



**AN UNDERSTUDY OF THE POLITICAL COMPETITION BETWEEN THE MAJOR POLITICAL PARTIES IN 2023 GOVERNORSHIP ELECTION IN DELTA STATE, NIGERIA USING NASH EQUILIBRIUM**

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**Cite this article:**

Eduiyovwiri, L. E., Unaegbu, E. N., Nwanunu, P., Ofodile, C. H. (2024), An Understudy of the Political Competition between the Major Political Parties in the 2023 Governorship Election in Delta State, Nigeria Using Nash Equilibrium. African Journal of Mathematics and Statistics Studies 7(4), 374-383. DOI: 10.52589/AJMSS-HIXH7UCJ

**Manuscript History**

Received: 15 Oct 2024

Accepted: 4 Dec 2024

Published: 23 Dec 2024

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**ABSTRACT:** *This paper discussed Nash Equilibrium relative to political competition in most political parties in Delta State. Emphasis was placed on the understudy of the political competition between major political parties in 2023 Governorship Elections in Delta State using Nash Equilibrium. This work uses the Prisoner's Dilemma-Non-Cooperative approach of games theory to extensively examine the political competition in parties using Nash Equilibrium. The importance of a free, credible and transparent electioneering process devoid of violence cannot be over-emphasize as it guarantee smooth transition from one democratic dispensation to another.*

*Data collection that aided this research work sourced through interview and from the website of Independent Electoral Commission (INEC), the electoral arbiter tasked with the responsibility conducting elections into various positions in Nigeria. This paper was developed to understudy the Political Competition between Major Political Parties in 2023 Governorship Election in Delta State Using Nash Equilibrium.*

**KEYWORDS:** Non-cooperative games, Pure strategy, Nash Equilibrium, Electoral Competitions, Prisoners Dilemma.



## INTRODUCTION

An election is an act of choosing or selecting candidates who will represent the people of a country in the parliament and in other positions in the government. Election is also said to be a contest between competing political parties or groups for government power [1].

The formal process of selecting a person for public office or of accepting or rejecting a political proposition by voting. It is important to distinguish between the form and the substance of elections. In some cases, electoral form are present but the substance of an election is missing, as when voters do not have a free and genuine choice between at least two alternatives [8].

Electoral systems determine “the rules according to which the voters may express their political preferences and according to which it is possible to convert votes into parliamentary seats or in government post”. Electoral systems depends on the socio-cultural, historical, geographic, economic and political conditions of a given state [16]. On the other hand, [3] said that they just constitute one method determining the nature of the prevailing political systems, including its inclusively towards “groups that had previously been locked in conflict”.

Games on the other hand is concerned with interactive decision making involving more than one person. Outcomes are determined by whatever combination of actions resulting from the independent choice of several individual decision makers.

The models of games theory are highly abstract representations of classes of real-life situations. Their abstractness allows them to be used to study a wide range of phenomena. For example, the theory of Nash equilibrium has been used to study oligopolistic and political competition.

Games theory uses mathematics to express its ideas formally. However, most game theoretical ideas are not inherently mathematical though a mathematical formation makes it easy to define concepts precisely, to verify the consistency of ideas, and to explore the implication of assumptions [17]. The Modern Mathematical approach of game theory is generally attributed to [9] and [10]. A question of priority was raised by Frechet suggestion that several “Zur Theories der Gesellascha Fisspielle” by [2] in the early 20’s really made grounds for game theory. The theories were then published with comments by Frechet and [9]. A game is defined as a competitive situation among  $n$  persons or groups, called players that is conducted under a prescribed set of rules with known pay offs. The rules define the elementary activities, or moves but each player knows the moves available to the other players. The final outcomes depends on the combination of strategies by the players [4].

Nash Equilibrium on the other hand is a component of game theory that asserts that a player will continue with their chosen strategy while knowing their opponent’s strategy as they have no incentive to change course. The Nash Equilibrium can be applied in a variety of real-life situations to determine what the best pay off in a scenario would be based on your decisions as well as knowledge of opponent’s decisions. The Nash Equilibrium is a decision-making theorem with game theory that states a player has the best deviating from their initial strategy.

The Prisoner’s Dilemma is a common game theory example and one that adequately showcases the effect of the Nash Equilibrium.



## RELATED WORKS

In 1950, [14] an American Mathematician came up with the Nash theory which stated ‘a situation in which a player will continue with their chosen strategy, having no incentive to deviate from it, after taking into consideration the opponents strategy (GAMES THEORY – NASH EQUILIBRIUM AND ITS APPLICATION 2015b). One of the greatest development in social was the creation of non-cooperative game theory by [11].

Evolutionary game theory is used to study players who adapt their strategies over a period of time to suit rules that need not be rational or forward-looking [15] in “Evolutionary game theory”. A Renaissance Games. In general, the development of strategies over time based on such rules follows a Markov Chain Model with various conditions as the present strategy profile or how the game has been played recently.

Given the set of candidates  $k = (1, \dots, k)$ , [13] describes each voter submits a ballot, which is a vector of  $k$  components. An electoral system is then defined by the set of possible ballots that each voter can submit and by the election rule that, given the ballots cast, selects the winner from the set  $k$ . Hence, with the plurality rule, every voter has the same strategy space, and each pure strategy is a vector. With plurality, the election rule selects the candidate of ties, to preserve the symmetry of the voters, we allow an equal probability lottery among the winners. In the context of deterministic population size voters’ strategic behaviour in a pure proportional system with multiple parties has been analyzed [6]. They show that, as the number of voters grow to infinity, in equilibrium basically voters split in two and only the two extremist parties’ takes votes. The policy outcome that is precisely the “cut point outcome”, that is, the outcome that is implemented when all voters whose bliss points are on its left vote for the leftmost party and all the voters whose bliss points are on its right vote for the right-most one. This result has been applied to other electoral systems exhibiting positive degrees of power sharing [12].

Voting and elections play an important part in the functioning of the human societies, and hold a lot of promise as a tool for preference aggregation in multiagent systems [7]. Costly voting is also studied by [18]. However, his focus is on comparing the social welfare under voluntary participation and that under compulsory participation. In addition, he does not assume that the voting cost are necessarily small, and only considers the case of two candidates.

## MATERIAL AND METHOD

This paper uses the Prisoner’s Dilemma – a common situation analyzed in game theory that can employ the Nash equilibrium. In this game, two criminals are arrested and each is held in solitary confinement with no means of communicating with the other. The prosecutors do not have the evidence to convict the pair, so they offer each prisoner the opportunity to either betray the other by testifying that the other committed the crime or cooperate by remaining silent.

If both prisoners betray each other, each serves five years in prison. If A betrays B but B remains silent, prisoner A is set free and prisoner B serves 10 years in prison, or vice versa. If each remains silent, then each serves just one year in prison. From the above, the Nash equilibrium is for both players to betray each other. Even though mutual cooperation leads to a better outcome if one prisoner chooses mutual cooperation and the other does not, one prisoner’s outcome is worse.



Data collection that aided this paper was gotten from the result of the 2023 Governorship Election as released by the Independent Electoral Commission (INEC) and from journals, texts, Google scholar etc.

Before analysis and conclusion, the data set was checked by transforming variable since it is a decision-making process.

## TWO-PERSON ZERO SUM AND NON-ZERO-SUM GAMES

In zero-sum games the total benefit to all players in the game, for every combination of strategies, always adds to zero (or more informally put, a player benefits only at the expense of others). Many games studied by game theorists (including the Prisoner's Dilemma) are non-zero-sum games, because some outcomes have not results or less than zero. Informally, in non-zero-sum games, a gain by one player does not necessarily correspond with a loss of another.

**Table 1: Matrix of Pay-offs**

Player I/Player II	$Y_1$	$Y_2$	...	$Y_n$
$X_1$	$a_{11}$	$a_{12}$	...	$a_{1n}$
$X_2$	$a_{21}$	$a_{22}$	...	$a_{2n}$
$X_n$	$a_{n1}$	$a_{n2}$	...	$a_{nn}$

Table 1 gives the amount  $a_{ij}$  won by player I from player II. If player I plays his  $i$ th pure strategy,  $X_i$  then player II plays his  $j$ th pure strategy  $Y_j$ . Thus, the matrix of pay-offs (game) of player I are the positive entries while the matrix of the pay-offs (game) of player II are the negative entries of the above matrix.

This paper will examine the result of the last 2023 governorship election held in Nigeria using Delta State as a case study. This will afford the researcher the opportunity to test the popularity of all the aspirants and the strategies employed to emerge victorious in results from sample location.

It examined how the political actors applied the strategies of grassroots campaign supporters' network and use of effective Media dissemination as the best tools to winning an election.

Three tables were examined. Table 2 showing the result of the last 2023 governorship election in Delta State released by the Independent National Electoral Commission (INEC), Table 3, shows the results of strategies employed in Effective Media dissemination and grassroots Campaign Network and Table 4 show the pay-off Matrix from the sample location. Next, the algebra of the game obtained and the conclusion obtained by comparison.

### The Algebra of the Game

**Table 2: Results from the 2023 Governorship Election Released by INEC**

	<b>Local Government</b>	<b>APC</b>	<b>LP</b>	<b>PDP</b>
1.	Aniocha North	4386	1883	8938
2.	Aniocha South	4622	5107	10,032
3.	Bomadi	4728	100	12,340



4.	Burutu	11,736	-	12,641
5.	Ethiope East	11,600	530	13,030
6.	Ethiope West	67548	304	7065
7.	Ika North-East	4733	1990	26,760
8.	Ika South	6790	4495	15,283
9.	Isoko South	15,954	-	19,963
10.	Isoko North	10,811	894	15,899
11.	Ndakwa East	9044	251	10,146
12.	Ndakwa West	10,252	935	15,539
13.	Okpe	8679	100	12,340
14.	Oshimili-North	5329	2983	35,966
15.	Oshimili-South	4763	10,148	23,149
16.	Patani	4743	85	6069
17.	Udu	13,154	1886	9,746
18.	Ughelli South	15,620	-	15,513
19.	Ughelli North	34,955	1438	15,198
20.	Ukwuani	7591	791	14,640
21.	Uvwie	12,389	6340	9776
22.	Warri South	11,569	3743	15,299
23.	Warri South West	3,770	140	7114
24.	Warri North	4,165	-	10,367
25.	Sapele	12,090	1458	15,217
Results		24,231	45,601	358,030

**Table 3: Results show the strategies of Effective Media dissemination and grassroots Campaign Network**

PDP	APC		
		B <sub>1</sub>	B <sub>2</sub>
	A <sub>1</sub>	4	2
	A <sub>2</sub>	1	3
	A <sub>3</sub>	5	3

**Table 4: Pay-off Matrix**

PDP	APC				
		B <sub>1</sub>	B <sub>2</sub>	Row minima	Maximin
	A <sub>1</sub>	4	2	2	
	A <sub>2</sub>	1	3	1	3
	A <sub>3</sub>	5	3	3	
	Column Maxima	5	3		
Minimax		3			



Saddle point  $\rightarrow$  Minimax = Maximin

Taking inequalities across column, we have

$$4x_1 + x_2 + 5x_3 \leq g$$

$$2x_1 + 3x_2 + 3x_3 \leq g$$

Recall that  $x_1 + x_2 = 1$  (Expectation of two person non-zero-sum games)

Taking inequalities across row, we have;

$$4y_1 + 2y_2 \geq g$$

$$y_1 + 3y_2 \geq g$$

$$5y_1 + 3y_2 \geq g$$

But  $y_1 + y_2 = 1$  (Expectation of two person non-zero-sum games)

$$y_2 = 1 - y_1$$

$$\rightarrow 4y_1 + 2y_2 \geq g$$

$$4y_1 + 2(1 - y_1) \geq g$$

$$4y_1 + 2 - 2y_1 \geq g$$

$$4y_1 - 2y_1 + 2 \geq g$$

$$2y_1 + 2 \geq g$$

$$\rightarrow y_1 + 3y_2 \geq g$$

$$y_1 + 3(1 - y_1) \geq g$$

$$y_1 + 3 - 3y_1 \geq g$$

$$3 + y_1 - 3y_1 \geq g$$

$$3 - 2y_1 \geq g$$

$$\rightarrow 5y_1 + 3y_2 \geq g$$

$$5y_1 + 3(1 - y_1) \geq g$$

$$5y_1 + 3 - 3y_1 \geq g$$

$$5y_1 - 3y_1 + 3 \geq g$$

$$2y_1 + 3 \geq g$$

$A_1$

If  $y_1 = 0$ ,  $g = 2$



$$g = 0, y_1 = -2/2 = -1$$

A<sub>2</sub>

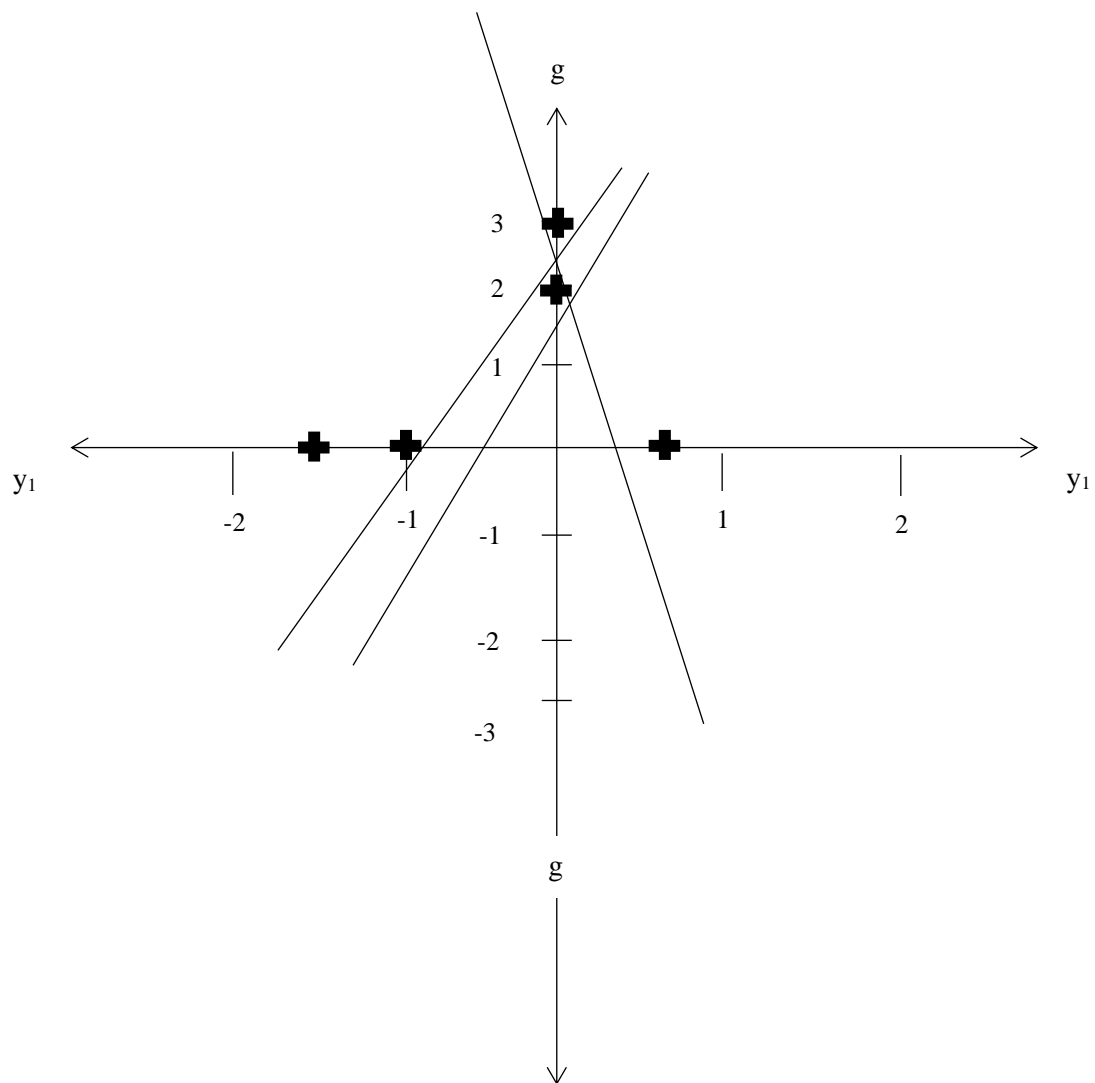
$$\text{If } y_1 = 0, g = 3$$

$$g = 0, y_1 = 2/3 = 0.6$$

A<sub>3</sub>

$$\text{If } y_1 = 0, g = 3$$

$$g = 0, y_1 = -3/2 = -1.5$$



Graph 1: showing the results of the two major political parties in 2023 governorship election



$$4x_1 + x_2 + 5x_3 \leq g$$

$$2x_1 + 3x_2 + 3x_3 \leq g$$

Let  $g = 3$  and  $x_1 = 0$

$$x_2 + 5x_3 = 3 \dots\dots\dots (1) \times 3$$

$$3x_2 + 3x_3 = 3 \dots\dots\dots (2) \times 1$$

$$3x_2 + 15x_3 = 9 \dots\dots\dots (3)$$

$$3x_2 + 3x_3 = 3 \dots\dots\dots (4)$$

$$(3) - (4): 12x_3 = 6$$

$$x_3 = \frac{6}{12}$$

$$x_3 = \frac{1}{2}$$

Substitute  $x_3 = \frac{1}{2}$  into (4)

$$3x_2 + 3 \times \frac{1}{2} = 3$$

$$3x_2 + \frac{3}{2} = 3$$

$$3x_2 = 3 - \frac{3}{2}$$

$$= 6 - \frac{3}{2}$$

$$= \frac{3}{2}$$

$$3x_2 = \frac{3}{2}$$

$$x_2 = \frac{3}{2} \times \frac{1}{3}$$

$$x_2 = \frac{1}{2}$$

## DISCUSSION OF RESULTS

Using table 4, notice that the pay-off matrix coincidentally possesses a saddle point at  $g = 3$  (minimax = maximin). PDP will try to minimize his greatest loss while trying to emerge winner in the election. It can only do this by selecting from strategy  $A_2$  and  $A_3$ . The biggest loss that can befall PDP if it chooses  $A_2$  is 1, which occurs when APC chooses  $B_1$ , implying a increase in effective media and grassroot campaign network. If PDP, choses  $A_3$ , the greatest loss will be 3, which occurs when APC chooses  $B_2$ , implying an increase in effective media and grassroot campaign network.

In order to minimize losses during election, PDP will choose strategy  $A_3$ , thus limiting his greatest loss to 3, which is the saddle point.





Using mixture of strategies but playing strategies  $A_2$  (Effective Media dissemination),  $\frac{1}{2}$ th of the time and  $A_3$  (grassroot campaign network),  $\frac{1}{2}$ th of the time, we obtain the best combination of balanced strategy in which PDP was able to emerge winner in 2023 Governorship election in Delta State.

## CONCLUSION

Although there is a geometric increase in grassroot campaign network and media dissemination from Table 4, which account for the landslide victory of PDP in the last governorship election in Delta State.

Notice that the strategies of Effective Media Dissemination and Grassroot campaign network which are pivotal to the success to an election are equilibrium (i.e.  $A_2 = A_3 = \frac{1}{2}$ th) which gave PDP an edge over APC to emerge winner in 2023 Governorship election.

Finally, based on the findings and circumstantial evidence provided from prior conclusion, we conclude that employing effective media dissemination and grassroot campaign network are the best strategies of ensuring victory in an election.

This research contributes to knowledge in the following areas of study:

1. It exposes political parties to the modern strategies in electioneering processes in an attempt to gain victory during election.
2. It enables firms adopt business strategies in a competitive environment so as to obtain more profit and to get a larger share of the market.
3. It assists government to formulate policies that will be beneficial to the masses.

Based on the findings, we conclude that political parties should always update themselves with modern strategies continuously in order to ensure victory in any election.

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