Determinants of Recurrence of Terrorist Attacks. Global Analysis with Panel Data*

[English Version]

Determinantes de recurrencia de ataques terroristas. Análisis global con datos panel

Determinantes da recorrência de ataques terroristas. Análise global com dados de painel

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Abstract

Objective: The objective of this study is to establish the determinants of the number of terrorist attacks in a territory over time. **Methodology**: Elements of both the theory of the attack claims and the recurrence of attacks are incorporated, to obtain a deeper analytical spectrum. Secondly, a negative binomial stochastic model with panel data is implemented, characterized by being dynamic to avoid endogeneity problems. The information used comes from the Global Terrorism Database, Big Allied and Dangerous, Political Terror Scale, and World Bank databases. **Results**: The initial results obtained indicate that the probability of terrorist attacks increases when there is a history of armed assault, a high educational level, suicide attacks, and attacks on civilians, while it decreases with high female labor participation and low corruption rates. Alternatively, the research found sufficient empirical evidence to affirm that the attack claims help to explain the phenomenon of the number of attacks by including civilian targets, the number of fatalities, armed assaults, and suicides. **Conclusions**: If variables from the number of attack theories are incorporated, such as female labor participation, variation in GDP *per capita*, education expenditures, and the corruption index, the results are significantly more robust. This broadens the argumentative spectrum and enhances the explanatory capacity of the variables amongst themselves.

Keywords: terrorism; terrorist attacks; claim; econometric models; panel data analysis.

Resumen

Objetivo: en este estudio, se tiene por objetivo establecer los determinantes del número de ataques terroristas en un territorio a través del tiempo. **Metodología:** como novedad, en primer lugar, se incorporan elementos tanto de la teoría del reclamo de los ataques como de la recurrencia de ellos, para tener un espectro analítico más profundo. Y, en segundo lugar, se implementa un modelo estocástico binomial negativo con datos panel, caracterizado por ser dinámico para evitar problemas de endogeneidad. La información utilizada proviene de las bases de datos Global Terrorism Database, Big Allied and Dangerous, Political Terror Scale y World Bank. **Resultados:** los resultados iniciales obtenidos indican que la probabilidad de ataques terroristas aumenta cuando hay antecedentes de asalto armado, alto nivel educativo, ataques suicidas y ataques a civiles; en tanto que disminuye con la existencia de una alta participación laboral femenina y bajos índices de corrupción. De otro lado, la investigación encontró evidencia empírica suficiente para afirmar que la teoría del reclamo de los ataques ayuda a explicar el fenómeno del número de ataques mediante la inclusión de los objetivos civiles, número

de víctimas fatales, asaltos armados y suicidios. **Conclusiones:** y aún más importante, si se incorporan variables propias de las teorías del número de ataques; tales como la participación laboral femenina, variación en el PIB per cápita, gastos en educación y el índice de corrupción, los resultados son significativamente más robustos al ampliar el espectro argumentativo y potenciar la capacidad explicativa de las variables entre sí.

Palabras clave: terrorismo; ataques terroristas; reclamo; modelos econométricos; análisis de datos de panel.

Resumo

Objetivo: o objetivo deste estudo é estabelecer os determinantes do número de ataques terroristas em um território ao longo do tempo. **Metodologia:** como novidade, em primeiro lugar, são incorporados elementos da teoria da reivindicação de atentados e da recorrência de atentados, a fim de obter um espectro analítico mais profundo. Em segundo lugar, é implementado um modelo estocástico binomial negativo com dados de painel, caracterizado por ser dinâmico para evitar problemas de endogeneidade. As informações utilizadas são provenientes dos bancos de dados Global Terrorism Database, Big Allied and Dangerous, Political Terror Scale e World Bank. **Resultados:** os resultados iniciais indicam que a probabilidade de ataques terroristas aumenta com o histórico de ataques armados, alto nível de escolaridade, ataques suicidas e ataques a civis, e diminui com a alta participação da força de trabalho feminina e baixos índices de corrupção. Por outro lado, a pesquisa encontrou evidências empíricas suficientes para afirmar que a teoria da reivindicação de ataques ajuda a explicar o fenômeno do número de ataques ao incluir alvos civis, número de fatalidades, ataques armados e suicídios. **Conclusões:** mais importante ainda, ao incorporar variáveis específicas das teorias do número de ataques, como a participação da força de trabalho feminina, a mudança no PIB *per capita*, os gastos com educação e o índice de corrupção, os resultados são significativamente mais robustos, ampliando o espectro argumentativo e aumentando o poder explicativo das variáveis em relação umas às outras.

Palavras-chave: terrorismo; ataques terroristas; reivindicações; modelos econométricos; análise de dados de painel.

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Introduction

Research on terrorism involves a diversity of topics. Prominent among them are the claim of terrorist attacks (Abrahms & Conrad, 2017; Brown, 2020; Kearns, 2019) and the determinants of terrorist attacks in a territory (Hamilton & Hamilton, 1983; Halkos et al., 2017; Li, 2005; Piazza, 2017), as well as studies on specific modes of terrorism, such as suicide attacks (Demir & Guler, 2021; Farnham & Liem, 2017; Mroszczyk, 2019; O'Rourke, 2009; Pape, 2003), or the organizational dynamics of terrorist groups (Abrahms & Potter, 2015; Abrahms, 2018; Byman & Kreps, 2010; Salehyan et al., 2014; Shapiro, 2013), among others. However, as Stohl (2012) argued, more quantitative work is needed in this field to obtain results based on robust research methods.

Two theoretical justifications can be identified for the motivations behind a terrorist attack. Skoll and Korstanje (2013) propose that terrorism is just a tool used by elite countries to advance their political and economic interests. Authors such as Moskalenko and McCauley (2009) argue that terrorism is a phenomenon that is distinct from activism and is experienced when an individual is willing to use violence within the framework of the illegal to promote a political cause.

Given the scope of the present work, the theoretical perspective of Moskalenko and McCauley (2009) will be justified to support the practical implications derived from the research. In this sense, the present document is useful because it allows one to delve deeper into the causes and implications of terrorism by quantifying the effects that the set of proposed variables has on the probability of a terrorist attack occurring in a country. From a practical perspective, this allows estimating the risk of new terrorist attacks per country, and the consequent implementation of preventive measures to reduce this probability. Similarly, the study of causal relationships in the phenomenon of terrorist attacks allows intuition of new explanatory relationships among the proposed variables. These relationships, accompanied by new theoretical advances, facilitate the understanding of the motivations and dynamics under which a terrorist group acts.

When dealing in a particular manner with studies related to the determinants of the number of terrorist attacks in a territory, factors such as the level of democracy, education, or economic growth have explanatory value for the studied phenomenon (Hamilton & Hamilton, 1983; Li, 2005; Piazza, 2017). Likewise, by transferring variables belonging to other phenomena related to terrorism, such as those from Abrahms and Conrad (2017), this research seeks to find new correlations between the variables and their set to expand the explanatory

framework of the probability of the occurrence of terrorist attacks in a given territory.

Specifically, it aims to find the relationship between the variables proposed by Abrahms and Conrad (2017), Halkos et al. (2017), and Piazza (2017) regarding the prediction of a future terrorist attack. From the theoretical foundation, it is possible to argue that the variables used by the aforementioned authors are complementary since the reasons for claiming an attack by a terrorist group are linked to the number of attacks experienced in a territory.

The first section introduces the topic and presents the theoretical references that support the variables and factors incorporated in the model proposed in this research. The second brings together a set of empirical and theoretical studies that provide an account of research on the determinants and incidence of terrorism by country. The third section describes the methodology implemented and presents the results obtained from the proposed modeling. The fourth section analyzes the results obtained in light of the theories considered. Finally, the conclusions affirm that the probability of terrorist attacks increases in a country when there is a history of armed assault, a high level of education, suicide attacks, and attacks on civilians, while the probability decreases when there is a high level of female labor participation and low corruption. Similarly, this section addresses a set of preventive measures that can have an impact on reducing the probability of a terrorist attack in an established territory.

Empirical and Theoretical Studies

Some terrorism research focuses attention on specific terrorist groups and locations (Brown, 2020; D'Souza, 2016; Elden, 2014; Ette & Joe, 2019; Rudner, 2017; Williams, 2011; Yadav, 2010), while others encompass multiple terrorist groups operating in diverse territories (Abrahms & Lula, 2012; Abrahms, 2013; Kluch & Vaux, 2016; Kearns, 2019; Young & Dugan, 2014). The former allows for the isolated analysis of conditions particular to a group and a territory, which allows for a more specific assessment in time and space, while the latter facilitates the drawing of general conclusions by observing global trends in the composition, dynamics, and organization of terrorist groups.

In the study by Hamilton and Hamilton (1983), with a sample of 16 countries during the 1968-1978 period, it was found that the more authoritarian governments have a greater facility to prevent the "contagion" of terrorism, while democratic societies have greater difficulties in curbing and dealing with this phenomenon. Similarly, Li (2005) studied the influence of the level of

democracy on transnational terrorism in 119 countries for the 1975-1997 period and concluded that higher levels of democracy reduce incidents of transnational terror.

Piazza's (2017) study analyzed far-right terrorism in the United States and found that the number of such terrorist attacks is influenced by variables such as female labor participation, abortion rate, and the political composition of the government during the subperiods studied. This shows that the phenomenon of terrorism is in direct conflict with the inclusion of women in the labor market and the liberalization of rights. However, in an earlier study, Piazza (2008) finds that market liberalization and democracy are not negatively correlated with international terrorism events. In turn, Halkos et al. (2017) found that the Islamic religion is a major determinant of terrorism in a country with high market affectation, evidencing that ideological radicalities directly impact terrorism.

Regarding the motivations for terrorism, Skoll and Korstanje (2013) propose that terrorism is just a tool used by elite countries to advance their political and economic interests. Such a tool has a historical origin dating back to past threats from communist regimes. In this sense, the phenomenon of terrorism is not as important as the control and monitoring measures that are implemented due to the feeling of uncertainty that spreads in the community (Skoll & Korstanje, 2013, p. 2). The authors assert that terrorism is a narrative that allows the mobilization of material and symbolic resources to administer the idea of sovereignty; under this perspective, terrorism is a phenomenon of mass control that serves the ruling classes.

Altheide (2007) agrees with what has been proposed, stating that the fear of terrorism —as a consequence of the September 11, 2001 attacks and the beginning of the war on terrorism— was a strategy that made possible the expansion of U.S. domestic control. From this perspective, the author states that Western countries initiated a propaganda campaign in which they portrayed themselves as a nation of superior morals and values:

> A key factor in propaganda is geared to not hearing the 'other's' voice, but rather, using language and discourse to negate the legitimacy – if not the relevance – of the other. This is easier to accomplish if the other is feared. (Altheide, 2007, p. 292).

These arguments agree with Altheide (2006), who states that terrorism is a discourse that reflects symbolic relations between order, harm, and threat, which are exploited by public policymakers. Under the narrative of terrorism, fear becomes part of everyday life by representing social life as dangerous and full of

potential victims. This symbology, in turn, invites greater protection, regulation, and intervention to thwart further terrorist events. Under this perspective, the phenomenon of terrorism is little more than a narrative expanded by the mainstream media, used as a tool for political control.

From a second perspective, Moskalenko and McCauley (2017; 2009) argue for the need to distinguish between activism and terrorism. Given previous work, such as that of Horgan (2006), has characterized the phenomenon of terrorism as a linear process that individuals go through, during which they have differentiated and progressive levels of commitment to the terrorist group. The authors propose to test the hypothesis that activism, understood as nonviolent and legal political action, is a prior state of radicalism, interpreted as violent and illegal political action. Using three surveys and the formulation of two indicators of political intention (ARIS and AIS), the authors find that activism and radicalism are two correlated but independent dimensions. In this sense, it is seen that those who intend to engage in lawful political activities without violence do not necessarily have a higher propensity to engage in extremist activities. Additionally, the authors choose a theory of transition to terrorism, according to which people can move directly from one state of commitment to another without passing through intermediate states. As a result, even someone who is not committed to a particular political cause may transition to radicalism after suffering a personal loss, coming into conflict with someone, or accepting an invitation from a radicalized friend (Horgan, 2006, p. 241).

The variety of studies published accounts for variables that influence terrorist attacks, including political involvement, workplace inclusion, educational levels, economic growth, religion, and personal motivations, among others. These factors, along with the terrorist groups' organizational structure about size, leadership, and territory, provide elements that help to explain why this study connects the possibility that a country will experience a new terrorist attack every year with the possibility that these attacks will be blamed on the terrorist groups.

As a result, based on the syncretism achieved in theories about international armed conflict that appear to be unrelated, this study establishes the factors that determine the number of terrorist attacks in a country over time. One such theory is the claim of the attack's theory proposed by Abrahms and Conrad (2017), which is supported by the ideas put forth by Moskalenko and McCauley (2009), Halkos et al., Piazza (2017), and other researchers with regards to the repetition of attacks.

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Methodology

Analysis of Description

Four data sources were used to obtain the information for this investigation: the Global Terrorism Database (GTD), Big Allied and Dangerous (BAAD), the Political Terror Scale (PTS), and the World Bank (WB). After cleaning, joining, and collapsing them, a final database with unbalanced panel data information that relates to 116 countries across seven years (2012-2018) was obtained. In other words, there is a large panel since there are more countries than periods studied. Only the observations of the study-relevant variables that didn't have any missing data were included in the information cleanup process. Additionally, to exclude anomalous data (outliers), only the information falling within percentiles 1 and 99 was included.

The definition of the variables used in the empirical model is shown in Table 1, and measures of the central tendency of the variables are shown in Table 2. It is important to keep in mind that the vast majority of the variables are quantitative, and only a small number are of a dichotomous or qualitative nature. In this sense, the median of the dichotomous variable corresponds to the presence of the examined attribute in each variable.

Table 1. *Definition of Variables.*

Variables	Definition	Type
attack	Number of attacks by terrorist organizations.	Quantitative
claimed	The attack claimed by terrorist organizations.	Qualitative 1 Attack claimed 0 Other case
civobj	Attacks on civilian targets.	qualitative 1 Yes, there were attacks on civilians 0 Other case

Variables	Definition	Type
nfat	Number of fatalities in the attacks.	Quantitative
vio	Violation of the right to physical integrity of citizens.	qualitative 1 There was a violation of rights 0 Other case
assas	Attack in the form of murder (assassination).	qualitative 1 Yes, there were murders 0 Other case
host	Existence of hostages taken in the attack.	qualitative 1 Hostage-taking 0 Other case
armass	Attack including armed assault.	qualitative 1 Armed assault. 0 Other case
size	The size of the terrorist organization is measured in persons.	Quantitative
nterr	A number of terrorist organizations.	Quantitative
stasp	State sponsorship of the terrorist organization.	qualitative 1 Islamism 0 Other case
islam	Terrorist organizations inspired by some form of Islam	qualitative 1 Islamism 0 Other case
sui	The attack was suicide.	qualitative 1 Suicide attack 0 Other case
damp	Damage to private property in the attack.	qualitative 1 There were damages 0 Other case

| Variables	Definition	Type
pfem	Percentage of female workers in a country's labor market each year.	Quantitative
Δgdppc	Variation percentage in GDP *per cápita*.	Quantitative
edu	Percentage of GDP spent by the government on education.	Quantitative
corr	Corruption index.	Quantitative

Table 2. *Measures of Central Tendency for Important Variables.*

Variable	Obs.	Media	Desv. Est.	Min.	Max.
attack	520	86.21	199.95	1.00	1364.00
claimed	520	31.22	87.95	0.00	669.00
civobj	520	29.51	71.70	0.00	627.00
nfat	520	312.42	1064.09	0.00	9604.00
vio	520	62.40	184.51	0.00	1317.00
assas	520	3.96	11.58	0.00	96.00
host	520	10.02	24.76	0.00	173.00
armass	520	22.81	54.63	0.00	474.00
size	520	4.24	31.59	0.00	358.00
nterr	520	5.26	7.19	1.00	61.00
stasp	520	19.95	123.46	0.00	1249.00
islam	520	14.93	118.54	0.00	1251.00
sui	520	6.90	28.33	0.00	367.00
damp	520	31.52	69.88	0.00	520.00
femp	516	47.76	18.84	6.00	85.68
Δgdppc	376	2.37E+10	1.59E+11	-6.85E+11	1.08E+12
edu	285	4.27	1.35	1.02	7.91
corr	504	0.45	0.21	0.04	0.97

Based on GTD, BAAD, PTS, and WB.

Following are descriptions of some of the variables used in the statistical model. The study's variable goal is the number of terrorist group-perpetrated attacks (attacks). According to the information, only 10 of the 116 countries that were studied account for 70% of them; Afghanistan stands out with a particularly high participation rate (16.7%), along with Iraq (13.6%) and India (8.2%). For this reason, the standard deviation significantly exceeds the median (see Table 2), and most of the violence is concentrated in a few countries in Africa and Asia.

Figure 1. *Higher Percentages of Terrorist Attacks on a Global Scale. 2012-2018.*
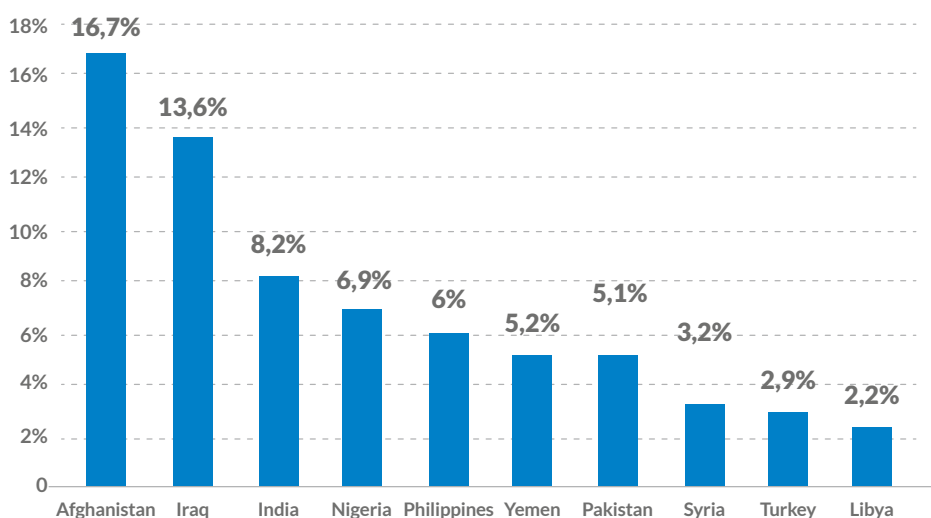
Source: Based on GTD, BAAD, PTS, and WB.

Regarding the variables covered by Abrahms and Conrad's (2017) theory, such as the reported attacks (claimed), the pattern is similar to the previous one because 75% of reported attacks have been condensed into nine countries, and once again, Afghanistan and Iraq are the countries where this phenomenon is more prevalent (more than 40% between the two).
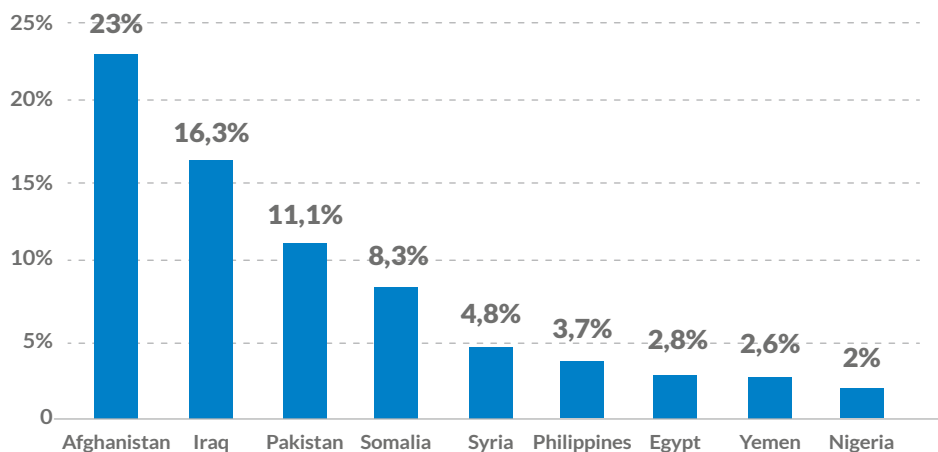
Figure 2. *Higher Percentages of Terrorist Attacks on a Global Scale 2012-2018.*

Source: Based on GTD, BAAD, PTS, and WB.

The previous data draws attention to the fact that there is a very comparable ratio between the percentage of attacks and the claims in graphs 1 and 2. This affirms that there is an empirical link between these two phenomena. With this in mind, the line-by-line correlation between attacks and claims results in a higher value (0.84) for the countries shown in the previous graphs and a higher value (0.9) for the entire sample. Although it is true that correlation does not imply causation, these numbers show that there is a substantial relationship between the number of attacks and the claims related to those attacks. This encourages incorporating Abrahms and Conrad's (2017) theory into the empirical analysis of the number of attacks proposed by Halkos et al. (2017) and Piazza (2017), among others. In a preliminary analysis, a panel data regression model with random effects between attacks and claims with and without controls by year and country was estimated. The results showed a high statistical significance that was independent of the functional approach taken; this showed that there were typically two attacks for every claim made. Results are shown in Table 3.

Table 3. *Preliminary Model Estimates.*

Dep var: Claimed				
	(1)	(2)	(3)	(4)
claimed	2.03***	2.00***	1.91***	1.82***
year	No	Yes	No	Yes
country	No	No	Yes	Yes
constant	18.2***	2.17	49.1	80.8
rho	0.37	0.4	0.00	0.00
obs.	520	520	520	520

Concerning the number of fatalities (*nfat*), the average over the sampling period rises to more than 312 victims per country (see Tables 1 and 2). However, due to the extreme standard deviation, there is now a concentration of these numbers in specific countries (Afghanistan 21.9; Nigeria 13.4%, and Iraq 21.1%). Another critical issue is the use of hostage-taking (*host*); on average, ten people per nation are deprived of their freedom each year due to attacks, and as has become customary, the countries that use restraints the most globally is Afghanistan (14.70%), India (13.60%), and Iraq (10.70%). But when it comes to attacks against civilians (*civobj*), things are a little bit different because, even if the average number of victims is around 30, Iraq, Nigeria, and Afghanistan are the countries with the highest prevalence rates, at 17.4%, 13.3%, and 10.6%, respectively.

The numbers show that variables associated with the theory of the number of attacks, such as female labor participation (*pfem*), are below 50%. This aims to document right-wing attacks that are brought on by social changes that challenge white male privilege. In this case, the countries with the lowest shares are Yemen (0.11%), Iraq (0.22%), and Syria (0.25%), which are also among the most violent countries in the world. Those with the highest female participation are Madagascar (85.68%), Rwanda (83.91%), and Nepal (80.45%), which do not initiate attacks. This implies that women's participation in the labor market may be a source of violence in the United States due to strong advancements in gender equality (Pérez-González, 2021), but that is not the case in the Middle East due to tradition and cultural factors that call for a strong woman's submission to patriarchal authority (Duderija, 2021).

Alternatively, the educational levels specified here, as well as the percentage of government spending in the GDP of each nation in this section, are also in the same situation as the case before. Although the average for the entire sample is 4.3%, it is elevated by the presence of Scandinavian countries like Norway

(7.9%), Sweden (7.6%), and Finland (6.8%), which record few terrorist attacks. Contrarily, the most violent countries show low levels of investment in education (Afghanistan 3.5% and Pakistan 2.6%), demonstrating a clear inverse relationship between education and terrorism.

Finally, the average value of the 'corruption index' (*corr*), which is defined here as the measurement of private power abuse on behalf of the executive branch and public administration, is 0.44, placing it slightly below its median value, indicating that corruption does exist in all countries but is not particularly pervasive. Analyzing the most violent countries, the index drops to 0.27, possibly indicating that the least developed countries have high levels of corruption and frequent terrorist attacks[1].

Empirical Modeling

To achieve the proposed goal, a model was built that captures the factors that determine the number of terrorist attacks in a country each year using a binomial negative model with dynamic panel data. This final component contributes to the empirical modeling of current armed conflicts because, as far as is known, no one has addressed the issue of potential endogeneity via simultaneity.

The choice of this model is because terrorist attacks in each country, per year, is a count variable that assumes finite values in the positive integers, and shows overdispersion i.e., the variance and mean of the distribution are not equal; therefore, it follows a negative binomial distribution. In addition, a lag is introduced in each of the dichotomous variables, and in the first differences in the quantitative variables to capture dynamic effects and avoid endogeneity problems.

In this way, this model observes the determinants that increase or decrease the risk of new terrorist attacks in the countries analyzed. It can be used by local governments or international bodies as a preliminary instrument to try to prevent or avoid attacks. Therefore, the model is a contribution to the empirical literature on terrorism internationally. It has the following form:

$$y_{it} = exp\left[\tau_0 + \sum_{j=1}^{3} \delta_j AC_{it}^j + \sum_{m=1}^{10} \delta_m X_{it}^m + v_i + \eta_{it}\right] \quad (4)$$

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1. These findings also suggest that controlling the stochastic model by country and year is advised because each has unique temporal dynamics.

Where y is the endogenous count variable, and *exp* is the exponential function. Once linearized, the model is estimated by maximum credibility. Explanatory variables are divided into those Abrahms and Conrad's analyses (2017); denoted as AC_{it}^j. The other group of variables (X_{it}^m) are derived from the theoretical contributions of Halkos et al. (2017); Piazza (2017); Li (2005); Hamilton and Hamilton (1983), among others. The v_i parameter of the sample, individual effects, and η_{it} are random errors that are assumed as a gamma distribution.

Specifically, in the *AC*, vector, dichotomous variables take a value of one if the event or characteristic takes place; if not, they take a value of zero. The variables that this vector includes are attacks on civilians (*civobj*), the number of fatalities (*nfat*), the high degree of violation of the right of the physical integrity of citizens (*vio*), assassination (*assas*), hostage-taking in the attack (*host*), armed assaults (*armass*), terrorist group size (*size*), number of terrorist groups (*nterr*) government support of the group (*stasp*), inspiration in the Islamic religion of the attacking group (*islam*), suicide attacks (*sui*) and, as mentioned, now includes the presence of damages to private property in the attacks (*damp*).

According to Abrahms and Conrad (2017), the objective variable is expected to show a positive sign. The authors suggest the presence of terrorist groups "descendent" with more experience, these groups will tend to ignore the negative consequences of attacking civilians (Downes, 2007; Toft & Zhukov, 2012), and, by the imitation effect proposed by Nacos (2009), these groups are expected to repeat the tactics of attacks on civilian populations, by observing cultural and ideologically similar groups.

Alternatively, a negative effect of the *nfat* variable is expected, as the States attacked will tend to counteract with greater force if the terrorist attack causes a greater number of victims. (Crelinsten & Schmid, 1992). In this way, after a terrorist attack with a large number of victims, the State counterattack is expected that temporarily reduces the capabilities of these groups and therefore the decrease of attacks in the future.

For the violation of civil rights (*vio*), a negative effect is expected on the probability of future terrorist attacks, because States with higher capacity for repression may exert higher costs on terrorist groups; this decreases the probability of future attacks (Downes, 2007).

Regarding assassination (*assas*), a positive effect is expected; because this type of attack promotes political instability in the attacked territory (Bell, 2017). Terrorist groups are expected to seek this instability through further attacks in the future. As for armed assaults (*armass*), a positive effect is expected (Phillips, 2012; Lee, 2013); considering that imitation plays a relevant role in tactics used by terrorists. Thus, groups imitate this type of attacks in the future if they observe

other terrorist groups implementing these tactics often including a reward for kidnapped individuals.

For the *sui* variable that involves suicide terrorist attacks, a positive effect is expected for the high strategic value (O'Rourke, 2009; Pape, 2003). It also motivates the imitation of this type of attacks. Regarding the variable of the organizational size of the group (*size*), a positive effect is expected; while the attacking terrorist group has a greater number of active members, it is more capable of carrying out a higher number of terrorist attacks, it has significant scope and is less likely to disintegrate against its competitors (Young & Dugan, 2014).

In the number of terrorist groups (*nterr*) a positive relationship with the endogenous variable is expected; since they must be differentiated by claiming their attacks for survival purposes (Nemeth, 2014). In addition, a territory with a greater number of terrorist groups may also have a higher level of competition; this can increase the level of future violence used by terrorist organizations (Hoffman, 2010).

In the face of State support (*stasp*), it is believed that government sponsorship of the terrorist organization will have a positive effect on the probability of future attacks. As Byman (2020) states, when groups are funded by a foreign government, they have a better supply of weapons, training, and shelter; this allows for greater attack capabilities and increases the probability of future attacks.

Regarding the influence of Islam, a direct relationship is expected because the dualistic vision of terrorist groups leads to not making concessions to the opponent, as the goal is to eliminate it (Wright, 2014). In this sense, these types of groups tend to be less sensitive to the costs arising from acts of violence, and therefore they may be more likely to carry out terrorist attacks in the future.

Finally, with respect to the *damp* variable (damage to private property in the attack), a positive effect is expected because attacks against private property may be more costly for the attacked State. This encourages terrorist groups to carry out future attacks to eliminate their opponent or force the attacked State within a negotiating context (Lake, 2002; Pape, 2003).

In vector X the participation of women in the labor market (*pfem*) is included, the variation of GDP *per capita* (*Δgdppc*) as a proxy of economic growth, education expenses in the total GDP (*edu*) as a proxy to the educational level of the country, and the level of corruption (*corr*) as a proxy to levels of democratic participation in the territory.

Women's participation in the labor market is expected to have a positive effect on the number of terrorist attacks, this can be an indicator of social change that increases the resentment of certain population groups that hold and wish to maintain status and privilege (Piazza, 2017). Variations in *per capita* GDP

are expected to have a negative effect on terrorist attacks count by country (Li, 2005). More expenses on education will have a negative impact. (Hamilton & Hamilton, 1983)[2].

Results

In general, modeling included several functional ways to deal with possible specification bias. To separately evaluate the explanatory capacity of the theories considered, the first column contains only the AC vector (excluding claims (*reclams*) that depend on the variables included in the vector), and in the second column, the X vector is included.

The third includes all the variables of the AC and X vectors. The fourth does the same and, to avoid possible multicollinearity problems, it includes some variables of the AC vector and all of X. As for the fifth column, this only includes the claim (reclamation) and the X vector because AC boosts the endogeneity problem. The sixth is similar and includes the expected value of the claim (*dado AC*) as an instrumental variable. For this purpose, a logit model with panel data under random effects between the claim and the remaining *AC* vector variables is estimated and its forecast is obtained[3]. Finally, column seven captures claims, such as the residuals of the *logit* model implemented in column six model; that is, it shows the part of the observed claims that are not explained by Abrahms and Conrad's theory (2017). This was done to investigate whether the depurated claims of the influence of the *AC* vector have some explanatory capacity in the model.

It should be noted that, regardless of the functional form, all are controlled by year and by country to account for exogenous macroeconomic and/or political shocks, as well as the socio-economical dynamics of each territory. Table 4 shows the results.

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6. Poverty is not included because of lack of information in many countries and also the possible collinearity with economic growth. Other collinearity variables, and therefore not included variables, are income inequality and the percentage of the population below the poverty line, and the unemployment rate with economic growth, among others.

7. This template is not shown in this paper, but it is available to the reader on request.

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Table 4. *Stochastic Model Results.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Attacks							
claim					1.040***		
					(0.001)		
claim_hat$_{t-1}$						1.150***	
						(0.003)	
claim_rest$_{t-1}$							1.030***
							(0.001)
pfem$_{t-1}$		0.336***	0.406**	0.411**	0.330***	0.311***	0.353**
		(0.127)	(0.166)	(0.155)	(0.132)	(0.123)	(0.145)
Δpibpc$_{t-1}$		0.737	0.921	0.852	0.620**	0.684*	0.663**
		(0.444)	(0.226)	(0.183)	(0.115)	(0.135)	(0.128)
edu$_{t-1}$		1.280**	1.170*	1.231**	1.429***	1.323***	1.360***
		(0.126)	(0.110)	(0.106)	(0.146)	(0.123)	(0.138)
corr$_{t-1}$		0.204***	0.475**	0.324***	0.134***	0.216***	0.155***
		(0.071)	(0.159)	(0.101)	(0.046)	(0.069)	(0.057)
objciv$_{t-1}$	1.004***		1.007***	1.006***			
	(0.001)		(0.002)	(0.001)			
nfat$_{t-1}$	0.742**		0,763	0.710*			
	(0.106)		(0.146)	(0.125)			
polterr$_{t-1}$	0.829*		1.096				
	(0.093)		(0.216)				
ases$_{t-1}$	1.301***		1.034				
	(0.114)		(0.129)				
reh$_{t-1}$	1.206**		1.136				
	(0.118)		(0.168)				
asarm$_{t-1}$	1.562***		1.570**	1.604**			
	(0.229)		(0.331)	(0.334)			
tamorg$_{t-1}$	1.205		1.024				
	(0.171)		(0.230)				
nterr$_{t-1}$	1.021***		1.013				
	(0.007)		(0.016)				

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$patest_{t-n1}$	1.253*		1.105				
	(0.173)		(0.242)				
$islam_{t-1}$	1.014		0.717	0.996			
	(0.164)		(0.222)	(0.188)			
sui_{t-1}	1.000		1.013**	1.015***			
	(0.001)		(0.005)	(0.005)			
$dapp_{t-1}$	1.003***		1.002				
	(0.000)		(0.002)				
year/country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ln r cons.	-0.215	-0.166	0.081	0.042	-0.080	-0.063	-0.119
	(0.153)	(0.188)	(0.201)	(0.199)	(0.193)	(0.192)	(0.191)
ln s cons.	1.089***	0.440*	0.807**	0.773***	0.434*	0.469*	0.465*
	(0.244)	(0.242)	(0.296)	(0.289)	(0.254)	(0.250)	(0.253)
no. of obs.	376	149	149	149	149	149	149
wald p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
chi2_c	470.69	321.503	155.8	178.334	289.289	290.304	290.318
p-value chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
log-l	-1689.425	-627.95	-610.510	-614.495	-620.551	-617.895	-624.64

The general results show that the choice of the negative binomial model is correct since the *p-values* associated with the test probation for similarity are correct (*p-value chi2* at the bottom of Table 4) for each functional form is equal to zero. This means that the panel estimator is better than the negative binomial grouped estimator with constant dispersion. In other words, the model is suitable, as there is overdispersion. Alternatively, the *p-value* of the Wald test shows that the variables together for each functional form are statistically significant.

Coefficients in this type of model are incidence rates, which must be interpreted in this context as the possibility of a country having new terrorist attack per year, due to the increase of a unit in the explanatory variable if quantitative, or a change of category if qualitative. If the coefficient exceeds the unit and it is statistically significant, it indicates a percentage increase in the risk of being attacked, while one lower than one implies a reduction.

Analysis of Results

In the first column, outcomes show that each variable in the Model for determining claims (Abrahams & Conrad, 2017) accounts for the number of terrorist attacks occurring in a country per year. However, the size of the terrorist organization (*size*), Islamic religion (*islam*), and suicide attacks (*sui*) do not exhibit a significant explanatory relationship with the occurrence of such attacks. The variables accounting for the highest occurrence are armed assaults (*armass)*, assassinations (*assas*), state sponsorship (*stasp*) and hostage-taking (*host*) because they exceed unity. In this regard, if a country has experienced armed assaults carried out by terrorist groups in the past, the risk of subsequent attacks is 1.6 times higher compared to countries without such history.

With respect to assassinations, if they have occurred in a particular country in the past, the likelihood of subsequent attacks rises 1.3 times a year in comparison to those territories without a record of such attacks. Additionally, if the terrorist group has received sponsorship from one or more governments, the probability of a subsequent attack is 1.3 times greater than in cases where no such support has been provided. Finally, within this group, a history of hostage-taking suggests a present risk of an attack increased by 1.2 when compared to situations without a record of this type of terrorist attack.

As previously mentioned, the positive effect of armed assaults on the dependent variable could be elucidated by the theory of imitation among terrorist groups (Phillips, 2012). In this regard, the increased likelihood of experiencing a terrorist attack in the future can be attributed to the copycat behavior observed among connected terrorist groups.

On the contrary, the positive effect of assassinations indicates that terrorist groups aim to increase the instability within the territory through subsequent attacks, following the occurrence of a terrorist assassination (Bell, 2017). According to Moskalenko and McCauley (2017), it can be asserted that individuals who engage in armed assaults occupy the bottom level of the pyramid of radicalization. If one considers assassinations, armed assaults, and hostage-taking as expressions of radicalization, it may be plausible to assert that the presence of radicalized individuals increases the likelihood of encountering new terrorist events, owing to their inclination toward expressing themselves through violence and unlawful means.

Regarding the impact of state sponsorship (*stasp*), findings suggest that when sponsored groups have better training and weapons, as well as safe havens, there are conditions for further terrorist attacks in the future (Byman, 2020). Hostage-taking increases the probability of a terrorist attack's success, creating a positive

impact on the likelihood of experiencing subsequent attacks. Furthermore, it fosters the imitation effect among other terrorist groups, when the initial attack was carried out successfully (Sandler & Scott, 1987). This dynamic is most likely to be evident in democratic countries, as they may be more susceptible to making concessions in response to the demands of terrorist groups (Lee, 2013). However, Piazza's (2008) assertion that higher levels of democracy and economic openness do not necessarily result in lower levels of terrorism is a consideration.

Variables such as civilian targets (*civobj*), the number of terrorist groups (*nterr*) and damage to private property (*damp*) may have less significant impacts because their values are very close to unity. This suggests that the occurrence of attack events is not significantly different from those countries where these phenomena do not occur.

The findings related to the civilian targets (*civobj*) can be explained from the perspective of Abrahms et al. (2018), in terms of the creation of "children" groups by other terrorist groups. These terrorist groups are characterized by their inclination to attack civilians, which can be attributed to their limited background and experience. In this regard, they mimic each other under the contagion effect (Nacos, 2009), which increases the probability of subsequent terrorist attacks on civilians.

The positive effect on the number of terrorist groups (*nterr*) variable indicates higher levels of competition in territories characterized by the greater presence of terrorist groups (Hoffman, 2010). Hence, territories exhibiting elevated levels of competition may experience increased levels of future violence, given the need for terrorist groups to capture sympathizers and ensure their presence and success.

As anticipated, the effect of damage to private property was positive, albeit modest, on the probability of experiencing subsequent terrorist attacks. This situation may arise from the belief held by terrorist groups that such attacks increase their coercive negotiation prowess (Lake, 2002; Pape, 2003).

Conversely, the number of fatalities (*nfat*) and political terror (*terrpol*) variables decrease the possibility of subsequent attacks per year by 0.74 and 0.83 times, respectively, in comparison to countries with a lower occurrence of these phenomena. This finding can be demonstrated by the non-negotiation policies adopted by certain States concerning terrorist groups, whose aim is to minimize the gain and maximize the costs for these groups (Wilkinson, 1981).

In this regard, following a terrorist attack resulting in a substantial number of victims, the targeted State will impose substantial costs upon the perpetrating group, thus discouraging other terrorist groups from engaging in subsequent attacks in the short term. The implementation of coercive tools by the State can lead to a short-term reduction of the capabilities of terrorist groups,

consequently decreasing the probability of experiencing subsequent terrorist attacks (Crelinsten & Schmid, 1992).

On the contrary, the negative effect of the political terror (*terrpol*) variable indicates that under specific circumstances, indiscriminate violence perpetrated by the State has a greater capacity to curtail the use of violence by insurgent groups (Downes, 2007). Accordingly, States endowed with a wider scope of authority on civil rights and civil liberties also hold the capacity to exert a significant detrimental impact on terrorist groups. This, in turn, tends to decrease the likelihood of subsequent attacks within their territories.

The second set of functional information in (Column 2) also encompasses statistically significant variables related to the theory of the number of attacks. However, economic growth *per capita* (*Δgdppc*) is not statistically significant, female participation (*pfem*), education expenditure (*edu*), and corruption (*corr*) are found to be statistically significant, and the signs are consistent with the expected direction.

In territories with a high proportion of female labor market, the likelihood of attacks is reduced by 0.34 times per year compared to territories with a high proportion of male labor participation. Furthermore, countries with lower levels of corruption encounter a decreased likelihood of attacks by 0.20 times in comparison to countries with high corruption levels. Finally, higher education expenditure raises the probability of attacks by 1.3 times in contrast to countries that allocate fewer resources to this particular expenditure.

The female participation (*pfem*) variable reveals that the negative effect on the explained variable contradicts Piazza's (2017) findings. Hence, this effect can be attributed to the reduced attractiveness of terrorist groups when alternative occupational opportunities are readily available (Bénézech & Estano, 2016). Under this condition, women, who may be susceptible to recruitment for certain forms of terrorism (O'Rourke, 2009), are likely to exhibit a reduced willingness to join terrorist groups when they have alternative occupational opportunities that offer them increased income possibilities.

The findings related to expenditures in education provide a higher level of identification of individuals who may be potential targets for terrorist groups (Krueger & Malečková, 2003). The Israeli-Palestinian conflict showed that educational level is positively related to the likelihood of becoming a member of a terrorist group (Berrebi, 2007). Therefore, communities with a higher level of political education, in terms of advocating for rights, may be more likely to engage in terrorist groups. This, in turn, could increase the likelihood of attacks given the higher educational level in the territory.

Corruption (*corr*) exhibits a negative effect on the likelihood of experiencing a terrorist attack in the future. This can be attributed to the fact that in regions

where corruption is prevalent and a familiar practice, organizations follow this path as a means of exerting influence. Conversely, in the absence of corruption, organizations may resort to terrorism as an alternative strategy to obtain their objectives (Simpson, 2014).

The third and fourth sets of functional information (Columns 3 and 4) show that when the variables of the two vectors (AC and X) are combined, only certain variables exhibit statistical significance. This could be attributed to the non-orthogonality between these variables. However, the findings in Columns 6, 7, and 8 exhibit different outcomes. Incorporating the claim, its forecast, and the residuals of the claim along with the other variables comprising the X vector reveals a high statistical significance because these models prove to be less susceptible to statistical deficiencies as they avoid the presence of endogeneity and multicollinearity. The coefficients are very similar in these sets of functional information and statistical significance is consistently maintained.

Hence, the prior existence of claims of terrorist attacks in countries leads to an increase in the likelihood of subsequent attacks by slightly more than once per year in comparison to territories where such claims do not exist. The GDP *per capita* growth is now statistically significant, indicating that a 1% increase in GDP per capita reduces the likelihood of a subsequent attack by roughly 0.6 times. As previously mentioned, female participation and low corruption rates reduce the likelihood of attacks, while high educational levels increase the likelihood of attacks.

Conclusions

These findings provide compelling empirical evidence to assert that Abrahms and Conrad's (2017) theory of attacks plays a significant role in comprehending the phenomenon of the number of attacks by including variables such as civilian targets, number of fatalities, armed assaults, and suicides.

Indeed, the inclusion of stochastic modeling variables such as female labor participation, variation in GDP *per capita*, education expenditures, and the corruption index, as commonly seen in explanatory theories of the number of attacks (Halkos et al., 2017; Hamilton & Hamilton, 1983; Li, 2005; Piazza, 2017) lead to significantly more robust findings. The incorporation of these variables broadens the argumentative spectrum and enhances the explanatory capacity of the variables among themselves.

Moreover, there are other variables that explain claims and influence the number of attacks which are not explicitly considered in Abrahms and Conrad's

(2017) modeling. In this regard, the stochastic modeling revealed the presence of unknown variables that possess explanatory capacity and, were not part of the theories incorporated in the initial modeling, indicating that this field of knowledge is not yet fully explored which opens the path to new theories and variables that can enhance the analysis and provide a comprehensive understanding of the factors influencing the occurrence of terrorist attacks.

Regarding the consequences of future terrorist attacks, it is possible to assert that countries should choose to constantly combat terrorist groups within their borders, with a focus on preventing them from developing. Moskalenko and McCauley's (2009) consideration is useful, which asserts that State pressure should be directed toward radical groups rather than activist groups. The rationale behind this distinction lies in the fact that these two units operate with distinct modalities of action.

Finally, further research in this field may be devoted toward particularizing the recurrence of attacks, taking into account the geographical regions, as well as the economic, social, and political conditions of the territories that characterize varied patterns in terrorist groups' behavior.

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