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Strengthening an integrated risk management approach to counter terrorism: Incorporating security, game theory, and economic diversification

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Abstract

This paper looks at the in-depth investigation into improving risk management tactics against terrorism using a multifaceted strategy that incorporates security measures, game theory concepts, and economic diversity. The goal of the study is to provide a comprehensive and strong framework that tackles both immediate security issues and long-term viable counterterrorism strategies in Nigeria. To find vulnerabilities and anticipate future threats, the integration of security measures include improving intelligence collecting, international cooperation, and border restrictions. By incorporating game theory ideas, it is possible to analyse the tactical exchanges between security forces and terrorists, providing insights into how the opposition makes decisions and allowing for the deployment of preventive measures. The use of the two-person zero sum game, the prisoner's dilemma which depicts the Nash Equilibrium named after the Nobel Laureate economist John Nash were used in explaining how the various terrorists attack can be curbed. Different strategies were also applied so as to enable one understand how the terrorists think, possibly attack their victims and also how their network works. The study discovered that the terrorists attack mainly the communities that produce agricultural products in commercial quantities which affects the agricultural economic diversification. The study also highlights the importance of economic diversification as a key element in mitigating terrorism's underlying causes. By encouraging economic expansion and development in fragile and volatile areas, this study also promotes economic growth, discouraging the extremist ideologies and strengthening local communities in Nigeria as a whole.

Keywords: Terrorists Attacks; Agricultural Diversification; Two-Person Zero Sum; Game Theory; Security

1. Introduction

Popular axiom notes that 'an idle mind is the devil's workshop' and a mind that is not engaged productively, is a curse to her community at large. A country that is blessed with a lot of natural resources is now facing a resource curse. The fear of the incessant attack of the terrorists sect (Boko-Haram, Fulani-herdsmen, etc) on highly resourceful areas like Benue, Kogi, Enugu, Taraba, Borno, Adamawa to mention but a few calls for serious attention. Nigeria, in trying to diversify its economy cannot make any serious way forward if issues such as security are not looked into. Security here includes both protection of lives and properties of her citizens. How do we think that we can make progress when today, we hear bomb blast, tomorrow, Fulani-farmers' clash, next tomorrow, the adoption of Chibok girls, Dapchi school girls, and so on. How can our minds be sound to think out what we ought to do to remain the giant of Africa. In the past, precisely in the 60s, the agricultural sector was the major source of our earnings but such cannot be said of today's economy. The truth is that efforts have been made to diversify the economy so that the country can earn via the agricultural sector, entertainment, tourism etc but the main thrust of the matter is after all investments and efforts in

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trying to see that we get to the greener pasture, all we can see is that insecurity abounds and thus we are as good as nothing. Security is number one and very important and this is the reason for this paper. This paper tends to look at how the terrorists attack can be managed and curbed by applying the use of game theory. In this paper, efforts would be made so as to critically examine the incessant attacks of the terrorist group via the use of game theory on major parts of the country especially parts of the country that are highly resourceful and blessed. The Nigerian economy is trying to diversify her economy but the issue lies on the fact that no meaningful progress can be achieved if the issue of security is not properly addressed. In trying to diversify our economy, the attacks of the terrorist sect continue to instill fear on its victims and thus the belief that there would always be a reprisal attack and no one knows when keeps a highly economically mind idle.

Game theory, though a scientific discipline is used in decision making process and thus used also in conflict scenarios, the concept of game theory uses mathematical ideas and is applied not only to mathematics but to other disciplines such as; Economics, Sociology, psychology [1] and Statistics, to mention but a few. The goal in game theory is also the strategy applied in the course of the game, this strategy in question is also referred to as the optimal choices that exist between the players [1]. Terrorism can be defined as a well-conceived idea and plan to intimidate and instill fear on a group or groups of person so as to gain political will from them forcefully. According to the United States of America code of federal regulations, it saw terrorism as the act of using violence and force against persons and properties alike so as to intimidate them or compel the government, the population into promoting political or social objectives. The U.S. code still explained that the act of terrorism is a "premeditated" behaviour, that is to say that it is a well-planned and articulated act. The only deficiency in the above definition by the U.S. code was the exclusion of religion, the act is premeditated but not for only political or social objectives but for religious reasons also, according to [2]. Majority of the attacks carried out by the terrorist sect in Nigeria were mainly religious in Nature, evidences like the killing that took place in June 4th , 2016 of a 74 year old Madam Bridget Agbahime (a Christian) at Kano market by an angry mob in the presence of the husband over an alleged blasphemy (the angry mob said she insulted prophet Muhammed), [3]; the 2017 religious killings in disguise of farmers/Fulani herdsmen clash in Enugu state, precisely Nimbo. Other examples include the bombing of a church on Easter day by Islamic terrorist in Kaduna, that is April 8th, 2012, the attack claimed almost 38 lives, another church (Deeper Life Church shooting) attacked at Okene on the 7th August, 2012, 19 persons including the pastor were confirmed dead, [4]are points to show blue back that most terrorist attacks are religious based. The terrorist sect is against western education and anything that supports or is dividend of the western culture like Christianity, education etc.

It is pertinent to think that most of the attacks carried out are done on states that are highly resourceful, for instance, the current attack on Benue state, precisely the Agatu town is a verifiable fact. Benue state is the food basket of the Nation, and is known for its man power skill when it comes to large scale yam cultivation. Taraba is known for legume cultivation and tomatoes, Borno are known for dry fishes, tomatoes, onions, legumes etc.

2. Game theory and terrorism

Nash equilibrium is a non-cooperative game theory. The Nash equilibrium has become the prominent pillar of game theory [5]. In the Nash equilibrium, all players do the best they can though not at the expense of the other players in the game. If the bargain is good, the players involved gain. A typical example is the Federal government and the terrorist sect. the thrust behind the Nash equilibrium is its bargaining strategy. The characteristics of the Nash equilibrium are:

The players are rational (that is, each player knows how to quantify its desires)

The players are skilled bargainers and are also aware of the desires of each other equally

According to Samuel Bowles definition of Nash equilibrium in an interview as seen by [5]; "a situation in which everybody is doing the best they can, given what everybody else is doing". Following this definition, it can be seen that the Nigerian government is doing her best in trying to protect her citizen because other countries are also doing the same. This is then applicable to the issue of corruption that has refused to let go, since other African countries are doing same. Trying to diversify since others are doing so and finally doing the best in fighting terrorists. Now, let's link the above definition of Nash equilibrium as given by Bowles to [6] curbing assumptions, firstly, there are three basic assumptions of the Nigerian government as regards security following the areas(states) that have being attacked before-

2.1. Assumption 1

The need for defense especially that all targets have some elements and same probability of being attacked again

2.2. Assumption 2

The probability of attack is most likely on a highly resourceful and valuable area (state) than area (state) with low resource or value

2.3. Assumption 3

The probability of a successful attack increases as target area with more value increases curbing assumptions as seen by [6] are:

Defensive resources shouldn't be saved for the proverbial rainy day rather security officers should use every resource or all resources at her disposal

Attackers are always out to maximize the total expected loss while defenders are interested in minimizing.

Let's view how far the Nigerian government has tried in abiding by the assumptions above. There had been attacks on areas like the Agatu town of Benue state, the Nimbo town of Enugu state, the Dapchi and Chibok in Borno;- the attacks carried out in these areas are of different degree and magnitude, the attack on Benue state is higher than that on Enugu, because there had been incessant attacks melted on them almost on a daily basis and the attack is still on-going. Following assumption 1 and Major's curbing assumption 1, it can be deduced and seen that there is actually need for defence and once an area has been attacked before, it is now a target area.

Following assumption 2, it can be seen that areas with high resources and values have a high probability of being attacked, Benue, is known for its exploits as regards agriculture, they are highly resourceful and blessed with food, no wonder they are referred to as "the food basket" of the Nation. This is the most likely reason for the continuous attacks on them, so areas with low resource are less likely to be attacked. Following Major's assumption, it is glaring that the attacker wants the total expected loss, that is losses like buildings, lives, properties and so on should be felt. Persons displaced, people maimed for life. For instance, the attack on Bornu numbered 100 to 2000 between the year 2014 through 2016 and the attack on Benue is still on-going with killings such as that, which took place on the 24th of April, 2018 that involved the killings of 2 catholic priests with 17 of their parishioners at St Ignatius Catholic Church, Ayar Mbalom Village in Gwer East local government area of Benue state and several more killings around Nigeria. The defenders in Major's assumption 2 are the victims, her government; they are interested in minimizing the total expected loss especially their lives. In minimizing their total expected loss, resources should be shifted from areas of lower concentration and target to higher concentration. The use of additional resources should be put in place so as to protect the already protected areas rather than including and protecting areas not attacked before. One can link the above illustration to the last basic assumption that successful attack increases as highly resourceful area increases its value. With the incessant attacks on these areas, one can confidently say that these attacks cannot allow meaningful policies come into play, diversification of our economy into agricultural sector or any other sector would find it almost impossible.

Let's view the policies that can come into place when the issue of terrorism is been discussed and then use the prisoner's dilemma in explaining further:

Antiterrorism policies in government can be reactive or proactive in nature[7]

Policies that aggressively go after the terrorists and eliminate their resources and infrastructure are proactive in nature while policies that involve measures that protect or divert attacks and also limit the consequences of further attacks are otherwise known as reactive in nature. The Federal government of Nigeria in practical applies both policies. Firstly, let's view the incessant attacks of the Boko haram sect in Nigeria; the Federal government uses the soldiers to fight them aggressively and to eliminate their resources (proactive), that is, a preemptive strike. On the other hand, the Federal government gave amnesty to them so that they can divert their attacks (reactive). In a nutshell, do they (terrorists) actually divert their attacks or do we say they just postpone future attacks.

3. Terrorism and economic context

A generally and more acceptable definition of terrorism was given by [8], where they rightly pointed out that any violence (normal or extranormal) that is used to obtain political aim or objective and that is directed towards a large audience or group of persons which therefore brings about fear and intimidation is regarded as Terrorism, this, according to them is a premeditated move. Terrorism in any economy comes with associated costs, costs such as failure of human capital, insecurity, indecision and doubt in the activity of consumers and investors alike, it can be seen that

there are costs also as regards movements, example can be seen in areas or sectors that are branded with restrictions and thus productivity is distorted because of increased expenses incurred as a result of terrorist incessant attacks. From the definition given by [8], the major hit of every terrorist is to destroy lives and properties. This can be traced to the Biblical verse of John 10 versus 10 that the thief cometh only to steal, kill and destroy and that HE has come to give us life in abundance. Now, the question lies on what is left of such economy?, of course, the economy in question will suffer from failure of human capital and productivity, insecurity, decline in consumption and investment, heavy tax on her citizens, loss of lives and properties and thus, costs incurred in the repairs of destroyed properties.

The economy of every state besieged by terrorism cannot grow. There are four main areas according to [9] that can be affected by terrorism in any economy from an economic point of view and they are; (a) the capital stock of any country which includes both the physical and human aspects (b) the uncertainty level would rise as a result of terrorist attack (c) because of insecurity, there would be increased spending so as to maintain security, this is because resources used in promoting security would been drained from the productive sector of the economy (d) amongst the sectors of the economy that are affected, tourism is one of them. It should be clear to the common man that terrorism is a form of aggression which is wired to a known target or known targets and whose primary aims are to draw attention of everybody, bring about change in people's attitude and opinion. In other for the terrorist to achieve their goal(s), it is discovered that the terrorists would create an environment of fear and uncertainty.

Several authors have looked into ways of using economic instruments in reducing and fighting terrorism, authors such as ([10]; [11], [12]) were amongst such authors. [10], believed that if a government wants to fight a terrorist sect, they should embark on other positive alternatives other than using a deterrence policy. This is because a deterrence option brings about more costs for the government than benefits (results) but the positive alternatives could be by raising the terrorist's opportunity costs to terrorism, which is, offering some positive incentives or tips for a terrorist that gives up terrorism, another way; is by reintegrating terrorists into the society again. This could be achieved by breaking the spirit of isolation imposed on them by their terrorist leaders like breaking every hindrance to them not having interpersonal relationships with their families and friends and so on. In an article by [13] on 'how to fight terrorism' [13] still looked at other alternatives to deterrence; he identified three ways in which he used the indifference analysis, (a). is to enhance the cost of terrorism, (b).cutting down of benefits of terrorism and (c) is to enlarge the benefits from people that are not terrorists (non-terrorist). Deterrence, according to [11], [12], is a negative way or approach to fighting terrorism. They pointed out each that in fighting terrorism, the general costs involved is more than what one can imagine and thus it would degenerate to a 'negative sum game'. The problem in such degenerative interaction is that each one of the parties involved is worse off.

4. The Structure of the Game

4.1. Entry Game

Let's suppose that there are basically 2 players or groups in an economy, group A: a promising government, group B: an anti-government (here, we can say terrorists).

Group B in stage 1 can decide to come into play by disrupting the government; here, they are referred to as potential threat (otherwise called Entrant), if they decide not to enter, then the promising government can achieve all her promises including diversifying her economy. If they decide to enter, war breaks.

This is a typical form of an extensive game in which there exists:

n-players

α-order of the game

∃ (There exists) available choices λ to each player, where n players numbers 1 to nth player at each β turn of play.

∃ $a\ \theta$ Information well known to each n players at β turn of play but unknown to the other players. (Note that 3 and 4 are seen at each decisive node)

∀ ($for\ all$) Selected movements made, ∃ a corresponding payoffs ascribed to each n players.

∀ Movements incurred by nature, ∃ a corresponding probability decisions available.

4.2. The Prisoner's Dilemma

Let's suppose that there are 2 prisoners and these 2 prisoners are in separate cells and are held by the police. The information that both of them committed the crime is known but there is need for more evidence to convict them of the crime.

Strategy 1

They (police) offer to release them but by using each prisoner against the other. Thus, trying to use one to expose the other. There are two choices before the prisoners and those choices are:

To confess or own up to the crime

Not confess or not to own up to the crime

Now, if they both refuse to own up or confess, then, each of them would finally go to jail for just 1 month.

If they both own up by confessing, then, they both go to jail for 3 months.

If at the end of the day, either of them owns up or confesses, then, the one that own up, which would be addressed as player 1 goes un-hooked (free) while player 2 goes to jail for 6 months.

Thus, it is interesting to note that these act is a simultaneous scenario because the players in question makes their decision without the other player knowing. See the table below;

Table 1 Prisoner's dilemma table

Prisoner 1		
Prisoner 2	confess	Not confess
Confess	3, 3	6, 0
Not confess	0, 6	1, 1

Let's depict the Nigerian scenario as the prisoner's dilemma whereby one of the players are the government and player 2 as the terrorist radicals. From the point of view of the table 1, the government and terrorist radicals have a mutual understanding, then, we say there is mutual cooperation and thus that would make both of them well off. This is represented at the top left square (3, 3) of the table 1, thus, the implication is that at every λ choices available to the government and to the terrorist radicals, they both accept to play along at that acceptable β turn of play. There is no pay off whenever there is mutual understanding. At the right (6,0), the government gains nothing from the terrorist radicals. The terrorist radical defects from the government, from the rules and regulations governing any country, distorting the peace and order of people around him, because the terrorist defected, he gains more from his move (6), while the government gains nothing, i.e. the (0). At the point where (1,1) is represented on the table, it simply depicts that both the government and terrorists earn nothing because there is no mutual agreement/ understanding, here, the government defected while the terrorist defected, see the bottom part of the square, i.e. the right side. The government's defects can be viewed from the angle of the government using the force personnel to instill law and order in the country. The best part is (0,6) where the government earns 6 and the other earns (0), that is, the terrorist radicals becomes law abiding and constructive in their thinking. The government here put their heads together and makes sure that the terrorist radicals don't go back to their old self. They can achieve this by introducing amnesty or programs that teach them the right values.

4.3. Two-Person Zero Sum Games

This is a game with only 2 players, we can call them as usual to be the Nigerian government (Player A) and the terrorist (Player B). What makes it 2-person zero sum game is the fact that the gain of one player is equal to the other player's loss such that the total sum of the 2-person zero sum games can be depicted in a payoff matrix. A payoff matrix is a satisfaction i.e. numerical measure of satisfaction that the Nigerian government gets at the end of the game (play) which could be in terms of losses or in terms of games.

Let's suppose that the 2 players (A and B), thus, Nigerian government and terrorist radicals have m strategies and n strategies, strategies here simply mean "moves" available to them. The total number of possible moves simply would be the mth move multiplied by the nth move i.e. m*n. In the course of the 2 person zero sum game, each player knows the other player's move and also that of his, so, every move made by the terrorist radicals are known to the Nigerian government and vice versa. We would for convenience sake, refer to the Nigerian government as player A and they would always be the gainers while player B, the terrorist radicals, the losers. Thus, the payoff matrix below would depict the game between the Nigerian government and the terrorist sect.

Table 2 Payoff matrix

	Terrorist radicals Player B		
Player A Nigerian government A_1	B_1 B_2 -1 2		B_3 -3
A_2	6 5		-6

We are to depict the optimal strategies (optimal strategy is a move that puts any of the player at a most advantageous position irrespective of the other's moves) for the Nigerian government and the terrorist radicals. We are to also determine what the value of their game is, the value of the game is simply the expected losses or gains available in the game when the game in question is played several times.

From table 2, the positive figures represent gains to the Nigerian government or losses to the terrorist radicals while the negative figures are thus, losses to the Nigerian government and gains to the terrorist radicals. Let's suppose now that the Nigerian government (player A) wants to make the best (maximize) of his least gains (minimum) from the terrorist radicals (player B) knowing that the payoffs given in the above matrix are what the Nigerian government (player A) receives, thus, their concerns are on the figures that show the minimums row wise. Now, the Nigerian government can only receive one of all the values or moves available to them and the best moves or values happens when the government of Nigeria selects option A_1 with payoff -3 to the Nigerian government whenever the terrorist radicals selects option B_3. On the other hand, the terrorist radicals would also want to minimize their losses and would prefer that their losses to the Nigerian government is as minimal as possible, thus column wise, the minimal of the losses available to them is also -3, which is only possible when the Nigerian (player A) selects her move A_1 and the terrorist radicals selects her own move A_1 and the terrorist radicals selects her own move B_3.

Therefore, it can be said that the saddle point, which signifies the equilibrium, that is the point where the best strategies lies, i.e. optimal strategies are seen in the table below, thus, the enclosed boxes and circled quantities show the saddle point

Table 3 Saddle Point Table

	Terrorist Radicals Player B				
Player A Nigerian Government A_1	B_1 -1	B_2 2	B_3	-3	Row Minimum -3*
Nigerian Government A_2	6	5	-6		-6
Column Maximum	6	5			-3=minimax

From the table above, the figure -3 in A_1 row wise and column B_3 is -3, thus it is the minimum of the maxima (column wise) and the maximum of the minima (row wise), which is the saddle point and the amount via the payoff is -3, which is for the Nigerian government (row wise) is the value of the game. This game isn't a fair one because the value of the game is not equal to zero. Recall that whenever there is an equilibrium, i.e. maximin value = minimax value, this point is called a saddle point.

In reality, what does the 2 person zero sum game mean, it implies that at -3, the Nigerian government actually don't seem to understand what is at stake, there is insecurity, an 'I don't care syndrome' in the system, lets use the abduction

of Chibok school girls as an illustration to further buttress our points. The terrorist sect abducted well over 100 school girls from a secondary school and the Nigerian government had series of negotiations with the terrorist sect, for more than 365 days, they were still on it, each player on its own best move, it got to the point where the Nigerian government was no longer showing interest in getting the girls released. The terrorist sect kept their attacks on high voltage with associated bombings and kept ordering the release of arrested terrorists, the game at that point was in favour of the terrorist sect, the policies laid down by the Nigerian government wasn't a good move and at the end, the game turns out to be unfair because in the process of the release of the Chibok girls, another set of school girls were abducted, released but still in hostage is Miss Leah Shaibu, who refused to denounce Christ Jesus.

5. Conclusion

In managing risks of terrorist attacks, it can be seen that the Nigerian government needs to understand how the terrorist radicals operate, so that they can always use their best strategies in outsmarting the terrorist radicals. The Nigerian government should also review or put policies that would look like the Prisoner's dilemma case. Whenever those radicals are arrested, they should be totally excluded from the larger society, they should be monitored and checkmated so as to see who visits them, they shouldn't be given privacy, thus, efforts should be geared towards correcting their ideologies and the right values imbied in them. They should be made to understand that Nigeria is ours and theirs alike and anyone advising them to kill, definitely doesn't have their best interest at heart. They should also understand that a divided country cannot stand and people should be allowed to freely participate in whatever religion they want to practice. They should be made to understand also that no religion is superior to the other. The prayers of the researcher is that God should have mercy on Nigeria, amen.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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