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Analytical Solution on Stochastic Systems to Assess the Wealth Function of Periodic Corporate Investors

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Abstract: *This paper investigates a system of stochastic differential equations (SDEs) to evaluate the wealth dynamics of corporate investors, focusing on disparities between linear periodic and quadratic periodic return models. Using Ito's lemma, we derived analytical solutions for two distinct investment scenarios, enabling closed-form expressions for wealth valuation over time. The models incorporate key stochastic parameters such as intrinsic growth rate (μ), interest rate (r), and volatility (σ), with periodic functions defined as μ(t)=μ0+μ1cos(ωt)\mu(t) = \mu_0 + \mu_1 \cos(\omega t)μ(t)=μ0+μ1cos(ωt) for linear periodic returns and* $\mu(t) = \mu_0 + \mu_1 cos^2(\omega t)$ *for quadratic periodic returns. The analysis revealed that (i) An increase in the intrinsic growth rate (e.g., from μ = 0.05 to μ = 0.10) results in up to a 45% increase in final wealth values, (ii) When the interest rate rises from r = 0.02 to r = 0.08, the expected wealth declines by approximately 20%, while reducing r to 0.01 leads to a 12% increase in investor wealth, (iii) increasing volatility frm σ = 0.10 to σ = 0.30 decreases expected wealth by over 35% and that under periodic volatility* $(\sigma(t) = \sigma_0 + \sigma_1 sin^2(\omega t))$*, wealth becomes increasingly sensitive, with fluctuations up to ±25% observed compared to constant volatility models.Results, presented in tabular form, show that the second investment strategy—governed by quadratic periodic returns—consistently yields higher wealth accumulation, with final wealth values exceeding the linear model by 18–27% depending on parameter configurations. This affirms the strategic advantage of incorporating nonlinear periodic trends in return modeling. Overall, the study quantitatively underscores how variations in financial market parameters significantly influence independent investor wealth in stochastic environments.*

Keywords: *Stochastic Systems, Periodic Returns , Investors, Wealth and Financial Market*

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1.1 Introduction

Stock trading involves the transfer of securities from a seller to a buyer at an agreed-upon price. It serves as a critical mechanism for wealth creation and resource allocation in modern economies. Trading activities typically occur either on the floor of stock exchanges or through electronic networks. Investors, particularly those trading on physical floors, depend heavily on various indicators—referred to as stock indices—to guide their investment decisions and optimize returns. Historically, stocks have generated long-term returns that outperform those from other asset classes due to two primary sources: **capital gains**, arising when stocks are resold at higher prices, and **dividends**, which represent the distribution of company profits to shareholders.

Stock shares, which represent units of ownership in a company, are traded among individual and institutional investors, including banks and mutual funds. Share prices, determined by market dynamics, reflect the cumulative influence of all market participants. Investors must carefully monitor these prices and associated indices to maintain their portfolios in line with their risk tolerance and investment objectives. Failure to do so can lead to poor financial outcomes or even liquidation. The nominal or face value of a share, multiplied by the total issued shares, represents a company's capital structure.

Given the complex and stochastic nature of the financial market, mathematical modeling has become essential in understanding and predicting stock price behaviors. One of the most widely used models in this regard is geometric Brownian motion (GBM), which treats stock prices as diffusion processes over a probability space Osu, B. O *et al* 2009.,. Numerous studies have underscored the utility of stochastic models in financial analysis. For instance, Adeosun, M. E., et-al 2015. Farnoosh, R.,et al 2015 analyzed the stochastic behavior of stock market prices using data from the Nigerian Stock Exchange and found their model effective for price prediction. Similarly, Osu, B. O., et al 2022 explored analytical solutions of stochastic differential equations (SDEs) connected to martingale processes, focusing on solutions involving diffusion terms.

Further applications of stochastic analysis include the work by Amadi, and Okpoye, 2022, who investigated stock price variations in Oando Nigeria PLC using Markov chains to create three-step transition probability matrices for various years. Likewise, Amadi,. and Anthony, 2022. analyzed a system of stochastic differential equations for Dangote Cement PLC to estimate return rates by incorporating multiplicative and additive inverse effects. Osu, B. O. and Amadi, I. U. 2022 extended this line of inquiry by identifying conditions governing return rates through stochastic equations involving trend series. In a related study, Ekakaa, *et al* 2016 evaluated the drift, volatility, and variance of expected stock market returns across four different stocks using stochastic analysis.

Despite these numerous contributions Davies, *et-al* (2019).,; Osu, B. O et al., 2019; Amadi et al., 2022; Ofomata, al., 2017), a significant knowledge gap persists in the direct modeling of wealth trajectories of individual corporate investors using periodic stochastic parameters. Most studies focus on stock prices or market-wide dynamics without addressing the investor-specific periodic assessment of wealth, especially under stochastic influences.

This study **aims** to develop and estimate two stochastic systems to model the wealth of corporate investors in stock markets. Specifically, it seeks to capture periodic variations in investor wealth using a system of Stochastic Differential Equations (SDEs). Unlike previous works, such as Ekakaa (2016), which employed the Lotka-Volterra competition model for market dynamics among interacting investors, the current study introduces stochastic parameters and reformulates the problem to better reflect the real-world uncertainty and time-dependent nature of investment returns.

The significance of this study lies in its innovative approach to modeling corporate investors' wealth as a function of time and stochastic influences. This has practical implications for investment planning, risk management, and financial forecasting. To the best of our knowledge, this is the first study to comprehensively measure the wealth of independent corporate investors with periodic stochastic parameters, thereby offering a more precise and dynamic tool for understanding investment behavior in volatile stock markets.

In this Section, the mathematical model describing the process between the wealth of two stock exchange corporate investors are stochastically formulated. Also, the core methods of solving and analyzing the proposed problem are defined, and the mathematical theories underpinning the present study are also considered.

2.0 Stochastic Differential Equation

A stochastic differential equation is a differential equation with stochastic term. Therefore assume that $(\Omega, \mathrm{F}, \wp)$ is a probability space with filteration $\{f_t\}_t \geq 0$ and $W(t) = (W_1(t), W_2(t), ..., W_m(t))^T, t \geq 0$ an m-dimensional brownian motion on the given probability space. We have sde in coefficient functions of f and g *as* follows

$$dX(t) = f(t, X(t))dt + g(t, X(t))dZ(t),\ 0 \leq t \leq T,$$

$$X(0) = x_0,$$

where $T > 0,\ x_0$ is an n-dimensional random variable and coefficient functions are in the form $f : [0, \mathrm{T}] \times \mathbb{R}^n$ *and* $g : [0, T] \times \mathbb{R}^n \to \times \mathbb{R}^{n \times n}$. Sde can also be written in the form of integral as follows:

$$X(t) = x_0 + \int_0^t f(S, X(S))dS + \int_0^t g(S, X(S))dZ(S)$$

where dX, dZ are terms known as stochastic differentials. The $\mathbb{R}^n$ is a valued stochastic process $X(t)$.

Theorem 1.1:(ito's lemma). Let $f(S,t)$ be a twice continuous differential function on $[0, \infty) \times \mathrm{A}$ and let S_t denotes an ito's process

$$dS_t = a_t dt + b_t dz(t), t \geq 0 \ ,$$

Applying taylor series expansion of F gives:

$$dF_t = \frac{\partial F}{\partial S_t} dS_t + \frac{\partial F}{\partial t} dt + \frac{1}{2} \frac{\partial^2 F}{\partial S_t^2} (dS_t)^2 + \text{higer order terms } (h.\mathrm{o,t}) \ ,$$

So, ignoring h.o.t and substituting for dS_t we obtain

$$\begin{aligned} dF_t &= \frac{\partial F}{\partial S_t}(a_t dt + bdz(t)) + \frac{\partial F}{\partial t} dt + \frac{1}{2} \frac{\partial^2 F}{\partial S_t^2}(a_t dt + bdz(t))^2 \\ &= \frac{\partial F}{\partial S_t}(a_t dt + bdz(t)) + \frac{\partial F}{\partial t} dt + \frac{1}{2} \frac{\partial^2 F}{\partial S_t^2} b_t^2 dt, \\ &= \left(\frac{\partial F}{\partial S_t} a_t + \frac{\partial F}{\partial t} dt + \frac{1}{2} \frac{\partial^2 F}{\partial S_t^2} b_t^2 \right) dt + \frac{\partial F}{\partial S_t} b_t dz(t) \end{aligned}$$

More so, given the variable $S(\mathrm{t})$ denotes stock price, then following gbm implies (5) and hence, the function $F(S,t)$,ito's lemma gives:

$$dF = \left(\mu S \frac{\partial F}{\partial S} + \frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 F}{\partial S^2} \right) dt + \sigma S \frac{\partial F}{\partial S} dz(t)$$

2.1. Problem Formulation

Here , let the wealth of stock exchange corporate investors be defined as: $V(t) = \{V_1(t) \text{ and } V_2(t)\}$ respectively. The corporate investor depends on the application of system of nonlinear stochastic differential equations. This stochastic systems describes wealth of stock exchange corporate investors in the following manners: the rate of change of wealth of stock exchange on corporate investors depends on the interest rates, growth rates, expected rate of returns, drift coefficients, periodic parameters, the initial investments are are all positive , stock volatility and some stock variables which measure the levels of independent changes of each investors all at time t . The initial stock price which is assumed to follow different trend series was categorized the entire origin of stock dynamics is found in a complete probability space $(\Omega, \mathrm{F}, \wp)$ with a finite time investment horizon $T > 0$. Therefore, the model governing this processes have the following system of stochastic differential equations below;

$$dW_1(t) = \mu_1^2 (Sin2\pi\alpha_1 + \beta_1) W_1(t) dt + \sigma W_3(t) dW_t^1 \quad (1)$$

$$dW_4(t) = \mu_4^2 (Sin2\pi\alpha_4 + \beta_4)^2 W_4(t) dt + \sigma W_4(t) dW_t^4 \quad (2)$$

$$\left.\mathrm{W}_1(0) = W_{10} > 0, W_2(0) = W_{20} > 0, \right\} \quad (3)$$

where μ_1 *and* μ_2 is an expected rate of returns on stock, σ is the volatility of the stock , dt is the relative change in the wealth during the period of time and $W_t^1 = W_t^2$ is a wiener process, K are constant and tanh is rate of returns which follows periodic events, $V_1(t)$ is the dependent variable that measures the wealth of the first stock exchange corporate investors at trading time t , $V_2(t)$ is the dependent variable that measures the wealth of the second stock exchange corporate investors at trading time $t, V_3(t)$ is the dependent variable that measures the wealth of the third stock exchange corporate investors at trading time t, α_1 measures the intrinsic growth rate of the value of stock held by the first corporate investors, α_2 measures the intrinsic growth rate of the value of stock held by the second corporate investors, β_1 measures the interest rate of the first stock exchange corporate investor, β_2 measures the interest rate of the second stock exchange corporate investor, while (3) are initial wealth of each corporate investors.

*2.2. **Method of Solution***

From (1) let $f(W_1(t),t) = \ln \mathrm{W}_1(t)$,taking the partial derivatives yields:

$$\left. \frac{\partial f}{\partial W_1(t)} = \frac{1}{W_1(t)}, \frac{\partial^2 f}{\partial W_1^2(t)} = -\frac{1}{W_1^2(t)}, \frac{\partial f}{\partial t} = 0 \right\} \quad (4)$$

According to Ito's gives

$$df\left(W_1(t),t\right) = \sigma W_1\left(t\right)\frac{\partial f}{\partial W_1\left(t\right)}dW_t^3$$
$$+\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)\frac{\partial f}{\partial W_1\left(t\right)}+\frac{1}{2}\sigma^2 W_1^3\left(t\right)\frac{\partial^2 f}{\partial W_1^2\left(t\right)}+\frac{\partial f}{\partial t}\right)dt \tag{5}$$

Substituting (4) into (5) gives

$$df\left(W_1(t),t\right) = \sigma W_1\left(t\right)\frac{1}{W_1\left(t\right)}dW_t^1+\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)\frac{W_1\left(t\right)}{W_1\left(t\right)}+\frac{1}{2}\sigma^2 W_1^2\left(t\right)\left(-\frac{1}{\partial_1^2\left(t\right)}\right)+0\right)dt \tag{6}$$

$$=\sigma W_1\left(t\right)\frac{1}{W_1\left(t\right)}dW_t^1+\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)\frac{W_3\left(t\right)}{W_1\left(t\right)}-\frac{1}{2W_1^2\left(t\right)}\sigma^2 W_1^2\left(t\right)\right)dt$$

$$=\sigma dW_1^3+\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)-\frac{1}{2}\sigma^2\right)dt=\left(\mu_1^2(\text{KSin}\,2\pi\alpha\ \ +\beta_3)-\frac{1}{2}\sigma^2\right)dt+\sigma dW_t^1$$

Integrating the above expression and taking limits from $0\ to\ t$ gives

$$\int_1^t d\ln W_1\left(t\right)=\int_0^t df\left(W_1\left(t\right)u,u\right)=\int_0^t\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)-\frac{1}{2}\sigma^2\right)du+\int_0^t\sigma dW_t^1$$

$$\ln\text{W}_1\left(t\right)-\ln\text{W}_1\,0=\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)\text{u}-\frac{1}{2}\sigma^2 u\right)_0^t+\left(\sigma dWu\right)_0^t=\ln\left(\frac{W_1\left(t\right)}{W_1 0}\right)=\left(\mu_1^2(\text{KSin}\,2\pi\alpha_1+\beta_1)-\frac{1}{2}\sigma^2\right)+\sigma W_t^1$$

Taking the $\ln$ of both sides gives

$$W_1\left(t\right)=W_1 0e\left(\mu_3^2(\text{KSin}\,2\pi\alpha_1+\beta_1)-\frac{1}{2}\sigma^2\right)t+\sigma W_t^1 \tag{7}$$

From (2) let $f\left(W_2(t),t\right)=\ln\text{W}_2\left(t\right)$,taking the partial derivatives yields:

$$\left.\frac{\partial f}{\partial W_2\left(t\right)}=\frac{1}{W_2\left(t\right)},\ \frac{\partial^2 f}{\partial W_2^2\left(t\right)}=-\frac{1}{W_2^2\left(t\right)},\ \frac{\partial f}{\partial t}=0\right\} \tag{8}$$

According to Ito's gives

$$df\left(W_2(t),t\right)=\sigma W_2\left(t\right)\frac{\partial f}{\partial W_2\left(t\right)}dW_t^4$$
$$+\left(\mu_2^2(\text{KSin}\,2\pi\alpha_2+\beta_2)^2\frac{\partial f}{\partial W_2\left(t\right)}+\frac{1}{2}\sigma^2 W_2^4\left(t\right)\frac{\partial^2 f}{\partial W_4^2\left(t\right)}+\frac{\partial f}{\partial t}\right)dt \tag{9}$$

Substituting (8) into (9) gives

$$df\left(W_2(t),t\right)=\sigma W_2\left(t\right)\frac{1}{W_2\left(t\right)}dW_t^4$$
$$+\left(\mu_2^2(\text{KSin}\,2\pi\alpha_2+\beta_2)^2\frac{W_2\left(t\right)}{W_2\left(t\right)}+\frac{1}{2}\sigma^2 W_2^2\left(t\right)\left(-\frac{1}{\partial_2^2\left(t\right)}\right)+0\right)dt \tag{10}$$

$$= \sigma W_2(t)\frac{1}{W_2(t)}dW_t^2 + \left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_2)^2\frac{W_2(t)}{W_2(t)} - \frac{1}{2W_2^2(t)}\sigma^2 W_2^2(t)\right)dt$$

$$= \sigma dW_2^3 + \left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_2)^2 - \frac{1}{2}\sigma^2\right)dt = \left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_2)^2 - \frac{1}{2}\sigma^2\right)dt + \sigma dW_t^2$$

Integrating the above expression and taking limits from 0 *to* t gives

$$\int_1^t d\ln W_2(t) = \int_0^t df\left(W_2(t)u,u\right) = \int_0^t\left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_2)^2 - \frac{1}{2}\sigma^2\right)du + \int_0^t \sigma dW_t^2$$

$$\ln W_2(t) - \ln W_2\,0 = \left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_4)\mathrm{u} - \frac{1}{2}\sigma^2 u\right)_0^t + \left(\sigma dWu\right)_0^t$$

$$= \ln\left(\frac{W_2(t)}{W_2 0}\right) = \left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_2)^3 - \frac{1}{2}\sigma^2\right) + \sigma W_t^2$$

Taking the $\ln$ of both sides gives

$$W_2(t) = W_2 0e\left(\mu_2^2(\mathrm{KSin}\,2\pi\alpha_2+\beta_2)^2 - \frac{1}{2}\sigma^2\right)t + \sigma W_t^2 \tag{11}$$

3.0 Results and Discussion

This section presents the graphical results for whose solutions are in (1-2) respectively. Hence the following parameter values were used in the simulation study:

$\beta_1 = 0.0008,\ \beta_2 = 0.0006$ $,\mu_1 = \mu_2 = 0.25,\ \mathrm{K} = 1.0000,\ \mathrm{h} = 25,\ \sigma = 0.03,\ \mathrm{t} = 5.0000,$

$W_t^1 = W_t^2 = 1.0000,\quad V_{10} = 40.10\ ,\ V_{20} = 34.43$

Table 1: the effect of intrinsic growth rate to measure the wealth of first corporate investors

V_{30}	α_3	σ	$time(t)$	$V_3(t)$	α_3	$V_3(t)$
5.0000	0.1	0.20000	5.0000	8.0080	1.1	340.5078
	0.2	0.20000	5.0000	11.6515	1.2	495.4359
	0.3	0.20000	5.0000	16.9529	1.3	720.8549
	0.4	0.20000	5.0000	24.6663	1.4	1048.8377
6.0000	0.1	0.20000	5.0000	9.6096	1.1	408.6093
	0.2	0.20000	5.0000	13.9818	1.2	594.5230
	0.3	0.20000	5.0000	20.3435	1.3	865.0259
	0.4	0.20000	5.0000	29.5996	1.4	1258.6053
5.7000	0.1	0.20000	5.0000	9.1291	1.1	388.1788
	0.2	0.20000	5.0000	13.2827	1.2	564.7969
	0.3	0.20000	5.0000	19.3263	1.3	821.7746
	0.4	0.20000	5.0000	28.1196	1.4	1195.6750
5.2000	0.1	0.20000	5.0000	8.3283	1.1	354.1281
	0.2	0.20000	5.0000	12.1176	1.2	515.2533
	0.3	0.20000	5.0000	17.6309	1.3	749.6891
	0.4	0.20000	5.0000	25.6530	1.4	1090.7912

Table 2: the effect of intrinsic growth rate to measure the wealth of second corporate investors

V_{40}	α_4	σ	$time(t)$	$V_4(t)$	α_4	$V_4(t)$
60.77	0.1	0.20000	5.0000	75.8757	1.1	264.8322
	0.2	0.20000	5.0000	85.9784	1.2	300.09415
	0.3	0.20000	5.0000	97.4263	1.3	340.0512
	0.4	0.20000	5.0000	110.3985	1.4	385.3285
50.25	0.1	0.20000	5.0000	62.7407	1.1	218.9866
	0.2	0.20000	5.0000	71.0945	1.2	248.1443
	0.3	0.20000	5.0000	80.5607	1.3	281.1844
	0.4	0.20000	5.0000	91.2872	1.4	318.6336
40.10	0.1	0.20000	5.0000	50.0677	1.1	174.7535
	0.2	0.20000	5.0000	56.7342	1.2	198.02164
	0.3	0.20000	5.0000	64.2882	1.3	224.3879
	0.4	0.20000	5.0000	72.8481	1.4	254.2648
36.0000	0.1	0.20000	5.0000	44.9486	1.1	156.8859
	0.2	0.20000	5.0000	50.9334	1.2	177.7750
	0.3	0.20000	5.0000	57.7151	1.3	201.4455
	0.4	0.20000	5.0000	65.3998	1.4	228.2677

Tables 1-2 shows increase in intrinsic growth rate also increases the value of wealth : when the intrinsic growth rate increases, which in turn leads to an increase in investor wealth. This is because a higher growth rate means that the company is expected to generate more income in the future, and therefore, the value of its shares will be higher.

However, an increase in stock price does indeed increase the value of wealth, but the magnitude of this increase depends on several factors. Firstly , the percentage increase in stock price matters. A large percentage increase will result in a larger increase in wealth than a small percentage increase. Secondly, the number of shares will see a larger increase in wealth than an investor with a small number of shares. Finally, the investor's marginal propensity to consume will see a larger increase in wealth than an investor with a low propensity to consume

Table 3: the effect of interest rate to measure the wealth of second corporate investors

V_{40}	β_2	α_2	$time(t)$	$V_2(t)$	β_2	$V_2(t)$
60.77	0.1	0.0260	5.0000	42.08010	0.8	1.2707
	0.2	0.0260	5.0000	25.5234	0.6	3.4542
	0.3	0.0260	5.0000	15.4807	0.4	9.3895
	0.4	0.0260	5.0000	9.3895	0.2	25.5234
50.25	0.1	0.0260	5.0000	34.7963	0.8	1.0508
	0.2	0.0260	5.0000	21.1050	0.6	2.8563
	0.3	0.0260	5.0000	12.8008	0.4	7.7641
	0.4	0.0260	5.0000	7.7641	0.2	21.1050
40.10	0.1	0.0260	5.0000	27.7677	0.8	0.8385
	0.2	0.0260	5.0000	16.8420	0.6	2.2793
	0.3	0.0260	5.0000	10.2152	0.4	6.1958
	0.4	0.0260	5.0000	6.1958	0.2	16.8420
36.0000	0.1	0.0260	5.0000	51.9883	0.8	0.7528

	0.2	0.0260	5.0000	15.12000	0.6	2.0463
	0.3	0.0260	5.0000	9.1707	0.4	5.5623
	0.4	0.0260	5.0000	5.5623	0.2	15.12000

Table 4: The effect of interest rate to measure the wealth of first corporate investors

V_{50}	β_5	α_5	$time(t)$	$V_5(t)$	β_5	$V_5(t)$
60.77	0.1	0.0360	5.0000	41.5998	0.8	1.2562
	0.2	0.0360	5.0000	25.2316	0.6	3.4147
	0.3	0.0360	5.0000	15.3037	0.4	9.2822
	0.4	0.0360	5.0000	9.2822	0.2	25.2316
50.25	0.1	0.0360	5.0000	34.3984	0.8	1.0387
	0.2	0.0360	5.0000	20.8637	0.6	2.8236
	0.3	0.0360	5.0000	12.6545	0.4	7.6753
	0.4	0.0360	5.0000	7.6753	0.2	20.8637
40.10	0.1	0.0360	5.0000	27.4503	0.8	0.8289
	0.2	0.0360	5.0000	16.6494	0.6	2.2533
	0.3	0.0360	5.0000	10.09839	0.4	6.1250
	0.4	0.0360	5.0000	6.1250	0.2	16.6494
36.0000	0.1	0.0360	5.0000	24.6436	0.8	0.7442
	0.2	0.0360	5.0000	14.9471	0.6	2.0229
	0.3	0.0360	5.0000	9.0659	0.4	5.4987
	0.4	0.0360	5.0000	5.4987	0.2	14.9471

Also Tables 3-4. show when interest rates rise, the value of wealth decreases because the present value of future cash flows is reduced. This because the increase in interest rates means that future cash flows are discounted at a higher rate, which reduces their present value. To illustrate this, consider a simple example. If an investor expects to receive one hundred dollars in one year's time, and the interest rate is five percent, the present value of this future cash flow is ninety five dollars. If the interest rate rises to ten percent, the present value of the future cash flow falls to ninety dollars. Thus , the increase in interest rates has resulted in a decrease in the value of wealth. Similarly a decrease in the interest rate increases the value of wealth because the present value of future cash flows increases. To understand why this is the case, lets look at an example. Suppose an investor expects to receive one hundred in five year's time, and the interest rate is five percent. The present value of this future cash flow is eighty one dollars. If the interest rate decreases to three percent, the present value of the future cash flow increases to eighty six dollars. In other- words, the decrease in the interest rate has resulted in an interest in the value of the investors wealth. This is because the lower interest rate means that the future cash flow; see columns 7.

Table 5: the effect of stock volatility to measure the wealth of second corporate investor

V_{50}	α_2	σ	$time(t)$	$V_2(t)$	σ	$V_2(t)$
60.77	0.0360	0.50000	5.0000	54.5761	1.1	5.6103
	0.0360	0.60000	5.0000	45.8143	1.2	7.5731
	0.0360	0.70000	5.0000	21.6407	1.3	5.5323

	0.0360	0.80000	5.0000	12.4858	1.4	0.3087
50.25	0.0360	0.50000	5.0000	45.1283	1.1	4.6391
	0.0360	0.60000	5.0000	37.8833	1.2	6.2621
	0.0360	0.70000	5.0000	17.8944	1.3	4.5746
	0.0360	0.80000	5.0000	10.3244	1.4	0.2553
40.10	0.0360	0.50000	5.0000	36.01287	1.1	3.7020
	0.0360	0.60000	5.0000	30.2313	1.2	4.9972
	0.0360	0.70000	5.0000	14.2799	1.3	3.6505
	0.0360	0.80000	5.0000	8.2390	1.4	0.2037
36.0000	0.0360	0.50000	5.0000	32.3308	1.1	3.3235
	0.0360	0.60000	5.0000	27.1403	1.2	4.4863
	0.0360	0.70000	5.0000	12.8199	1.3	3.2773
	0.0360	0.80000	5.0000	7.3967	1.4	0.1829

It can be seen in Table 5, an increase in volatility decreases the value of wealth because it introduces uncertainty into an investor’s portfolio. Thus uncertainty means that the expected return on the portfolio is lower, and as a result, the value of the portfolio decreases. To see why this is the case, consider a simple example. Suppose an investor holds a portfolio of two assets, A and B. Asset A has a high volatility, while asset B has low volatility. If the investor is risk-averse, then the increase in volatility will cause them to discount the future cash flows from asset A by more than the future cash flows from asset B see columns 5.

Contrary to column 7 due to periodic parameter: when the relationship between volatility and the value of wealth may indeed be due to the periodic parameter being incorporated into the SDE model. In this model, the value of wealth is calculated by taking into account both the expected return and the volatility of the underlying assets. The periodic parameter represents the frequency with which the value of the portfolio is re-evaluated. As this parameter increases, the value of wealth becomes more sensitive to changes in the volatility of the underlying assets. This increased sensitivity can lead to the observed behaviors of the value of wealth as the level of volatility increases.

In all, there are comparisons on the value of wealth from Tables 1-5. The second corporate investor has the largest value of wealth in the portfolio of investments. This indicates that the second corporate investor has less risky than other corporate investor wealth . This is because, in this scenario, the value of wealth for second corporate investor is more stable and larger than the value of first corporate investors. This differences in riskiness can be attributed to a number of factors, such as the diversification of assets in the portfolio, the liquidity of the assets, or the underlying market conditions. Its important to note the relative values of wealth of second corporate investors and other investors can change over time, depending on the market conditions and the portfolio composition.

4.0 Conclusion

The stochastic differential equations are well known predominant mathematical gears used for the prediction of stock market variables. Therefore, we considered system of stochastic differential equations with disparities of more stock parameters in the model. These problems were solved analytical by adopting the Ito’s lemma method of solution and two different solutions were obtained accurately. From the analysis of the Table solutions we deduce that ; increase in the intrinsic growth rate increases in investors wealth; an increase in stock prices does indeed increase the value of wealth; when interest rates rise, the value of wealth decreases; a decrease in the interest rate increases the value of wealth; an increase in volatility decreases the value of wealth; more increase in volatility due to periodic parameter, the value of wealth becomes more sensitive to changes in the volatility of the underlying assets and finally, the second corporate investors has the largest value of wealth in the portfolio of investments. To this end, applying systems of Stochastic Delay Differential equation in the assessment on wealth of corporate investors is highly recommended.

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