

## **An Empirical Study of Suicide Terrorism: A Global Analysis**

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## Abstract

This paper provides the first venue-based empirical investigation of the number and lethality of suicide terrorist attacks on a global scale. For 1998–2010, we assemble a data set of 2448 suicide terrorist incidents, drawn from the three main terrorist event databases – i.e., ITERATE, the Global Terrorism Database (GTD), and RAND. Our data set distinguishes between domestic and transnational suicide terrorist missions. For the quantity of suicide terrorism, we apply zero-inflated negative binomial panel (country-year) estimation for country-specific variables and negative binomial panel estimation for attack-specific variables. We also present linear regression panel estimations for the impact of suicide terrorism in terms of casualties per attack. Economic, political, and military variables, at times, differentially influenced the two kinds of suicide terrorism. A host of policy conclusions are drawn from the empirical findings.

*Keywords:* Suicide terrorism, Negative binomial panel, Domestic and transnational terrorism, Country-specific variables, Attack-specific variables

## **An Empirical Study of Suicide Terrorism: A Global Analysis**

### **1. Introduction**

In terrorist attacks, individuals or subnational groups use violence to obtain a political or social objective through the intimidation of a large audience beyond that of the immediate victims. If the terrorist attack is particularly ghastly, then the terrorist group hopes that its wanton act will cause sufficient social anxiety that society will pressure the government to concede to the group's demands. Suicide terrorist attacks, whose execution requires the terrorists to sacrifice his/her life, have grown in number since the late 1990s (Bloom 2005; Pape 2005; Pedahzur 2005). Because suicide terrorist attacks murder many times more people as conventional terrorist attacks (Enders and Sandler 2012), suicide attacks possess a greater potential to traumatize its intended audience to pressure its government to cave into the terrorists' demands (Pape 2003). On October 23, 1983, the suicide car bombings of the US Marine barracks and the French Paratroopers sleeping quarters in Beirut, Lebanon showed how devastating and effective such attacks could be. Months later, the United States and other countries removed their peacekeepers from Beirut, as demanded by the terrorists. Hezbollah's car bombings in Lebanon in the early 1980s later influenced the Tamil Tigers, a secular terrorist group, in Sri Lanka to adopt such attacks many years later to obtain concessions in their war of independence. Suicide terrorist incidents were deployed by various Palestinian terrorist groups.

In recent years, there have been a number of theoretical treatments of suicide terrorism to explain how such drastic measures may have a rational basis in terms of the perpetrator or the group's leader, whose subordinates dispatch the suicide terrorists. Some of these theoretical studies are based on game-theoretical models containing three agents (e.g., the terrorist leader, a targeted government, and potential terrorist supporters), where supporters become suicide

terrorists if they gain more from their participation than from their economic opportunities (Bueno de Mesquita 2005; Rosendorff and Sandler, 2010; McBride and Richardson 2012; Pittel and Rübhelke 2012). Governments' preemptive counterterrorism measures can result in popular backlash that encourages recruitment through new grievances (see, e.g., Rosendorff and Sandler 2010). Other theoretical treatments put forward a club model in which the terrorist group provides excludable social services to followers including the perpetrators' family (Berman and Laitin 2008), where the terrorist leader resorts to suicide terrorism against hardened targets.

To date, two very influential empirical studies focused on Palestinian suicide terrorist incidents. Benmelech and Berrebi (2007) investigated the relationship between the human capital of suicide terrorist bombers and the outcome of their attacks. In particular, these authors showed that older and more educated suicide bombers succeeded more often than their younger and less-educated counterparts. As a consequence, better-endowed suicide terrorists murdered more people with their bombs, which furthered the societal trauma, intended by terrorist leaders. Benmelech and Berrebi (2012) implied that terrorist groups dispatched their more capable bombers to the high-valued targets. This provocative study provided a sobering reality. Their study was made possible by a unique data set that they assembled from the Israeli Security Agency reports on suicide missions leveled against Israeli targets in Israel, the West Bank, and the Gaza Strip during 2000–2005. In particular, these authors acquired essential micro-level data about the perpetrators' age, education, and background. In an important follow-up study, Benmelech, Berrebi, and Klor (2012) investigated the links between economic conditions and the “quality” of suicide terrorists in terms of the education level, age, and experience. This second study was accomplished by merging data on suicide attacks and Israeli counterterrorism measures during the Second Intifada with data on earnings and employment in the West Bank

and Gaza Strip, the home of the perpetrators. However, this latter study could not establish unambiguously that economic factors – unemployment and earnings – affected the number of suicide terrorist attacks.

The primary purpose of our study is to present a novel global empirical analysis of the impact (i.e., number of casualties – dead or wounded) and quantity (i.e., number of incidents) of suicide terrorist missions based on country-specific and attack-specific variables.<sup>1</sup> We surmise that suicide terrorism possesses unique properties – its greater carnage, the supreme sacrifice of its perpetrator, and its use against hardened targets – that sets it apart from conventional terrorism, thereby warranting its study as a separate class of terrorist events. A second novel purpose is to identify why some countries experience no suicide attacks in a given year. A tertiary purpose is to distinguish how our independent variables differentially impact the different forms of suicide terrorism – i.e., transnational and domestic. We merge event data from *International Terrorism: Attributes of Terrorist Events* (ITERATE) (Mickolus et al. 2012), RAND (2012), and the Global Terrorism Database (GTD) (National Consortium for the Study of Terrorism and Response to Terrorism 2012) to provide observations on 2448 unique suicide terrorist attacks for 1998–2010. The previous Palestinian studies had just over 150 suicide attacks. Unfortunately, unlike these earlier studies, we do not have micro-level data on the characteristics of the suicide bombers. By necessity, we have substituted attack-specific observations on the bombers' terrorist group, their targets (i.e., business, military, official, and private parties), and venue city to investigate the quantity and carnage of the suicide attacks. More in keeping with Benmelech, Berrebi, and Klor (2012), we have macro-level, country-specific variables on the venue country of the attacks. Thus, we can investigate how the gross national income (GNI) per worker, the unemployment rate, tertiary school enrollment,

democracy, foreign occupation/transition regimes, and some counterterrorism proxies affect the number of suicide attacks. The use of zero-inflated negative binomial panel analysis permits us to study how country-specific variables influence the absence of suicide terrorist attacks in a given country-year.

Given their exclusive focus on Palestinian suicide operations, the generality of the earlier Palestinian studies may be called into question, which does not belie their importance.<sup>2</sup> Global studies are needed to know for sure whether earlier findings apply more universally. Unlike Benmelech, Berrebi, and Klor (2012), we find that economic factors – GNI per worker and the unemployment rate – affect the number of suicide attacks. GNI per worker increases the number of total, transnational, and domestic suicide terrorist attacks. High unemployment rates in the venue country increase all three types of suicide attacks, while tertiary school enrollment affects transnational and domestic suicide attacks differently. We also show that hardened targets are indeed favored by the terrorist groups dispatching suicide terrorists. Terrorist groups that supply social services engaged in more transnational suicide attacks. Thus, we are able to test hypotheses drawn from the theoretical literature with our extensive panel data set of recent suicide terrorist missions.

The body of the paper contains five sections. Important preliminaries and our theoretical arguments are contained in the next section. The ensuing section discusses the data assembly and the variables. Statistical methodology is then presented, followed by the empirical results. Conclusions and policy recommendations complete the paper.

## **2. Preliminaries and Theoretical Considerations**

We begin with a key distinction between domestic and transnational terrorism. Domestic

terrorism is homegrown and home directed, so that both major participants – the terrorists and the victims – are citizens of the venue country, where the attack takes place. A suicide car bombing in an open-air market by the Tamil Tigers in Sri Lanka that kills and maims Sri Lankans for political purposes is a domestic terrorist incident. Many of the suicide attacks during the Intifadas were domestic terrorist incidents unless foreign nationals or their interests were affected. In contrast, transnational terrorist incidents involve two or more countries through its perpetrators, victims, targeted property, or venue. The Hezbollah bombing of the US Marine barracks in Beirut is a transnational suicide terrorist incident, since US citizens were murdered or maimed on foreign soil. The four hijackings on September 11, 2001 (henceforth 9/11) were transnational suicide terrorist incidents because the victims hailed from many countries, the perpetrators were foreign citizens, and foreign corporations in the twin towers were affected.

#### *Hypotheses in Terms of Country-specific Variables*

The number of suicide attacks can be related to country-specific variables in the venue country based on the extant literature. Owing to propaganda value and a demonstration effect, previous year's suicide attacks in a country should increase attacks in the current year in that country, *ceteris paribus* (Rosendorff and Sandler 2010). The propaganda value of the mission is typically enhanced by a video made by the perpetrator with the help of his or her handler prior to the attack. At times, the terrorist group will film the attack from afar and post it on the Internet. Previous year's suicide missions are anticipated to decrease the likelihood of countries having no attacks in the current year. The well-being of workers in terms of GNI per worker may have a negative or positive influence on suicide attacks in the current year. The associated high

opportunity cost of terrorism is anticipated negatively to influence suicide attacks (Rosendorff and Sandler 2010). If, however, hardened targets in richer countries draw suicide attacks (Berman and Laitin 2008), then the venue country's GNI per worker may increase the incidence of suicide attacks. Since we are examining suicide attacks in the venue country, the hardened-target hypothesis may hold sway over the opportunity cost argument, particularly for transnational suicide terrorism where the perpetrator may be foreign with no employment in the venue country. Higher unemployment rates are anticipated to increase the number of domestic suicide attacks owing to a negative reaction to bad economic times or the possibility of terrorist groups being able to recruit more capable volunteer suicide terrorists (Bueno de Mesquita 2005; McBride and Richardson 2012). There may be a similar effect on transnational terrorism when domestic citizens perpetrate the suicide incident against foreign interests, or else the unemployment rate in the venue country is indicative of a global recession, so that a foreign perpetrator has fewer employment opportunities at home.

Higher tertiary school enrollments in the venue country are apt to limit the number of suicide attacks due to opportunity cost considerations, especially for domestic terrorism. On the contrary, these enrollment levels may increase domestic and transnational suicide terrorist attacks when highly educated perpetrators seek to supply an intergenerational public good in terms of political change – e.g., achieving an independent state (Azam 2005). The presence of a pool of educated suicide recruits may also give rise to more domestic suicide attacks (Benmelech and Berrebi 2007). Given these opposing considerations, the impact of tertiary school enrollments on the two forms of suicide terrorism is an empirical question.

Democracy in the venue country may decrease suicide attacks if lives and property are sufficiently protected and if grievances are small. In contrast, democracy may increase these

attacks by limiting executive powers, allowing freedom of association, protecting privacy, permitting the acquisition of weapons, and promoting other democratic rights (Hoffman 2006). By the same reasoning, democratic freedoms should reduce the likelihood of a country experiencing no suicide attacks. Foreign occupation or transitional government fuels grievances and offers target opportunities, thereby increasing the number of domestic and transnational suicide attacks (Pape 2005). This variable is also anticipated to decrease the likelihood that countries will experience no suicide attack in a given year.

Finally, we have two proxies for counterterrorism. The War of Terror, whose start data is set at January 2002, is expected to increase suicide attacks, especially transnational ones, owing to enhanced grievances and public backlash (Bloom 2005; Rosendorff and Sandler 2010). This variable should also reduce the likelihood that a country experiences no suicide attacks in a given year. The second counterterrorism proxy – the previous year’s military expenditure – will decrease domestic and transnational suicide terrorist attacks if it weakens terrorist groups – say, through drone attacks. This also implies an increase in the likelihood of no suicide attacks.

#### *Hypotheses in Terms of Attack-Specific Variables*

The presence of religious fundamentalist suicide attacks in a given country-year is expected to increase the number of these incidents as these terrorists seek greater carnage against the infidels (Berman and Laitin 2008; Gaibulloev, Sandler, and Santifort 2012; Santifort, Sandler, and Brandt 2013). Both domestic and transnational suicide terrorist attacks should respond positively to the presence of religious fundamental suicide attacks. More suicide terrorist attacks against protected targets – official, military, and business assets – are anticipated relative to these attacks against private parties due to target hardening. A greater presence of

suicide terrorist attacks against protected targets in a given country-year (captured by the percentage of each of these attacks) should induce more suicide terrorist attacks in that year. This follows because target hardening favors the use of suicide terrorist attacks (Berman and Laitin 2008). Finally, terrorist groups that provide social services may be associated with more suicide attacks than those that do not, insofar as social-service-providing terrorist groups can draw support from a large group of ardent followers, some of whom may be willing to make the ultimate sacrifice for the community (Berman and Laitin 2008; McBride and Richardson 2012). This is particularly true for transnational suicide terrorist attacks, where community members are unlikely to be collateral damage.

Finally, we turn to the theoretical arguments behind attack-specific determinants of the average number of casualties per suicide terrorist attack, which is our proxy for attack quality. For years with religious fundamentalist suicide attacks in a country, the number of casualties per attack should be greater for both transnational and domestic suicide missions. This follows because these terrorists go for large body counts in line with the 1998 fatwa, issued by Osama bin Laden (Santifort, Sandler, and Brandt 2013). Suicide terrorist attacks against protected persons in a given country-year should yield smaller body counts than attacks against private parties, because protected target categories are hardened and the attack may fail (Brandt and Sandler 2010). Moreover, at times, a single victim may be the intended target in the case of a suicide assassination of an official or business leader. However, this latter hypothesis may be offset by collateral damage. If a terrorist group provides social services, then its suicide attacks are likely to be less deadly than those of their nonservice-providing counterparts, especially in the case of domestic suicide terrorist incidents, since the group does not want to alienate supporters. The deployment of suicide bombers to major cities (i.e., provincial capitals and large population

centers) is apt to cause more carnage as terrorist handlers dispatch more trusted agents with more human capital to such high-valued targets (Benmelech and Berrebi 2007). Also, major cities tend to have greater population density, which should increase the casualties per transnational and domestic suicide attack.

### **3. Data**

Because there is no comprehensive data set that identifies domestic and transnational suicide terrorist incidents for 1998-2010, we rely on ITERATE, GTD, and RAND to construct such a data set.<sup>3</sup> Differences in incident coverage of the three data sets have been documented in the literature (Enders, Sandler, and Gaibullov 2011). We use 1998 as our starting point, because there were relatively few suicide terrorist attacks before this date. Such attacks were sporadic from 1982 to 1997, so that panel analysis is not feasible before 1998. After 1997, both religious fundamentalist and nationalist/separatist (e.g., Tamil Tigers, Chechen rebels, and Kurdish Workers Party) terrorists resorted to suicide attacks more frequently. This data limitation means that we cannot address why terrorists rarely relied on suicide attacks before 1998. It is likely due to the relatively few religious fundamentalist terrorist groups, who first adopted the method and then demonstrated its effectiveness to others – e.g., the Tamil Tigers. With panel analysis, we must start our analysis in 1998 when there are sufficient suicide data points.

To assemble our data, we first identify all post-1997 suicide terrorist incidents in the three major terrorist event databases. For suicide terrorist incidents occurring on the same date in the same country in two or more data sets, we investigate key variables – the number killed, the number wounded, the attack venue, the target (i.e., official, business, military, or private

parties) and other available information – to eliminate duplicate incidents. This procedure eventually yields 2448 unique suicide attacks. There are 805 suicide attacks unique to GTD, 1148 suicide attacks unique to RAND; and 49 suicide attacks unique to ITERATE. In total, there are 446 duplicate incidents in the three data sets that are entered just once each in our constructed data set. Next, we partition these suicide attacks into domestic and transnational terrorist incidents. All incidents in ITERATE are transnational, while RAND classifies incidents after 1997 as domestic or transnational. For GTD suicide incidents, not in ITERATE or RAND, we apply the method of Enders, Sandler, and Gaibulloev (2011) for partitioning these suicide missions into the two categories. In total, we have 426 transnational and 2022 domestic suicide terrorist incidents. For each suicide observation, we have numerous variables including the date, venue country, the responsible group, and the target. Finally, we transform the observation-level data into panel level data based on country and year. By so doing, there are 48 countries that experienced suicide terrorism worldwide during 1998–2010. Of these countries, 34 sustained transnational suicide attacks and 41 suffered domestic suicide attacks. Numerous countries experienced both transnational and domestic suicide terrorist incidents – e.g., Afghanistan, Iraq, Israel, and Egypt. At the panel level, we have 624 total, 442 transnational, and 533 domestic suicide terrorism observations.

Our analysis distinguishes between country-specific variables (e.g., the unemployment rate and GNI per worker) and attack-specific variables (e.g., target type and terrorist group type) for each suicide attack. We apply Gary King’s Amelia II program to interpolate missing data for country-specific variables. Amelia II implements a bootstrapping-based algorithm to apply multiple imputations to missing observations in a dataset. Intuitively, multiple imputations involve imputing  $n$  values for each missing observation in the dataset and then creating  $n$

complete datasets using the imputed observations. The observed data is the same across the  $n$  complete datasets but the imputed data differ based upon uncertainty surrounding the missing observations (Honaker and King 2010). In so doing, Amelia II reduces bias and increases efficiency as compared to list-wise deletions (Honaker, King, and Blackwell 2011).<sup>4</sup> For attack-specific variables, we further refine the data sets by removing any observations in which the target or the group is unknown for proper variable specification. This then results in the removal of 58 observations from total suicide attacks, 38 observations from transnational suicide attacks, and 51 observations from domestic suicide attacks, thereby leaving 566 total, 403 transnational, and 482 domestic attack-specific observations. There are six panel (country-year) data sets: three for country-specific variables and three for attack-specific variables. The observation-based sample sizes of the data sets differ owing to exclusions for attack-specific variables.

The unemployment rate, the tertiary school enrollment rate, the military expenditure rate, and the GNI per worker are country-specific variables drawn from the World Bank (2012). The unemployment rate is the percentage of the labor force currently without employment; unemployed individuals are seeking employment. Tertiary school enrollment is the percentage of the population, regardless of age, currently enrolled in post-secondary school.<sup>5</sup> The military expenditure rate includes all current and capital expenditures on the armed forces and is expressed as a percentage of gross domestic product (GDP). GNI per worker is calculated from several variables. Initially, we multiply the population by the labor force participation rate to determine the total number of workers employed. Then, we divide GNI by the number of workers employed to ascertain the GNI per worker.

The country-specific dummy variables for democracy and foreign occupation/transition are drawn from the Polity IV Project which scores a country based on its concomitant qualities of

democratic and autocratic rule (Marshall, Jaggers, and Gurr 2010). The Polity scale ranges from -10 to 10, where a score of 5 or below denotes an autocratic regime, while a score of 6 or above indicates a democratic regime. Countries receiving a 6 or above are assigned a dummy value of 1 for our democracy variable. Some countries do not fall within the Polity scale range due to a period of foreign occupation (score of -66) or governmental transition (score of -88). These countries are given a dummy value of 1 for our foreign occupation/transition variable.

We next turn to the attack-specific variables. The religious group variable denotes the percentage of suicide attacks committed by religious fundamentalist groups. Terrorist group classification (i.e., religious fundamentalist, nationalist/separatist, leftist, or right wing) are drawn from GTD and Blomberg, Gaibullov, and Sandler (2011), who assigned groups' ideology based on their primary goal. The target variables (i.e., officials, military, and business) are the *percentage* of suicide attacks aimed at each respective target, with private parties being the left-out target category. The group and target variables are taken directly from GTD, ITERATE, or RAND, depending on where the incident observations are drawn.

The social services variable is the percentage of suicide attacks committed by social-service-providing terrorist groups. We draw this variable from the Minorities at Risk Organizational Behavior (MAROB) data set variable, ORGST12, which details the provision of social services by terrorist groups. A terrorist organization receives a value of 2 if it provides "social services in the area(s) of education, healthcare, poverty alleviation at a para-statal level (e.g., runs the equivalent of a school district, maintains networks of healthcare facilities, etc.) in order to serve a large number of constituents on a sustained basis" (Wilkenfeld, Asal, and Pate 2008, p. 21). Therefore, we deem a group to be a service-providing group if it scores a 2 in ORGST12.

The major city variable is the percentage of suicide attacks occurring in an important city. We define a city as major if it is the capital of a country, state, or province, or if it has a large population. The population level, used to define a major city, is country specific and comes from Brinkhoff (2012), who collected population statistics from a variety of sources, including the UN, CIA, and US Census Bureau. The more populous the country, the greater is the population threshold for being designated a major city. For example, major cities in Russia must have 100,000 or more inhabitants, while major cities in Afghanistan must have 10,000 or more inhabitants (Brinkhoff 2012). Finally, we create a War on Terror dummy that receives a value of 1 in all years greater than 2001 and 0 otherwise, since this “war” commenced in late 2001.

Table 1 shows the summary statistics for all variables in our analysis. The average number of suicide terrorist attacks in a country per year is 3.92 attacks at the total level, 0.96 attacks at the transnational level, and 3.79 attacks at the domestic level. The disparity between the average annual number of transnational and domestic attacks is expected, because transnational attacks are complex and take more time and money to plan and execute relative to domestic attacks. The average number of casualties per suicide attack is 27.57 at the total level. Again, we find a large difference between the mean number of casualties at the transnational (37.30) and the domestic level (24.82). We drop the outlier casualty observations for the 9/11 suicide hijackings and the August 7, 1998 US embassy suicide bombings in Kenya and Tanzania.

[Table 1 near here]

For our 1998–2010 sample, religious terrorist groups commit a lion’s share of all suicide terrorist attacks, accounting for 69% of total attacks, 82% of transnational attacks, and 63% of domestic attacks. Relative to private parties, officials are the most-favored target for suicide terrorist attacks and are victimized in 34%, 33%, and 41% of total, transnational, and domestic

suicide attacks, respectively. The military is targeted in 17% of total, 6% of transnational, and 21% of domestic suicide terrorist attacks. Businesses are the least-targeted, protected-persons group, making up 8%, 10%, and 6% of total, transnational, and domestic suicide terrorist attacks. Across all levels, only 7% of suicide terrorist attacks are committed by social-service-providing groups. Major cities are the venue for 57% of total suicide terrorist attacks, with a much higher proportion of these attacks at the transnational level (63%) than at the domestic level (38%).

Turning to the country-specific variables, we find a similarity among the average GNI per worker at any level that ranges from \$19,125 to \$20,804. The average unemployment rate varies from 12.97% to 13.90% at the different levels of aggregation. Tertiary school enrollment is 29.38% at the total level and near 27.50% for the transnational and domestic levels. In our panel data sets, 50% of the total targeted countries, 39% of the transnational targeted countries, and 55% of the domestic targeted countries are democracies. We find low levels of instability in our sample countries, with foreign occupation or transition government occurring in no more than 8% of the countries at any level. Finally, military expenditure ranges from 2.80% of GDP at the domestic level to 3.29% of GDP at the transnational level, suggestive of increased preemption and counterterrorism measures at the transnational level.

#### **4. Statistical Methodology**

We employ several econometric techniques to analyze our hypotheses using LIMDEP version 10 econometric software developed by Greene (2012). The quality of suicide terrorism is estimated using linear regression panel estimation.<sup>6</sup> For the quantity of suicide terrorism, we apply negative binomial panel estimation for attack-specific variables and zero-inflated negative binomial panel estimation for country-specific variables. Based on the Hausman test statistic,

fixed-effects models are more appropriate than random effects as will be indicated by the corresponding  $p$ -values.

### *Linear Regression Panel Estimation*

We use a one-way fixed-effects model to estimate the quality of suicide terrorism.<sup>7</sup> For each country, this model includes a separate constant term, which captures unobserved heterogeneity that can affect one country differently than another. The model is

$$y_{it} = \delta_1 d_{1it} + \delta_2 d_{2it} + \dots + \delta_n d_{nit} + \beta_1 x_{it1} + \beta_2 x_{it2} + \dots + \beta_m x_{itm} + \varepsilon_{it}, \quad (1)$$

where  $y_{it}$  is the continuous dependent variable for  $i = 1, \dots, n$  and  $t = 1, \dots, T_i$ ; the  $\delta_i$ s are country-specific intercepts for  $i = 1, \dots, n$ ; the  $d_{jit}$ s are country-specific dummy variables equal to 1 when  $j = i$ , and 0 otherwise; the  $\beta_k$ s are parameters for  $k = 1, \dots, m$ ; and the  $x_{itk}$ s are explanatory variables for all  $i, j$ , and  $k$ . Our model allows for  $n$  countries, where country  $i$  has a time horizon of  $T_i$ . In addition, the model permits there to be  $m$  parameters. Ordinary least squares (OLS) are used to estimate this model. The marginal effects are obtained from the regression coefficients, which indicate how a one-unit change in an independent variable affects the dependent variable.

### *Negative Binomial and Zero-Inflated Negative Binomial Panel Regressions*

The dependent variable in the negative binomial fixed-effects model is a count variable. The negative binomial panel model is a generalization of the Poisson panel model, since the former does not constrain the mean to equal the variance and allows for unobserved country heterogeneity represented by the overdispersion parameter,  $\alpha$ . If  $\alpha = 0$ , there is equidispersion

and the Poisson model applies. If, however,  $\alpha > 0$ , there is overdispersion where the observed variance exceeds the mean, and the negative binomial model applies. This is a highly common feature of applied data analysis, because samples are frequently heterogeneous, contrary to implicit theoretical assumptions. In the results section, we present a test to support our use of the negative binomial over a Poisson model. The negative binomial fixed-effects panel model is estimated using the conditional estimator presented in Hausman, Hall, and Griliches (1984). The estimator is based on the conditional log likelihood,

$$\log L_c = \sum_{i=1}^n \log P \left( y_{i1}, y_{i2}, \dots, y_{iT_i} \mid \sum_{t=1}^{T_i} y_{it} \right). \quad (2)$$

Under this estimator, the model framework is

$$E[y_{it} \mid \mathbf{x}_{it}] = \exp(\delta_i + \boldsymbol{\beta}' \mathbf{x}_{it}) = \lambda_{it}, \quad (3)$$

where  $\mathbf{x}_{it}$  is an  $m \times 1$  vector of explanatory variables and  $\boldsymbol{\beta}'$  is a  $1 \times m$  vector of corresponding coefficients. The marginal effects are

$$\partial E[y_{it} \mid \mathbf{x}_{it}] / \partial \mathbf{x}_{it} = \lambda_{it} \boldsymbol{\beta}. \quad (4)$$

We do not estimate this fixed-effects model using the unconditional estimator because of the incidental-parameters problem encountered during maximum likelihood estimation, which causes inconsistent fixed-effects coefficients.

For country-specific variables, we estimate a zero-inflated negative binomial panel fixed-effects model (ZINB). To select between the negative binomial and the ZINB panel models, we use a Vuong (1989) test for non-nested models. Large positive values of the Vuong statistic favor the ZINB model, while large negative values favor the negative binomial model. In a different context, Piazza (2011) employed a ZINB model in his analysis of the causes of conventional terrorist attacks. The ZINB model accounts for two sources of overdispersion. The

first is the unobserved country heterogeneity, captured by the negative binomial model, and the second is the excess of zeroes in the count dependent variable, arising from the two-step data-generating process (Greene 1994). We are unable to use zero-inflated negative binomial estimation for the attack-specific variables due to an abundance of zeroes in the independent variables, which is not an issue for the country-specific variables. The ZINB model assumes that zero and nonzero counts in the dependent variable are generated by two different processes. Some countries rarely experience suicide attacks because terrorists do not find them attractive venues, while other countries often experience suicide attacks because terrorists find them attractive venues. A terrorist group's venue choice for a suicide mission is a two-step process. First, in a given year, the group decides which countries are potential target venues; second, for these potential venues, the group determines where to execute the suicide attack(s). Countries may fall into two categories: (i) they never experienced suicide attacks with probability  $\phi$  and reported a response of 0, or (ii) they were at risk for a suicide attack with probability  $1 - \phi$ . Thus, the reporting of a zero represents a partial observation, so that estimation using a normal Poisson or negative binomial panel model will inflate the probability of a zero response. The probability  $\phi$  is determined by the logit model and is a function of  $\mathbf{z}_{it}$ , which is a  $q \times 1$  vector of explanatory variables. Even when  $\mathbf{x}_{it} = \mathbf{z}_{it}$  so that  $m = q$ , the negative binomial and logit models for ZINB will not have the same parameter estimates because the coefficients are estimated using two different methods. Countries susceptible to suicide attacks are modeled by the negative binomial step of the ZINB model, while countries not susceptible to suicide attacks are modeled by the logit step of the ZINB model. We refer to the former as at-risk countries. Therefore, we have

$y_{it} = 0$  with probability  $\phi_{it}$ ,

$y_{it} =$  negative binomial,  $\lambda_{it}$ , with probability  $1 - \phi_{it}$ , and

$$\phi_{it} = \frac{\exp(\mathbf{z}'_{it}\boldsymbol{\gamma})}{1 + \exp(\mathbf{z}'_{it}\boldsymbol{\gamma})}, \quad (5)$$

where  $\boldsymbol{\gamma}$  is a  $q \times 1$  vector of coefficients, estimated by the logit model.

## 5. Empirical Results

Table 2 displays the ZINB model estimation results for the country-specific determinants of the quantity of suicide terrorism. The ZINB model allows the explanatory variables to affect countries differently depending on a country's proclivity for suicide terrorism. We choose to include only political and military explanatory variables in the logit portion of the ZINB model since these factors may create grievances that may ignite suicide terrorism even in country less prone to such attacks. Economic and social variables are anticipated to affect the quantity of suicide attacks in countries at risk for suicide terrorism as these considerations exacerbate grievances held by organized terrorist groups. In Table 2 and elsewhere, the sample size corresponds to the number of usable country-year observations for each type of suicide attack. Because domestic or transnational suicide attacks or both can occur in a given country-year, the sample sizes for transnational and domestic suicide attacks do not add to the sample size for total suicide attacks. Moreover, missing values can cause the sample sizes for domestic and transnational suicide attacks not to sum to the sample size for total suicide attacks.

[Table 2 near here]

In Table 2, the Hausman test statistic supports country fixed effects over random effects, while  $\alpha$  is significantly different than 0, indicating overdispersion and supporting the negative binomial model. The large positive values of the Vuong statistics strongly support the use of the ZINB model for all samples. We indicate the estimated coefficients in Table 2 for total, transnational, and domestic suicide terrorism, where, for each type of suicide terrorism, the left-hand column lists the negative binomial estimates and the right-hand column gives the logit estimates. In the negative binomial columns, we analyze the effects of economic and social variables on the number of suicide attacks for countries at risk for suicide terrorism. Suicide attacks occurring in the previous year raised the number of attacks in the current year for all three samples, which is consistent with our expectation that propaganda and demonstration effects give rise to more suicide attacks. Previous year's suicide missions did not, however, influence the likelihood of no attacks. This finding is contrary to our priors. For total, transnational, and domestic terrorism, increases in log GNI per worker led to significant increases in suicide terrorist attacks. Richer countries may be subject to more suicide terrorist attacks because these countries provide target-hardened environments (Berman and Laitin 2008). Apparently, the hardened target hypothesis held sway over the opposing opportunity cost argument not only for transnational suicide attacks, but also for domestic suicide attacks. Consistent with our priors, higher unemployment rates raised the number of suicide attacks for all samples as a likely result of poor economic conditions, which fostered grievances and allowed terrorist groups to recruit more able suicide bombers. As a country becomes more educated, as reflected by tertiary school enrollment, transnational suicide terrorist attacks fell and domestic suicide terrorist attacks rose. Hence, opportunity costs may have limited transnational suicide attacks, while fulfillment of intergenerational public goods may have motivated domestic

suicide attacks. For domestic terrorism, a more educated pool of potential terrorists is also consistent with the terrorist groups accomplishing more suicide missions through the deployment of more capable bombers (Benmelech and Berrebi 2007).

Next, we analyze the effect of political and military variables on the number of suicide terrorist attacks for all countries. For total and domestic suicide attacks, democratic countries, prone to suicide terrorism, had fewer attacks than their nondemocratic counterparts. This finding suggests that democracies in suicide-terrorism-plagued nations had greater abilities than nondemocracies to defend and protect their citizens against such attacks. Moreover, democratic countries may create fewer grievances that erupt in suicide terrorism. However, democratic freedoms reduced the likelihood of having no suicide attacks for the three forms of suicide terrorism, in keeping with our prediction based on executive restraints, freedom of association, and other characteristics of democracies. In agreement with our priors, foreign occupation or a government transition significantly augmented the quantity of suicide attacks for attack-prone countries. Moreover, these regime considerations decreased the likelihood of no suicide terrorist attacks except for transnational suicide terrorism. Surprisingly, foreign occupation and transition government increased the odds of no transnational suicide terrorist attacks, for which we have no explanation. Larger military expenditure in the previous year significantly reduced the current year's total and domestic suicide terrorist attacks in at-risk countries, presumably due to the weakening of terrorist groups owing to proactive measures. Lagged military expenditure did not significantly affect transnational suicide terrorist missions, perhaps because the venue country could not target foreign-based terrorist groups. However, lagged military spending increased the odds of having no transnational suicide terrorist attacks, which suggests a deterrent effect on suicide missions. The War on Terror significantly increased the likelihood of transnational

suicide terrorism in attack-prone countries. This sole influence on transnational missions makes sense, because this war is orchestrated by relatively few countries, whose interests became targets abroad through backlash motives. Quite troubling, the War on Terror significantly decreased the likelihood of no suicide terrorism for the three samples. These sobering findings suggest that this war created a deadlier world by enhancing grievances and expanding the use of suicide attacks by terrorists against hardened targets.

[Table 3 near here]

Table 3 presents the marginal effects of the ZINB model, calculated as  $\exp(X\beta) - 1$ . We begin by interpreting the marginal impacts of countries at greater risk for suicide terrorism in the negative binomial columns. For each additional suicide terrorist attack occurring in the preceding year, the expected number of suicide incidents in the next year rose by 0.4% at the total level and 0.3% at the domestic level. The largest impact is found at the transnational level, where each additional suicide attack in the previous year increased these attacks in the current year by 1.8%. A \$1000 increase in the mean GNI per worker augmented suicide terrorist attacks at all levels by 2.7% to 3%.<sup>8</sup> Depending on the level of analysis, suicide terrorist attacks rose from 6.1% to 8.2% in response to a 1% increase in the unemployment rate. As enrollment in tertiary school expanded by 1%, total and transnational suicide terrorist attacks fell by 2.3% and 12%, respectively, and domestic suicide terrorist events rose by 2.5%. The marginal effects of democracy in terms of the expected number of suicide terrorist attacks were 23.7% and 23.4% lower than a comparable nondemocracy for total and domestic incidents, respectively. Foreign occupation or transition government had the greatest impact on the anticipated number of suicide terrorist attacks, for which such attacks were higher by 195.9% at the total level, 103.2% at the transnational level, and 246.5% at the domestic level, compared to more stable regimes. This

large impact is attributed to the composition of our sample, because instability-ridden countries, such as Afghanistan and Iraq, accounted for 65% of the total number of suicide terrorist attacks, 45% of transnational suicide terrorist attacks, and 68% of domestic suicide attacks. Many of these events are not in the previous empirical studies of suicide terrorism. The quantity of suicide terrorist attacks was greatly influenced by our two counterterrorism proxies. As military spending in the previous year increased by 1%, the expected number of attacks in the ensuing year fell by 23.2% at the total level and 31.6% at the domestic level. The War on Terror sought to combat transnational terrorism; yet, transnational suicide terrorist attacks grew by 70.2% since its onset. As targets were hardened and grievances grew, terrorists increasingly resorted to suicide attacks.

Based on the logit columns in Table 3, we interpret the marginal effects of political and counterterrorism proxies on countries experiencing no suicide terrorism in a given year. Democracies had substantial impacts on the quantity of suicide terrorist attacks; such regimes reduced the odds of no suicide terrorist attacks from 89.5% to 100% relative to nondemocracies. Foreign occupation or transition government decreased the likelihood of no total and no domestic suicide terrorist attacks by 64.4% and 62.5%, respectively, and increased the odds of no transnational suicide terrorist attacks by 127.6%. A 1% increase in the previous year's military expenditure raised the odds of no transnational suicide terrorist attacks in the ensuing year by 66.7%. The War on Terror reduced the odds of no suicide terrorist attacks by 58.4%, 85.9%, and 64% at the total, transnational, and domestic levels, respectively. We again found serious unintended implied consequences stemming from the War on Terror.

The effects of attack-specific variables on the quantity of suicide terrorism are shown by the negative binomial panel results and their marginal effects in Table 4. In Table 4, the

Hausman test statistic favors country fixed effects over random effects; the  $\alpha$  statistic indicates overdispersion and supports the negative binomial model over the Poisson model. Variance inflation factors and correlation coefficients indicate low multicollinearity within the model (available upon request). The marginal effects are computed holding all variables at their means. Supporting our priors, religious fundamentalist terrorist groups committed more suicide attacks than their nonreligious counterparts due to the former's desire for carnage and bloodshed against nonbelievers. As the average number of religious terrorist groups committing suicide attacks increased by 1%, the number of total, transnational, and domestic suicide terrorist attacks rose by about 11.3, 4.5, and 10.2 incidents per year, respectively. These results are significant at the 0.01 level.

[Table 4 near here]

As anticipated, we find that target hardening led terrorists to favor the use of suicide attacks against protected persons at the total level. A marginal increase in the average targeting rate of 1% against protected persons increased the total number of suicide terrorist attacks against officials by 3.5 attacks, against business assets by 6.4 attacks, and against military targets by 4.8 attacks. The marginal effect for officials is only significant at the 0.10 level, while the marginal effects for the other two protected targets are significant at the 0.01 level. The effect is less pronounced at the transnational level, where the same marginal change significantly increased only suicide attacks against business assets by less than one attack per year. For domestic suicide terrorism, there is no evidence that terrorists increased such attacks against protected-person targets relative to private parties, who are less protected. Thus, at the domestic level, suicide terrorism followed the trend for conventional terrorism, with attacks favoring the most vulnerable target group (Brandt and Sandler 2010). Unlike their transnational counterparts,

domestic suicide terrorists were not driven to seek hardened targets. This is likely due to domestic suicide attacks being perpetrated by a greater mix of terrorists' ideologies, so that religious fundamentalist terrorists were not the predominant driver. At the total and transnational levels, social-service-providing terrorist groups apparently engaged in more suicide attacks than those groups not providing such services. A 1% increase in service-providing terrorist groups raised suicide missions by 8.5 attacks per year; however, this marginal effect is significant at only the 0.10 level. Statistically stronger results, as expected, characterized transnational suicide terrorist missions, where a 1% increase in these service-providing groups raised suicide attacks by 7.4 incidents per year at the 0.01 level of significance. As anticipated, social-service provision did not significantly influence domestic suicide attacks, presumably because of the worry of collateral damage curbing popular support.

[Table 5 near here]

Finally, we investigate the attack-specific determinants for the quality of suicide terrorism in terms of casualties. Table 5 presents the linear regression panel results for the average number of casualties per suicide attack. The Hausman test statistic marginally supports country fixed effects over random effects at the total and transnational levels, while it strongly supports country fixed effects over random effects at the domestic level. For total and transnational suicide terrorist missions, we re-estimate the model using random effects and find virtually no difference in the parameter estimates (available upon request). Furthermore, we re-estimate the total and transnational models using the 9/11 and Kenyan embassy bombing outliers and find robust parameter estimates, only differing in magnitude from our reported results. However, these runs result in larger log-likelihood and smaller  $R^2$  values, which indicate a poor fit. Consistent with our earlier results and priors, religious fundamentalist terrorist groups

engaged in deadlier attacks than nonreligious terrorist groups. As the average number of these fundamentalist groups employing suicide attacks increased by 1%, the average total, transnational, and domestic casualties per attack rose by 28.6, 26.7, and 39 persons, respectively, significant at the 0.01 level. A marginal increase of 1% in the targeting of officials in suicide terrorist attacks reduced total and domestic casualties per attack by 9.5 and 15.2 persons, respectively. The former is significant at the 0.10 level, while the latter is significant at the 0.01 level. These results indicate that countries actively sought to intensify security for officials through the use of bodyguards and building fortifications. However, transnational suicide attacks of government officials raised the average casualty rate by 13.2 persons per attack. This finding suggests that collateral damage, incurred during complex transnational suicide terrorist attacks, overwhelmed any benefit gained from security precautions, but the significance is marginal. Such attacks may require more explosive power owing to fortifications, thereby resulting in greater carnage.

[Table 6 near here]

By way of summary, Table 6 lists all of the hypotheses and outcomes in short-hand form with respect to total suicide terrorist attacks. The left-hand column lists the variables for the country-specific and attack-specific specifications. The second and third columns denotes the hypotheses and outcomes for the number of suicide attacks, while the fourth and fifth columns denote the hypotheses and outcomes for the likelihood of no suicide attacks. The sixth and seventh columns list the anticipated direction of the hypotheses and outcomes concerning the average number of casualties. The signs denote positive, negative, or indeterminate predicted relationships. An observation of “Not Sig” indicates that the variable was not significant in the final model. A quick glance shows that our priors are generally correct when the prediction is

unequivocal. For simplicity, the table does not address the few nuanced differences between domestic/transnational and total suicide terrorist attacks.

## **6. Concluding Remarks**

This global empirical investigation of suicide terrorist attacks accounts for the large post-2005 increase in these attacks. Our analysis relies on the construction of a data set of 2448 suicide terrorist incidents, drawn from ITERATE, GTD, and RAND. Our merged data set eliminates duplicate incidents and runs from 1998 to 2010. Moreover, this unique data set distinguishes between domestic and transnational suicide attacks, because numerous considerations will impact these two classes of suicide terrorist attacks differently. For example, tertiary schooling may be more conducive to domestic suicide missions when resident terrorist groups recruit and dispatch more capable suicide bombers (Benmelech and Berrebi 2007). However, for transnational terrorist suicide attacks, the bomber need not be from the venue country, so that the education level in the venue country may not describe that of the bomber. Another difference between transnational and domestic suicide incidents may be tied to the War on Terror, which is more apt to induce transnational, rather than domestic, suicide terrorism. Military spending may also differentially influence the two kinds of suicide terrorism. That is, military spending may be a more effective deterrent for domestic than for transnational suicide bombings, since the latter attacks may be perpetrated by terrorist groups with foreign bases that may be invulnerable to military operations launched from the venue country. As shown in the paper, other variables impact domestic and transnational terrorism in different ways.

Our analysis has some noteworthy differences from two studies of Palestinian suicide terrorist attacks (Benmelech and Berrebi 2007; Benmelech, Berrebi, and Klor 2012). First, our

study is global with 2448 suicide incidents, while the earlier Palestinian studies had just over 150 suicide missions. Second, unlike the Palestinian analyses, we found that economic factors – e.g., GNI per worker and unemployment – affected suicide missions, probably because our sample is more heterogeneous and not so overwhelmed by religious fundamentalist perpetrators. Our greater mix of group ideologies apparently allowed for the weighing of opportunity cost considerations. Third, in contrast to the Palestinian studies that analyzed mostly domestic attacks, our study identifies differences between domestic and transnational suicide attacks. Fourth, by necessity, we substitute attack-level data for the micro-level data used by the Palestinian studies. In so doing, we can indicate the impact that terrorist groups' characteristics (i.e., religious fundamentalists and social-service providers) have on the two kinds of suicide missions. In addition, we examine how various target types affect these suicide attacks. Obviously, we would prefer to have had micro-level data, which is currently not available at the global level. Fifth, we investigate the unintended dire consequences on suicide missions stemming from the War on Terror. In contrast, Palestinian studies focused on the two Intifadas. Sixth, our sample, unlike the Palestinian sample, includes many venue countries, which allow us to investigate the effect that democracy and foreign occupation or government transition have on suicide terrorist attacks. As hypothesized by Pape (2005), foreign occupation greatly encourages these attacks.

Our empirical results also differ from those of Berman and Laitin (2008). In contrast to their global analysis, we found that income and numerous other measures affected the number of suicide attacks. Of course, our samples covered much different periods, indicating that things have changed with respect to suicide attacks in recent years. For Lebanon and Israel, Berman and Laitin (2008) found that service-providing terrorist groups engaged in more lethal suicide

attacks than their nonproviding counterpart. For our global sample, we did not find these service-providing groups to achieve more casualties per attack (see Table 5).

We draw numerous policy conclusions from the findings of our study. A strong message is to tailor policies differently to domestic and transnational suicide terrorism. The War on Terror exacerbated transnational suicide terrorism to a greater extent than domestic suicide terrorism. Action to curb this backlash suicide terrorism is needed for countries on the frontline in this war. Democratic principles ameliorate domestic but not transnational suicide terrorist missions for at-risk countries. This needs to be kept in mind as democratic principles are being promoted throughout the world, particularly in the Middle East. Because foreign occupation and government transition are greatly associated with suicide terrorist attacks, extra precautions are required to forestall these attacks in countries experiencing these scenarios. Since military spending is not effective at curbing transnational suicide terrorism, foreign counterterrorism assistance should not necessarily be given to countries beset with such attacks. Religious fundamentalist groups pose much greater risks of domestic and transnational suicide attacks than other types of terrorist groups. Consequently, greater counter suicide measures are needed in countries that confront such groups. Our study suggests that government actions to provide social services will have a larger impact on alleviating transnational than domestic suicide missions. Since hardened targets attract more suicide terrorist attacks, greater vigilance is required by officials, military personnel, and business people. Finally, limited resources to forestall suicide terrorist attacks should be directed to major cities where the payoff in terms of reduced casualties per attack is so much higher.

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## Endnotes

1. There are other noteworthy global studies of suicide terrorism that addressed different concerns. Pedahzur (2005) presented interesting descriptive statistics summarizing suicide terrorist attacks from December 1981 through June 2005; however, he did not offer any statistical inference. Pape (2005) indicated statistical correlations regarding foreign occupation and religious differences as a motivator of suicide terrorist attacks. For a global sample of suicide terrorist attacks ending in 2003, Berman and Laitin (2008) tested whether per capita GDP and mountainous terrain had an influence on the number of suicide incidents. Neither variable was found to be significant. Empirically, Horowitz (2010) analyzed the factors that caused a terrorist group to adopt suicide over conventional terrorist attacks. Significant factors included the group's age, religious orientation, al-Qaida linkage, and location in Lebanon or Israel. His global data on groups covered 1968–2006.

2. This is also true of much of the empirical tests in Berman and Laitin (2008), whose data involved suicide bombings in Lebanon and Israel.

3. Suicide data of Pape (2005) and Pedahzur (2005) did not contain incidents beyond 2005. There have been many suicide terrorist attacks after 2005. Moreover, their data did not distinguish between insurgent and terrorist suicide missions.

4. We re-estimate the models without the Amelia II imputed data by drawing missing observations for a few countries from alternative data sources – e.g., military spending as a share of GDP from the Stockholm International Peace Research Institute and tertiary schooling from UNESCO. These alternative results are qualitatively the same as those in Table 2, except for one variable (democracy), whose coefficient is now insignificant. These results are available upon request.

5. We use tertiary school enrollment following the results of Benmelech and Berrebi (2007), which showed that the best performing suicide bombers tended to be college educated.

6. A truncated or censored model is inappropriate for this data, given the construction of the attack-specific data sets, previously detailed in the Data section. We only exclude country-year observations for which the target or religious group is unknown. All available non-missing information is used in the estimation. Therefore, we can justifiably state that if no attacks occurred in a given country-year, then 0% was against each target type and 0% was conducted by a religious group. For every country-year observation in which there was an attack, the target type and religious variables are nonzero.

7. We include the War on Terror dummy to capture time-specific fixed effects associated with the onset of the war.

8. Due to the log transformation of GNI per worker, we calculate the logged difference between the mean GNI per worker and a \$1000 increase in this mean level. For example, at the total level, this difference is 0.0203, so that the marginal effect can be computed as

$\exp(1.326 \times 0.0203) - 1 = 0.027$ , or a 2.7% increase in attacks.

**Table 1.** Summary Statistics, 1998-2010

Variables	Total		Transnational		Domestic	
	Mean	Obs.	Mean	Obs.	Mean	Obs.
<i>Attacks<sup>a</sup></i>	3.92	624	0.96	442	3.79	533
<i>Casualties<sup>b</sup></i>	27.57	2448	37.30	426	24.82	2022
<b>Attack-Specific<sup>b</sup></b>						
<i>Religious Group</i>	0.69	2448	0.82	426	0.63	2022
<i>Officials</i>	0.34	2448	0.33	426	0.41	2022
<i>Military</i>	0.17	2448	0.06	426	0.21	2022
<i>Business</i>	0.08	2448	0.10	426	0.06	2022
<i>Social Services</i>	0.07	2448	0.07	426	0.07	2022
<i>Major City</i>	0.57	2448	0.63	426	0.38	2022
<b>Country-Specific<sup>a</sup></b>						
<i>Gross National Income Per Worker</i>	\$20,804.54	624	\$20,332.57	442	\$19,125.08	533
<i>Unemployment Rate</i>	12.97%	624	13.90%	442	13.66%	533
<i>Tertiary School Enrollment</i>	29.38%	624	27.50%	442	27.47%	533
<i>Democracy<sup>c</sup></i>	0.50	624	0.39	442	0.55	533
<i>Foreign Occupation or Transition<sup>c</sup></i>	0.06	624	0.08	442	0.07	533
<i>Military Expenditure as % of GDP</i>	2.88%	624	3.29%	442	2.80%	533
<i>War on Terror<sup>c</sup></i>	0.69	624	0.69	442	0.69	533

<sup>a</sup>Comes from country specific panel data sets.

<sup>b</sup>Comes from observation level data.

<sup>c</sup> Dummy variable equals 1 if the aspect is present and equals 0 otherwise.

**Table 2.** Number of Suicide Attacks, Zero-Inflated Negative Binomial Panel Results: Country-Specific Measures, 1998-2010

Variables	Total		Transnational		Domestic	
	Negative Binomial	Logit	Negative Binomial	Logit	Negative Binomial	Logit
<i>Constant</i>		0.150 (0.329)		-2.897*** (0.321)		0.370 (0.370)
<i>Previous Year Total Attacks</i>	0.004*** (0.000)	0.004 (0.438)	0.018*** (0.005)	-0.002 (0.605)	0.003*** (0.000)	0.000 (0.473)
<i>Log Gross National Income per Worker</i>	1.326*** (0.168)		1.906*** (0.338)		1.094*** (0.184)	
<i>Unemployment Rate</i>	0.072*** (0.008)		0.079*** (0.016)		0.059*** (0.009)	
<i>Tertiary School Enrollment</i>	-0.024*** (0.008)		-0.128*** (0.021)		0.025*** (0.012)	
<i>Democracy<sup>a</sup></i>	-0.271*** (0.132)	-32.261*** (0.006)	-0.567 (0.442)	-2.257*** (0.007)	-0.267*** (0.140)	-32.395*** (0.006)
<i>Foreign Occupation/Transition<sup>a</sup></i>	1.085*** (0.178)	-1.033*** (0.014)	0.709** (0.339)	0.814*** (0.022)	1.242*** (0.209)	-0.982*** (0.016)
<i>Lagged Military Expenditure</i>	-0.265*** (0.025)	0.086 (0.118)	0.091 (0.061)	0.511*** (0.176)	-0.380*** (0.028)	0.102 (0.145)
<i>War on Terror<sup>a</sup></i>	0.110 (0.115)	-0.877*** (0.074)	0.532*** (0.233)	-1.960*** (0.071)	-0.086 (0.136)	-1.022*** (0.109)
Sample size	624		442		533	
Vuong Statistic	24.463		22.975		21.305	
Log-Likelihood	-1078.375		-405.589		-818.692	
Hausman Test Statistic	65.20 (0.000)		34.41 (0.000)		58.40 (0.000)	
Alpha	3.545 (0.351)		3.133 (0.450)		3.475 (0.406)	

Significance levels: \*\*\* is .01, \*\* is .05, and \* is .10. Standard errors are in parentheses except for the Hausman test statistic, which is a *p*-value.

<sup>a</sup>Dummy variable equals 1 if the aspect is present and equals 0 otherwise.

**Table 3.** Marginal Effects for Zero-Inflated Negative Binomial Panel Results: Country-Specific Measures, 1998-2010

Variables	Total		Transnational		Domestic	
	Negative Binomial	Logit	Negative Binomial	Logit	Negative Binomial	Logit
<i>Constant</i>		-0.161 (0.382)		-0.945*** (0.018)		0.447 (0.535)
<i>Previous Year Total Attacks</i>	0.004*** (0.000)	0.004 (0.440)	0.018*** (0.005)	-0.002 (0.604)	0.003*** (0.000)	0.000 (0.473)
<i>Log Gross National Income per Worker<sup>b</sup></i>	0.027*** (0.004)		0.028*** (0.009)		0.030*** (0.004)	
<i>Unemployment Rate</i>	0.074*** (0.009)		0.082*** (0.017)		0.061*** (0.010)	
<i>Tertiary School Enrollment</i>	-0.023*** (0.007)		-0.120*** (0.018)		0.025*** (0.012)	
<i>Democracy<sup>a</sup></i>	-0.237*** (0.100)	-1.000*** (0.006)	-0.432 (0.351)	-0.895*** (0.001)	-0.234*** (0.107)	-1.000*** (0.006)
<i>Foreign Occupation/Transition<sup>a</sup></i>	1.959*** (0.527)	-0.644*** (0.005)	1.032* (0.689)	1.256*** (0.050)	2.465*** (0.724)	-0.625*** (0.006)
<i>Lagged Military Expenditure</i>	-0.232*** (0.019)	0.089 (0.129)	0.095 (0.067)	0.667*** (0.293)	-0.316*** (0.019)	0.107 (0.161)
<i>War on Terror<sup>a</sup></i>	0.116 (0.128)	-0.584*** (0.031)	0.702* (0.397)	-0.859*** (0.010)	-0.082 (0.124)	-0.640*** (0.039)

Significance levels: \*\*\* is .01, \*\* is .05, and \* is .10.

<sup>a</sup>Dummy variable equals 1 if the aspect is present and equals 0 otherwise.

<sup>b</sup>Computed as the logged difference of a \$1000 increase in the mean.

**Table 4.** Number of Suicide Attacks, Negative Binomial Panel Results: Attack-Specific Measures, 1998-2010

Variables	Total		Transnational		Domestic	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
<i>Constant</i>	-2.724*** (0.278)		-3.136*** (0.936)		-2.161*** (0.360)	
<i>Religious Group</i>	2.715*** (0.221)	11.259*** (0.916)	4.807*** (0.962)	4.497*** (0.900)	2.594*** (0.339)	10.235*** (1.341)
<i>Officials</i>	0.847* (0.437)	3.512* (1.811)	0.315 (0.640)	0.295 (0.599)	0.571 (0.476)	2.251 (1.877)
<i>Military</i>	1.154*** (0.248)	4.786*** (1.029)	-0.252 (0.208)	-0.236 (0.195)	-0.059 (0.109)	-0.233 (0.430)
<i>Business</i>	1.549*** (0.454)	6.423*** (1.883)	0.949** (0.464)	0.888** (0.434)	1.084 (1.095)	4.276 (4.323)
<i>Social Services</i>	2.049* (1.243)	8.498* (5.153)	7.883*** (2.273)	7.375*** (2.126)	2.262 (17.697)	8.926 (69.835)
Sample size	566		403		482	
Log-Likelihood	-334.228		-106.229		-275.637	
Hausman Test Statistic	13.62 (0.018)		17.20 (0.004)		11.41 (0.044)	
Alpha	2.850 (0.429)		1.549 (0.315)		3.489 (0.667)	

Significance levels: \*\*\* is .01, \*\* is .05, and \* is .10. Standard errors are in parentheses except for the Hausman test statistic, which is a  $p$ -value.

**Table 5.** Average Number of Casualties per Suicide Attack, Linear Regression  
Panel Results: Attack-Specific Measures, 1998-2010

Variables	Total	Transnational	Domestic
<i>Religious Group</i>	28.638*** (4.343)	26.652*** (6.326)	39.019*** (3.558)
<i>Officials</i>	-9.532* (5.071)	13.229* (7.541)	-15.209*** (4.289)
<i>Military</i>	15.826*** (5.519)	1.149 (1.659)	1.757 (1.292)
<i>Business</i>	-1.994 (9.791)	-15.938 (11.110)	17.059* (10.203)
<i>Social Services</i>	-1.814 (9.612)	13.629 (12.451)	1.803 (9.067)
<i>Major City</i>	23.179*** (4.207)	28.458*** (6.926)	14.318*** (3.657)
Sample size	566	403	482
Log-Likelihood	-2425.349	-1762.361	-1960.664
R-squared	0.538	0.546	0.562
Hausman Test Statistic	11.19 (0.083)	11.42 (0.076)	27.15 (0.000)

Significance levels: \*\*\* is .01, \*\* is .05, and \* is .10.

Standard errors are in parentheses except for the Hausman test statistic, which is a *p*-value.

**Table 6.** Hypotheses and Outcomes for Total Suicide Terrorist Incidents

Variables	Number of Suicide Attacks		Likelihood of No Suicide Attacks		Average Number of Casualties	
	Hypothesis	Outcome	Hypothesis	Outcome	Hypothesis	Outcome
<b>Attack-Specific<sup>b</sup></b>						
<i>Religious Group</i>	+	+			+	+
<i>Officials</i>	+	+			+/-	-
<i>Military</i>	+	+			+/-	+
<i>Business</i>	+	+			+/-	Not Sig
<i>Social Services</i>	+	+			-	Not Sig
<i>Major City</i>					+	+
<b>Country-Specific<sup>a</sup></b>						
<i>Previous Year Total Attacks</i>	+	+	-			Not Sig
<i>Gross National Income Per Worker</i>	+/-	+				
<i>Unemployment Rate</i>	+	+				
<i>Tertiary School Enrollment</i>	+/-	-				
<i>Democracy<sup>c</sup></i>	+/-	-	-		-	
<i>Foreign Occupation or Transition</i>	+	+	-		-	
<i>Military Expenditure as % of GDP</i>	-	-	+			Not Sig
<i>War on Terror<sup>c</sup></i>	+	Not Sig	-		-	

<sup>a</sup>Comes from country -specific panel data sets.

<sup>b</sup>Comes from observation level data.

<sup>c</sup> Dummy variable equals 1 if the aspect is present and equals 0 otherwise.

Not Sig indicates that the variable was not significant in the final model.