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THE CONTAGIOUS DIFFUSION OF WORLD-WIDE TERRORISM:

IS IT LESS COMMON THAN WE MIGHT THINK?*

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ABSTRACT

Studies of the contagious spread of insurgency and conflict across national boundaries have generated a good deal of empirical research over time. While the contagious spread of terrorism has also been a policy concern, few empirical studies exist on the extent to which terrorism spreads contagiously. This paper uses methods developed by criminologists to study the spread of crime to examine the world-wide diffusion of terrorism from 1970 to 2013. We distinguish between contagious increases (based on shared borders) and non-contagious increases (where no borders are shared). We define the "domino effect" as a particular type of contagious diffusion where high levels of terrorism spread to an adjoining country but also remain high in the host country. Our analysis shows that both contagious and non-contagious diffusion has been rare over the past 43 years, non-contagious diffusion is more common than contagious, and when contagious diffusion occurs, it is very likely to occur according to the domino effect.

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Researchers and policy makers have long been concerned with the possibility that terrorism and other forms of political conflict and violence may quickly spread from one country to another. Analogies are often drawn to infectious disease with the implication that once a major outbreak is under way in a particular country, if unchecked it may rapidly "infect" other regions and even countries, spiraling out of control as in an epidemic.[1] The "domino theory," a related variant of the contagion argument, became popular in the late 1940s, when William Bullitt, a former U.S. ambassador to Moscow, voiced the fear that unless the United States took aggressive countermeasures, communism would spread from the Soviet Union through China and Southeast Asia.[2] While the domino theory was primarily about the contagious spread of communism rather than political violence, it assumed that this contagion would happen across countries that shared borders. Recently, the rapid rise of the Islamic State of Iraq and the Levant (ISIL) has raised similar concerns about the contagious spread of terrorism across the border of Syria and Iraq into Turkey, Jordan, and elsewhere.[3]

While there has been a growing literature on the extent to which civil war,[4] ethno-nationalist conflict,[5] insurgency,[6] and state failure[7] are geographically contagious, there have been a limited number of studies of the different forms of contagion and the extent to which these forms are observed for terrorism. The extant literature on the geography of terrorism is modest and most of the studies that exist focus on the distribution and diffusion of terrorism in specific countries,[8] "hot spots" across countries within regions,[9] regions,[10] or the diffusion of specific terrorist tactics.[11]

In this paper, we draw on methods developed for studying the spatial diffusion of crime[12] to examine the world-wide diffusion of terrorism over more than four decades (1970–2013). We distinguish between contagious diffusion where high levels of terrorism spread to an adjoining country from a host country but remain at high levels in the host country (referred to here as *expanded contagion*) from contagious diffusion where high levels of terrorism spread to an adjoining country but do not remain high in the host country (*displaced contagion*). Note that expanded diffusion references the specific outcome commonly known as "the domino effect." Both of these types of diffusion differ from non-contagious diffusion whereby the tactic may spread to countries that do not share borders.

Our analysis of annual terrorist attacks for all non-island countries of the world shows that terrorist attacks since 2010 are more concentrated at the national level than at any other time since our data begin in 1970. We also find that contagious diffusion (both expanded and displaced) has been uncommon over this time period, but that when it occurs it is likely to take the expanded (or domino) form. Of the more than four decades in our study, contagious diffusion is most common in the 1990s, following the break-up of the Soviet Union. Three regions have significantly more contagious diffusion of terrorism: the Middle East/North Africa, Western Europe and Latin America.[13] We discuss the implications for future research and policy.

Domino Effects and the Diffusion of Political Violence across National Borders

The possibility of contagion, particularly domino effects, have influenced U.S. foreign policy for a long time. In an attempt to rally congressional and public support for increased U.S. aid to the French, for example, President Eisenhower gave an historic press conference on April 7, 1954, in which he argued that in Southeast Asia, "you have a row of dominoes set up, you knock

over the first one, and what will happen to the last one is the certainty that it will go over very quickly."[14] Eisenhower's "falling domino principle" specifically referred to the risk that communist regimes would spread rapidly throughout the world if the United States did not take action to prevent communist insurgency in third-world countries. The notion dominated U.S. thinking about Vietnam for the next decade. Before Eisenhower, a similar argument also influenced the Truman Administration's decision to intervene in Greece and Korea.[15] More recently, the domino theory has been used to justify American interventions in Latin America, Iraq, and Middle East.[16] Its influence also has extended to foreign policymakers in Germany, Britain, and other countries.[17]

While the domino theory that developed during the Cold War referred to the spread of communism, the basic idea is much broader, and has increasingly been used to study the contagious spread of political violence. According to O'Sullivan the domino theory of contagious political violence posits that violence "proceeds from one neighboring country to another in contagious sequence."[18] O'Sullivan argues that domino thinking was strongly supported by Henry Kissinger and other top leaders in the Nixon administration.[19] In a popular geography textbook, de Blij and Muller define domino theory as a proposition that "holds that destabilization *from any cause* in one country can result in the collapse of order in a neighboring country, starting a chain of events that can affect a series of contagious states in turn" (emphasis added).[20] The authors apply this domino model to events in Southeast Europe, arguing that conflict there had spread from Slovenia to Croatia, to Bosnia-Herzegovina, Serbia-Montenegro and Albania and was even threatening the stability of Greece and Turkey. And as noted above, more recently there has been growing policy concern (although few empirical analyses thus far) about the seemingly contagious spread of political violence in the wake of the rapid rise of the

ISIL across the borders of Syria, Iraq and beyond. For example, Spurlock refers to the recent conflict in Syria as "the contagious war" and notes that the fight has moved from Syria to "every single one … (of its) neighbors."[21]

Despite the long-term policy interest in the domino effect and in the contagious spread of political violence more generally, we were able to identify only a few studies on the diffusion of terrorism across national borders and no study to date that applies the methods used here. We rely on these sources to develop several exploratory hypotheses for the analysis that follows.

Midlarsky, Crenshaw and Yoshida provide an early study of the cross-national diffusion of international terrorism from 1968 to 1974, arguing that terrorism in one country might increase the probability of terrorism in other countries through "demonstration effects": countries with high diplomatic status that experience a growth in terrorism will be more likely to be emulated by their neighbors.[22] Using Poisson and negative binomial probability models, the authors find evidence of demonstration effects through terrorist attacks in Latin American and West European countries in the late 1960s and early 1970s. However, the argument that the diplomatic status of a country predicts its degree of imitability is found to operate in Latin American countries only during the second portion of the analysis period. Moreover, Heyman and Mickolus point out that the authors do not demonstrate that terrorism spreads from Latin America to Western Europe but only that rates of terrorism in Western Europe increase following increases in Latin American rates.[23] In other words the quantitative analysis does not examine whether specific terrorist groups in each region are actually cooperating, exchanging support and transporting their activities between regions. Finally, Midlarsky et al.'s analysis is limited to international attacks in the late 1960s and early 1970s.

Hamilton and Hamilton conduct a quantitative analysis of the spread of terrorism across 16 countries for the years 1968 to 1978 and find less evidence of contagious increases in countries that were less democratic, poorer and less well educated.[24] They argue that these results suggest that countering terrorism may be easier in more repressive than more open societies. However, their analysis is limited in terms of the countries and years included and like most of the early research on this topic is limited to international attacks.

More recently, Braithwaite and Li employ spatial statistics to identify terrorism "hot spot" neighborhoods and assess the impact of these hot spots on future patterns of terrorist attacks.[25] They define hot spots as groups of countries that experience a larger number of terrorist attacks than would be expected of an average neighborhood in the international system if the process of terrorist attacks were random. In a pooled time-series analysis of 112 countries from 1975 to 1997 they find that compared to countries outside hot spots, those located inside hot spots are significantly more likely to experience an increase in terrorism in the next period. This effect is robust under alternative definitions of geographic proximity and across the two most popular measures of local hot spots. The authors also find that countries experiencing large numbers of terrorist attacks are often located within hot spots, but that not all countries within hot spots have experienced large numbers of terrorist incidents. The analysis controls for region, per capita GDP, and several other important economic and political measures, but is limited to international terrorism, ends in 1997, and does not distinguish between different types of diffusion.

Neumayer and Plumper draw on Huntington's "clash of civilizations" argument[26] to conceptualize contagious diffusion of terrorism in terms of whether the nationality of the target is likely to be from a different "civilization" than the nationality of the perpetrators.[27] Using data on international terrorist attacks and controlling for several rival explanations, the authors find

evidence that terrorist attacks from a predominantly Muslim country on a western country increase the probability of attacks by other groups from predominantly Muslim countries on western countries. The authors acknowledge that while they find evidence consistent with Huntington's predictions, the effects are modest. Moreover, the study does not directly measure different types of diffusion and is limited to international attacks.

Cliff and First test for evidence of diffusion by examining terrorist activity in three state dyads: Lebanon-Israel, Peru-Colombia, and India-Pakistan.[28] Using data from 1970 to 2007 on both domestic and international terrorist attacks, the authors conclude that there is evidence of diffusion of terrorism in all three dyads, although the precise patterns vary for each. However, the study is limited to three dyadic relationships.

Testing for the Cross-National Diffusion of Terrorism

To date there have been few cross-national comparative studies of the diffusion of terrorism and those that exist have been limited mostly to case studies of small groups of countries,[29] or track only international terrorism,[30] shown to represent just 10-20 percent of all attacks.[31] There is more empirical evidence for diffusion from other types of political conflict, especially civil war.[32] However, it is unknown to what extent results for the diffusion of civil war generalize to terrorist attacks. We were unable to identify any prior research that looks for evidence of the world-wide cross-national diffusion of terrorism over an extended time period.

Given that there are few prior studies on the specific topic we are addressing we regard our work as exploratory. However, we are able to formulate some initial expectations that can be tested. First, journalistic accounts on the diffusion of terrorism have often assumed that it is a serious and widespread phenomenon; in particular the recent growth of ISIL in which instability

in Syria has spread into Iraq and Turkey has received a great deal of attention.[33] However, our examination of prior empirical research[34] suggests that the phenomenon may be less common than is frequently assumed.

Second, based on the few studies that do exist, it seems likely that when cross-national increases in terrorism do occur, contagious terrorism through direct contact between countries will be less common than increases in countries without such direct contact, for the simple fact that there are many more opportunities for non-contagious than contagious increases: while contagion is limited to the small number of countries physically adjoining the target country, non-contagious increases can happen when there is an increase in any country in the world. This reasoning leads us to expect that non-contagious increases in terrorism will be more common than contagious increases.

Finally, with the increasing interconnectedness of the world through the expansion of communication and transportation networks and globalization we might expect the importance of territorial propinquity for the spread of terrorism to decline over time. For example, Midlarsky, Crenshaw and Yoshida argue that in the modern period terrorist organizations are far more likely to learn about the success of other terrorist organizations through the media.[35] More recently, growing concerns with the sophisticated communication efforts of ISIL and the recruitment of thousands of foreign fighters from around the world to the conflict[36] have raised international concerns with the ability of the Internet to spread propaganda from terrorist organizations more effectively than ever before.[37] While there has been little empirical research on this topic, much of the recent policy commentary[38] has followed this train of thought, making the outbreak of new attacks less dependent on bordering conflicts. This reasoning leads us to expect that the ratio of non-contagious to contagious increases in terrorism will increase over time.

Data and Methods

World-wide terrorism data

Terrorism in the Global Terrorism Database (GTD) is defined as "the threatened or actual use of illegal force and violence by non-state actors to attain a political, economic, religious, or social goal through fear, coercion, or intimidation."[39] Because the characteristics of the GTD are described in detail elsewhere,[40] we offer only a brief explanation here. Major limitations of open source data include media reporting biases, incomplete information and the challenges of distinguishing terrorism from other forms of violence, including genocide, insurrection, insurgency and civil war.[41] Early versions of the GTD were based mostly on individual news outlets such as the Associated Press, Agence France-Presse, and the BBC. Over time data collection has relied increasingly on existing media aggregators such as Lexis/Nexis, Factiva, and the Open Source Center. At present, the data collection process begins with a universe of 1.6 million articles published daily worldwide in order to identify the relatively small subset of articles that describe terrorist attacks. It uses customized search strings to isolate an initial pool of potentially relevant articles, followed by more sophisticated techniques to further refine the search results.

Our analysis includes 115,228 terrorist attacks from the GTD that occurred in 148 countries from 1970 to 2013.[42] We base the analysis on the boundaries of the Esri World Countries mapped with ArcGIS software.[43] During the analysis period the world's countries experienced important changes including the unification of East and West Germany; the dissolution of the Soviet Union, Czechoslovakia, and Yugoslavia; and the independence movements of Eritrea and South Sudan. To accommodate these changes while maximizing the range of variables available for analysis, we modified the Esri World Countries Base map to represent the countries given in

Appendix A. To maximize the sample size available for analysis we treated Czechoslovakia, Eritrea, South Sudan and Yugoslavia as if their boundaries stayed the same over time, imputing information based on data from the post-breakup period. We excluded countries that are islands and thus have no neighbors.[44]

<center>Appendix A about here</center>

Methods

To test for contagious diffusion around the world we calculate Local Indicators of Spatial Autocorrelation (LISA) statistics.[45] These analyses allow us to assess the extent to which terrorist attacks spread by contagious diffusion and how the patterns change over time. We use the same methods to test for the domino pattern—defined here as a specific type of contagious diffusion.

Testing for Contagious and Non-Contagious Increases in Terrorism

Using LISA statistics we can measure how common contagious and non-contagious increases in terrorism have been, whether non-contagious increases are becoming more common over time and also the extent to which contagious diffusion fits the domino pattern. These methods were previously used to study the spatial diffusion of crime,[46] and we provide a brief description here. We define countries as neighbors using "rook contiguity" (i.e., two countries are considered adjacent if they share a common border).[47] LISA statistics provide a formal representation of the relationships between values at a local unit and its neighbors. Compared to simple measures of global autocorrelation, they offer a more precise means of displaying spatial relationships. Thus while global spatial autocorrelation statistics such as the Moran's *I* summarize spatial dependencies in the overall data, LISA statistics provide a measure of the extent to which the arrangement of values around a specific location deviates from spatial

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randomness[48] and allow for the identification of clusters of high and low values. The LISA statistic (L) for unit i is defined as:

$$L_i = Z_i, \sum_j W_{ij} Z_j$$

where Z_i represents the number of incidents at location i, standardized as the deviation from the mean, Z_j indicates the number of incidents for all neighboring units j, also standardized as deviations from the mean, and W_{ij} denotes a matrix of row-standardized spatial weights, which indicates how location i is spatially related to the neighboring units j.

Thus, using LISA statistics, spatial associations are described by a pair of values (XY) for the variable of interest (incident counts). The pair of values consists of the standardized value of the incident count in the current (X) or local country and the standardized value of the incident count in a neighboring (Y) country or countries. Furthermore, each value is either high (H) or low (L) relative to the mean and these values are used to place all countries into four types of spatial association: (1) low-low (LL), low local values associated with low neighbor values; (2) high-low (HL), high local values associated with low neighbor values; (3) low-high (LH), low local values associated with high neighbor values; and (4) high-high (HH), high local values associated with high neighbor values. Based on these LISA statistics, all transitions of countries can be categorized as contagious or non-contagious depending on whether changes could have come from adjacent countries.

We are especially interested here in determining whether the source of change within a specific country can be associated with diffusion from a neighboring country or with more general changes in another part of the world. We do this by comparing the values of LISA statistics at year t with those at year $t + 1$. Because we are determining the source of attacks that

diffuse *to* a particular country, any transitions where the value of the current country has remained unchanged are considered stationary, even if the values of neighboring countries have changed.

In this paper we distinguish between the two types of contagious diffusion identified above. We define expanded diffusion (domino effects) as a situation where countries' terrorist attacks transition from LH (low local value, high neighbor value) at year *t,* to HH (high local value, high neighbor value) at year *t + 1*. In other words this is a situation where a country has low numbers of attacks one year but borders a country (or countries) with high levels of attacks and in the following year, the target country also has high levels of attacks. Displaced contagion instead tracks countries that transition from LH at year *t* to HL at year *t + 1*. In this situation a country has low numbers of attacks one year but borders a country (or countries) with high levels of attacks and in the following year, the target country also has high levels of attacks but its neighbor (or neighbors) no longer do. We regard as stationary all cases where the target country starts low and remains low or starts high and remains high. Non-contagious increases are simply those cases where terrorism increases in a non-contiguous country. We calculate LISA statistics for all terrorist attacks based on yearly changes in event counts for the years 1970 to 2013.

RESULTS

The Spatial Distribution of Terrorist Attacks, 1970 to 2013

Before turning to the LISA estimates we provide general information on the spatial distribution of world-wide terrorist attacks from 1970 to 2013. Figure 1 compares trends in terrorist attacks with measures of the dispersion and concentration of terrorist attacks over time. *Dispersion* is the total percent of countries that experienced terrorist attacks each year and

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concentration is the average number of attacks for each country that experienced attacks. For ease of interpretation we multiply the dispersion measure by 100 and the concentration measure by 50.

Figure 1 about here

Figure 1 shows that total attacks increase steadily throughout the 1970s and 1980s until the early 1990s, followed by a rapid decline, and then starting in the mid-2000s, an even more rapid increase. Total attacks in 2013 are at the highest level for the series. These patterns produce a long run-up of attacks until the early 1990s and then a U-shape distribution in total terrorist attacks from the early 1990s to a trough in the early 2000s and finally a sharp increase leading to the end of the series in 2013.

The trends in dispersion and concentration show considerable variation when compared to the frequency of attacks. The dispersion measure tracks rising frequencies of terrorist attacks closely from 1970 until the late 1980s, but then increases more rapidly and for a longer period of time than the measure of total attacks. In general, these patterns indicate that from the late 1980s until the early 1990s the total number of terrorist attacks increased more slowly than the proportion of countries around the world that reported terrorist attacks: world-wide terrorism became more dispersed. As with the frequency of attacks, the dispersion measure begins to decline following a high point of 80% in 1992 and after about 15 years of steady declines, reaches a low point of 33% in 2004. Following this low point dispersion increases again until the series end in 2013. However, even with these recent increases the average dispersion of terrorist attacks remains far below the series high point reached in 1992. In general, compared to the frequency of terrorist attacks, the dispersion of attacks increases much more slowly in the ten years ending in 2013.

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The concentration measure, which examines the average number of attacks for countries experiencing attacks, looks different from either the total frequency or the dispersion measure. In general, concentration increases gradually from 1970 until reaching a peak in 1984. It then declines slowly until reaching a low point in 1998. It then rises rapidly, especially in the last few years of the series. The widest gap between the total frequency of attacks and the concentration of attacks is in the early 1990s. Similarly, the gap between dispersion and concentration peaks in the early 1990s. Dispersion and concentration measures have greatly narrowed since then and the early 2010s marks the narrowest gaps between dispersion and concentration in the 44 years included in the analysis. For example, in 2013, just three countries—Iraq, Afghanistan and Pakistan—are the locations for 58% of all terrorist attacks. In short, the last few years of the series are notable for having an exceptionally large proportion of terrorist attacks generated by a relatively small number of countries.

Measuring Contagious and Non-Contagious Increases

Using counts of yearly transitions of LISA statistics, we next compute and compare the proportion of: (1) all transitions that result in changes in country levels of activity, (2) all transitions where country levels of activity remain unchanged (stationary), (3) total increases (low to high) and decreases (high to low), (4) contagious and non-contagious increases, and (5) whether contagious diffusion is expanded (the domino effect) or displaced. In Table 1 we present these proportions for all annual transitions 1970 to 2013.

Table 1 about here

We divide the transitions in Table 1 by decade, leaving the available years since 2010 as a separate category. The total number of transitions for all countries in the analysis for a complete

decade is 1,480. We have fewer transitions than this for the 1990s because of missing data for 1993 (see note 44) and fewer transitions for the 2010s because we have only four years of data. According to Table 1, annual country-level transitions are far more likely to be stationary than to change; stationary outcomes outnumber changes by nearly 17 to one. These differences are highly significant across all five time periods and for the total.[49] On average for the entire sample a country's level of terrorism changes (either significant increase or decrease) about 5.5 percent of the time. Changes are least common in the 1980s and 2010s and most common in the 1990s. In general, we find strong support for our first expectation: country-level diffusion of terrorist attacks is rare.

Not surprisingly, when countries do change, increases and decreases are about equally likely—51 percent of the time we see increases and 49 percent of the time we see decreases. None of the comparisons of increases and decreases by decade are statistically significant.

As explained above, the LISA statistics allow us to contrast contagious and non-contagious increases and thereby test directly our second expectation: that non-contagious increases are more common than contagious increases. According to Table 1 and in support of our expectations, non-contagious increases are significantly more common than contagious increases for the analysis as a whole and for the 1970s and 2000s. Three-fifths of the observed increases in terrorism observed over 43 years are non-contagious.

But contrary to our expectations there is little evidence in Table 1 that non-contagious increases are becoming more common than contagious increases over time. While it is true that non-contagious increases are significantly more common than contagious increases in the 2000s, in the 1970s the ratio is nearly as high and during the period 2010 to 2013 the ratio reaches the lowest point in the series. Thus, we do not find consistent support for the prediction that non-

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contagious increases are becoming more common than contagious increases during the period spanned by our data.

In the last two columns of Table 1 we contrast the two forms of contagious diffusion, expanded and displaced. In general, expanded diffusion—popularly known as the domino effect—is about ten times more common than displaced diffusion. In short, expanded diffusion is consistently more common than displaced diffusion and the differences are statistically significant for the full analysis and for every decade except the 2000s.

To summarize, the LISA analysis shows that major changes (increases and decreases) in rates of terrorism across countries are rare, contagious increases are rarer still, although where they occur they are overwhelmingly likely to be domino effects (i.e., expanded diffusion). There is no consistent evidence that non-contagious increases in terrorist attacks are becoming more common than contagious increases over time.

World-Wide Examples of Contagious Diffusion

As we saw in Table 1, of the 6,216 world-wide opportunities for contagious diffusion between 1970 and 2013, we find a total of 69 (1.1%) occurrences—62 of which (89.8%) are examples of expanded diffusion (the domino effect). In Table 2 we list all 62 occurrences of expanded contagious diffusion by region, the target country (i.e., country that experiences contagious diffusion), the target country's neighbors, the country or countries where the high rate of terrorism originates (i.e., source countries), and the decades when the contagious diffusion happens. All nine world regions have at least one country that experiences contagious diffusion of terrorism. Latin America has the most with ten examples, followed by the Middle East/North Africa with seven, Western Europe with six, Sub-Saharan Africa with four, South Asia with

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three, North America and East Europe with two each, and East and Central Asia and Southeast
Asia/Oceania with one each.

<div align="center">Table 2 about here</div>

Table 2 also shows that contagious diffusion is most common in the 1990s (26 cases) and
least common in the 2000s (nine cases from 2000-2009). Patterns of contagious diffusion are
also related to the interaction between region and time period. Thus, 19 out of 20 examples in
Latin America, 12 of 14 examples in Western Europe, and both examples in North America take
place in the 1990s or earlier. By contrast, 10 of the 12 examples for the Middle East/North
Africa, seven of the eight examples in South Asia, three of four in Sub-Saharan Africa, and both
of the examples in South Asia took place in the 1990s or later.

Table 2 shows that a total of 36 countries were the targets for the cases of contagious
diffusion of terrorism since 1970. The country that experiences the single largest number of
contagious effects is Bangladesh—whose terrorist attack increases are linked four times to India
and once to Myanmar and India both, starting in the 1980s and continuing in the four years after
2009. Ten countries are the targets for three instances of contagious diffusion (France, Greece,
Ireland, Bolivia, Honduras, Venezuela, Georgia, Iran, Lebanon and Myanmar).

Discussion and Conclusions

In this paper, we borrow a method used in criminology to examine how common contagious
diffusion of terrorist violence across national boundaries has been for the years 1970 to 2013. In
particular, we distinguish between contagious increases that occur in direct contact between
spatially contiguous countries and non-contagious increases that occur without direct contact.
We also distinguish between contagious diffusion where high levels of terrorism spread to an

adjoining country from a host country but remain at high levels in the host country (expanded

diffusion or the domino effect) from contagious diffusion where high levels of terrorism spread

to an adjoining country but cease to remain high in the host country (displaced diffusion). We

find that annual increases in country-level terrorist attacks have been uncommon over the past 43

years, but when they do occur, non-contagious increases are more common than contagious

increases. Moreover, when contagious increases occur, they are very likely to take the expanded

diffusion (or domino) form. We find no consistent evidence that the ratio of non-contagious to

contagious increases is getting larger over time.

Our analysis of annual terrorist attacks for all non-island countries of the world shows that

terrorist attacks since 2003 are at once less dispersed and more concentrated at the national level

than at any time in more than four decades. A likely explanation for both this dispersion and

concentration is the large increases in terrorism following the US-led invasions of Afghanistan in

2001 and Iraq in 2003. It seems logical that the dispersion of terrorist attacks decreased during

the peak years of the US-led occupation of Iraq and Afghanistan because there were active

kinetic measures in place to reduce the ability of terrorist organizations to plan and project

attacks elsewhere. At the same time, the concentration of terrorist attacks in Iraq and

Afghanistan during this period is largely responsible for driving up worldwide levels of

concentration. For example, in 2013, terrorist attacks in Iraq and Afghanistan alone accounted

for 38% of all world-wide attacks.

We find strong support for the conclusion that annual increases in country-level terrorist

attacks are relatively rare and that contagious diffusion is rarer still. And indeed, we use a fairly

conservative measure of contagious diffusion in this paper. In our analysis we operationalize

world-wide contagious diffusion by identifying situations where from $Year^{t}$ to $Year^{t+1}$, two or

more adjacent countries experience levels of terrorism that move on average from low to high. Because our study covers a 44-year time span (1970-2013), future research should examine other time periods, such as the early Cold War period from the late 1940s to the 1960s when the domino theory was an especially important part of political discourse. It would also be useful for research to apply our conceptualization of diffusion to other types of violent events not systematically captured in the GTD, including civil war, insurgency and genocide.

To understand the mechanisms of terrorism diffusion, future research should also examine the extent to which the cases of contagious diffusion of terrorism identified here are due to the same organizations or movements. As we noted above, policy concern about Vietnam in the 1960s was not just about whether a variety of guerilla organizations would conquer that country and then march into Laos, Cambodia and Thailand; it was a concern that members of the world-wide Communist party would do so. Similarly, concerns about the spread of terrorism from Iraq or Syria to other countries are largely concerns about the spread of a more or less cohesive political movement, not diverse groups of terrorists with different ideological backgrounds.

Raising issues like these greatly increases the difficulty of identifying and interpreting instances of contagious diffusion. For example, for the period from 2010 to 2013 we report six examples of terrorism domino effects (see Tables 1 and 2): Somalia to Kenya (2011), Iraq to Syria (2011), Iraq and Greece to Turkey (2011), India to Bangladesh (2013), India to Nepal (2013), and Israel and Syria to Lebanon (2013). It would be useful to explore in greater detail than was possible in this paper the unique characteristics of each of these examples. But such analysis will be challenging. For example, LaFree, Dugan and Miller report that in over half of the attacks in the GTD, no specific perpetrator organization can be identified.[50] While a full analysis of these issues is beyond the scope of this paper we can use these six cases of terrorism

domino effects to illustrate the complexity of determining the extent to which examples of contagious diffusion are being driven by the same organizations or political movements.

Among the six examples listed above, those that seem most likely to involve attacks across borders by organizations sharing the same ideology are the diffusion from Somalia to Kenya in 2011, from Iraq to Syria in 2011, and from India to Nepal in 2013. GTD data attribute 61 attacks to al-Shabaab in Somalia in 2010 and 32 attacks to al-Shabaab in Kenya in 2011. Of the six cases, this one probably comes closest to fitting the domino effect ideal: where the same movement strikes over time across national boundaries. But even here there is ambiguity. Thus, in Somalia in 2010 in addition to attacks from al-Shabaab, there are attacks attributed to Hizbul al Islam and the Islamic Party of Somalia. While these attacks are not by the same organization they are arguably part of a general radical Islamist movement. But in addition, no group is attributed responsibility for 51 (37.8%) of the attacks in Somalia in 2010 and 9 (22.0%) of the attacks in Kenya in 2011.

The other five examples from 2010 to 2013 get progressively more complex. The diffusion of terrorist attacks from India to Nepal in 2013 can be firmly linked to the Communist Party-Maoist which was attributed responsibility for 213 attacks in India in 2012 and 32 attacks in Nepal in 2013. But at the same time there were a bewildering array of other attacks in India in the same year from a wide variety of other groups (e.g., the Garo National Liberation Army, Hizbul Mujahideen). Moreover, no group was attributed responsibility in 233 (37.8%) of the Indian cases in 2012 and 58 (56.9%) of the Nepal cases in 2013. Missing data on perpetrators of attacks is even greater in the case of Iraq and Syria. The terrorist diffusion from Iraq to Syria in 2011 can be attributed in part to al Qaeda in Iraq but the data on perpetrators are missing for 92.2% of the Iraqi attacks and 83.7% of the Syrian attacks.

Even from this brief consideration it is clear that every one of the examples could benefit from a detailed case study. However, the more general point is that by submitting our conception of contagious diffusion to stricter standards requiring evidence of participation by a specific group or movement is almost certainly going to further reduce the world-wide examples of it.

We found consistent support for our expectation that non-contagious increases are more common than contagious increases. In fact, across the entire analysis period, instances of non-contagious increases are 53.6% higher than contagious diffusion. But while this confirmed our expectation it is nonetheless striking how uncommon non-contagious increases have been. Recall that all that is required for a case of non-contagious increase is for a country to transition from low rates in year "t" to high rates in year "t + 1." What comes through most generally in the case of terrorism levels over time for the past half century is overwhelming cross-national stability.

Given the enormous advances in communications in the past four decades including especially the explosive growth of the Internet, we expected that compared to contagious increases, non-contagious increases would become more common over time. More than 30 years ago, Midlarsky, Crenshaw and Yoshida argued that over time terrorist organizations are more likely to learn about the success of other terrorist organizations through the media.[51] And many commentators have noted the increasing importance of modern communication technologies for the spread of terrorism.[52] But despite these arguments there is little evidence from our analysis that compared to contagious increases, non-contagious increases are becoming more common over time. In fact, we saw a substantially larger proportion of non-contagious to contagious increases in the 1970s than for the period since 2010. Future research should explore the

relationship between contagious and non-contagious diffusion of terrorism and the extent to which contagious and non-contagious increases in terrorist attacks have similar dynamics.

Our analysis did uncover prominent examples of the contagious spread of diffusion across the time period analyzed, most recently in South Asia, the Middle East and North Africa and Sub-Saharan Africa. However, it appears that overall the contagious spread of terrorism is relatively uncommon. If confirmed by additional research, these findings suggest that when it comes to terrorist threats, policymakers might worry less about shoring up states surrounding those experiencing widespread terrorist attacks than dealing directly with those states experiencing the high attack levels. In any event, terrorist attacks spreading across countries like dominos have been rare over the past four decades.

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[50] LaFree, Dugan, and Miller (see note 12 above), 77.

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Table 1. Summary of Spatial Transitions at Country Level

	N of Transitions	Total		Changes		Increases		Contagious Diffusion	
		Stationary N (%)	Change N (%)	Increase N (%)	Decrease N (%)	Contagious N (%)	Non-cont. N (%)	Expanded N (%)	Displaced N (%)
1970s	1480	1404 (94.9) ***	76 (5.1) ***	45 (59.2)	31 (40.8)	15 (33.3) **	30 (66.7) **	12 (80.0) **	3 (20.0) **
1980s	1480	1427 (96.4) ***	53 (3.6) ***	25 (47.2)	28 (52.8)	13 (52.0)	12 (48.0)	12 (92.3) ***	1 (7.7) ***
1990s	1332	1209 (90.8) ***	123 (9.2) ***	65 (52.8)	58 (47.2)	26 (40.0)	39 (60.0)	25 (96.2) ***	1 (3.8) ***
2000s	1480	1409 (95.2) ***	71 (4.8) ***	29 (40.8)	42 (59.2)	9 (31.0) *	20 (69.0) *	7 (77.8)	2 (22.2)
2010–2013	444	426 (95.9) ***	18 (4.1) ***	11 (61.1)	7 (38.9)	6 (54.5)	5 (45.5)	6 (100.0) **	0 (0.0) **
Total (1970–2013)	6216	5875 (94.5) ***	341 (5.5) ***	175 (51.3)	166 (48.7)	69 (39.4) ***	106 (60.6) ***	62 (89.9) ***	7 (10.1) ***

Notes: Data were missing for 1993; values with asterisks denote that the probability of observing these percentages is less than 5% if the true value is 50% (analogous to a significance level of less than 0.05; * $p < .05$; ** $p < .01$; *** $p < .001$).

Table 2. Countries experiencing expanded contagious diffusion (domino effects) in terrorism activities, 1970–2013
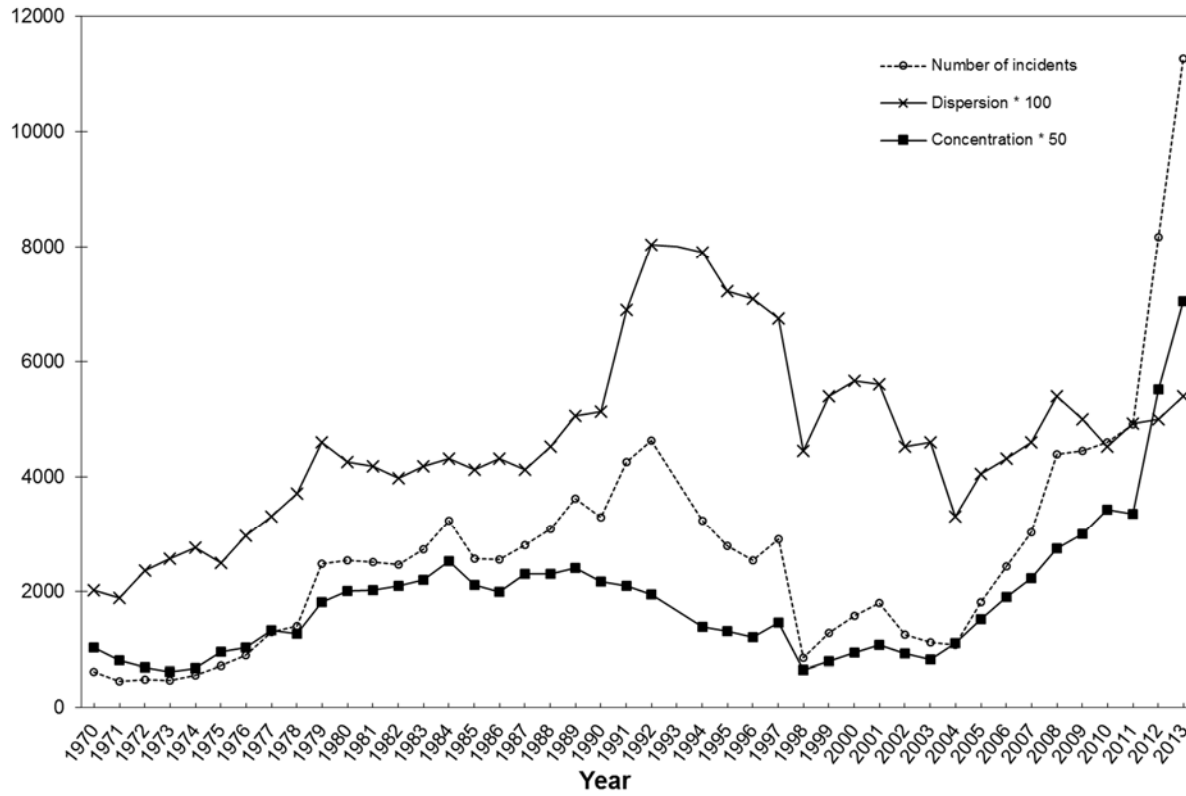
Region	Target country (N=36)	Neighboring countries	Number of times experiencing contagious diffusion (name of source countries) in:					
			1970-2013	1970s	1980s	1990s	2000s	2010-2013
South Asia								
	Bangladesh	India, Myanmar	5		1 (India)	2 (India)	1 (India, Myanmar)	1 (India)
	Nepal	China, India	2			1 (India)		1 (India)
	Afghanistan	China, Iran, Pakistan, Tajikistan, Turkmenistan, Uzbekistan	1			1 (Pakistan, Tajikistan)		
Western Europe								
	France	Andorra, Belgium, Germany, Italy, Luxembourg, Spain, Switzerland	3	1 (Spain, Germany)		1(Spain, Germany)	1 (Spain)	
	Greece	Albania, Bulgaria, Turkey, Yugoslavia	3		1 (Turkey)	1 (Turkey)	1 (Turkey)	
	Ireland	United Kingdom	3	2 (United Kingdom)	1 (United Kingdom)			
	Belgium	France, Germany, Luxembourg, Netherlands	2	1 (France, Germany)	1 (France, Germany)			
	Portugal	Spain	2	1 (Spain)	1 (Spain)			
	Italy	Austria, France, Switzerland, Yugoslavia	1			1 (France, Yugoslavia)		
Latin America								
	Bolivia	Argentina, Brazil, Chile, Paraguay, Peru	3		2 (Argentina, Chile, Peru)	1 (Chile, Peru)		
	Honduras	El Salvador, Guatemala, Nicaragua	3		2 (El Salvador, Guatemala, Nicaragua)	1 (Guatemala)		
	Venezuela	Brazil, Colombia, Guyana	3			2 (Columbia, Brazil)	1 (Colombia)	
	Argentina	Bolivia, Brazil, Chile, Paraguay, Uruguay	2		1 (Bolivia, Chile)	1 (Chile)		

Region	Target country (N=36)	Neighboring countries	Number of times experiencing contagious diffusion (name of source countries) in:					
			1970-2013	1970s	1980s	1990s	2000s	2010-2013
	Brazil	Argentina, Bolivia, Colombia, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela	2	1 (Colombia)		1 (Peru, Columbia)		
	Chile	Argentina, Bolivia, Peru	2	2 (Argentina)				
	Ecuador	Colombia, Peru	2	1 (Colombia)	1 (Colombia, Peru)			
	Guatemala	Belize, El Salvador, Honduras, Mexico	1	1 (Mexico)				
	Panama	Colombia, Costa Rica	1			1 (Colombia)		
	Peru	Bolivia, Brazil, Chile, Colombia, Ecuador	1	1 (Chile, Colombia)				
Eastern Europe	Georgia	Armenia, Azerbaijan, Turkey, Russia	3			2 (Turkey, Russia)	1 (Turkey, Russia)	
	Albania	Greece, Yugoslavia	1			1 (Yugoslavia, Greece)		
North America	Canada	United States	1	1 (United States)				
	Mexico	Belize, Guatemala, United States	1	1 (United States)				
Middle East & North Africa	Iran	Afghanistan, Armenia, Azerbaijan, Iraq, Pakistan, Turkmenistan, Turkey	3	1 (Turkey)		2 (Turkey, Pakistan, Afghanistan, Iraq)		
	Lebanon	Israel, Syria	3				2 (Israel)	1 (Israel, Syria)
	Syria	Iraq, Israel, Jordan, Lebanon, Turkey	2	1 (Turkey, Israel, Lebanon)				1 (Iraq)
	Egypt	Israel, Libya, West Bank and Gaza Strip, Sudan	1			1 (Israel, West Bank and Gaza Strip)		

Region	Target country (N=36)	Neighboring countries	Number of times experiencing contagious diffusion (name of source countries) in:					
			1970-2013	1970s	1980s	1990s	2000s	2010-2013
East & Central Asia	Iraq	Iran, Jordan, Kuwait, Saudi Arabia, Syria, Turkey	1			1 (Turkey)		
	Israel	Jordan, Lebanon, West Bank and Gaza Strip, Syria, Egypt	1			1 (West Bank and Gaza Strip, Lebanon)		
	Turkey	Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Iran, Iraq, Syria	1					1 (Iraq, Greece)
	China	Afghanistan, Bhutan, India, Kazakhstan, Kyrgyzstan, Laos, Mongolia, Myanmar, Nepal, North Korea, Pakistan, Tajikistan, Vietnam, Russia	2			1 (Pakistan, Russia, India, Tajikistan)	1 (Afghanistan, India, Nepal, Pakistan, Russia)	
Sub-Saharan Africa	Kenya	Ethiopia, Somalia, Tanzania, Uganda, Sudan	1					1 (Somalia)
	Mozambique	Malawi, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe	1		1 (South Africa)			
	Namibia	Angola, Botswana, South Africa, Zambia	1			1 (Angola, South Africa)		
	Rwanda	Burundi, Congo (Kinshasa), Tanzania, Uganda	1			1 (Burundi, Uganda)		
Southeast Asia & Oceana	Myanmar	Bangladesh, China, India, Laos, Thailand	3	1 (India)		1 (India, China Bangladesh, Thailand)	1(India, Thailand)	

Notes: The 7 cases of non-domino contagious diffusion were: Chile (1979), France (2002), Greece (1981 and 2006), Guatemala (1975), Iran (1978), and Israel (2000).

Figure 1. Frequency, dispersion and concentration of terrorism attacks, 1970–2013

APPENDIX A. Countries/Territories Listed Within Each Region

Region	Countries/Territories
1: East and Central Asia	China, Kazakhstan, Kyrgyzstan, Mongolia, North Korea, South Korea, Tajikistan, Turkmenistan, and Uzbekistan
2: Eastern Europe	Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Czechoslavakia (Czech Republic, and Slovak Republic), Estonia, Georgia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Russia (Soviet Union), Ukraine, and Yugoslavia (Bosnia-Herzegovina, Croatia, Macedonia, Montenegro, Serbia, and Slovenia)
3: Latin America	Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay, and Venezuela
4: Middle East and North Africa	Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, Turkey, United Arab Emirates, West Bank and Gaza Strip, and Yemen (North Yemen, and South Yemen)
5: North America	Canada, Mexico, and the United States
6: South Asia	Afghanistan, Bangladesh, Bhutan, India, Nepal, and Pakistan
7: Southeast Asia and Oceana	Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Thailand, Timor-Leste, and Vietnam (North Vietnam, and South Vietnam)
8: Sub-Saharan Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo (Brazzaville), Congo (Kinshasa), Cote d'Ivoire (Ivory Coast), Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe
9: Western Europe	Andorra, Austria, Belgium, Denmark, Finland, France, Germany (East Germany, and West Germany), Gibraltar, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom of Great Britain and Northern Ireland