However, most of the analysis

to this point has considered the impact on conflicts such as war without considering alternative types of conflict such as terrorism. For example, Hess and Orphanides (1995, 2001) estimate the probability of conflict for the U.S. doubles when the economy has recently been in an economic contraction and the president is running for reelection. Similarly, Stoll (1984), Ostrom and Job (1986), Russett (1990), Lian and O’Neal (1993), DeRouen (1995), Wang (1996) Gelpi (1997), and Brueck (2002) have found important linkages between the incidence of war and the political cycle and/or the business cycle.

Broader definitions of conflict have been considered in more recent research. In their analysis, Blomberg, Hess and Thacker (2002), and Blomberg and Hess (2002) provide more specific definitions of conflict such as external conflict (e.g. wars) and internal conflict (e.g. coups). After doing so, however, rather than finding a systematic relationship across all countries and time, they found a *conditional* conflict-growth relationship, that can only be identified once the region and initial conditions are taken into account. While the above research provides a foundation for the determinants of terrorism, it still does not address the question our paper raises—does the economy help influence the initiation of terrorist activities in a *systematic* way? And if so, what is the theoretical justification for it? The model and the analysis in the next two section seek to address these questions.

3 The Theory

In this section, we sketch out a theory of the links between economic variables and terrorist attacks. We construct a model that combines features of the static model of Grossman (1991) and the dynamic model of Tornell (1998). Prior to presenting our model, it is important to keep in mind our paper’s objectives. First, we use the simple model to provide important theoretical structure for linking economic activity and terrorism. The model describes not just the links between the economy and conflict, but also the links between the economy and the *type* of conflict, whether a civil war or a terrorist attack. Second, other models could yield predictions similar to those from our approach: hence, the empirical results are by no means proof of the superiority of this model over others. Instead, we simply use this model to provide some structure and intuition for

the empirical results. Finally, this model (and our empirical results) focus only on the economic explanations for terrorist activities. By no means do we imply that economic explanations underlie *all* terrorist activity, or that better economic times will prevent *any particular* terrorist act from taking place.

The theory we use draws on the work of Grossman (1991) and Tornell (1998). Grossman’s model describes insurrections and the suppression of insurrections as being related to the technology of soldiering and rebellion, to the production technology as well as to the amount of resources being extracted by the rulers in the form of taxes. Tornell’s model describes the behavior of organized groups that extract rents from the economy, eventually depleting the resources to a point where one group decides to abandon this *status quo* in an attempt to consolidate their power and deprive the other group of their power. Although Tornell’s model is used to analyze the question of why economic reforms come from within, the framework is general enough to be used for addressing economic explanations for global terrorism.

The basic structure of the model is as follows: There are two organized groups in the economy: a government and dissidents.¹ Both groups appropriate the stock of resources in the economy a_t , which has a raw growth rate of β . The government appropriates resources at a rate γ whereas the dissident group extracts resources from the economy at a lesser rate δ , i.e. $\delta < \gamma$. The evolution of assets in the economy is, described by the equation

$$\dot{a}_t = \beta * a_t - \gamma * a_t - \delta * a_t.$$

The dissident group has three options. First, it can choose to attack the government and seek to overthrow it. If it is successful in this endeavor, then the dissident group gets a share of the productive resource base in the economy and also gets to restructure the economy and set the new rules for the economy. To be more specific, at time τ , the dissident group can mount a “rebellion attack” that lasts h periods, expending a fraction $q^R \in (0, 1)$ of its appropriation in the process. If it succeeds, with probability θ , it takes over the role of the government and gets to extract a larger

¹Just as Tornell categorizes potentially heterogeneous sub-groups under the broad rubric of “unions” or “corporations”, the rubric of “dissidents” can cover many groups with different objectives and ideologies.

fraction of resources, γ instead of δ .² It also gets future control over setting the rules in the new economy. We denote the present value of income gained by setting these new rules by the term W .

The second option for the dissident group is to mount a low intensity attack on the government in the form of a “terrorist attack”. These are not as intense as an overthrowing of the government but are instead designed to signal unhappiness with the *status quo* and to increase their control over the economy. To be more specific, at time τ , the dissident group can mount a “terrorist attack” that lasts h periods, expending a fraction $q^T \in (0, 1)$ of its appropriation in the process, where $q^T < q^R$. To be concrete, we define $q^T = (q^R)^\alpha$, where $0 < \alpha < 1$. The parameter α is a key parameter in our model. It captures the efficiency of the dissidents’ technology. As dissidents become more capable in terrorist acts, $\alpha \rightarrow 1$. The difference between a “terrorist” attack and a “rebellion attack” is that if the former succeeds it does not get more control of the fiscal assets in the economy, but it does get more agenda setting power over the rules of the economy³: we denote the present value of income gained by partially setting these new rules as αW . Note that we link the institutional terrorist technology to the payoff as well. In this way, when $\alpha \rightarrow 1$, the net benefits for terrorism rise relative to war due to some institutional technology factor.

The final option for the dissident group is, of course, to maintain the *status quo*. They will only choose to maintain the *status quo* if the cost of mounting either a terrorist attack or a rebellion attack is too high relative to the reward of doing so.⁴

We can now compare the payoff functions under the three options. If we assume a subjective rate of time preference, ρ , the payoff to the dissident group from maintaining the *status quo* $S(\tau)$ is

$$S(\tau) = \int_0^\tau \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \int_\tau^{\tau+h} \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \int_{\tau+h}^\infty \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds. \quad (1)$$

Equation (1) divides the payoff into three main time parts: the past periods before consid-

²While some readers may view θ as increasing in q , such an amendment to the model only strengthens our findings.

³Note that we are implicitly assuming that the probability of success in a terrorist attack is the same as the probability of success in overthrowing the government. Such a simplification does not meaningfully affect the results presented below.

⁴Note that, the government, while not being modeled explicitly, is not completely passive. The rate at which they choose to extract resources γ , the policies that it chooses to affect the growth of the economy, and the resources that they devote to soldiering all affect the resources that the dissident group has to expend in order to mount a successful attack.

ering attack $t \in [0, \tau)$, the possible insurrection period, $t \in [\tau, \tau + h)$, and the remaining periods, $t \in [\tau + h, \infty)$. As $S(\tau)$ is the *status quo*, the values in the integrals are the same in each period, so that $S(\tau) = \int_0^\infty \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds$.

We next turn our attention to the payoff for the rebellion option. The payoff to the dissident group from launching an attack sufficient to overthrow the *status quo* differs from the above because of two factors: the cost the group has to pay during the τ to h period long insurrection and the benefits that it gets if the insurrection is successful, consisting of greater extraction of the asset stock and the ability to set the new rules for the economy. For simplicity, we assume that an unsuccessful insurrection does not result in any governmental retribution (so that you get to go back to the *status quo* extraction).⁵ The payoff of launching a rebellion $R(\tau)$ is then

$$R(\tau) = \int_0^\tau \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \int_\tau^{\tau+h} \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} (1 - q^R) ds + (1 - \theta) \int_{\tau+h}^\infty \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \theta \int_{\tau+h}^\infty \gamma a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \theta W e^{-\rho(\tau+h)} \quad (2)$$

While the first terms in equations (1) and (2) are the same, the remaining terms show the differences described in the preceding paragraph. Note that as the probability of success approaches zero without expending any cost q^R , equation (2) reduces to (1).

Finally, we describe the payoff to the dissident group from launching a terrorist attack, i.e. an attack that is not of sufficient scale to overthrow the *status quo* but large enough to potentially increase the dissident group's agenda setting power. The primary difference in the terrorist case versus the rebellion case is that it costs less $q^T < q^R$ and the extraction rate over the period from $\tau + h$ to ∞ remains at δ instead of γ ; with the group only receiving partial benefit from changing the rules of the economy αW . The payoff of launching a terrorist attack $T(\tau)$ can be expressed as

$$T(\tau) = \int_0^\tau \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \int_\tau^{\tau+h} \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} (1 - q^T) ds + \int_{\tau+h}^\infty \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \theta \alpha W e^{-\rho(\tau+h)} \quad (3)$$

⁵This could be amended without any loss of generality. However, to keep things simple, we choose not to include such an extension.

Having described each payoff separately, we now compare them directly so that we can examine the conditions that lead to rebellion and terrorism over *status quo* responses. For expositional purposes, we begin by comparing Terrorism to the Status Quo, T and S, and then compare Rebellion to the Status Quo, R and S. Finally, we compare R to T. In other words, we examine the conditions under which some attack is warranted. After that, we examine which sort of attack is warranted, R or T.

Mathematically, the difference between the payoff from terrorism and the *status quo* is given by

$$T(\tau) - S(\tau) = -q^T \int_{\tau}^{\tau+h} \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \theta W e^{-\rho(\tau+h)}. \quad (4)$$

Notice that the *status quo* differs from the terrorist outcome in two significant ways: first a terrorist attack carries a cost of q^T of foregone extraction during the attack period, and second, the terrorist attack, if successful, allows the group a greater ability to change the rules of the economy. The sign of equation (4) is therefore ambiguous. It also follows that the difference between the payoff from rebellion and the *status quo* is given by:

$$R(\tau) - S(\tau) = -q^R \int_{\tau}^{\tau+h} \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \theta \int_{\tau+h}^{\infty} (\gamma - \delta) a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds + \theta W e^{-\rho(\tau+h)}. \quad (5)$$

From this equation, we see that the payoff between R and S leads to an equation that cannot be arbitrarily signed either, indicating that at a given point in time there is no reason for rebellion to be preferred to the *status quo*.

However, even if initially the *status quo* yields a more favorable outcome than either a rebellion or a terrorist attack, since the benefit from either attack (W) is fixed, while the costs (a portion of the extraction from a dwindling stock of assets) are decreasing over time, the payoff to attack will become higher than the payoff to pursuing the status quo at some point in the (perhaps distant) future.⁶ The question then becomes, what type of attack will be undertaken by

⁶While we have concentrated our discussion on cases in which some type of insurrection is inevitable, there are obvious cases under which the *status quo* may be preferred, since the cost of any type of insurrection may be prohibitive resulting in the payoff from the *status quo* being higher than either option. This will occur when q^T or q^R are prohibitively large, or when the growth rates are sufficiently large. Since these issues are tangential to the present paper, we have not studied this issue in more detail in this paper.

the dissident group?

To answer this question, we examine the difference between the payoff from launching a rebellion and the payoff from terrorism:

$$\begin{aligned}
R(\tau) - T(\tau) &= (q^T - q^R) \int_{\tau}^{\tau+h} \delta a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds \\
&\quad + \theta \int_{\tau+h}^{\infty} (\gamma - \delta) a_0 e^{(\beta-\gamma-\delta)s} e^{-\rho s} ds \\
&\quad + (1 - \alpha)\theta W e^{-\rho(\tau+h)}
\end{aligned} \tag{6}$$

Since the resources expended for terrorism are less than the resources expended for rebellion, $(q^T - q^R) < 0$, there is the possibility that the additional resources expended for a successful rebellion are much smaller than the additional payoff that a rebellion brings. Hence, when there is some sort of attack, terrorism is preferred over rebellion, when payoffs for rebellions are smaller and costs for rebellions are greater. Intuitively, we would expect these costs to be higher given higher economic growth (high β), lower extraction by the government (low γ) and higher extraction by the dissidents (high δ).

To formalize this, consider Proposition 1.

Proposition 1 *Lower economic growth (low β) and higher shares to the government (high γ) increase the likelihood of a rebellion or terrorist attack.*

To see this, consider equation (4). It is obvious when we take the simple partials, $\frac{\partial(T-S)}{\partial\beta} < 0$ and $\frac{\partial(T-S)}{\partial\gamma} > 0$. The equation for the rebellion payoff leads to the same result provided the two parties are extracting resources at a rate that exceeds the raw growth rate β . If so, then $\frac{\partial(R-S)}{\partial\beta} < 0$.

■

Notice, it is only under very stringent conditions that conflict will never occur. In general, as the resources in the economy dwindle, conflict becomes a more attractive option for the dissident groups. Since the resources of the economy depend on how high the tax rates are, and on how low the extraction rates are, we would expect that economies with low growth rates, high government tax rates and higher political unrest (disgruntlement of dissident groups with their extraction rate)

would have higher incidences of conflict. So, during poor economic times (low β), and when the relative share of the pie is smaller (high γ), dissidents will attack by some means.

To investigate which mode of conflict will be chosen, we consider the equilibrium where attack is first chosen over the *status quo* and within the attack types, terrorism is chosen over rebellion. Using equation (6), we see that the payoff to using terrorism as a mode of conflict instead of rebellion will be high, when the cost differential in initiating rebellion ($q^R - q^T$) is high. Intuitively, one would expect that the difference between the resources needed to initiate a rebellion and the resources needed to initiate a terrorist attack depend on the institutional processes of the economy (which can include a variety of factors including GDP per capita, income distribution, military spending, ethnic divisions etc.) We can specify these costs as working through α . Furthermore, the benefits to using terrorism as opposed to rebellion also depend positively on α , which is the degree to which the dissident group can set the agenda using terrorist attacks.⁷

To see this formally, we consider the following proposition:

Proposition 2 *Institutional processes that favor terrorist activities (high α) increase the probability of a terrorist attack over a rebellion.*

To see this, we repeat the analogous experiment from **Proposition 1**. From equation (6), $\frac{\partial R-T}{\partial \alpha} < 0$ ■

So what do **Proposition's 1** and **2** imply? Conflict is likely to occur when the economy is failing (e.g. β falls) and when dissident groups receive smaller portions of the pie. However, the key to whether the group chooses to rebel or commit a terrorist act depends crucially on their access to the government α . When groups have fewer channels to construct an organized uprising (high α), they must resort to terrorist acts during poor economic times. However, if they can organize, it might be more beneficial for them to initiate a civil war. This would be in line with the empirical results in Blomberg and Hess (2002) that show a strong correlation between adverse economic outcomes and the prevalence of civil war. However, the present paper is more concerned

⁷Other factors that may influence α such as the government's willingness to accede to terrorist demand, the degree of sympathy from inside the government etc. can influence the terrorist's ability to change the rules of the economy to its liking.

with the conditions under which terrorism will be chosen over war. In the subsequent section, we will explore this implication of our model to see if in fact terrorism is chosen by those countries with high α during bad economic times.

In summary, we have constructed a simple theory that predicts conflict to be more likely in bad times: when the resource base of the economy shrinks, dissident groups are less likely to be satisfied with claiming their low share of the smaller pie and are likely to instigate some type of conflict to increase their share of the pie. Furthermore, the theory predicts that the choice between a rebellion, in which the dissidents overthrow the government, and a terrorist attack, in which the dissidents seek to improve their voice in the economy, depend on the degree to which the government is responsive to the terrorists demands and on the soldiering technology of the economy. Richer countries that have better institutions, stronger economies and well-equipped armies raise the cost of rebellion to the point that dissident groups prefer to resort to terrorism.

4 Data and Preliminary Analysis

In this section, we describe the data employed in the paper and then examine and present its empirical regularities. The data were obtained from two different sources. To measure terrorist activities, we employ the ITERATE data set from Mickolus *et al* (1995). The economic data are obtained from the update to the Summers and Heston (1991) data set.

We begin by describing the ITERATE data set. The ITERATE project began as an attempt to quantify characteristics, activities and impacts of transnational terrorist groups. The data set is grouped into four categories. First, there are incident characteristics which code the timing of each event. Second, the terrorist characteristics yield information about the number, makeup and groups involved in the incidents. Third, victim characteristics describe analogous information on the victims involved in the attacks. Finally, life and property losses attempt to quantify the damage of the attack. The empirical work below focuses on the incidence of terrorist events, though other qualitative features of the data are also discussed.

In order to be considered an international/transnational terrorist event, the definition in

ITERATE is as follows: “the use, or threat of use, of anxiety-inducing, extra-normal violence for political purposes by any individual or group, whether acting for or in opposition to established governmental authority, when such action is intended to influence the attitudes and behavior of a target group wider than the immediate victims and when, through the nationality or foreign ties of its perpetrators, its location, the nature of its institutional or human victims, or the mechanics of its resolution, its ramifications transcend national boundaries.”

The economic data are from the Summers and Heston data set. We calculated log per-capita annual growth rates of the data for most countries from 1968 to 1991. The remaining data employed are given in a straight forward manner defined by Summers and Heston. The main advantage of employing the Summers and Heston data set is that it is calculated in PPP adjusted exchange rates so cross-country comparisons can be made with better adjustments due to price differences.

In all, there are 159 countries over 24 years providing 3816 observations in the ITERATE data set. The Summers and Heston data set is given for 152 countries over 25 years providing 3800 observations. When we combine them, we are left with 127 countries over the years 1968 to 1991 giving us a rich panel of 3014 observations.

To get a snapshot of what is revealed by the data, we begin by examining the incidence of terrorism. Figure 1 is a map of the world which includes all of the countries in our sample from 1968-1991. Each country has a graduated blue color with the darkest representing the countries with the most terrorist events and the lightest representing the countries with the least. The areas of the world that appear to be those with the most terrorism are the Americas and Europe whereas there appears to be far less terrorism in Africa.

If we compared these results to the economy, we would see a striking similarity. Figure 2 is an analogous map of the world however color now represents real GDP per capita. Obviously the richest areas such as North America and Europe are still very blue, whereas Africa is the opposite.⁸

How do we interpret this in the context of our model? The above “mapping” of terrorism to the economy is obviously too simplistic. It is unlikely that only the wealthy engage in terrorist

⁸This is further seen in our three dimensional map in Figure 3 in which color is denoted by terrorism and height is denoted by GDP per capita.

activities whereas the poor do not. There must be some other factor at work here.

The model presented in the previous section provides an explanation for this data snapshot. We showed that the decision to engage in “terrorism from within” is driven by two key factors—an institutional one and an economic one. We begin by describing the institutional factor that helps explain Figure 1.

Our model derives an equilibrium in which groups that do not have *direct* access to the elites send their message by committing terrorist activities since they do not have a voice in the political process. Since the democracies of Europe and North America are largely driven by major parties, fringe groups tend to get far less representation in the legislatures. In these cases, our model predicts there would be more terrorism. In the non-democratic states in Africa, there is no *direct* or even *indirect* access to the government. In this case, in order to get action, they must develop a unified resistance and resort to actual war with the opposing government to make change. In fact, Blomberg and Hess (2002) showed that there is indeed much more civil war in Africa vs. the North America and Europe. These institutional differences would help explain Figure 1.

Next, we explain the economic factor that relates Figure 1 to Figure 2. Our model showed that if there is a sufficient pie to fight over (high GDP per capita), then in bad times the fringe groups will resort to violence to get change. The size of the economic pie is indeed greatest in North America and Europe as seen in Figure 2. However, Figure 2 also shows that the size of the economic pie is rather small in Africa. So even if their institutional structure were different they might be less likely to commit a terrorist offense given the lack of economic change that is possible.

To see this in practice, we present a case study from two of the rich countries in each of the geographical locations—one from North America and one from Europe. First, we consider the United States. By some measures the U.S. is the richest country in the world. Interestingly enough, we find it is clearly the country with the most terrorist incidents as well. During the period 1968-1991, there was an average of 28 terrorist attacks per year.⁹ Table 2A provides a breakdown of which groups engaged in terrorist activities over the time sample. We break the time sample into three equal periods. Notice that one of the main perpetrators, in the first two periods but not in the

⁹See Table 1 for a complete list of countries and average annual terrorist attacks.

third is the FALN (Armed Front for National Liberation), a group lobbying for the separation of Puerto Rico from the United States. Furthermore, unknown groups remain quite active throughout the sample. This highlights one of the main points in our theoretical analysis. Terrorist attacks are predominantly instigated by fringe organizations that would not ordinarily get their agenda heard in the legislature.

Next, we consider France which is the European country with the most terrorism. Table 2B is constructed analogously to Table 2A. It is interesting to note how similar they are. Once again, unknown is the main source for terrorist attacks so an economic model might again aid in explaining the incidence of terrorism. Furthermore, of the main identifiable groups, the predominant entity is the Corsican National Liberation Front, a fringe group whose motives and role is comparable to the FALN within the United States. This points to an institutional structure - broadly consistent with the theory presented in the previous section - that facilitates terrorism by fringe groups that are potentially unhappy with the status quo, yet lacking in the support or resources necessary for bringing about broad based institutional change that conforms more to their preferred world view.

Interestingly, more terrorism also tends to take place during the earlier time periods rather than in the later time period. Our model would also have an explanation for this phenomenon. Our model predicts that in bad economic times there is more impetus for terrorism. Clearly the number and severity of economic contractions are much larger during the 1968-84 period rather than the 1985-1991 period.

While these maps and tables are thought provoking and provide some indirect support for our theory, they are not a formal test. To explore the model's predictions systematically, we consider a more formal structure. In what follows, we describe our formal empirical model.

5 Methodology and Empirical Results

In this section, we analyze the dynamics of economic activity and terrorism. In particular, we analyze these patterns over several relevant sub-samples. Following Burns and Mitchell (1944), we measure short run economic activity as discrete regimes, namely, contractions and expansions. The

former are periods where economic activity as measured by the growth of real GDP growth per-capita are negative, whereas for the latter they are non-negative. Similarly, terrorism is defined if a country has any terrorist incidents in a given year. Alternatively, peace is a period of no terrorism.

5.1 Simple Empirical Regularities

In this subsection, we formalize the empirical relationship between growth and terrorism by first examining the univariate dynamics of each. We do this so that we can establish some simple empirical facts about terrorism and contractions as well as provide an introduction to Markov Processes.

Markov processes are dynamic processes which capture the observed transitions from one state at time period $t-1$, to either remain in that state at time period t or to switch to another state at time period t . This has the natural interpretation for business cycles as the economy is in either one of two states: economic contraction or expansion. For purposes of our analysis, we define a recession in to be a period of negative per-capita growth of real GDP during and an expansion as a period of non-negative growth. As these are mutually exclusive, we define a contraction (expansion) in period $t-1$ as C_{t-1} (E_{t-1}). The specification of a Markov process is an attempt to specify the extent to which a particular state of the economy in a previous period affects the probability of an expansion or contraction in the current period.¹⁰

With this generalization as background, we define p_{ij} as the conditional probability that the economy is in state $i = C, E$ in period $t-1$ and in the state $j = C, E$ in period t . The 2×2 transition probability matrix is therefore:

$$\begin{bmatrix} PR(C_t|C_{t-1}) & PR(E_t|C_{t-1}) \\ PR(C_t|E_{t-1}) & PR(E_t|E_{t-1}) \end{bmatrix} = \begin{bmatrix} p_{CC} & p_{CE} \\ p_{EC} & p_{EE} \end{bmatrix} \quad (7)$$

where PR will denote probability. One attractive feature of this formulation is that and each row

¹⁰This specification of a first order Markov process follows Blomberg and Hess (2002). Higher order Markov processes can be specified by allowing the economy's state in period $t-1$ and earlier to independently affect the economy's state in period t . For the purposes of this study, however, we maintain a first order structure on our analysis as higher order Markov processes dramatically increases the number of parameters to be estimated and reduce the precision of these estimates.

of the transition matrix sums to one. So this 2×2 Markov transition matrix only requires us to estimate two parameters as $p_{CE} = 1.0 - p_{CC}$ and $p_{EC} = 1.0 - p_{EE}$. The log-likelihood function, $\ln(L)$ for the 2×2 Markov process is:¹¹

$$\ln(L) = n_{CC}\ln(p_{CC}) + n_{CE}\ln(1 - p_{CC}) + n_{EC}\ln(1 - p_{EE}) + n_{EE}\ln(p_{EE}) \quad (8)$$

where n_{ij} be the number of occurrences of state i in period $t - 1$ and in state j in period t . It is straightforward to show that the maximum likelihood estimators of the probabilities are simply $\hat{p}_{CC} = n_{CC}/n_C$ and $\hat{p}_{EE} = n_{EE}/n_E$, where n_j is the number of observations in state j at time $t-1$. In other words, p_{ij} is the observed fraction of times that state j was observed at time t when state i was observed at time $t - 1$.

Table 3 reports the results from our estimation of these transitional probabilities. The first column of results reports the estimates for the economy whereas the second column reports the analogous exercise for terrorism. Each panel of the Table reports the results for 13 samples of countries. The samples are for the entire data set (ALL), and those based on initial income: namely, the country's whose initial real GDP per-capita in 1967 was below the median (LOW INCOME), and those that were above the median (HIGH INCOME). Finally we separately examine fully democratic countries (DEMOCRACIES), non-fully democratic countries (NON-DEMOCRACIES), African countries (AFRICA) and non-African countries (NON-AFRICA), and Democratic and High Income Countries (High Income & Democratic).

The first row of the panel reports the transitional probability of remaining in a contraction this period, given that you were in a contraction last period, $p_{CC} = PR(C_t|C_{t-1})$. The second row of the panel reports the expected duration associated with that probability which is calculated as $DUR(C|C_{t-1}) = 1/(1 - p_{CC})$. Rows three and four present the analogous transition probability and duration of an expansion. The fifth row of the table reports the long run, steady-state fraction of time that the economy is in a contraction, $\overline{PR}(C) = (1 - p_{EE})/(2 - p_{CC} - p_{EE})$. Finally, the sixth row report the p-value for the test of the null hypothesis that the sub-sample states of nature were generated from the full-sample probabilities.¹²

¹¹We ignore terms that are not functions of the probabilities p_{ij} .

¹²More specifically, one evaluates log-likelihood for the sub-sample using the maximum likelihood estimates obtained

The results are quite intriguing. In the first column of the top panel, we show that, the probability of remaining in a contraction another year (p_{CC}) is about .45 for the full sample, and hence the probability of switching to an expansion phase is .55 ($.55 = 1.0 - .45$). This number may seem rather high when considering industrialized business cycles. However, given that much of the sample is taken from developing countries, the estimate is not as surprising. The probability of remaining in an expansion another year is about .77, which implies that the corresponding probability that the expansions will switch to a contraction next year is .23 ($.23 = 1.0 - .77$). These transitional probabilities translate into an expected duration of contractions of just under 2 years and just over 4 years for expansions. The top panel of the table also reports that there is a contraction (i.e. negative growth) in about one-in-three years in the sample.

The remaining panels of the first column of Table 3 present the estimation results of the Markov process for several important sub-samples of the data. There are three noteworthy, as well as statistically significant, differences in the univariate results for economic contractions and expansions when we consider sub-groups. First, countries with higher income at the beginning of the sample have longer, more persistent expansions. More specifically, the duration of expansions, conditional on being in a state of expansion, is only three years for low income countries but almost six years for high income countries. However, the duration of contractions is not affected by a country's income status. Second, Africa, has both more contractions and shorter expansions as compared to non-African countries, and these differences are statistically significant at below the conventional .10 levels as reported in the p-value row. Indeed, the expected duration of expansions is about 2.5 years, while it is over 5 years for non-African countries and over 6 years for high income, democratic countries. African countries are in the state of economic contraction about 43 percent of the time, as compared to only 26 percent of the time for non African countries. These findings are, no doubt, due to the widespread lack of economic growth over the past several decades in Africa. Finally, democratic countries tend to have fewer and shorter contractions and longer and more frequent expansions than non-democratic countries.

Similarly, using the methodology discussed above, we can also estimate the transitional

from the sub-sample and the full sample and then constructs a likelihood ratio test between the two. The p-value is obtained from a χ^2 distribution with two degrees of freedom, stemming from the two estimated transition parameters.

patterns between Terrorism and Peace. The estimation results from these Markov processes are reported in the second column of results of Table 3. For the full sample, as shown in the top panel, these findings bear the unfortunate news that Terrorism is not a rare and unusual event, as it accounts for approximately 46 percent of the sample. Moreover, once one enters into a period of terrorism, the conditional expected duration spell of terrorism is just under 4 years, and its conditional probability of continuing an additional year is 74 percent.

The sub-samples of the data for the Terrorism data also reveal a number of important empirical features. First, countries with higher income at the beginning of the sample have more persistent episodes of terrorism, that are more durable and more frequent. Indeed, high income countries have terrorist events in about sixty percent of their sample, as compared to low income countries that have terrorist events in about thirty percent of their sample. Also, the conditional duration of terrorism continuing given that it has started is over .8 for high income countries, though only .6 for low income countries. Second, democracies appear to be more affected by terrorism than non-democracies: terrorism is more prevalent, durable and persistent in democracies as compared to non-democracies. Third, Africa, has about one-third as many years with terrorist events as non-African countries: slightly more than 60 percent of the non-African sample has a year coded with a terrorist incident, whereas slightly less than 20 percent of the African sample has a year coded with a terrorist incident. As well, the conditional persistence of terrorist events is much lower in African (about probability .5) as compared to non-African countries (about probability .8), while the conditional persistence of peace is much higher in Africa (about probability .9) as compared to non-African countries (about probability .65).

These preliminary findings suggest that for most countries, prosperity and terrorism are the norm. Moreover, while economic contractions and periods free from terrorist events do occur, the former occurs less frequently for high income and democratic countries, while the latter occurs more frequently for richer countries. As an important caveat, however, Todd Sandler made the important comment to us that a possible explanation for why high income and democratic countries have more terrorism is that they simply have fewer press restrictions: hence, they may appear to have more terrorism simply because their news agencies may be more likely to report it. While the findings in this sub-section may be affected by this criticism, those in the following sub-section would not be.

Indeed, in the following sub-section, we demonstrate that the propensity for terrorism is affected by the business cycle for democratic and high income countries. Such a finding of a cyclical economic predecessor to terrorism would not be a direct by-product of sample selection issues driven by countries that have a free press.

5.2 Identifying the Transitions Into Terrorism and Economic Contractions

In this subsection, we extend the empirical model presented above so that we may investigate the joint determination of terrorism and contractions. The methodology employed in this section is similar to that used in the previous section and in Blomberg and Hess (2002). Consider the joint determination of terrorism, T_t , and contraction, C_t . To keep the accounting straight, denote state 1 as the joint occurrence of internal conflict and contraction, $T_t \& C_t$, state 2 as the joint occurrence of internal conflict and expansion, $T_t \& E_t$, state 3 as the joint occurrence of internal peace and contraction $P_t \& C_t$, and state 4 as the joint occurrence of internal peace and expansion $P_t \& E_t$. As before, we can then estimate the transition matrix of probabilities, but now there are 4 possibilities such that p_{ij} for $i, j = 1, 4$ specifies the transitions from state i in period $t - 1$ to state j in period t .

Table 4 provides the estimation results of this bivariate Markov process. The tables are organized in a similar fashion to Table 3. Not only are we interested in estimating the parameters from these Markov processes, however, but more importantly we are interested in using these estimated transition probabilities from the Markov matrix to help to identify ‘causal’ timing patterns in the data. To keep our reporting of the estimates parsimonious, we restrict our presentation to key statistics such as testing whether $PR(T_t|P_{t-1}\&C_{t-1}) = PR(T_t|P_{t-1}\&E_{t-1})$.¹³ The estimates and the restriction are reported in the top panel of the table. The restriction on the likelihood function can be implemented, and the restrictions can be tested using a χ^2 likelihood ratio test with one degree of freedom. The reported p-value is presented in Table 4 and is labeled in the row immediately following the estimated transition probabilities. In this way, we wish to infer that economic contractions cause an increase in the transition from internal peace to terrorism

¹³This requires estimating the parameters of the log-likelihood function subject to the additional constraint that $p_{31} + p_{32} = p_{41} + p_{42}$.

since it is temporally prior to the incident. Of course, terrorism may be more persistent when coupled with a contraction than otherwise. This, of course, can be explored by examining whether $PR(T_t|T_{t-1}\&C_{t-1}) = PR(T_t|T_{t-1}\&E_{t-1})$, and testing whether the two are equal. This is done in the second panel of the table.

As well, we also test for whether the pattern of contractions is affected by terrorism. For example, we examine whether the transition probability from expansion to contraction rises if a conflict is present, by testing the null hypothesis that $PR(C_t|T_{t-1}\&E_{t-1}) = PR(C_t|P_{t-1}\&E_{t-1})$, against the alternative that these parameters should be freely estimated – see third panel.¹⁴ Finally, we test for whether the conditional persistence of economic contractions is affected by the presence of terrorism in the fourth panel – $PR(C_t|T_{t-1}\&C_{t-1}) = PR(C_t|C_{t-1}\&E_{t-1})$

Not surprisingly, the results in Table 4 point to a broad dependence between terrorist incidents and economic contractions, though not for all countries. Indeed, for the full data sample (column 1 of results), the estimated conditional probability of terrorism is not significantly affected by whether a contraction occurred in the most recent year or not at the .10 level. Similarly, the likelihood of a contraction is not affected by terrorism. For example, for the full data sample, the conditional probability of a terrorist activity next period given that a country is currently at peace is .196 if the economy is also expanding, while it is .197 if the economy is contracting: namely, $PR(T_t|P_{t-1}\&E_{t-1})$ and $PR(T_t|P_{t-1}\&C_{t-1})$ are essentially identical.

However, for a number of important sub-groups listed at the top of the table, there is strong dependence between terrorism and economic activity. There are three noteworthy points centering on how income and governance account for this dependence. First, the relationship between terrorism and the economy appears to be quite important for High Income countries, though not for Low Income countries. For example, the conditional persistence of terrorist events is significantly higher when an economic contraction has occurred (.782) as compared to when an economic expansion has occurred (.718). Moreover, a contraction is more likely to start after a terrorist episode has taken place as compared to when a terrorist episode has not taken place.¹⁵ Both of these findings, however, do not hold for low income countries. Second, the relationships between terrorism

¹⁴This again requires estimating the parameters of the log-likelihood function subject to the additional constraint that $p_{22} + p_{24} = p_{42} + p_{44}$.

¹⁵ $PR(C_t|P_{t-1}\&E_{t-1}) = .146 < .188 = PR(C_t|T_{t-1}\&E_{t-1})$ with a p-value of .026.

and the economy are quite different for Democratic and non-Democratic countries. In particular, Democratic countries have significantly more persistent contractions during periods of terrorism (conditional on starting in a contraction), and significantly more persistent terrorism (conditional on starting in a terrorist episode) during economic contractions. In other words, for Democratic countries, $PR(T_t|T_{t-1}\&E_{t-1}) < PR(T_t|T_{t-1}\&C_{t-1})$ and $PR(C_t|P_{t-1}\&C_{t-1}) < PR(C_t|T_{t-1}\&C_{t-1})$. Again, these important findings for Democracies, do not hold for non-Democracies.

Combining High Income and Democratic countries together also reveals an important pattern of statistically significant relationships between economic activity and terrorist incidents. Strikingly, it appears that the critical finding is that current periods of economic contractions make future terrorist events more likely. This result can be gleaned from the following two observations. First, periods of peace are more likely to turn to periods of terrorism if the economy is in an economic contraction. In other words, $PR(T_t|P_{t-1}\&C_{t-1}) > PR(T_t|P_{t-1}\&E_{t-1})$. Second, periods where terrorist events take place are more likely to remain in the state of terrorism if the economic is in an economic contraction: namely, $PR(T_t|T_{t-1}\&C_{t-1}) > PR(T_t|T_{t-1}\&E_{t-1})$. Taken together, these two findings suggest that for countries that are both high income and democratic, economic contractions make future terrorism more likely.

In summary, the results from Table 4 are quite strong and statistically significant. Economic contractions and terrorist events are simply not independent events that can be considered in isolation from one another. The strongest link between the two appears to be from economic contractions to increased frequencies of terrorism. This link, however, is not constant across all countries but rather is driven to a large extent by higher income and democratic governance. Contractions make countries more likely to transition to terror and remain there. There is some additional evidence that terrorism leads to an increase in the initiation and continuation of economic contractions.

6 Conclusion

This paper develops a model whereby terrorist events are endogenously determined within the model. Our main theoretical result is that an equilibrium can be sustained where groups with limited access to opportunity may find it rational to engage in terrorist activities while policy-maker elites may find it rational not to engage in opening access to these groups. The result is then a pattern of reduced economic activity and increased terrorism.

To explore the model's implications, we construct a rich panel data set of 130 countries from 1968 to 1991 of terrorist and economic variables. We find a broad set of empirical findings that economic activity and terrorism are not independent of one another. In particular, high income and democratic countries appear to have higher incidence of terrorism, and lower incidence of economic contraction. Furthermore, the terrorism they do observe appears to be impacted by the economic business cycle: namely, periods of economic weakness increase the likelihood of future terrorist activities. These results are in support of our theoretical model.

Table 1: Terrorist Incidence Around the World
Average Annual Incidence 1968-1991

COUNTRY	AVG. NO.	COUNTRY	AVG. NO.	COUNTRY	AVG. NO.
ALGERIA	0.54	GUATEMALA	6.42	PARAGUAY	0.38
ANGOLA	2.00	GUINEA	0.00	PERU	9.88
ARGENTINA	15.58	GUINEA-BISSAU	0.00	PHILIPPINES	11.00
AUSTRALIA	1.63	GUYA.	0.08	POLAND	0.58
AUSTRIA	3.29	HAITI	1.17	PORTUGAL	3.13
BAHAMAS	0.00	HONDURAS	3.38	PUERTO RICO	1.79
BAHRAIN	0.13	HONG KONG	0.50	QATAR	0.04
BANGLADESH	0.42	HUNGARY	0.33	REUNION	0.00
BARBADOS	0.21	ICELAND	0.08	ROMANIA	0.29
BELGIUM	4.33	INDIA	6.21	RWANDA	0.00
BELIZE	0.00	INDONESIA	1.42	SAUDI ARABIA	0.75
BENIN	0.00	IRAN	4.67	SENEGAL	0.08
BHUTAN	0.00	IRAQ	1.83	SEYCHELLES	0.04
BOLIVIA	3.17	IRELAND	3.38	SIERRA LEONE	0.04
BOTSWANA	0.29	ISRAEL	9.08	SINGAPORE	0.46
BRAZIL	3.00	ITALY	14.83	SOLOMON IS.	0.04
BULGARIA	0.13	IVORY COAST	0.21	SOMALIA	0.79
BURKI. FASO	0.08	JAMAICA	0.67	SOUTH AFRICA	0.92
BURUNDI	0.08	JAPAN	2.17	SPAIN	10.92
C.A.R.	0.13	JORDAN	3.29	SRI LANKA	0.75
CAMEROON	0.13	KENYA	0.33	ST.KITTS&NEVIS	0.00
CANADA	1.71	KOREA, REP.	3.04	ST.LUCIA	0.00
CAPE VERDE IS.	0.00	KUWAIT	2.00	ST.VINCENT &GRE	0.00
CHAD	0.33	LAOS	0.38	SUDAN	1.92
CHILE	5.96	LESOTHO	0.29	SURIME	0.25
CHINA	0.21	LIBERIA	0.58	SWAZILAND	1.13
COLOMBIA	10.17	LUXEMBOURG	0.21	SWEDEN	1.92
COMOROS	0.00	MADAGASCAR	0.00	SWITZERLAND	2.83
CONGO	0.08	MALAWI	0.04	SYRIA	1.79
COSTA RICA	2.42	MALAYSIA	2.96	TAIWAN	0.29
CYPRUS	5.21	MALI	0.00	TANZANIA	0.29
CZECHOSLOVAKIA	0.17	MALTA	0.38	THAILAND	2.08
DENMARK	1.25	MAURITANIA	0.08	TOGO	0.13
DJIBOUTI	0.33	MAURITIUS	0.00	TONGA	0.00
DOMINICA	0.04	MEXICO	3.75	TRINIDAD&TOBAGO	0.38
DOMINICAN REP.	1.08	MONGOLIA	0.00	TUNISIA	0.79
ECUADOR	1.92	MOROCCO	0.79	TURKEY	10.92
EGYPT	3.42	MOZAMBIQUE	2.71	U.K.	19.92
EL SALVADOR	7.58	MYANMAR	0.42	U.S.A.	27.63
ETHIOPIA	2.54	NAMIBIA	0.17	U.S.S.R.	1.79
FIJI	0.21	NEPAL	0.21	UGANDA	0.79
FINLAND	0.00	NETHERLANDS	6.46	UNITED ARAB E.	0.25
FRANCE	23.29	NEW ZEALAND	0.21	URUGUAY	2.00
GABON	0.17	NICARAGUA	1.29	VANUATU	0.00
GAMBIA	0.00	NIGER	0.25	VENEZUELA	2.83
GERMANY, EAST	0.33	NIGERIA	0.25	WESTERN SAMOA	0.00
GERMANY, WEST	16.00	NORWAY	0.50	YEMEN	0.50
GHANA	0.08	OMAN	0.04	YUGOSLAVIA	0.67
GRE.DA	0.04	PAKISTAN	5.25	ZAIRE	0.33
GREECE	15.21	PANAMA	1.88	ZAMBIA	0.92
		PAPUA N.GUINEA	0.21	ZIMBABWE	1.79

Notes: All information in this table was obtained from ITERATE data set.

Table 2A: Terrorist Groups in the U.S.
Average Incidence Over Each Time Period

	Number	Percent	Name of Organization
1968- 1975	42	17.57	Unknown
	29	12.13	FALN (Armed Front for National Liberation)
	23	9.62	El Poder Cubano (Cuban Power)
	22	9.21	Jewish Defense League
	17	7.11	MIRA
	10	4.18	Secret Cuban Government
	9	3.77	Cuban Action Commandos
	8	3.35	Indeterminate anti-Castro Cubans
	7	2.93	No group involved
	7	2.93	El Condor
1976- 1983	79	23.12	Unknown
	60	16.71	FALN (Armed Front for National Liberation)
	31	8.64	Omega-7
	30	8.36	No group involved
	18	5.01	Jewish Defense League
	14	3.9	Indeterminate Puerto Rican groups
	8	2.23	Indeterminate Serbo-Croat
	8	2.23	Justice Commandos of the Armenian Genocide
	6	1.67	Jewish Armed Resistance
	5	1.39	Pedro Ruiz Botero Commandos
1984- 1991	30	55.56	Unknown
	4	7.41	No group involved
	4	7.41	IRA Provos
	3	5.56	Jewish Defense League
	3	4.29	Indeterminate Sikh extremists
	2	2.86	United Freedom Fighters Federation
	2	2.86	PLO

Notes: All information in this table was obtained from ITERATE data set.

Table 2B: Terrorist Groups in France
Average Incidence Over Each Time Period

	Number	Percent	Name of Organization
1968- 1975	37	35.24	Unknown
	7	6.67	Popular Front for the Liberation of Palestine
	4	3.81	Committee of Coordination
	4	3.81	Puig Antich Ulrike Meinhof Commando
	3	2.86	No group involved
	3	2.86	French Students
	3	2.86	Charles Martel Group
	3	2.86	Youth Action Group
	3	2.86	GARI (International Revolutionary Action)
	3	2.86	Wrath of God
	1976- 1983	73	25.61	Unknown
31		10.88	Corsican National Liberation Front
12		4.21	Bakunin Gdansk Paris Group
12		4.21	Armenian Secret Army for the Liberation of Armenia
9		3.16	Orly Group
7		2.46	Direct Action
7		2.46	Indeterminate Armenian Nationalists
6		2.11	Organization of October 3rd
5		1.75	Ukrainian Nationalists
5		1.75	Lebanese Armed Revolutionary Faction
1984- 1991		46	26.74	Unknown
	27	15.7	Corsican National Liberation Front
	12	6.98	Committee of Solidarity with Arab prisoners
	7	4.07	GAL- Anti-terrorist Liberation Group
	7	4.07	ETA
	7	4.07	Islamic Jihad
	4	2.33	No group involved
	4	2.33	Direct Action
	4	2.33	Armenian Secret Army for the Liberation of Armenia
	4	2.33	Islamic Resistance Front

Notes: All information in this table was obtained from ITERATE data set.

**Table 3: Estimates of 2×2 Markov Processes
for the Economy and Terrorism**

Data	c Statistic	EVENT X		
		Economic Contraction (C)	Terrorist Incident (T)	NOBS
ALL	$PR(X_t|X_{t-1})$	0.472	0.741	3014
	$DUR(X|X_{t-1})$	1.895	3.863	
	$PR(X_t^c|X_{t-1}^c)$	0.743	0.777	
	$DUR(X^c|X_{t-1}^c)$	3.902	4.482	
	$\overline{PR(X)}$	0.326	0.465	
	$p - value$			
LOW INCOME	$PR(X_t|X_{t-1})$	0.465	0.600	1511
	$DUR(X|X_{t-1})$	1.870	3.312	
	$PR(X_t^c|X_{t-1}^c)$	0.677	0.826	
	$DUR(X^c|X_{t-1}^c)$	3.096	5.753	
	$\overline{PR(X)}$	0.373	0.312	
	$p - value$	0.002	0.001	
HIGH INCOME	$PR(X_t|X_{t-1})$	0.482	0.811	1503
	$DUR(X|X_{t-1})$	1.930	5.291	
	$PR(X_t^c|X_{t-1}^c)$	0.804	0.696	
	$DUR(X^c|X_{t-1}^c)$	5.575	3.286	
	$\overline{PR(X)}$	0.279	0.612	
	$p - value$	0.002	0.001	
DEMO- CRACIES	$PR(X_t|X_{t-1})$	0.403	0.818	1197
	$DUR(X|X_{t-1})$	1.677	5.508	
	$PR(X_t^c|X_{t-1}^c)$	0.811	0.703	
	$DUR(X^c|X_{t-1}^c)$	5.295	3.365	
	$\overline{PR(X)}$	0.241	0.613	
	$p - value$	0.001	0.001	
NON- DEMO- CRACIES	$PR(X_t|X_{t-1})$	0.505	0.658	1675
	$DUR(X|X_{t-1})$	2.019	2.918	
	$PR(X_t^c|X_{t-1}^c)$	0.690	0.791	
	$DUR(X^c|X_{t-1}^c)$	3.224	4.767	
	$\overline{PR(X)}$	0.388	0.384	
	$p - value$	0.001	0.001	

Continued.

Table 3 (continued): Estimates of 2×2 Markov Processes for the Economy and Terrorism

Data	Statistic	EVENT X		
		Economic Contraction (E)	Terrorist Incident (T)	NOBS
AFRICA	$PR(X_t|X_{t-1})$	0.498	0.484	1111
	$DUR(X|X_{t-1})$	1.991	1.939	
	$PR(X_t^c|X_{t-1}^c)$	0.613	0.880	
	$DUR(X^c|X_{t-1}^c)$	2.588	8.355	
	$\overline{PR(X)}$	0.436	0.197	
	$p - value$	0.001	0.001	
NON-AFRICA	$PR(X_t|X_{t-1})$	0.447	0.788	1903
	$DUR(X|X_{t-1})$	1.809	4.714	
	$PR(X_t^c|X_{t-1}^c)$	0.803	0.665	
	$DUR(X^c|X_{t-1}^c)$	5.067	2.982	
	$\overline{PR(X)}$	0.264	0.614	
	$p - value$	0.001	0.001	
HIGH INCOME & DEMO	$PR(X_t|X_{t-1})$	0.425	0.838	910
	$DUR(X|X_{t-1})$	1.740	6.456	
	$PR(X_t^c|X_{t-1}^c)$	0.838	0.641	
	$DUR(X^c|X_{t-1}^c)$	6.178	2.788	
	$\overline{PR(X)}$	0.224	0.692	
	$p - value$	0.001	0.001	

X refers to the events Economic Contraction (C) and Terrorist Incident (T). The superscript c refers to the complement of an event, e.g. the complement of Contraction is Expansion, $E = C^c$, and the complement of Terrorist Incident is Peace, $P = T^c$. $PR(\cdot)$ refers to probability, and $PR(X_t|X_{t-1})$ is the transition probability that event X will occur in period t , given that event X occurred in period $t - 1$. $\overline{PR(\cdot)}$ is the asymptotic probability of the event and $DUR(\cdot)$ refers to the conditional expected duration of an event. $p - value$ is the p-value from a likelihood ratio test that the estimated coefficients from the transition matrix are the same in the sub-samples and the full samples. The test is distributed χ^2 with 2 degrees of freedom. The sub-samples are for the entire data set (ALL), countries with below the median level of initial real GDP per-capita in 1967 (LOW INCOME), and those with incomes above the median (HIGH INCOME), fully democratic countries in 1967 (DEMOCRACIES), non-fully democratic countries (NON-DEMOCRACIES), African countries (AFRICA) and non-African countries (NON-AFRICA).

Table 4: Estimates of 4×4 Markov Processes for the Economy and Terrorism

SAMPLE	ALL	LOW INC.	HIGH INC.	DEMO	NON- DEMO	AFRICA	NON- AFRICA	HIGH INC. \times DEMO
$PR(T_t|P_{t-1}\&E_{t-1})$	.196	.177	.211	.209	.195	.121	.235	.206
$PR(T_t|P_{t-1}\&C_{t-1})$	.197	.171	.252	.258	.201	.148	.272	.252
p-value	[.927]	[.831]	[.206]	[.347]	[.271]	[.242]	[.228]	[.085]
$PR(T_t|T_{t-1}\&E_{t-1})$	.654	.515	.718	.722	.583	.344	.708	.770
$PR(T_t|T_{t-1}\&C_{t-1})$	.694	.577	.782	.816	.670	.515	.758	.881
p-value	[.124]	[.177]	[.049]	[.050]	[.102]	[.242]	[.080]	[.041]
$PR(C_t|P_{t-1}\&E_{t-1})$	.239	.355	.146	.213	.272	.388	.160	.148
$PR(C_t|T_{t-1}\&E_{t-1})$	.224	.305	.188	.242	.236	.381	.198	.200
p-value	[.399]	[.102]	[.026]	[.428]	[.838]	[.878]	[.035]	[.192]
$PR(C_t|P_{t-1}\&C_{t-1})$	.497	.502	.466	.365	.463	.512	.460	.354
$PR(C_t|T_{t-1}\&C_{t-1})$	.486	.497	.477	.495	.488	.523	.472	.462
p-value	[.866]	[.909]	[.826]	[.067]	[.655]	[.827]	[.765]	[.313]

See Table 3. P and E refer to the states of “Peace” and “Economic Expansion”, respectively. Note that Peace is the complement of Terrorism, $P = T^c$, while Expansion is the complement of Contraction, $E = C^c$. p-value, reported in square brackets, is the test that the two preceding probabilities are equal to one another. The test is distributed χ^2 with 1 degrees of freedom.

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Figure 1: Americas and Europe Experience More Terrorism Than Africa
(Shades of Blue Denote Terrorism Incidence)

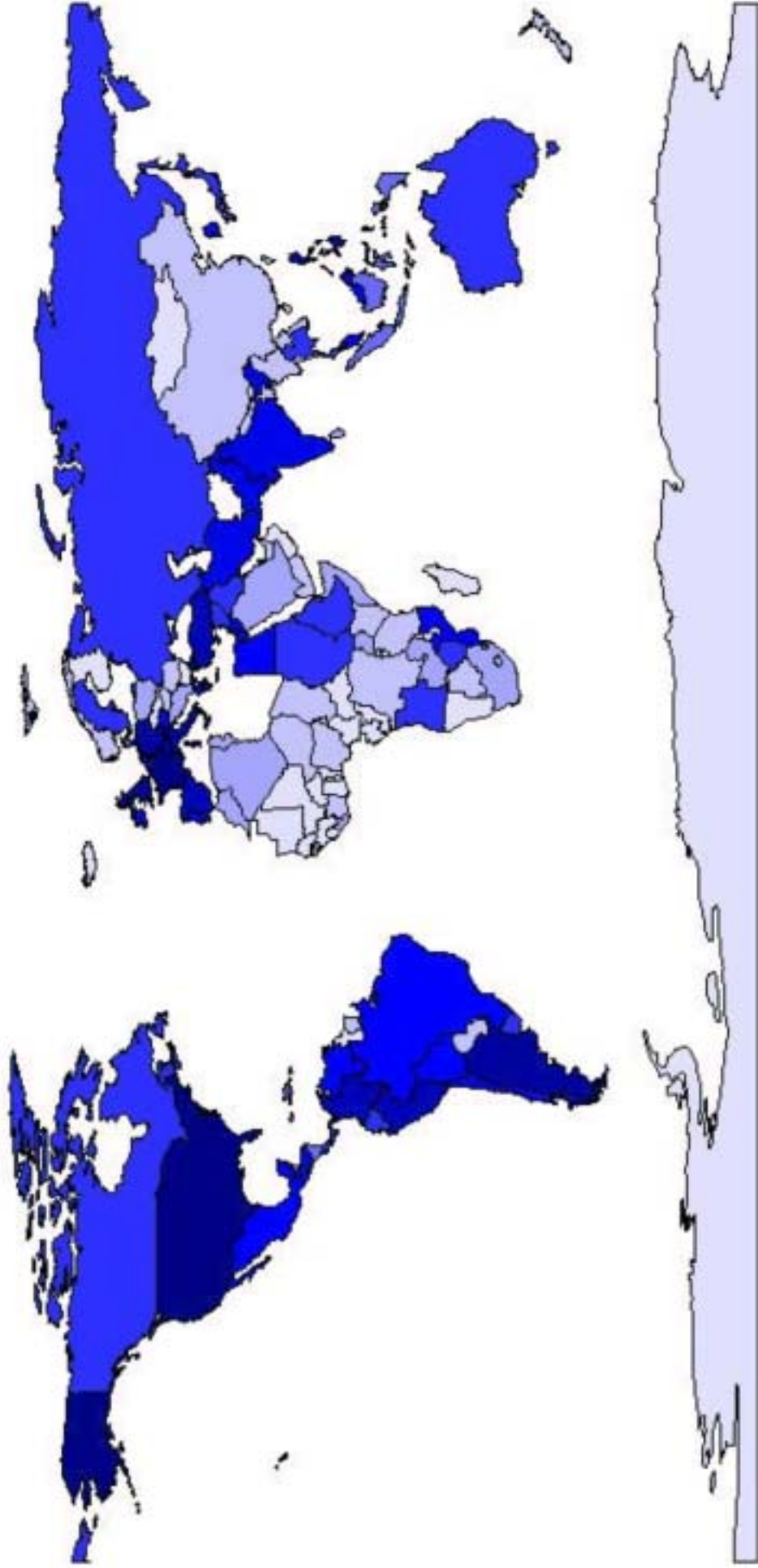


Figure 2: North America and Europe Are Richer than Africa
(Shades of Blue Denote Levels of GDP per Capita)

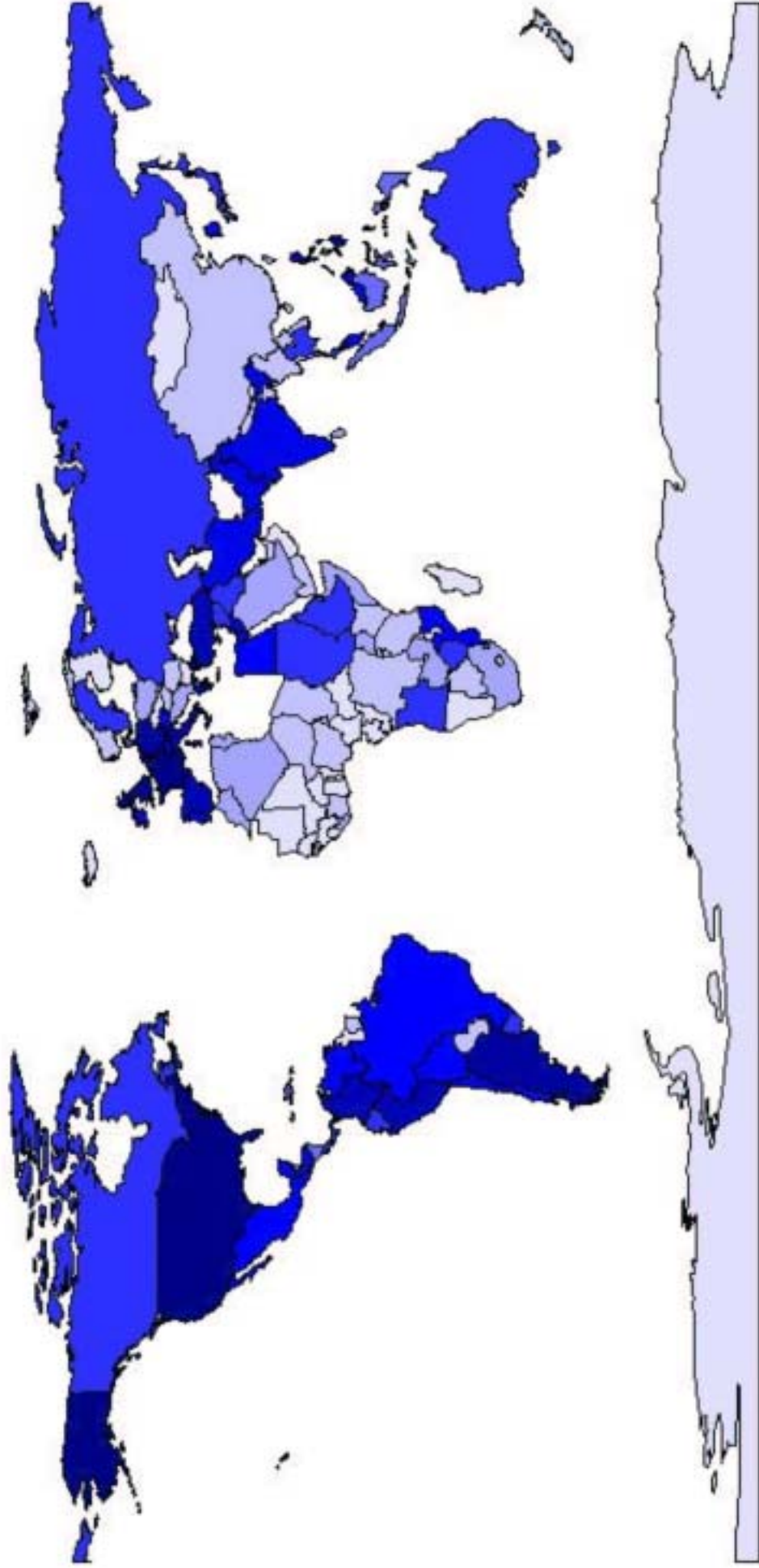


Figure 3: Europe and North America Have More Terrorism and Income than Africa
(Darker Shade of blue refers to more terrorist incidence: Height refers to more GDP per Capita)

