
MATHEMATICAL MODELING OF ELECTION RESULT OF A TWO-PARTY SYSTEM IN A DEMOCRATIC SETUP

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ABSTRACT

Nigeria has been practicing multi-party system of politics long ago, and the contestants are too numerous. This system gives way for rigging and political lobbying. However, it has been discovered that two-party system is the best political system that can give good and accurate election results in Nigeria, as observed in the annulled June 12 election of 1993. In this paper, we develop a model that can predict the election result between any two political parties in any democratic setup. We also illustrate the practical implementation of the model.

Keywords: Election, Two-Party System, Democracy, Impeachment, Tribunals, Election-Rigging.

INTRODUCTION

According to the contribution of Benjamin Ginsberg as found in the Microsoft Encarta 2007, Election is the procedure that allows members of an organization or community to choose representatives who will hold positions of authority within it. The most important elections select the leaders of local, state, and national governments. The chance to decide who will govern at these levels serves as an opportunity for the public to make choices about the policies, programmes, and future directions of government action. At the same time, elections promote accountability. The threat of defeat at the polls exerts pressure on those in power to conduct themselves in a responsible manner and take account of popular interests and wishes when they make their decisions. In general, proportional representation works to the advantage of smaller or weaker groups in society, while plurality and majority rules tend to help larger and more powerful forces. Proportional representation systems boost participation by increasing the value of a vote to smaller or more marginal portions of a national population.

In the developing countries of the world, the unwise seem to be ruling the wise, and injustice seem to be prevailing over justice. Impeachment saga everywhere and friction between political god-fathers and god-sons. In the resent, election-petition tribunals have had hectic days, declaring some election results null and void, while some results are upheld, and other petitions thrown out. All these happen because the contestants are numerous. Hence, it could be deduced that two-party system is the best system in any democratic setup, as it is the only system that reduce to the minimum, political frictions.

In the world today, politics has become very controversial because of multy-party system. This is so because almost all human endeavours involve some measure of political game, and hence, the world has been politicized.

This apart, people see politicking as the easiest way of accumulating wealth, rather than a way of contributing one's quota to the well-being of the entire populace when in office.

Making effort to proffer solution for this problem, this paper seeks to develop model for predicting election results for any two political parties in any democratic setup.

MODEL FORMULATION

Suppose an X political party with X_0 population is to contest an election with a Y political party with population Y_0 . Also suppose the Y party however has political strategy or gimmick which makes each Y-member α times efficient as an X-member, we formulate the model for the outcome of the resulting election as follows:

Present population of party X is X_0 .

Let number of members of party X at a time t be $X(t)$

And number of members of party Y at a time t be $Y(t)$
(Where $X(t)$ and $Y(t)$ are continuous functions)

If Δx denote the number of X-members decamping to party Y in a time interval Δt ,

and Δy denote the number of Y-members decamping to party Y in a time interval Δt ,

Then, $\Delta x = \lambda Y(t) \Delta t$, $\lambda < 0$. (λ being number of members of X won over by each member of Y.)

Similarly, $\Delta y = \beta X(t) \Delta t$, $\beta < 0$. (β being number of members of Y won over by each member of X.)

As $t \rightarrow 0$, we have

$$\frac{dx}{dt} = \lambda Y(t) \quad (1)$$

$$\frac{dy}{dt} = \beta X(t) \quad (2)$$

This set of equations form a couple system.

Hence, we cannot integrate either of the equations separately.

$$\begin{aligned} \therefore \frac{dY}{dX} &= \frac{\frac{dY}{dt}}{\frac{dX}{dt}} = \frac{\beta X(t)}{\lambda Y(t)} \\ \Rightarrow \frac{dY}{dX} &= \frac{\beta X(t)}{\lambda Y(t)} \end{aligned}$$

This leads to separable equation

$$YdY = \frac{\beta}{\lambda} XdX$$

Integrating both sides, we have

$$\frac{Y^2}{2} = \frac{\beta}{\lambda} \frac{X^2}{2} + C \quad (*)$$

Where C is the constant of integration

But each member of Y-party is α times as efficient as each member of X-party.

$$\text{i. e. } \frac{\lambda}{\beta} = \alpha$$

$$\Rightarrow \lambda = \alpha\beta$$

Hence, equation (*) becomes

$$\frac{Y^2}{2} = \frac{\beta}{\alpha\beta} \frac{X^2}{2} + C$$

$$\Rightarrow \frac{1}{2} Y^2 = \frac{X^2}{2\alpha} + C$$

This is election result model.

MODEL ILLUSTRATION

A party X with population 12000 is about to contest an election against a party Y with population 600 members. Five time election records however show that for every 2 votes cast for X, 3 votes were cast for Y.

Solution:

Using the model above,

$$\frac{1}{2} Y^2 = \frac{X^2}{2\alpha} + C.$$

At time t_0 , $Y_0 = 600$, $X_0 = 12000$

But records show that Y is 1.5 times as efficient as X.

This $\Rightarrow \alpha = 1.5$

We note that Y_0 = initial population of Y,

And that X_0 = initial population of X.

Hence, from the model $\frac{1}{2} Y^2 = \frac{X^2}{2\alpha} + C$,

$$\text{We have } \frac{1}{2} Y^2 = \frac{X^2}{2(1.5)} + C = \frac{X^2}{3} + C$$

To determine the value of C,

we substitute $Y = 600$ and $X = 12000$ in the equation above to get

$$C = -47820000$$

Hence the election equation becomes

$$3Y^2 = 2X^2 - 286920000$$

If party X wins, then $Y = 0$

$$\text{Hence, } 2X^2 = 286920000$$

$$\Rightarrow X = \sqrt{143460000}$$

So, for party X to win, $X =$

If party Y wins, then $X = 0$

$$\text{Hence, } 3Y^2 = -286920000$$

This is not real.

Hence, Y needs $\frac{1}{1.5}$ of party X to win.

So, in this case, X has won the election.

RECOMMENDATION

This model is highly recommended to predict the winning party in any two-party system in any democratic setup.

LIMITATION

There is usually a limitation to any physical model. Hence, this model fails if:

- (i) the election is not properly conducted.
- (ii) rigging is allowed (i.e. election is not free and fair).
- (iii) the efficiency (α) of one party over the other is not appropriately measured.

CONCLUSION

If this model is well implemented, it will enable us to predict the winner of any election of two-party system with accuracy.

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