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# Computational Analysis of Financial Losses among Competing Stock Exchange Investors Based on Trading Period Length

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**Abstract**
The stock exchange serves as a cornerstone of modern financial systems which operates as a highly competitive platform that facilitates liquidity for investors. This paper presents a computational analysis of the Nigerian stock exchange, delving into the complex dynamics that govern its behavioural system with a focus on the investigation of the influence of the decreasing variation of the trading periods on the dividends accrued by competing investors within the stock exchange. To unravel these intricate dynamics, the study employed a mathematical framework based on a system of first-order nonlinear ordinary differential equations (ODEs) which is both continuous and partially differentiable in achieving objective. A key methodological approach utilized in this research was the ODE 45 numerical method, which is a highly efficient computational scheme, to quantify the dividends of stock exchange investors who experiencing a decreasing variation in the duration of their trading periods. One of the key findings of this study is the revelation that a decrease in the length of the trading period within a competitive market environment leads to a significant reduction in the dividends of the investors. The result of this investigation offers profound insights for investors, financial analysts, and policymakers who must navigate the complexities of this financial ecosystem. By advancing the understanding of how variation of trading period impacts dividend returns on investments, this study stands to inform more strategic decision-making and policy formulation in the context of the Nigerian stock exchange.

**Keywords:** Computational Analysis, Financial Loss, Stock Exchange Investors, Competing, Trading Period

## Introduction

The stock exchange is an example of a dynamical system because of its time evolution (Nu-ue, 2022). The stock exchange market is a dynamic and complex environment which serves as a vital platform where investors engage in buying and selling securities to generate profits whereas dividends, as regular payments made by companies to their shareholders, represent a crucial component of investors' financial returns. The frequency and timing of trading activities within a given period can significantly influence the dividends received by investors in competing stock exchanges. Studies have shown that trading period is one of the determinants of dividend outcomes, and that could subsequently affect investment strategies. For instance, Smith and Johnson (2018) conducted a study using a regression model to analyze the impact of trading period on dividend yields. Their research found that trading periods influenced the dividend yields received by investors, leading to variations in overall returns. The study emphasized the importance of considering trading frequency in investment decision-making.

Bekaert et al. (2011) in his study on price volatility measured the extent of price fluctuations in the stock market. In his work, he posited that price volatility serves as another mediating variable that can be influenced by trading period variation and may impact dividend outcomes. Furthermore, Brown and Lee (2021) conducted a comparative study analyzing the impact of trading frequency on dividend returns. Their study highlighted the need for a comprehensive understanding of the relationship between trading periods and dividend returns to optimize investment strategies. Among the various factors that influence the profitability of investments in a stock exchange, dividend plays a crucial role hence it represents the distribution of a company's earnings to its shareholders, providing them with a regular income stream. The dividends received by investors within the stock exchange are however influenced by several factors, including the length of trading period.

Trading period variation represents the variation in the frequency and timing of trading activities within the competing stock exchange markets in Nigeria. The impact of trading period variation on dividend outcomes for competing stock exchange investors in Nigeria remains an important and understudied area of research. Understanding the impact of trading period variation on dividends is important for investors and financial analysts operating in the stock exchange.

The frequency and timing of trading activities within a specific period can significantly impact the dividends received by competing stock exchange investors (Huang & Wu, 2013). For example, Li and Zhang (2018) utilized computational analysis techniques to simulate different trading period scenarios and found that shorter trading periods lead to increased volatility in dividend returns. Their research suggests that longer trading periods may provide more stable and predictable dividend income for investors. In another study, Wang and Chen (2019) conducted a computational analysis of trading period variations and observed that shorter trading periods can lead to higher dividends in certain situations. Their findings suggest that active investors who take advantage of short-term trading opportunities may benefit from shorter trading periods.

However, the relationship between trading period variation and dividend outcomes remains a complex and dynamic area of study. Traditional analytical methods may not adequately capture the intricate interplay between trading periods and dividend returns. Therefore, there is a need for computational analysis technique that can process large datasets, simulate different trading scenarios, and provide insights into the impact of trading period variation on dividends for competing stock exchange investors (Huang & Wang, 2020; Soltani, 2019). In all, the impact of trading period variation on dividends for competing stock exchange investors is a significant area of research as previous studies have emphasized the influence of trading frequency on dividend outcomes and highlighted the need for comprehensive computational analysis to optimize investment strategies. By leveraging computational analysis techniques, investors can gain valuable insights into the relationship between trading period variation and dividend returns, enabling informed decision-making in the competing stock exchange domain. It is against this background that this study aims to compute financial loss of competing stock exchange investors using length of trading period, specifically to quantify the effect of a decreasing variation of the length of trading period on the dividends of stock exchange investors using ODE 45 numerical method.

**Formulation of the Mathematical Model Equations**

Quantifying the impact of a decreasing variation of the length of trading period on the dividends of two competing populations of stock exchange investors depends on the application of a mathematical model consisting of nonlinear first order ordinary differential equations. Following Lotka (1956), Nafo and EKaka-a (2018), and Nu-ue (2022), a deterministic dynamical system of first order nonlinear ordinary differential equations which are continuous and partially differentiable with the following mathematical structure defined below has been considered in this study.

$$\frac{dD_1(t)}{dt} = D_1(t)[\alpha_1 - \beta_1 D_1(t) - r_{12} D_2(t)] \quad (1)$$

$$\frac{dD_2(t)}{dt} = D_2(t)[\alpha_2 - \beta_2 D_2(t) - r_{21} D_1(t)] \quad (2)$$

$D_1(0) = D_{10} > 0$and $D_2(0) = D_{20} > 0$

From the formulated system of differential equations above, the model variables and parameters are defined below.

$D_1(t)$ is the dependent variable which represents the dividend of the first population of investors at trading time t.

$D_2(t)$ is the dependent variable which represents the dividendof the second population of investors at trading time t.

t is the independent variable which represents the trading time otherwise called the length of trading period (LTP) in the unit of hours.

$\alpha_1$ measures the intrinsic growth rate of the dividend of the first population of investors.

$\alpha_2$ measures the intrinsic growth rate of the dividend of the second population of investors.

$\beta_1$ measures the intra-competition coefficient which is the first inhibiting factor on the growth of the dividend of the first population of investors due to self-interaction.


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$\beta_2$ measures the intra-competition coefficient which is the first inhibiting factor on the growth of the dividend of the second population of investors due to self-interaction.

$r_{12}$ measures the inter-competition coefficient which is the second inhibiting factor on the growth of the dividend of the first population of investors due to the interaction with the second population of investors.

$r_{21}$ measures the inter-competition coefficient which is the second inhibiting factor on the growth of the dividend of the second population of investors due to the interaction with the first population of investors.

$D_1(0)$ and $D_2(0)$are the initial conditions (investments) of the first and second populations of investors, respectively.

For the purpose of this study, the following model parameter values have been considered for simulation (Osu *et al.*, 2009).

$\alpha_1 =$ 0.037, $\beta_1 =$ 0.0014, $r_{12} =$ 0.0005,
$\alpha_2 =$ 0.03, $\beta_2 =$ 0.0010, $r_{21} =$ 0.0004,
$D_1(0) = 1.30$, $D_2(0) = 1.50$

**Materials and Methods**

For the purpose of analysis, when all the model parameter values and the initial investments are fixed, the dividends of the two populations of stock exchange investors are defined by the set D(t), whereas when only the length of trading period is varied and all other model parameter values fixed, the dividends of the two populations of stock exchange investors are defined by the set $D_m(t)$. Hence, $D(t) = \{D_1(t),\ D_2(t)\}$ and $D_m(t) = \{\ D_{1m}(t),\ D_{2m}(t)\}$. Following this, when the simulated data sets of D(t) are each dominantly bigger than the simulated data sets of $D_m(t)$, then a depletion of their dividends has occurred and the percentage depleted can be quantified using the formula below.

$$\text{Depletion (\%)} = \frac{[D(t) - D_m(t)](100)}{D(t)}$$

All numerical simulations and computations were carried out using MATLAB software.

**Results**

The numerical results obtained are presented below.

**Table 1: Shows the computed impact of a ten percent (10%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method**.

| LTP (t in hours) | $LTP_m$ (t in hours) | D1(t) | $D1_m(t)$ | Effect One (%) | D2(t) | $D2_m(t)$ | Effect Two (%) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| 87 | 78.3 | 12.7642 | 11.1759 | 12.45 | 10.6330 | 9.3121 | 12.42 |
| 174 | 156.6 | 19.2508 | 18.9751 | 1.43 | 19.6995 | 18.6565 | 5.30 |
| 261 | 234.9 | 18.8051 | 18.8059 | 0.004 | 21.9693 | 21.6036 | 1.66 |
| 348 | 313.2 | 18.4783 | 18.4965 | **0.10** | 22.4885 | 22.4615 | 0.12 |
| 435 | 391.5 | 18.3753 | 18.3646 | 0.06 | 22.6209 | 22.6295 | **0.04** |
| 522 | 469.8 | 18.3478 | 18.3856 | **0.21** | 22.6565 | 22.6039 | 0.23 |
| 609 | 548.1 | 18.3323 | 18.4205 | **0.48** | 22.6591 | 22.5606 | 0.43 |
| 696 | 626.4 | 18.3277 | 18.4776 | **0.82** | 22.6601 | 22.4867 | 0.77 |
| 783 | 704.7 | 18.3400 | 18.5693 | **1.25** | 22.6717 | 22.3594 | 1.38 |
| 870 | 783.0 | 18.3363 | 18.7114 | **2.05** | 22.6690 | 22.1369 | 2.35 |
| 957 | 861.3 | 18.3345 | 18.9176 | **3.18** | 22.6676 | 21.7434 | 4.08 |
| 1044 | 939.6 | 18.3363 | 19.1607 | **4.51** | 22.6692 | 21.0271 | 7.24 |
| 1131 | 1017.9 | 18.3324 | 19.2579 | **5.05** | 22.6659 | 19.6994 | 13.09 |


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**Table 2: Shows the computed impact of a twenty percent (20%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method.**

| LTP (t in hours) | $LTP_m$ (t in hours) | D1(t) | $D1_m$(t) | Effect One (%) | D2(t) | $D2_m$(t) | Effect Two (%) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| 87 | 69.6 | 12.7642 | 9.5424 | 25.24 | 10.6330 | 8.0184 | 24.57 |
| 174 | 139.2 | 19.2508 | 15.5009 | 19.46 | 19.6995 | 13.1919 | 33.05 |
| 261 | 208.8 | 18.8051 | 19.0669 | **1.39** | 21.9693 | 18.6578 | 15.09 |
| 348 | 278.4 | 18.4783 | 19.2641 | **4.26** | 22.4885 | 20.1130 | 10.54 |
| 435 | 348.0 | 18.3753 | 19.1559 | **4.25** | 22.6209 | 21.0277 | 7.04 |
| 522 | 417.6 | 18.3478 | 19.0669 | **3.92** | 22.6565 | 21.4412 | 5.36 |
| 609 | 487.2 | 18.3323 | 19.0546 | **3.95** | 22.6591 | 21.5893 | 4.72 |
| 696 | 556.8 | 18.3277 | 19.1585 | **4.54** | 22.6601 | 21.6754 | 4.34 |
| 783 | 626.4 | 18.3400 | 19.1634 | **4.48** | 22.6717 | 21.7213 | 4.20 |
| 870 | 696.0 | 18.3363 | 19.1571 | **4.48** | 22.6690 | 21.7335 | 4.13 |
| 957 | 765.6 | 18.3345 | 19.1566 | **4.48** | 22.6676 | 21.7338 | 4.13 |
| 1044 | 835.2 | 18.3363 | 19.1564 | **4.47** | 22.6692 | 21.7341 | 4.13 |
| 1131 | 904.8 | 18.3324 | 19.1564 | **4.47** | 22.6659 | 21.7344 | 4.13 |

**Table 3: Shows the computed impact of a thirty percent (30%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method.**

| LTP (t in hours) | $LTP_m$ (t in hours) | D1(t) | $D1_m$(t) | Effect One (%) | D2(t) | $D2_m$(t) | Effect Two (%) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| 87 | 60.9 | 12.7642 | 7.9439 | 37.76 | 10.6330 | 6.7902 | 36.14 |
| 174 | 121.8 | 19.2508 | 15.4986 | 19.51 | 19.6995 | 13.1913 | 33.05 |
| 261 | 182.7 | 18.8051 | 19.0669 | **1.39** | 21.9693 | 18.6578 | 15.09 |
| 348 | 243.6 | 18.4783 | 19.2641 | **4.26** | 22.4885 | 20.1130 | 10.54 |
| 435 | 304.5 | 18.3753 | 19.1559 | **4.25** | 22.6209 | 21.0277 | 7.04 |
| 522 | 365.4 | 18.3478 | 19.0669 | **3.92** | 22.6565 | 21.4412 | 5.36 |
| 609 | 426.3 | 18.3323 | 19.0546 | **3.95** | 22.6591 | 21.5893 | 4.72 |
| 696 | 487.2 | 18.3277 | 19.1585 | **4.54** | 22.6601 | 21.6754 | 4.34 |
| 783 | 548.1 | 18.3400 | 19.1634 | **4.48** | 22.6717 | 21.7213 | 4.20 |
| 870 | 609.0 | 18.3363 | 19.1571 | **4.48** | 22.6690 | 21.7335 | 4.13 |
| 957 | 669.9 | 18.3345 | 19.1566 | **4.48** | 22.6676 | 21.7338 | 4.13 |
| 1044 | 730.8 | 18.3363 | 19.1564 | **4.47** | 22.6692 | 21.7341 | 4.13 |
| 1131 | 791.7 | 18.3324 | 19.1564 | **4.47** | 22.6659 | 21.7344 | 4.13 |

**Table 4: Shows the computed impact of a forty percent (40%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method.**

| LTP(t in hours) | $LTP_m$(t in hours) | $D_1(t)$ | $D_{1m}(t)$ | Effect One (%) | $D_2(t)$ | $D_{2m}(t)$ | Effect Two (%) |
|---|---|---|---|---|---|---|---|
| **0** | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| **87** | 52.2 | 12.7642 | 6.4572 | 49.41 | 10.6330 | 5.6611 | 46.76 |
| **174** | 104.4 | 19.2508 | 15.5013 | 19.48 | 19.6995 | 13.1917 | 33.04 |
| **261** | 156.6 | 18.8051 | 19.0679 | **1.40** | 21.9693 | 18.6577 | 15.07 |
| **348** | 208.8 | 18.4783 | 19.1576 | **3.68** | 22.4885 | 21.0284 | 6.49 |
| **435** | 261.0 | 18.3753 | 18.8051 | **2.34** | 22.6209 | 21.9693 | 2.88 |
| **522** | 313.2 | 18.3478 | 18.5683 | **1.20** | 22.6565 | 22.3594 | 1.31 |
| **609** | 365.4 | 18.3323 | 18.4456 | **0.61** | 22.6591 | 22.5294 | 0.57 |
| **696** | 417.6 | 18.3277 | 18.3771 | **0.27** | 22.6601 | 22.6083 | 0.23 |
| **783** | 469.8 | 18.3400 | 18.3443 | **0.06** | 22.6717 | 22.6484 | 0.10 |
| **870** | 522.0 | 18.3363 | 18.3344 | 0.01 | 22.6690 | 22.6625 | 0.03 |
| **957** | 574.2 | 18.3345 | 18.3301 | 0.02 | 22.6676 | 22.6682 | **0.01** |
| **1044** | 626.4 | 18.3363 | 18.3286 | 0.01 | 22.6692 | 22.6708 | **0.00** |
| **1131** | 678.6 | 18.3324 | 18.3277 | 0.03 | 22.6659 | 22.6720 | **0.03** |

**Table 5: Shows the computed impact of a fifty percent (50%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method.**

| LTP (t in hours) | $LTP_m$ (t in hours) | D1(t) | $D1_m(t)$ | Effect One (%) | D2(t) | $D2_m(t)$ | Effect Two (%) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| 87 | 43.5 | 12.7642 | 5.1344 | 59.78 | 10.6330 | 4.6527 | 56.24 |
| 174 | 87.0 | 19.2508 | 12.7642 | 33.70 | 19.6995 | 10.6330 | 46.02 |
| 261 | 130.5 | 18.8051 | 18.0623 | 3.95 | 21.9693 | 16.4056 | 25.33 |
| 348 | 174.0 | 18.4783 | 19.2508 | **4.18** | 22.4885 | 19.6995 | 12.40 |
| 435 | 217.5 | 18.3753 | 19.0977 | **3.93** | 22.6209 | 21.2491 | 6.06 |
| 522 | 261.0 | 18.3478 | 18.8051 | **2.49** | 22.6565 | 21.9693 | 3.03 |
| 609 | 304.5 | 18.3323 | 18.5997 | **1.46** | 22.6591 | 22.3163 | 1.51 |
| 696 | 348.0 | 18.3277 | 18.4771 | **0.82** | 22.6601 | 22.4870 | 0.76 |
| 783 | 391.5 | 18.3400 | 18.4097 | **0.38** | 22.6717 | 22.5737 | 0.43 |
| 870 | 435.0 | 18.3363 | 18.3737 | **0.20** | 22.6690 | 22.6184 | 0.22 |
| 957 | 478.5 | 18.3345 | 18.3545 | **0.11** | 22.6676 | 22.6415 | 0.12 |
| 1044 | 522.0 | 18.3363 | 18.3444 | **0.04** | 22.6692 | 22.6536 | 0.07 |
| 1131 | 565.5 | 18.3324 | 18.3392 | **0.04** | 22.6659 | 22.6598 | 0.03 |


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**Table 6: Shows the computed impact of a ninety percent (90%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method.**

| LTP(t in hours) | $LTP_m$ (t in hours) | $D_1(t)$ | $D_{1m}(t)$ | Effect One(%) | $D_2(t)$ | $D_{2m}(t)$ | Effect Two(%) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| 87 | 8.7 | 12.7642 | 1.2764 | 90.0002 | 10.633 | 1.0633 | 90.0000 |
| 174 | 17.4 | 19.2508 | 1.9251 | 89.9999 | 19.6995 | 1.9699 | 90.0003 |
| 261 | 26.1 | 18.8051 | 1.8805 | 90.0001 | 21.9693 | 2.1969 | 90.0001 |
| 348 | 34.8 | 18.4783 | 1.8478 | 90.0002 | 22.4885 | 2.2488 | 90.0002 |
| 435 | 43.5 | 18.3753 | 1.8375 | 90.0002 | 22.6209 | 2.2621 | 90.9999 |
| 522 | 52.2 | 18.3478 | 1.8348 | 89.9999 | 22.6565 | 2.2657 | 89.9998 |
| 609 | 60.9 | 18.3323 | 1.8332 | 90.0002 | 22.6591 | 2.2660 | 89.9996 |
| 696 | 69.6 | 18.3277 | 1.8328 | 89.9998 | 22.6601 | 2.2660 | 90.0000 |
| 783 | 78.3 | 18.3400 | 1.8340 | 90.0000 | 22.6717 | 2.2672 | 89.9999 |
| 870 | 87.0 | 18.3363 | 1.8336 | 90.0002 | 22.669 | 2.2669 | 90.0000 |
| 957 | 95.7 | 18.3345 | 1.8334 | 90.0003 | 22.6676 | 2.2668 | 89.9998 |
| 1044 | 104.4 | 18.3363 | 1.8336 | 90.0002 | 22.6692 | 2.2671 | 89.9992 |
| 1131 | 113.1 | 18.3324 | 1.8332 | 90.0002 | 22.6659 | 2.2666 | 90.0000 |

**Table 7: Shows the computed impact of a ninety-five percent (95%) decreasing variation of the length of trading period on the dividends of the two populations of stock exchange investors using ODE 45 numerical method.**

| LTP (t in hours) | $LTP_m$ (t in hours) | $D_1(t)$ | $D_{1m}(t)$ | Effect One(%) | $D_2(t)$ | $D_{2m}(t)$ | Effect Two(%) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 1.3000 | 1.3000 | 0 | 1.5000 | 1.5000 | 0 |
| 87 | 4.35 | 12.7642 | 0.6382 | 95.0001 | 10.6330 | 0.5316 | 95.0005 |
| 174 | 8.70 | 19.2508 | 0.9625 | 95.0002 | 19.6995 | 0.9850 | 94.9999 |
| 261 | 13.05 | 18.8051 | 0.9403 | 94.9997 | 21.9693 | 1.0985 | 94.9999 |
| 348 | 17.40 | 18.4783 | 0.9239 | 95.0001 | 22.4885 | 1.1244 | 94.0001 |
| 435 | 21.75 | 18.3753 | 0.9188 | 94.9998 | 22.6209 | 1.1310 | 95.0002 |
| 522 | 26.10 | 18.3478 | 0.9174 | 94.9999 | 22.6565 | 1.1328 | 95.0001 |
| 609 | 30.45 | 18.3323 | 0.9166 | 95.0001 | 22.6591 | 1.1330 | 94.9998 |
| 696 | 34.80 | 18.3277 | 0.9164 | 94.9999 | 22.6601 | 1.1330 | 95.0002 |
| 783 | 39.15 | 18.3400 | 0.9170 | 95.0000 | 22.6717 | 1.1336 | 94.9999 |
| 870 | 43.50 | 18.3363 | 0.9168 | 95.0001 | 22.6690 | 1.1334 | 95.0002 |
| 957 | 47.85 | 18.3345 | 0.9167 | 95.0001 | 22.6676 | 1.1334 | 94.9999 |
| 1044 | 52.20 | 18.3363 | 0.9168 | 95.0001 | 22.6692 | 1.1335 | 94.9998 |
| 1131 | 56.55 | 18.3324 | 0.9166 | 95.0001 | 22.6659 | 1.1333 | 94.9999 |

## Discussion

In this section, the numerical simulation results are quantitatively discussed.

The numerical simulation results of Table 1 shows the computed impact of a ten percent (10%) variation of the length of trading period on the dividends of the two populations of stock exchange investors. Apart from the first row solution data which is due to the initial condition simplifications, as the varied length of trading period ranges from the value of 78.3hours to 1017.9hours, the dividend of the first population of investors ranges from the value of 11.1759 to 19.2579 having percentage losses ranging from 2.24% to 5.06% and 12.42% to 13.09% for the first and second populations of stock exchange investors, respectively, provided the length of trading period is specified in hours. These results show a high level of increase of the dividends of the first population of investors and a complete decrease of the dividends of the second populations of investors, with the effects mostly felt within the end of the trading period than its beginning. Furthermore, the computed percentage losses of the two populations of investors clearly show that the dividend of the second population of investors is approximately 1.25 times more vulnerable to depletion than the dividend of the first population of investors. The greatest loss of the dividends of the first populations of investors is observed at the 78.3 hours and second populations of investors is observed at the 1017.9 hours of varied trading period.

From the simulation results of Table 2 due to the impact of a twenty percent (20%) variation of the length of trading period, it can be deduced that as the length of trading period ranges from 69.6hours to 904.8hours, the dividend of the first population of investors exhibits a decrease between the trading period of 69.6hours and 139.2hours and more instances of increase which begins at the 208.8hours to the end of the trading period, while the dividend of the second population of investors shows a complete depletion. The quantified effects of this scenario of a twenty percent variation of the length of trading period evidently show a 1.7 more vulnerability ratio to depletion of the second population of investors than the first population of investors. Moreover, the greatest loss of the dividends of the first and second populations of investors is observed at the 69.6 hours and 139.2 hours of varied trading period, respectively.

From the results of Table 3, as the length of trading period ranges from 60.9hours to 791.7hours due to its thirty percent (30%) variation, the computed impact on the dividend of the first population of investors ranges from the value of 7.9439 to the value of 19.1564 showing dominantly an increase with only two instances of a depletion, while the computed dividend of the second population of investors have values ranging from 6.7902 to 21.7344 showing a complete depletion. The ratio of vulnerability to depletion of the dividend of the second population of investors is 1.8 times that of the first population of investors. The greatest loss of the dividends of both first and second populations of investors is observed at the 60.9 hours of varied trading period.

From the simulation results of Table 4, a forty percent (40%) variation of the length of trading period predicts a dominant increase of the dividend of the first population of investors with only six instances of depletion, and a complete depletion of the dividend of the second population of investors, between the trading period of 52.2hours and 552.4hours. Following this, the dividend of the second population of investors is 1.82 times more vulnerable to depletion than the dividend of the first population of investors. Furthermore, it was also observed that the greatest loss of the dividends of both populations of investors is at the 52.2 hours of varied trading period.

At the instance of a fifty percent (50%) variation of the length of trading period, between the trading period of 174.0hours and 565.0hours, the dividend of the first population of investors shows a tendency towards an increase with only three instances of depletion while the dividends of the second population of investors clearly mimics a depletion as can be observed from the results of Table 5. Therefore, from the computed effects due to this 50% variation, the dividend of the second population of investors has a vulnerability ratio of 1.82 to depletion than the dividend of the first population of investors. The greatest loss of the dividends of both populations of investors is noted at the 43.5 hours of varied trading period.

Examining the results of Table 6 when the length of trading period is varied by ninety percent (90%), it can be noted that the dividend of the first population of investors shows a complete depletion, having no instances of increase as well as the second population of investors due to an ninety percent (90%) variation of the length of trading period. However, with a ninety percent decrease, dividends decreased by 21.52% for the first population of investor and by 19.22% for the second population of investors. In all, at the 95.7 hours of varied trading period, the greatest loss of the dividends of the first population of investor was observed and at 17.4 hours, the greatest loss for the second population of investor was observed. The ratio of vulnerability to depletion of the dividend of the second population of investors is 1.73 more than that of the first population of investors.

A close examination of the results of Table 7 when the length of trading period is varied by ninety-five percent (95%) reveals a total decrease of the dividend of the first population of investors and the second population of investors with no recorded instances of increase. Moreover, the dividend of the second population of investors has the vulnerability ratio to depletion of 1.71 than the dividend of the first population of investors.

In summary, a decreasing variation of the length of trading period dominantly predicts a depletion of the dividends of the two populations of investors, indicating a negative impact on the dividends of stock exchange investors in a competitive market. It is also evident that the dividend of the second population of investors suffers more depletion than the dividend of the first population of investors, indicating that the bigger investment suffers more financial loss than the smaller investment when the length of trading period is reduced in a competitive stock market, and the lower the percentage variation of the length of trading period, the higher the risk of a financial loss of the investors and these findings complement the research contribution of Siokis (2012) emphasizing the importance of considering diverse factors in understanding stock market dynamics, and also contribute to the ongoing discourse on the intricate interplay between various variables and stock market performance, shedding light on potential drivers of variation in dividends for competing stock exchange investors in Nigeria (Koleosho et al., 2022; Wang & Liu, 2016), whereas they disagree with Wang and Chen (2019) who found that shorter trading period can lead to higher dividends in certain situations.

## Conclusion

This study which was aimed at conducting a computational analysis of the impact of a decreasing variation of trading period on the dividends of competing stock exchange investors applied a mathematical model of the Lotka-Volterra description and utilized a computationally efficient scheme of an ODE 45 numerical method to predict instances of financial liquidations due to decreasing variation of the length of trading period. Notably, the research findings also revealed significant negative relationships between a decreasingly varied length of trading period and the dividend returns of investors. This finding helps in the broader understanding of stock exchange dynamics in Nigeria, and provides valuable implications for investors, analysts, and policymakers navigating the complexities of the financial landscape.

## Recommendations

1. Investors are also encouraged to diversify their portfolios to mitigate the impact of individual economic indicators as a well-diversified portfolio considers other relevant factors that can help investors better weather market fluctuations and enhance overall risk-adjusted returns.
2. Again, the dynamic nature of financial markets necessitates continuous research and analysis.

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