European Xtramile Centre of African Studies (EXCAS)

EXCAS Working Paper

WP/19/026

Terrorism and social media: global evidence

Forthcoming: Journal of Global Information Technology Management

Simplice A. Asongu
African Governance and Development Institute,
P.O. Box 8413 Yaoundé, Cameroon.
E-mails: asongusimplice@yahoo.com, asongus@afridev.org

Stella-Maris I. Orim
School of Engineering, Environment and Computing,
Coventry University, Priory Street, Coventry CV1 5DH, UK
E-mail: S.Orim@coventry.ac.uk

Rexon T. Nting
University of Wales, Trinity Saint David Winchester House,
11 Cranmmer Road, London, UK, SW9 6EJ.
Emails: rexon.nting@uwtsd.ac.uk /
rexonting@hotmail.com

Research Department

Terrorism and social media: global evidence

Simplice A. Asongu, Stella-Maris I. Orim & Rexon T. Nting

January 2019

Abstract

The study assesses the relationship between terrorism and social media from a cross section of 148 countries with data for the year 2012. The empirical evidence is based on Ordinary Least Squares, Negative Binomial and Quantile regressions. The main finding is that there is a positive relationship between social media in terms of Facebook penetration and terrorism. The positive relationship is driven by below-median quantiles of terrorism. In other words, countries in which existing levels of terrorism are low are more significantly associated with a positive Facebook-terrorism nexus. The established positive relationship is confirmed from other externalities of terrorism: terrorism fatalities, terrorism incidents, terrorism injuries and terrorism-related property damages. The terrorism externalities are constituents of the composite dependent variable.

JEL Classification: D83; O30; D74
Keywords: Social Media; Terrorism

1. Introduction

The positioning of this study builds on three main tendencies in scholarly and policy-making circles, notably: (i) the growing challenge of terrorism across the world, (ii) the policy concern of social media in fuelling violence and terrorism and (iii) gaps in the literature[1]. These points are substantiated in chronological order.

First of all, terrorism is a growing challenge to the prosperity of nations. It is important to note that, terrorism is defined in this study as the actual and threatened use of force by sub-national actors with the purpose of employing intimidation to meet political objectives (Enders & Sandler, 2006). Accordingly, recent geopolitical events such as the 2011 Arab Spring have increased externalities of weak and failed states such civil war and terrorism across the Middle East, Africa and Asia (GTI, 2014; Asongu *et al*., 2018a). As we shall substantiate below, even developed countries have been experiencing the negative externalities of this terrorism phenomenon. To put this point into more perspective, Libya in the post-Gaddafi era has become a failed state owing to *inter alia*: various rebel factions fighting to have control over the country and determine the laws in the country in order to chart a post-conflict course of economic development. The narrative maintains that Yemen is also a failed State reflecting the same characteristics because the fragile politico-economic and social situation of the country is being fuelled by wars that are fought by more technically-advanced countries with geopolitical objectives (Asongu *et al*., 2018a). For instance, Saudi Arabia and Iran are backing antagonistic elements behind the fragile political situation in Yemen. The political stalemate in Syria has resulted in considerable negative consequences for neighbouring countries (e.g. Lebanon and Iraq), especially with the rise and fall of the Islamic State of Iraq and the Levant (ISIL). According to the narrative, in Africa, the Boko Haram in Nigeria has been causing social turmoil in the country as well as in neighbouring countries such as Cameroon, Niger and Chad (Solomon, 2017; Asongu & Biekpe, 2018).

More developed countries have not been immune to the recent waves of terrorist attacks because of a number of notable incidences, which include: the aborted 2015 attacks in Verviers, Belgium; the Australian-Sydney crisis in December 2014; the February 2015 attacks in Australia; the "Charlie Hebdo" 2015 incidence in Paris, the November 2015 attacks in France and the July 2015 attacks at the "Promenade des Anglais" in Nice and the stream of attacks in Great Britain (22nd of March 2017 Westminster attack, 22nd of May 2017

[1]Social media and Facebook are used interchangeably throughout the study because of data availability constraints in the other social media indicators.

Manchester Arena bombing, 3rd of June 2017 London attack, 19th of June Finsbury Park Attack and 15th of September London tube train attack). Among possible determinants of terrorism, social media has been documented as a mechanism by which recruitments of terrorists and propaganda of terrorism is channelled (Gates & Podder, 2015).

Second, there is no consensus in the literature on the policy concerns surrounding the role of social media in fuelling terrorism. This is essentially because one strand of the literature is of the position that social media accelerates political instability and violence (Dreyfuss, 2017a; Browning, 2018; Patton *et al.*, 2014; Storrod & Densley, 2017; Bejan, 2018; Dean, Bell & Newman, 2012; Taylor, Fritsch & Liederbach, 2014). Conversely, a contending strand maintains that social media can be employed to reduce violence and political polarization (Barberá, 2015; Parkyn, 2017). Concerning the former framework, the positive incidence of social media on the 2011 Arab Spring has been documented by Wolfsfeld *et al.* (2013) while Bastos *et al.* (2015) have established the connection between protests and social media. With regard to the contending strand, Barberá (2015) has established that social media can increase political harmonization which is susceptible of decreasing political anger that can fuel terrorism. Furthermore, the strand of the literature is also supported with the position that unrests can be reduced through collaborative and networking mechanisms (Parkyn, 2017). The narrative maintains that social media can provide a good platform on which discussions between rebel factions can take place in order to assuage externalities such as political instability and terrorism. Surprisingly, as apparent from Section 2 and further perusal of the existing studies, empirical literature on the relevance of social media on terrorism is sparse.

Third, the highlighted gap in the literature is apparent because social media is a relatively new phenomenon. According to attendant narratives, the importance of social media has not been given the necessary scholarly attention. The sparse empirical literature is traceable to constraints in data availability. This is essentially because, there are only five macroeconomic empirical studies using Facebook penetration as a measure of social media. Jha and Sarangi (2017) have investigated how Facebook penetration influences corruption. The effect of Facebook penetration on natural resource governance has been examined by Kodila-Tedika (2018) whereas Jha and Kodila-Tedika (2018) have assessed if democracy is driven by Facebook penetration. Asongu and Odhiambo (2019a, 2019b) have assessed the relationships between social media, governance and tourism.

Noticeably from the above, this study adds to the recent strand of studies on development consequences of social media by exploiting the new dataset in order to assess

the nexus between Facebook penetration and terrorism. The positioning also responds to recent policy concerns on the sparse documentation of the consequences of social media (World Bank, 2016). Moreover, exploratory discourses on the relevance of social media in terrorism have not been backed with empirical validity (Patrikarakos, 2017). Hence, this study contributes to the terrorism literature by putting some empirical validity to discourses in order to establish whether the purported positive nexus between terrorism and social media withstands empirical scrutiny. The attendant research question is the following: what is the relationship between social media and terrorism?

In order to provide an answer to the underlying research question, the study uses a cross section of 148 countries with data for the year 2012. The empirical evidence is based on Ordinary Least Squares, Negative Binomial and Quantile regressions. The main finding is that there is a positive relationship between Facebook penetration and terrorism. The positive relationship is driven by below-median quantiles of terrorism. In other words, countries in which existing levels of terrorism are low are more significantly associated with a positive Facebook-terrorism nexus. The established positive relationship is confirmed from other externalities of terrorism: terrorism fatalities, terrorism incidents, terrorism injuries and terrorism-related property damages.

The inquiry is positioned as an applied research study because the intuition for assessing the nexus between social media and terrorism is sound, given that information technology can be used to organise and coordinate terrorism activities. In essence, applied research is not exclusively based on the acceptance or rejection of existing theories, but could provide the basis for theory-building. Hence, this study is consistent with the extant literature in arguing that applied research that is based on sound intuition is a useful scientific activity (Costantini & Lupi, 2005 ; Narayan et al., 2011; Asongu & Nwachukwu, 2016).

The positioning of the study on the nexus between social media and terrorism also departs from contemporary global information technology management literature which has focused on *inter alia*: the importance of globalisation in patterns of information technology (Lee & Joshi, 2016); differences in the diffusion of social media across cultures (Khan & Dongping, 2017); patterns of combined usage of information technology and innovation in Europe (Billon et al., 2017); cultural practices and virtual social network diffusion (Krishnan et al., 2016); progress in the international hyperlink network (Barnett et al., 2016); youth civic engagement behaviour on social media (Warren et al., 2016; Montgomery & Xenos, 2008; Valenzuela et al., 2012); linkages between information technology, information sharing and inclusive development (Afutu-Kotey et al., 2017; Asongu & Boateng, 2018; Bongomin et al.,

2018 ; Gosavi, 2018; Humbani & Wiese, 2018; Isszhaku et al., 2018; Minkoua Nzie et al., 2018; Muthinja & Chipeta, 2018; Abor et al., 2018; Tchamyou, 2019; Tchamyou et al., 2019) and determinants of information technology in developing countries (Asongu et al., 2018b).

The rest of the study is structured as follows. A review of existing literature is covered in Section 2 while the data and methodology are disclosed in Section 3. Section 4 presents the empirical results while Section 5 concludes with implications and future research directions.

2. Review of existing literature

2.1 Drivers and deterrents of terrorism

The terrorism literature has failed to engage the dimension of social media as a driver of terrorism. As summarized in Table 1, the surveyed literature has failed to engage the element of social media, probably because of data availability constraints. The surveyed literature is expanded in four main strands, namely: (i) foreign aid and policy; (ii) democracy, civil liberties and state failure; (iii) welfare and foreign occupation and (iv) military expenditure.

First, with regard to the nexus between policy and terrorism, Savun and Phillips (2009) have investigated why countries that are associated with better democratic values are more likely to be affected by transnational terrorism. The authors have concluded that, the relationship depends on the behaviour of the country. They maintain that, irrespective of the type of regime (i.e. democratic versus autocratic regimes), if political systems are more concerned with international politics, they are equally more likely to be vulnerable to transnational terrorism. This is not the case with countries that pursue isolationist projects. The nexus between refugees, humanitarian aid and terrorism have been assessed by Choi and Salehyan (2014) who have established that “no good deed goes unpunished”. The finding builds on the evidence provided which support the perspective that aid allocations enable the elite in militant factions to loot and corrupt: incidences which provide opportunities for foreign interest in a country to be targeted and attacked by terrorists. In another study published the same year, Button (2014) used the mechanisms of “interstate rivalry” in the examination of why the use of development assistance for counterterrorism purposes does not work in all circumstances. The author maintains that when foreign aid from the United States of America (USA) is sent to recipients who are associated with interstate rivalry, the underlying recipients also in turn employ development assistance as an instrument of war against their rivals. Hence, the foreign aid intended to be used in fighting terrorism is not used accordingly, but invested to ensure victory in interstate wars.

Button and Carter (2014) have shown that the connection between foreign aid and transnational terrorism is contingent on whether terrorism in the country receiving foreign aid threatens the interest of the USA or not. The authors have concluded that allocation of development assistance from the USA is more directly to countries in which the interests of the USA are likely to be targeted by terrorists. Eng and Urperlainen (2015) have established that, while for the purpose of credibility, considerable rewards are promised by donors, these donors equally promise severe sanctions that are often out of proportion. The authors also find that the underlying rewards and sanctions cannot be simultaneously engaged unless such actions are supported by domestic interest groups. Asongu and Ssozi (2017) have established that foreign aid is most effective in the fight against terrorism in nations where existing levels of terrorism are highest.

The second strand focuses on civil liberties, democracy and state failure. Within this framework, Lee (2013) has examined the nexus between democracy, hostage-taking and civil liberties in order to provide insights into how types of governments are linked to terrorism. The study is based on the premise that terrorism-motivated hostage-taking has a higher propensity to be associated with governments that are democratic because much emphasis is placed on personal freedom and human values.

The relationship between "military and economic development assistance from the United States" and the rise of anti-American terrorism is investigated by Gries *et al.* (2015) who conclude that terrorism-related anti-American sentiments are fuelled by a combination of dependence (i.e. economic and military reliance) and local repression. No evidence is found to support the view that development assistance from the USA helps in making the USA safer. Coggins (2015) assesses if state failure causes terrorism to establish that, failed and failing states are substantially not associated with higher levels of terrorism. However, nations that are collapsing politically and in a state of war, are linked with higher incidences of terrorism. Asongu and Nwachukwu (2017) have shown that terrorism affects governance dynamics (political, economic and institutional components) whereas Asongu *et al.* (2018a) have concluded that good governance mechanisms (especially political stability) can be used to effectively fight terrorism.

Table 1: Drivers and Deterrents of Terrorism

Author(s)	Period	Sample	Methodology	Terrorism Dynamics	Instruments	Effects on terrorism
Tavares (2004)	1987–2001	2725 observations and 1428 attacks	OLS	Domestic and transnational Terrorism	Democracy	The instrument reduces terrorism
Testas (2004)	1968–1991	37 Muslim countries	Poisson Regression Model	Transnational terrorism	University enrolment	The instrument increases terrorism
Bravo & Dias (2006)	1997–2004	60–85 Countries	OLS	Domestic and transnational terrorism	Adult population literacy rate	The instrument reduces terrorism
Drakos & Gofas (2006)	1985–1998	139 Countries	Negative Binomial and Zero-inflated Negative Binomial Regressions	Transnational terrorism	Trade openness and Polity	The instruments reduces terrorism
Kurrild-Klitgaard et al. (2006)	1996–2002	97–121 Countries	binary logistical regression	Transnational terrorism	political rights and civil liberties	The instruments reduces terrorism
Azam &Thelen (2008)	1990–2004	176 Countries	negative binomial model	Transnational terrorism	Secondary school enrolment	The instrument reduces terrorism
Savun & Phillips (2009)	1968-2001 and 1998-2004	163 Countries	Zero-Inflated Negative Binomial Regression	Domestic and Transnational Terrorism	Democracy and foreign policy behaviour	Isolationist foreign policy and less democracy breed less terrorism
Azam &Thelen (2010)	1990–2004	132 Countries	negative binomial model	Transnational terrorism	Secondary school enrolment	The instrument reduces terrorism
Choi (2010)	1984-2004	131 countries	negative binomial maximum likelihood regression, averaged negative binomial regression and rare event logit models	Domestic and international terrorism	Democratic rule of law	The instrument reduce terrorism
Krieger & Meierrieks (2010)	1980-2003	15 Western European countries	negative binomial count model	Home-grown terrorism	Social spending	Higher spending in some field reduces terror
Kavanagh (2011)	1992–1996	Lebanon	Logit model	Domestic terror (Hezbollah militants)	The role of education and poverty in terrorism participation	poverty increases terrorism participation for individuals with high education
Bhavnani (2011)	2006-2008	Israel and two rival Palestinian factions	Logistic regression	Transnational terrorism	Selective violence based on political control	Selective violence based on Israeli control
Hoffman et al. (2013)	1975-1995	Undisclosed. Use of annual costs of attacks	ZINB (zero-inflated negative binomial) regression models	Transnational terrorism	Press freedom and publicity	Demand for press attention fuels terrorism
Lee (2013)	1978-2005	Hostage events	the multilevel Poisson model	Hostage-taking terrorism	Democratic values (Civil liberties and press freedom)	Democratic values motivate terrorism
Bell et al. (2014)	1970-2006	144 countries	Negative Binomial Regression	Domestic and transnational terrorism	Lack of transparency (internal & external)	Internal & external transparency increases domestic and transnational terrorism
Button (2014)	1968-2008	Recipients of USA foreign aid	duration and count models	International terrorism	USA foreign aid	Effective when recipient state do not have conflicting priorities
Button & Carter (2014)	1970-2007	USA and USA allies	Non-contemporary regressions	Global and transnational terrorisms	USA foreign aid	Effective when USA interest are threatened
Choi & Salehyan (2014)	1970-2007	154 Countries	negative binomial regression and tobit	Domestic and transnational	Infusion of aid resources	Countries with more refugees

			model	terrorism		experience more terrorism
Collard-Wexler et al. (2014)	1980-2008	74 foreign state occupations	Naïve and Hardening mechanisms models based on Pape's theory of occupation	Suicide attacks in countries experiencing foreign military occupation	Avoidance of foreign military interventions to mitigate suicide attacks in countries experiencing military interventions.	Foreign occupations increases suicide attacks
Enders et al. (2014)	1970-2010	Undisclosed	Terrorism Lorenz curve and nonlinear smooth transition regressions	Domestic and transitional terrorism	Real GDP per capita	Terrorism more concentrated in middle-income countries
Brockhoff et al. (2015)	1984-2007	133 countries	Two-step cluster analysis	Domestic terrorism	Education	Education decreases terrorism especially when socio-economic conditions are better
Coggins (2015)	1999-2008	155 countries	GEE1 Negative Binomial	Location, perpetrator, domestic, domestic-perpetrator, international-location and international-perpetrator terrorisms.	Stages of failed states	Avoidance of failed states in war or political collapse
Gries et al. (2015)	1984-2008	126 countries	Negative Binomial Regression and System GMM	Anti-USA terrorism	USA aid dependence	USA aid-dependence fuels Anti-USA terrorism
Asongu & Ssozi (2017)	1984-2008	78 developing countries	Quantile regressions	domestic, transnational, unclear and total terrorism dynamics	Bilateral, Multilateral and Total aid	Aid is effective in the highest quantile of transnational terrorism
Choi & Piazza (2017)	1981-2005	138 Countries	negative binomial maximum-likelihood regression model	Suicide attacks in countries experiencing military interventions	Avoidance of foreign military interventions to mitigate suicide attacks in countries experiencing military interventions.	Certain features of pro-government intervention increase suicide attacks in countries experience military interventions
Asongu & Nwachukwu (2018a)	1984-2008	78 developing countries	GMM (Roodman)	Domestic & Transnational	Catch-up for policy harmonization	13.34-19.92 years for domestic terrorism and 24.67-27.88 years for transnational terrorism
Asongu et al. (2019)	1998-2012	53 African countries	GMM (Roodman)	Domestic, transitional, unclear and total terrorism dynamics	Political stability, "voice & accountability", government effectiveness, regulatory quality, corruption-control and the rule of law	All the engaged governance instruments negatively affect terrorism

GMM: Generalized Method of Moments.

The third strand focuses on papers that have investigated the relationship between terrorism and welfare. Kieger and Meirrieks (2010) in this strand have assessed the relationship between terrorism and welfare capitalism in the world. The authors have

established that in some sectors (e.g. public housing), social spending does not cause domestically-grown terrorism. However, the public spending in other sectors (e.g. labour market programs, unemployment and health) deter the occurrence of terrorism. In the same vein, Asongu *et al*. (2017) have concluded that inclusive human development is a significant tool in the fight against terrorism. The differing nonlinear nexus between terrorism and levels of income is examined by Enders *et al*. (2014) who establish that attacks of transnational and domestic nature are apparent in middle income countries. According to Kavanagh (2011), for students who have at least a high school educational level, their poverty status increases their sympathy for the Hezbollah militant movement.

The fourth strand is concerned with studies that have assessed the relationship between foreign occupation, military interventions and terrorism. In this strand, Collard-Wexler *et al*. (2014) examine whether suicide attacks are motivated by foreign occupation and find a significant impact. Choi and Piazza (2017) assess if suicide attacks are motivated by military interventions to find that in exceptional situations, some foreign interventions lead to suicide attacks in countries where military interventions occur. Asongu and Amankwah-Amoah (2018) have concluded that a critical mass of between 4.224 and 7.363 of military expenditure as a percentage of GDP is required to completely nullify the negative effect of terrorism on capital flight.

2.2 Social media, ideological polarization and radicalisation

As recently documented by Barberá (2015), social media improves the exposure of citizens to diverse political information and political views. This diversity could lead to political polarization and ultimately to political terror. The relationship between social media, ideological polarization and radicalization can be discussed in two main strands, notably: (i) the role of social media in political information and (ii) the importance of social media in political polarization and political radicalization.

Concerning the first strand, social media enables citizens from different political ideologies to connect with each other and exchange information. As substantiated by Kaplan and Haenlein (2010), the consumption of political information through social media is not exclusively restricted to interactions between friends, family, acquaintance and co-workers. Hence, the information diversity and heated exchanges can fuel political polarization and radicalization. Accordingly, when citizens are using social media, it is very unlikely for them to select the information that they will be exposed to, because information is incidental, in

addition to the fact that users are exposed to all information that is shared by their friends and acquaintances (Brundidge, 2010).

In accordance with Barberá (2015), the diversity of information can best be articulated by a report from the Pew Research Center. According to the centre, as of 2013, approximately 50% of users of social media (i.e. Facebook and Twitter) consumed news from various websites. Moreover, according to the same narrative, about 78% of the users were equally incidentally exposed to information of political nature. According to Burke and Kraut (2014), offline networks overlap with personal networks: which is further evidence of the diversity of information that social media users can consume. Furthermore, the firmness of interpersonal relationships is contingent on how often users interact with social media and recommend news to be consumed by other users (Mutz, 2006; Gilbert & Karahalios, 2009; Bakshy *et al*., 2012; Jones *et al*., 2013; Messing & Westwood, 2014).

With regard to the second consideration on the relevance of social media in political radicalization and political polarization, while existing literature has substantially documented the role of social media in reducing political polarization and political terror, we argue in this study that the relationship between social media and terrorism is still open to debate. The underlying studies include: the use of social media to connect users with the same ideological standpoints (Conover *et al*., 2012; Smith *et al*., 2014; Barberá & Rivero, 2014; Colleoni *et al*., 2014); the contingency of the exposure to political information on the users' network heterogeneity (Mutz, 2006; Bakshy *et al*., 2012). Consistent with Barberá (2015), the heterogeneity of information from social media could increase political moderation and less violence for various motives, *inter alia*: political tolerance and "*greater awareness of rationales for oppositional views*" (Mutz, 2002, p.114), a learning mechanism for political socialization (Stoker & Jennings, 2008) and mitigation of overconfidence in political positions (Ortoleva & Snowberg, 2015; Iyengar *et al*., 2012).

In spite of these tendencies, social media can still promote political polarization, political radicalization and by extension terrorism, because as we have motivated in the introduction, there is a strand in the literature maintaining that social media accelerates political violence and political instability (Patton *et al*., 2014; Dreyfuss, 2017a; Browning, 2018; Storrod & Densley, 2017; Bejan, 2018). Emphasis on political dimensions of instability is consistent with the definition of terrorism used in this study, notably: terrorism is defined as the actual and threatened use of force by sub-national actors with the purpose of employing intimidation to meet political objectives (Enders & Sandler, 2006).

3. Data and methodology

3.1 Data

This study examines a cross-sectional sample of one hundred and forty eight countries with data for the year 2012. The data is obtained from the Global Peace Index (GPI) (2016). The sources used in the GPI (2016) include: Qualitative assessments by the Economic Intelligence Unit (EIU) analysts' estimates; the Uppsala Conflict Data Program (UCDP) Battle-Related Deaths Dataset; the Institute for Economics and Peace (IEP); the United Nations Office on Drugs and Crime (UNODC) Surveys on Crime Trends; the Operations of Criminal Justice Systems (CTS); the International Institute for Strategic Studies (IISS), the United Nations Committee on Contributions and Asongu and Odhiambo (2019b). The dataset is limited to one hundred and forty eight countries and for the year 2012 because of data availability constraints. Accordingly, Facebook data is available only for the year 2012. It comes from Asongu and Odhiambo (2019b) and is measured as the share of population using Facebook. It is important to note that "Quintly" which is a social media benchmarking and analytics Solution Company is the original source of the data. Consistent with the motivation of this study, the Facebook data has been recently used by five studies to assess the relevance of social media in development outcomes (Jha & Sarangi, 2017; Kodila-Tedika, 2018; Jha & Kodila-Tedika, 2018; Asongu & Odhiambo, 2019a, 2019b).

The outcome variable is the global terrorism index (GTI) from GTI (2014). This main outcome variable is decomposed into four terrorism externalities, namely: terrorism fatalities, terrorism incidents, terrorism injuries and terrorism-related property damages. Accordingly, the terrorism externalities are the four components of the GTI used as the main outcome variable. Consistent with recent literature on conflicts, crimes, violence and terrorism (Blanco & Grier, 2009; Freytag *et al*., 2011; GPI, 2016; Asongu & Kodila-Tedika, 2016, 2017; Asongu *et al*., 2018c; Asongu & Nwachukwu, 2018), the study adopts four non-dummy and two dummy control variables, namely: access to weapons, violent crime, conflict intensity, political instability, low income countries and South Asian nations. The first-four are non-dummy variables while the last-two are dummy variables. From intuition and corresponding literature motivating the choice of the control variables, a positive relationship is expected between non-dummy variables and terrorism because these variables reflect risk factors that fuel terrorism and associated externalities. The dummy variables are used to control for the unobserved heterogeneity.

It is important to emphasize that the dependent variables are log-transformed in some estimations so that they should be consistent with data behaviour needed for the empirical

strategies. Accordingly, Ordinary Least Squares (OLS) and Quantile regressions can use log-transformed dependent variables. Conversely, count data can be used for the Negative Binomial regressions because the empirical strategy is not consistent with dependent variables that follow a normal distribution. Appendix 1 provides the definitions and sources of the variables while Appendix 2 discloses both the summary statistics in Panel A and sampled countries in Panel B. The summary statistics informs the research with two main insights. On the one hand, the mean values of the engaged variables are comparable. Accordingly, in the empirical literature, units of variables being examined should be comparable in terms of mean values in order for the estimation to be robust. For instance, it is not feasible to compare decimal points with thousands or millions of units. On the other hand, the variations from the perspective of standard deviations are high enough for the study to expect significant estimated linkages from the empirical results. The correlation matrix is provided in Appendix 3.

3.2 Methodology

3.2.1 Ordinary Least Squares

An Ordinary Least Squares (OLS) approach is adopted by the study because of the cross sectional nature of the dataset. The choice of this estimation approach is in line with recent literature based on cross sectional data (Andrés, 2006; Asongu, 2013a; Kodila-Tedika & Asongu, 2015). Equation 1 below shows the relationship between terrorism and social media, to be estimated

$$T_i = \alpha_1 + \alpha_2 SM_i + \alpha_3 X_i + \varepsilon_i, \qquad (1)$$

where $T_i (SM_i)$ represents a terrorism (social media) indicator for country i, α_1 is a constant, X is the vector of control variables, and ε_i the error term. X contains: access to weapons, violent crime, conflict intensity, political instability, low income and South Asia. The terrorism indicators are: the global terrorism index, terrorism fatalities, terrorism incidents, terrorism injuries and terrorism-related property damages

3.2.2 Negative Binomial Regressions

Given the positive skew associated with the terrorism variables, a Negative Binomial regression is also employed on terrorism outcome variables that are not log-transformed. This empirical strategy is consistent with recent literature using this type of data (Choi & Luo,

2013; Choi, 2015). In the regression, the mean of y is determined by the exposure time t and a set of k regressor variables (the *x's*). The expression relating these quantities is presented in Equation (2):

$\mu_i = exp(\ln(t_i) + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki})$, (2)

where, $x_1 \equiv 1$ and β_1 is the intercept. $\beta_1, \beta_2, \ldots, \beta_k$ correspond to unknown parameters to be estimated. Their estimates are symbolized as $b_1, b_2, \ldots, b_k$. The fundamental Negative Binomial regression model for an observation i is written as in Equation (3):

$$\Pr(Y = y_i|\mu_i, \alpha) = \frac{\Gamma\left(y_i + \alpha^{-1}\right)}{\Gamma(\alpha^{-1})\Gamma(y_i + 1)}\left(\frac{1}{1+\alpha\mu_i}\right)^{\alpha^{-1}}\left(\frac{\alpha\mu_i}{1+\alpha\mu_i}\right)^{y_i}, \quad (3)$$

where, $\mu_i = t_i\mu$ and $\alpha = \frac{1}{\nu}$ in the generalised Poisson Distribution which includes a gamma noise variable with a mean of 1 and a scale of ν. The parameter μ represents the mean incidence rate of *y* per unit of exposure or time. Hence, μ is the risk of a new occurrence of the event during a specified exposure period, t (NCSS, 2017).

3.2.3Quantile Regressions

The OLS and Negative Binomial regressions presented in the previous two sections estimate the outcome variable at the mean of the conditional distribution. However, such estimation techniques are characterized by the shortcoming that the relationship between Facebook penetration and terrorism may be conditional on existing levels of terrorism, such that it is important to distinguish between low, intermediate and high initial levels of terrorism in the regression exercise. The Quantile regression technique satisfies this requirement because parameter estimates are obtained at multiple points of the conditional distribution of the outcome variable (Koenker & Bassett, 1978). The Quantile regression approach is being increasingly employed in various fields of economic development in order to increase room for policy implications, notably: in corruption (Billger & Goel, 2009; Okada & Samreth, 2012; Asongu, 2013b), finance (Asongu, 2014a) and health (Asongu, 2014b) studies.

The θ^{th} quantile estimator of terrorism is obtained by solving the following optimization problem, which is presented without subscripts in Eq. (4) for the purpose of simplicity and readability.

$$\min_{\beta \in R^k}\left[\sum_{i \in \{i: y_i \geq x_i'\beta\}} \theta\left|y_i - x_i'\beta\right| + \sum_{i \in \{i: y_i < x_i'\beta\}} (1-\theta)\left|y_i - x_i'\beta\right|\right], \quad (4)$$

where, $\theta \in (0,1)$. Contrary to the OLS which is fundamentally based on minimizing the sum of squared residuals, with QR, the weighted sum of absolute deviations are minimised. For example the 10th or 25th quantiles (with θ=0.10 or 0.25 respectively) by approximately weighing the residuals. The conditional quantile of terrorism or y_i given x_i is:

$$Q_y(\theta / x_i) = x_{i'}\beta_\theta , \quad (5)$$

where unique slope parameters are modelled for each θ^{th} specific quantile. This formulation is analogous to $E(y / x) = x_{i'}\beta$ in the OLS slope where parameters are assessed only at the mean of the conditional distribution of terrorism. For Eq. (5), the dependent variable y_i is terrorism while x_i contains a constant term: *access to weapons, violent crime, conflict intensity, political instability, low income* and *South Asia*.

4. Empirical results

4.1 Terrorism and social media

In this section, the empirical findings on the relationship between social media and terrorism are presented. Table 2 shows results from Ordinary Least Squares (OLS) and Negative Binomial regressions whereas Table 3 discloses findings from Quantile regressions. In Table 2, the OLS results are presented on the left-hand side while the Negative Binomial results are provided on the right-hand side. For both estimation techniques in the first table, there is an incremental improvement in the variables contained in the conditioning information set. Accordingly, the first of the four specifications is a univariate regression whereas the last-three are multivariate regressions. Whereas the univariate specification is not negatively significant in the OLS regressions, it is negatively significant in the Negative Binomial regressions. However, as more variables are added to the specifications, the relationship is not positively significant for both estimation techniques in the second sets of specifications. In the third sets of specifications, Facebook penetration is positively significant in OLS and not in the corresponding Negative Binomial regressions. Consistency in the regression output in terms of the independent variable of interest is only apparent in the last sets of specifications whereas the estimated nexus from Facebook penetration is positively significant in both OLS and Negative Binomial specifications.

Table 2: Ordinary Least Squares and Negative Binomial regressions

Variables and Information Criteria	Panel A: Dependent variable: Global Terrorism							
	Ordinary Least Squares (OLS) LnTerrorim				Negative Binomial Regression (NBR) Terrorism			
Constant	**0.868*** **	0.005	-0.369	**-0.516** **	**0.850*** **	**-0.819***	**-1.195** **	**-1.547*** **
	(0.000)	(0.984)	(0.137)	**(0.046)**	**(0.000)**	**(0.095)**	**(0.019)**	**(0.002)**
Facebook Penetration	-0.004	0.002	**0.008** **	**0.010** **	**-0.011***	0.002	0.010	**0.015** **
	(0.136)	(0.493)	**(0.020)**	**(0.010)**	**(0.050)**	(0.728)	(0.140)	**(0.040)**
Access to Weapons	---	0.101	-0.029	-0.036	---	0.201	-0.063	-0.084
		(0.193)	(0.679)	(0.597)		(0.119)	(0.614)	(0.481)
Violent Crime	---	**0.146***	0.038	0.050	---	**0.251** **	0.084	0.097
		(0.059)	(0.565)	(0.448)		**(0.013)**	(0.446)	(0.350)
Conflict Intensity	---	---	**0.431*** **	**0.397*** **	---	---	**0.694*** **	**0.652*** **
			(0.000)	**(0.000)**			**(0.000)**	**(0.000)**
Political Instability	---	---	-0.015	0.042	---	---	-0.095	0.040
			(0.864)	(0.602)			(0.537)	(0.785)
Low Income	---	---	---	-0.054	---	---	---	-0.180
				(0.707)				(0.451)
South Asia	---	---	---	**0.900*** **	---	---	---	**1.141*** **
				(0.000)				**(0.001)**
Fisher	2.24	**4.94*** **	**19.20*** **	**19.96*** **				
Adjusted R^2	0.013	0.092	0.305	0.367				
Log likelihood					-273.727	-267.429	-253.443	-247.576
Likelihood Ratio (LR) Chi-Square					**3.74***	**16.33*** **	**44.31*** **	**56.04*** **
Likelihood Ratio (LR) for Alpha					**1.185*** **	**0.986*** **	**0.600*** **	**0.449*** **
Pseudo R^2						0.029	0.080	0.101
Observations	148	148	148	148	148	148	148	148

***,**,*: significance levels at 1%, 5% and 10% respectively.

Noticeably, our best estimator is also the estimator that is consistently significant in the left-hand and right-hand sides. This is essentially because the last sets of specifications in the two estimation strategies suffer the least from the issue of "variable omission bias" that is likely to bias estimated coefficients. It is also important to note that the coefficient of adjustment is highest in the last specification of OLS estimations. In other words, in the real world, Facebook penetration and terrorism do not interact in isolation. The significant determinants in the conditioning information set display the expected positive sign.

The Quantile regressions are presented in Table 3. The fact that the estimated value of Facebook penetration differs across specifications in the conditional distribution of terrorism is an indication that the choice of the estimation technique is relevant to articulate how existing levels of terrorism influence the relationship being investigated. The main finding is that the estimated relationship is only significant in the below-median quantiles of the conditional distribution of terrorism. In other words, countries in which existing levels of terrorism are low are also more significantly associated with a positive Facebook-terrorism nexus. The significant control variables display the expected outcomes.

Table 3: Quantile Regressions

Variables and Information Criteria	Dependent variables: Global Terrorism				
	Q.10	**Q.25**	**Q.50**	**Q.75**	**Q.90**
Constant	**-0.148****	**-0.713*****	-0.675	0.126	0.567
	(0.023)	**(0.000)**	(0.140)	(0.815)	(0.176)
Facebook Penetration	**0.002*****	**0.008*****	0.010	0.007	0.006
	(0.002)	**(0.005)**	(0.117)	(0.366)	(0.254)
Access to Weapons	-0.013	0.022	-0.056	-0.182	-0.053
	(0.365)	(0.612)	(0.629)	(0.254)	(0.735)
Violent Crime	0.003	0.008	0.068	0.118	0.093
	(0.778)	(0.849)	(0.504)	(0.381)	(0.374)
Conflict Intensity	0.022	**0.243*****	**0.551*****	**0.483*****	**0.335*****
	(0.154)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Political Instability	**0.037****	0.033	-0.045	0.037	0.024
	(0.023)	(0.570)	(0.742)	(0.812)	(0.833)
Low Income	0.010	0.003	-0.104	-0.181	-0.212
	(0.729)	(0.973)	(0.667)	(0.559)	(0.394)
South Asia	**0.485*****	**1.312*****	**0.858****	**0.860*****	**0.482*****
	(0.000)	**(0.000)**	**(0.033)**	**(0.003)**	**(0.007)**
Pseudo R^2	0.028	0.109	0.278	0.227	0.247
Observations	148	148	148	148	148

*, **, ***: significance levels of 10%, 5% and 1% respectively. OLS: Ordinary Least Squares. R^2 for OLS and Pseudo R^2 for quantile regression. Lower quantiles (e.g., Q 0.1) signify nations where Global terrorism is least.

4.2 Extension with externalities of terrorism and social media

In this section, we further assess if the established positive relationship between Facebook penetration and terrorism withstands empirical scrutiny when terrorism is decomposed into constituent elements, namely: terrorism fatalities, terrorism incidents, terrorism injuries and terrorism-related property damages. Hence, instead of having one dependent variable as with the previous regressions, we have four dependent variables. The corresponding findings are presented in Table 4. In the table, the OLS results are provided on the left-hand side while Negative Binomial findings are disclosed on the right-hand side. In both estimation techniques, control variables used for the regressions in Tables 2-3 are employed in the estimations. However, owing to lack of space, the control variables are not reported. It is apparent from the findings that the positive association between Facebook penetration and terrorism withstands empirical scrutiny within the framework of externalities of terrorism.

The analysis in Table 3 is also replicated for Quantile regressions within the context of terrorism externalities. Unfortunately, the findings are not feasible throughout the conditional distribution of the outcome variables owing to issues in degrees of freedom. The corresponding findings which are not used for policy implications are available upon request.

Table 4: OLS and Negative Binomial extensions with Externalities of Terrorism

Variables and Information Criteria	Dependent Variables: Externalities of Terrorism							
	Ordinary Least Squares (OLS): LnTerrorism				Negative Binomial Regression (NBR): Terrorism			
	Ln.Incidents	Ln.Fatalities	Ln.Injuries	Ln.Property Damages	Incidents	Fatalities	Injuries	Property Damages
Constant	**-2.108*** (0.001)**	**-2.295*** (0.001)**	**-2.671*** (0.000)**	**-1.741*** (0.001)**	**-3.027** (0.021)**	**-4.434*** (0.002)**	**-4.605*** (0.004)**	**-5.003*** (0.000)**
Facebook Penetration	**0.026*** (0.002)**	**0.015* (0.060)**	**0.021** (0.021)**	**0.018** (0.012)**	**0.046** (0.027)**	0.014 (0.542)	0.021 (0.368)	**0.051** (0.014)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fisher	**12.15*** **	**8.76*** **	**11.76*** **	**8.37*** **				
Adjusted R^2	0.401	0.408	0.420	0.378				
Log likelihood					-380.763	-307.922	-358.881	-281.745
Likelihood Ratio (LR) Chi-Square					**71.83*** **	**73.92*** **	**65.45*** **	**68.48*** **
Likelihood Ratio (LR) for Alpha					**5.173*** **	**6.816*** **	**8.210*** **	**5.276*** **
Pseudo R^2					0.086	0.107	0.083	0.108
Observations	148	148	148	148	148	148	148	148

***,**,*: significance levels at 1%, 5% and 10% respectively.

5. Concluding remarks and future research direction

The study has assessed the relationship between terrorism and social media from a cross section of 148 countries with data for the year 2012. The empirical evidence is based on Ordinary Least Squares, Negative Binomial and Quantile regressions. The main finding is that there is a positive relationship between social media in terms of Facebook penetration and terrorism. The positive relationship is driven by below-median quantiles of terrorism. In other words, countries in which existing levels of terrorism are low are more significantly associated with a positive Facebook-terrorism nexus. A reason why such significant association is more apparent in countries with low levels of terrorism could be that, in countries where terrorism levels are high, other social media and information technology platforms are used for the organisation and coordination of terrorism activities. The established positive relationship is confirmed from other externalities of terrorism: terrorism fatalities, terrorism incidents, terrorism injuries and terrorism-related property damages. The terrorism externalities are constituents of the composite dependent variable.

The fact that the Facebook-terrorism nexus is exclusively apparent in countries where initial levels of terrorism are low is an indication that blanket policies pertaining to the investigated relationship are ineffective unless they are contingent on varying levels of terrorism and tailored differently across countries with low, intermediate and high initial levels of terrorism.

The findings in this study have clarified the existing debate in the literature on whether social media fuels or mitigates terrorism. To this end, we have used a hitherto unexplored dataset on Facebook penetration. Hence, while the findings are consistent with the strand of

literature supporting the positive role of social media in violence, conflicts, crimes and terrorism (Wolfsfeld *et al.*, 2013; Bastos *et al.*, 2015; Dreyfuss, 2017a; Browning, 2018; Patton *et al.*, 2014; Storrod & Densley, 2017; Bejan, 2018), at the same time, the findings counteract the results maintaining that social media can be effectively used to curb terrorism and violence (Barberá, 2015; Parkyn, 2017). It what follows, more implications are discussed in the light of contributions of the study to the information systems community.

It is apparent from the findings that the managing body of Facebook may not be doing enough in prevention of the use of its social media platform to fight terrorism (Dreyfuss, 2017b). However, this inference should be considered in the light of the sampled year and hence, may not reflect contemporary efforts by Facebook to stamp-out the use of the social media platform for the organisation and coordination of terrorism. In essence, more complex algorithms need to be developed to trace and address online content that is characterised by extremist rhetoric, violent images, organisation of violence and propagation of hate. Moreover, it is worthwhile for Facebook and by extension, the information systems community to work hand-in-hand with the law enforcement and terrorism experts in order to improve on identification and monitoring parameters of terrorism.

Beyond the above recommendations, the surge in terrorism tendencies (especially transnational terrorism) will require some policy harmonization among elements of the information systems community as well as between governments hosting these underlying communities. In other words, country-specific policies may not be enough if terrorists are using the same social media platforms and mechanisms worldwide. Therefore, the suggested policy harmonization should entail the sharing of intelligence against terrorism, adoption of most efficient tools in the fight against terrorism as well as the development of common algorithms that are designed to combat the scourge. In regions already sharing common economic policies such as the African (AU) and the European Union (EU), a legal framework coupled with a collaborative environment is worthwhile. Accordingly, such international frameworks are essential because terrorism and hate speeches are not limited to one specific country, but permeate boarders and hence, common legislation and mechanisms are imperative. In summary, Facebook and by extension, the information systems community should cooperate in improving sensitization and awareness against terrorism as well as developing common cross-country Terrorism Tracking Systems (TTS) pertaining to social media.

The main caveat of this study is that the established findings are relationships and hence causality should not be inferred from them unless the results are substantiated with

other estimation techniques from which causality can be inferred, as more data become available. This caveat also doubles as a future research direction. Furthermore, it is also worthwhile to emphasize that Facebook may not be representative of social media. However, given data availability constraints, other variables of social media could not be taken on board and therefore should be considered in future studies.

Compliance with Ethical Standards

The authors are self-funded and have received no funding for this manuscript.

The authors also have no conflict of interest.

This article does not contain any studies with human participants or animals performed by the authors.

References

Abor, J. Y., Amidu, Y., & Issahaku, H., (2018). "Mobile Telephony, Financial Inclusion and Inclusive Growth", *Journal of African Business*, 18(4), pp. 430-453.

Afutu-Kotey, R. L. , Gough, K. W., & Owusu, G., (2017). "Young Entrepreneurs in the Mobile Telephony Sector in Ghana: From Necessities to Aspirations", *Journal of African Business*, 18(4), pp. 476-491.

Andrés, A. R., (2006). "Software piracy and income inequality". *Applied Economic Letters*, 13 (2), pp. 101-105.

Asongu, S. A., (2013a). "How has mobile phone penetration stimulated financial development in Africa", *Journal of African Business*, 14(1), pp. 7-18.

Asongu, S. A., (2013b). "Fighting corruption in Africa: do existing corruption-control levels matter?", *International Journal of Development Issues*, 12(1), pp. 36-52.

Asongu, S. A., (2014a). "Financial development dynamic thresholds of financial globalization: evidence from Africa", *Journal of Economic Studies*, 41(2), pp. 166-195.

Asongu, S. A., (2014b). "The impact of health worker migration on development dynamics: evidence of wealth-effects from Africa", *The European Journal of Health Economics*, 15(2), pp. 187-201.

Asongu, S. A., & Amankwah-Amoah, J., (2018). "Mitigating capital flight through military expenditure: Insight from 37 African countries", *Research in International Business and Finance*. 45(October), pp. 38-53.

Asongu, S. A., & Biekpe, N., (2018). "Globalization and terror in Africa", International Economics, 156(December), pp. 86-97.

Asongu, S. A., & Boateng, A., (2018). "Introduction to Special Issue: Mobile Technologies and Inclusive Development in Africa", *Journal of African Business*, 19(3), pp. 297-301.

Asongu, S. A., & Kodila-Tedika, O., (2016). "Fighting African conflicts and crimes: which governance tools matter?", *International Journal of Social Economics*, 43(5), pp. 466-485.

Asongu, S. A., & Kodila-Tedika, O., (2017). "Trade, aid and terror", *International Journal of Development Issues*, 16(1), pp. 2-24.

Asongu, S. A., & Nwachukwu, J. C., (2016). "Revolution empirics: predicting the Arab Spring", *Empirical Economics*, 51(2), pp. 439–482.

Asongu, S. A., & Nwachukwu, J., (2017). "The Impact of Terrorism on Governance in African Countries", *World Development*, 99(November), pp. 253-270.

Asongu, S. A., & Nwachukwu, J., (2018). "Fighting Terrorism: Empirics on Policy Harmonization", *German Economic Review,* 19(3), pp.237-259.

Asongu, S. A., Nwachukwu, J. C., & Aziz, A., (2018b). "Determinants of Mobile Phone Penetration: Panel Threshold Evidence from Sub-Saharan Africa." *Journal of Global Information Technology Management*, 21(2), pp.81-110.

Asongu, S. A., & Odhiambo, N. M., (2019a). "Governance and social media in African countries: An empirical investigation", *Telecommunications Policy*,43(5), pp. 411-425.

Asongu, S. A., & Odhiambo, N. M., (2019b). "Tourism and Social Media in the World: An Empirical Investigation", *Journal of Economic Studies*, DOI: 10.1108/JES-07-2018-0239.

Asongu, S. A., & Ssozi, J., (2017). "When is Foreign Aid Effective in Fighting Terrorism? Threshold Evidence", *International Economic Journal,* 31(3), pp.370-389.

Asongu, S. A., Tchamyou, V. S., Asongu, N., & Tchamyou, N., (2018a). "The Comparative African Economics of Governance in Fighting Terrorism", *African Security*, 11(4), pp. 296-338.

Asongu, S. A., Tchamyou, V. S., Asongu, N., & Tchamyou, N. P., (2017a). "The Comparative African Economics of Inclusive Development and Military Expenditure in Fighting Terrorism". *Journal of African Development*, 19(2), pp. 77-91.

Asongu, S. A., Tchamyou, V. S., Asongu, N., & Tchamyou, N. P., (2019). "Fighting terrorism in Africa: evidence from bundling and unbundling institutions", *Empirical Economics*,56(3), pp. 883–933.

Asongu, S. A., Tchamyou, V. S., Minkoua, N, J. R., Asongu, N., & Tchamyou, N. P., (2018c). "Fighting terrorism in Africa: Benchmarking policy harmonization", *Physica A: Statistical Mechanics and its Applications*, 492(February), pp. 1931-1957.

Azam, J.-P., & Thelen, V., (2008). "The Roles of Foreign Aid and Education in the War on Terror.", *Public Choice*, 135(3/4), pp. 375-397.

Azam, J.-P., & Thelen, V., (2010). "Foreign Aid versus Military Intervention in the War on Terror.", *Journal of Conflict Resolution*, 54(2), pp. 237-261.

Bakshy, E., Rosenn, I., Marlow, C., & Adamic, L.,(2012). "The role of social networks in information diffusion". In Proceedings of the 21st international conference on World Wide Web. ACM pp. 519–528.

Barber, B. R., (2003). Strong democracy: Participatory politics for a new age. University of California Press.

Barberá, P., (2015). "How Social Media Reduces Mass Political Polarization. Evidence from Germany, Spain, and the U.S.", New York University, New York. http://rubenson.org/wp-content/uploads/2015/10/barbera-tpbw.pdf (Accessed: 03/05/2018).

Barberá, P., & Rivero, G., (2014). "Understanding the political representativeness of Twitter users.", *Social Science Computer Review*, 33(6), pp. 712-729.

Barnett, G. A., Park, H. W., & Chung, C. J., (2016). "Evolution of the International Hyperlink Network", *Journal of Global Information Technology Management*, 19(3), pp. 174-189.

Bastos, M. T., Mercea, D., & Charpentier, A., (2015). Tents, Tweets, and Events: The Interplay Between Ongoing Protests and Social Media". *Journal of Communication*, 65(2), pp. 320–350.

Bejan, V., Hickman, M., Parkin, V. S., & Pozo, V. F., (2018). "Primed for death: Law enforcement-citizen homicides, social media, and retaliatory violence", *Plus One*, DOI:10.1371/journal.pone.0190571.

Bell, S. R., Clay, K. C., Murdie, A., & Piazza, J., (2014). "Opening Yourself Up: The Role of External and Internal Transparency in Terrorism Attacks", *Political Research Quarterly*, 67(3), pp. 603-614.

Billon, M., Lera-Lopez, F.,& Marco, R.,(2017). "Patterns of Combined ICT Use and Innovation in the European Regions", *Journal of Global Information Technology Management*, 20(1), pp. 28-42.

Billger, S. M., & Goel, R. K., (2009). "Do existing corruption levels matter in controlling corruption? Cross-country quantile regression estimates", *Journal of Development Economics*, 90(2), pp. 299-305.

Blanco, R., & Grier, B., (2009). "Long Live Democracy: The Determinants of Political Instability in Latin America", *The Journal of Development Studies*, 45(1), pp. 76-95.

Bongomin, G. O. C., Ntayi, J. M., Munene J. C., & Malinga, C. A., (2018). "Mobile Money and Financial Inclusion in Sub-Saharan Africa: the Moderating Role of Social Networks", *Journal of African Business.* 18(4), pp. 361-384.

Bravo, A. B. S., & Dias, C. M. M., (2006). "An Empirical Analysis of Terrorism: Deprivation, Islamism and Geopolitical Factors." *Defence and Peace Economics*, 17(4), pp. 329-441.

Brockhoff, S., Kieger, T., & Meierrieks, D., (2014). "Great Expectations and Hard Times - The (Nontrivial) Impact of Education on Domestic Terrorism", *Journal of Conflict Resolution*, 59 (7), 1186-1215.

Browning, J., (2018). "Authorities Ask If Social Media to Blame for London Murders", *Bloomberg Technology*, https://www.bloomberg.com/news/articles/2018-04-13/london-murders-leave-u-k-asking-if-social-media-is-to-blame (Accessed: 28/04/2018).

Brundidge, J., (2010). "Encountering "difference" in the contemporary public sphere: The contribution of the Internet to the heterogeneity of political discussion networks." *Journal of Communication*, 60(4), pp. 680-700.

Burke, M., & Kraut, R. E., (2014). "Growing closer on facebook: changes in tie strength through social network site use". In Proceedings of the 32nd annual ACM conference on Human factors in computing systems. ACM pp. 4187-4196.

Button, A., (2014). "US foreign aid, interstate rivalry, and incentives for counterterrorism cooperation", *Journal of Peace Research*, 51(6), pp. 741-754.

Button, A., & Carter, D. B., (2014). "Fair-Weather Allies? Terrorism and the Allocation of US Foreign Aid", *Journal of Conflict Resolution*, 58(7), pp. 1144-1173.

Choi, S-W., (2015). "Economic growth and terrorism: domestic, international, and suicide", *Oxford Economic Papers*, 67(1), pp. 157–181.

Choi, S-W., & Luo, S., (2013). "Economic Sanctions, Poverty, and International Terrorism: An Empirical Analysis," *International Interactions*, 39(2), pp.217-245.

Choi, S-W., (2010). "Fighting Terrorism through the Rule of Law?", *The Journal of Conflict Resolution,* 54(6), pp. 940-966.

Choi, S-W., & Piazza, J. A., (2017), "Foreign Military Interventions and Suicide Attacks", *Journal of Conflict Resolution*, 61(2), pp. 271–297.

Choi, S-W., & Salehyan, I., (2014). "No Good Deed Goes Unpunished: Refugees, Humanitarian Aid, and Terrorism", *Conflict Management and Peace Science*, 30(1), pp. 53-70.

Coggins, B. L., (2015). "Does State Failure Cause Terrorism? Empirical Analysis (1999-2008)?", *Journal of Conflict Resolution*, 59(3), pp. 455-483.

Collard-Wexler, S., Pischedda, C., & Smith, M. G., (2014). "Do Foreign Occupations Cause Suicide Attacks?", *Journal of Conflict Resolution*, 58(4), pp. 625-657.

Colleoni, E., Rozza, A., & Arvidsson, A., (2014). "Echo Chamber or Public Sphere? Predicting Political Orientation and Measuring Political Homophily in Twitter Using Big Data." *Journal of Communication*, 64(2), pp. 317–332.

Conover, M. D., Gonçalves, B., Alessandro F., and Filippo Menczer. F.,(2012). "Partisan Asymmetries in Online Political Activity." *EPJ Data Science*, 1(1), pp. 1-19.

Costantini, M., & Lupi, C., (2005). "Stochastic Convergence among European Economies", *Economics Bulletin*, 3(38), pp.1-17.

Dean, G., Bell, P., & Newman, J. (2012). "The dark side of social media: review of online terrorism". *Pakistan Journal of Criminology*, 3(3), pp. 103-112.

Drakos, K., & Gofas. A., (2006). "In Search of the Average Transnational Terrorist Attack Venue." *Defence and Peace Economics* , 17(2), pp. 73-93.

Dreyfuss, E., (2017a). "Facebook streams a murder, and must now face itself", WIRED. https://www.wired.com/2017/04/facebook-live-murder-steve-stephens/ (Accessed: 28/04/2018).

Dreyfuss, E., (2017b). "Facebook's counterterrorism playbook comes into focus", *WIRED*, https://www.wired.com/story/facebook-counterterrorism/(Accessed: 13/05/2019).

Enders, W., Hoover, G. A., & Sandler, T., (2014). "The Changing Nonlinear Relationship between Income and Terrorism", *Journal of Conflict Resolution*, 60(2), pp. 195-225.

Enders, W, & Todd, S., (2006). The Political Economy of Terrorism. New York: Cambridge University Press.

Eng, M. E., & Urperlainen, Y., (2015). "The Domestic Sources of Donor Credibility When and How Can Domestic Interest Groups Improve the Effectiveness of Threats and Promises?", *Journal of Conflict Resolution*, 59(2), pp. 283-309.

Freytag, A., Kruger, J. J., Meierrieks, D., & Schneider, F., (2011). "The origins of terrorism: Cross-country estimates of socio-economic determinants of terrorism", *The European Journal of Political Economy*, 27(Supplement 1), pp. S5-S16.

Gates, S.,& Podder, S., (2015). "Social Media, Recruitment, Allegiance and the Islamic State",*Perspectives on Terrorism*, 9(4), pp.107-116.

Gilbert, E., & Karahalios, K., (2009). "Predicting tie strength with social media". In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM pp. 211–220.

Gosavi, A., (2018). "Can mobile money help firms mitigate the problem of access to finance in Eastern sub-Saharan Africa", *Journal of African Business*. 18(4), pp. 343-360.

Gries, T., Meierrieks, D., & Redlin, M., (2015). "Oppressive governments, dependence on the USA, and anti-American terrorism", *Oxford Economic Papers*, 67 (1), pp. 83-103.

GTI (2014). "Global Terrorism Index: Measuring and Understanding the Impact of Terrorism", *Institute for Economics and Peace*, pp. 2-90. http://www.visionofhumanity.org/sites/default/files/Global%20Terrorism%20Index%20Report%202014_0.pdf (Accessed: 28/04/2015).

GPI (2016). Global Peace Index 2016. Institute for Economics & Peace.

Hoffman, A. M., Shelton, C., & Cleven, E., (2013). "Press Freedom, Publicity, and the Cross National Incidence of Transnational Terrorism", *Political Research Quarterly*, 66 (4), pp. 896-909.

Humbani, M., & Wiese, M., (2018). "A Cashless Society for All: Determining Consumers' Readiness to Adopt Mobile Payment Services", *Journal of African Business*, 18(4), pp. 409-429..

Issahaku, H., Abu, B. M., & Nkegbe, P. K., (2018). "Does the Use of Mobile Phones by Smallholder Maize Farmers Affect Productivity in Ghana?", *Journal of African Business,* 19(3), pp. 302-322.

Iyengar, S., Gaurav S., & Yphtach L., (2012). "Affect, not ideology a social identity perspective on polarization." *Public Opinion Quarterly*, 76(3), pp. 405-431.

Jha, C.K. & Kodila-Tedika, O., (2018). "Does Social Media Promote Democracy? Some Empirical Evidence", *SSRN Working Paper* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3277152 (Accessed: 11/05/2019).

Jha, C.K. & Sarangi, S., (2017)."Does social media reduce corruption?" *Information Economics and Policy*, 39(June), pp. 60–71.

Jones, J. J, Settle, J. E., Bond, R. M., Fariss, C. J., Marlow, C., & Fowler, J. H., (2013). "Inferring tie strength from online directed behavior." *PloS ONE*, 8(1), pp. 52168.

Kaplan, A. M., & Haenlein. M., (2010). "Users of the world, unite! The challenges and opportunities of Social Media." *Business horizons*, 53(1), pp. 59-68.

Kavanagh, J., (2011), "Selection, Availability, and Opportunity: The Conditional Effect of Poverty on Terrorist Group Participation", *Journal of Conflict Resolution*, 55(1), pp. 106-132.

Khan, I., & Dongping, H., (2017). "Variations in the diffusion of social media content across different cultures: A communicative ecology perspective", *Journal of Global Information Technology Management*, 20(3), pp. 156-170.

Kodila-Tedika, O., (2018). "Natural Resource Governance: Does Social Media Matter?", *MPRA Paper* No. 84809, Munich.

Kodila-Tedika, O., & Asongu, S. A., (2015). "The effect of intelligence on financial development: a cross-country comparison", *Intelligence*, 51(July-August), pp. 1-9.

Koenker, R., & Bassett, Jr. G. (1978), "Regression quantiles", *Econometrica*, 46(1), pp. 33-50.

Krieger, T., & Meierrieks, D., (2010). "Terrorism in the Worlds of Welfare Capitalism", *Journal of Conflict Resolution*, 54(6), pp. 902-939.

Krishnan, S., & Ahmed, M., &AlSudiary, T., (2016). "Cultural Practices and Virtual Social Networks Diffusion: An International Analysis Using GLOBE Scores", *Journal of Global Information Technology Management*, 19(3), pp. 154-173.

Kurrild-Klitgaard, P., Justesen, M. K., & Klemmensen, R., (2006). "The Political Economy of Freedom, Democracy and Transnational Terrorism." *Public Choice*, 128(1/2), pp.289-315.

Lee, C-Y., (2013). "Democracy, civil liberties, and hostage-taking terrorism", *Journal of Peace Research*, 50(2), pp. 235-248.

Lee, K., & Joshi, K., (2016). "Importance of Globalization in the Information Technology Convergence Era", *Journal of Global Information Technology Management*, 19(1), pp. 1-5.

Minkoua Nzie, J. R., Bidogeza, J. C., & Ngum, N. A., (2018). "Mobile phone use, transaction costs, and price: Evidence from rural vegetable farmers in Cameroon", *Journal of African Business*, 19(3), pp. 323-342.

Montgomery, K. C., & Xenos, M., (2008). *Civic life online: Learning how digital media can engage youth*. MIT Press.

Muthinja, M. M., & Chipeta, C., (2018). "What Drives Financial Innovations in Kenya's Commercial Banks? An Empirical Study on Firm and Macro-Level Drivers of Branchless Banking", *Journal of African Business*, 18(4), pp. 385-408.

Mutz, D.C., (2002). "Cross-cutting social networks: Testing democratic theory in practice." *American Political Science Review*, 96(1), pp. 111-126.

Mutz, D. C., (2006). Hearing the other side: Deliberative versus participatory democracy. Cambridge University Press.

Narayan, P. K., Mishra, S., & Narayan, S., (2011). "Do market capitalization and stocks traded converge? New global evidence", *Journal of Banking and Finance*, 35(10), pp. 2771-2781.

NCSS (2017). "Negative Binomial Regression", NCSS Statistical Software, https://ncss-wpengine.netdna-ssl.com/wp-content/themes/ncss/pdf/Procedures/NCSS/Negative_Binomial_Regression.pdf (Accessed: 16/05/2017).

Okada, K., & Samreth, S. (2012). "The effect of foreign aid on corruption: A quantile regression approach", *Economic Letters*, 11(2), pp. 240-243.

Ortoleva, P., & Snowberg. E., (2015). "Overconfidence in Political Behavior". *American Economic Review*, 105(2), pp. 504-535.

Parkyn, R., (2017). "The role of social media in development", The World Bank https://blogs.worldbank.org/publicsphere/role-social-media-development (Accessed: 27/04/2018).

Patrikarakos, D., (2017). "WAR IN 140 CHARACTERS: How Social Media Is Reshaping Conflict in the Twenty-First Century". Basic Book. https://www.hachettebookgroup.com/titles/david-patrikarakos/war-in-140-characters/9780465096152/ (Accessed: 04/05/2018).

Patton, D. U., Hong, J. S., Ranney, M., Patel, S., Kelley, C., Eschmann, R., & Washington, T., (2014). "Social media as a vector for youth violence: A review of the literature", *Computers in Human Behavior*, 35(June), pp. 548-553.

Savun, B., & Phillips, B. J., (2009), "Democracy, Foreign Policy, and Terrorism", Journal *of Conflict Resolution*, 53(6), pp. 878-904.

Solomon, S., (2017). "Terrorism Deaths in Africa Falling After Hitting Record Highs", VOA News, https://www.voanews.com/a/africa-terrorism-deaths-falling/3934505.html (Accessed: 13/12/2018).

Storrod, M. L., & Densley, J. A., (2017). "'Going viral' and 'Going country': the expressive and instrumental activities of street gangs on social media", *Journal of Youth Studies*, 20(6), pp. 677-696.

Tavares, J., (2004). "The Open Society Assesses Its Enemies: Shocks, Disasters and Terrorist Attacks." *Journal of Monetary Economics*, 51(5), pp. 1039-1070.

Taylor, R. W., Fritsch, E. J., & Liederbach, J. (2014). *Digital crime and digital terrorism.* Prentice Hall Press.

Tchamyou, V.S., (2019)."The Role of Information Sharing in Modulating the Effect of Financial Access on Inequality", *Journal of African Business*. DOI: 10.1080/15228916.2019.1584262.

Tchamyou, V. S., Erreygers, G., &Cassimon, D., (2019). "Inequality, ICT and Financial Access in Africa", *Technological Forecasting and Social Change*,139 (February), pp. 169-184.

Testas, A., (2004). "Determinants of Terrorism in the Muslim World: An Empirical Cross sectional Analysis." *Terrorism and Political Violence*, 16(2), pp.253-273.

Valenzuela, S., Arriagada, A., & Scherman, A. (2012). "The social media basis of youth protest behavior: The case of Chile". *Journal of Communication*, 62(2), pp. 299-314.

Warren, A. M., Jaafar, N. I.,&Sulaiman, A., (2016). "Youth Civic Engagement Behavior on Facebook: A Comparison of Findings from Malaysia and Indonesia", *Journal of Global Information Technology Management*, 19(2), pp. 128-142.

Wolfsfeld, G., Segev, E., & Sheafer, T., (2013). "Social Media and the Arab Spring", *The International Journal of Press/Politics*, 18(2), pp. 115-137.

World Bank (2016). "World Development Report 2016: Digital Dividends", The World Bank http://www.worldbank.org/en/publication/wdr2016 (Accessed: 27/04/2018).

Appendices

Appendix 1: Definitions and sources of variables

Variables	Definitions of variables and sources
Global Terrorism	Global Terrorism Index (GTI, 2014)
Terrorism incidents	Logarithm (1+ base) of Total number of terrorist incidents in a given year.
Terrorism fatalities	Logarithm (1+ base) of Total number of fatalities caused by terrorists in a given year
Terrorism injuries	Logarithm (1+ base) of Total number of injuries caused by terrorists in a given year
Terrorism-related property damages	Logarithm (1+ base) of the measure of the total property damage from terrorist incidents in a given year.
Facebook Penetration	Facebook penetration (2012), defined as the percentage of total population that uses Facebook (Asongu & Odhiambo, 2019b).
Access to Weapons	Ease of access to small arms and light weapons (Global Peace Index, 2016) Qualitative assessment by EIU analysts (Global Peace Index, 2016)
Violent crime	Level of violent crime (Global Peace Index, 2016) Qualitative assessment by EIU analysts (Global Peace Index, 2016)
Conflict Intensity	Conflict Intensity (Global Peace Index, 2016)
Political instability	Political instability Qualitative assessment by EIU analysts (Global Peace Index, 2016)

"Uppsala Conflict Data Program (UCDP). The Institute for Economics and Peace (IEP). The Economic Intelligence Unit (EIU). United Nations Peacekeeping Funding (UNPKF). GDP: Gross Domestic Product. The International Institute for Strategic Studies (*IISS).*

Appendix 2: Summary Statistics and presentation of countries

Panel A: Summary statistics

Variables	Mean	Standard dev.	Minimum	Maximum	Obsers
Global Terrorism (Ln)	0.796	0.753	0.000	2.306	148
Terrorism incidents(Ln)	1.243	1.766	0.000	7.263	148
Terrorism fatalities(Ln)	1.069	1.840	0.000	7.920	148
Terrorism injuries(Ln)	1.268	2.105	0.000	8.803	148
Terrorism-related property damages(Ln)	0.855	1.452	0.000	6.532	148
Facebook Penetration	19.868	18.566	0.038	97.636	148
Access to Weapons	3.118	1.077	1.000	5.000	148
Violent Crime	2.774	1.109	1.000	5.000	148
Conflict Intensity	2.432	1.164	1.000	5.000	148
Political Instability	2.546	1.004	1.000	5.000	148

Panel B: Sampled countries (148)

"Afghanistan; Albania; Algeria; Angola; Argentina; Armenia; Australia; Austria; Azerbaijan; Bahrain; Bangladesh; Belarus; Belgium; Benin; Bhutan; Bolivia; Bosnia and Herzegovina; Botswana; Brazil; Bulgaria; Burkina Faso; Burundi; Cambodia; Cameroon; Canada; Central African Republic; Chad; Chile; China; Colombia; Costa Rica; Croatia; Cyprus; Czech Republic; Democratic Republic of the Congo; Denmark; Djibouti; Dominican Republic; Ecuador; Egypt; El Salvador; Equatorial Guinea; Eritrea; Estonia; Ethiopia; Finland; France; Gabon; Georgia; Germany; Ghana; Greece; Guatemala; Guinea; Guyana; Haiti; Honduras; Hungary; Iceland; India; Indonesia; Iraq; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Kenya; Kuwait; Kyrgyz Republic; Laos; Latvia; Lebanon; Lesotho; Libya; Lithuania; Macedonia (FYR); Madagascar; Malawi; Malaysia; Mali; Mauritania; Mauritius; Mexico; Moldova; Mongolia; Montenegro; Morocco; Mozambique; Namibia; Nepal; Netherlands; New Zealand; Nicaragua; Niger; Nigeria; Norway; Oman; Pakistan; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Portugal; Qatar; Republic of the Congo; Romania; Russia; Rwanda; Saudi Arabia; Senegal; Serbia; Sierra Leone; Singapore; Slovakia; Slovenia; Somalia; South Africa; South Korea; Spain; Sri Lanka; Swaziland; Sweden; Switzerland; Tajikistan; Tanzania; Thailand; The Gambia; Togo; Trinidad and Tobago; Tunisia; Turkey; Turkmenistan; Uganda; Ukraine; United Arab Emirates; United Kingdom; United States of America; Uruguay; Uzbekistan; Venezuela; Vietnam; Yemen and Zambia".

Standard dev: standard deviation. Obsers: Observations.

Appendix 3: Correlation matrix

Weapons	Crime	Confl. Inten	Pol. Inst	Facebook	Terror Incidents	Terror Fatalities	Terror Injuries	Terror Prop.D	Global Terrorism	
1.000	0.636	0.605	0.615	-0.545	0.278	0.373	0.345	0.288	0.251	Weapons
	1.000	0.563	0.492	-0.449	0.314	0.401	0.360	0.317	0.284	Crime
		1.000	0.685	-0.531	0.490	0.552	0.564	0.462	0.517	Conf. Intern
			1.000	-0.650	0.274	0.339	0.363	0.233	0.280	Pol. Inst.
				1.000	-0.097	-0.223	-0.210	-0.103	-0.114	Facebook
					1.000	0.912	0.924	0.970	0.849	Terror incidents
						1.000	0.950	0.911	0.778	Terror Fatalities
							1.000	0.915	0.799	Terror Injuries
								1.000	0.790	Terror Prop. D
									1.000	Global Terrorism

Weapon: Access to weapons. Crime: Violent crime. Pol. Inst: Political Instability. Facebook: Facebook Penetration. Terror Prop. D: Terror-related Property Damages.