The Effects of Unequal Changes in the Initial Capital on the Dividends of Two Competing Investors in a Stock Exchange

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ARTICLE INFO	ABSTRACT
Published Online: 07 May 2022	The effects of unequal changes of the values of initial capital on the dividends of two competing investors trading in the same environment were quantified using a numerical method. From the results of our analysis, we observed that in the events of unequal upward variation of the initial investment values of the two investors, there is a predominant increase in the dividends of the first investor while the second investor is susceptible to financial liquidation. This important result will
Corresponding Author: **Nafo, N.M**	be useful in providing some insight on the allocation of capital to investors for effective competition.
KEYWORDS: Initial investment, competing investors, numerical method, dividends, liquidation	

INTRODUCTION

In a competitive environment, the optimum operation of two interacting investors trading over time is dependent on a number of factors, both intrinsic and extrinsic (Nafo (2016). The initial investment value of a trader is one important factor that can cause disparity in the dividends of two competing investors in the stock exchange. In this work, we will study the effects of changes in the values of the initial capital on the dividends of the competing investors in the stock exchange in the event of unchanging values of our model parameter values, as well as other exogenous economic factor which can affect the wealth of investors.

MATHEMATICAL FORMULATION

We will investigate our proposed problem by using a typical model formulation of Lotka-Volterra type with deterministic parameter values (Lakka et al (2013), Tang and Zhang (2005), Khamis et al (2011), Alessandre (2014), Cajueior et al (2009), Chakarabati (2016), Chiange et al (2008), Khodabin and Shekarabi (2016), Lee et al (2005), Modis (1999), Shiller (1981). This model consists of a system of continuous nonlinear first order ordinary differential equations.

It is given by:

$$\frac{dw_1(t)}{dt} = w_1(t)(\alpha_1 - \beta_1 w_1(t) - \gamma_1 w_2(t)) \qquad (1)$$

$$\frac{dw_2(t)}{dt} = w_2(t)(\alpha_2 - \beta_2 w_2(t) - \gamma_2 w_1(t))$$

$$\qquad (2)$$
$$w_1(t) > 0 , \; w_2(t) > 0$$

Where

$w_1(t)$ represents the dividend of the first of investor at time t

$w_2(t)$ represents the dividend of the second of investor at time t

α_1 is the intrinsic growth rate of the dividend of the first of investor

α_2 is the intrinsic growth rate of the dividend of the second of investor

β_1 is the intra-competition coefficient which is the inhibiting factor on the growth of the dividend of the first of investor due to its interaction with itself.

β_2 is the intra-competition coefficient which is the inhibiting factor on the growth of the dividend of the second of investor due to its interaction with itself.

γ_1 is the inter-competition coefficient which is the inhibiting factor on the growth of the dividend of the first of investor due to the interaction of the second of investor.

γ_2 is another inter-competition coefficient which is the inhibiting factor on the growth of the dividend of the second investor to the interaction of the first of investor.

$w_1(0)$ and $w_2(0)$ are the initial dividend of the first and second investor respectively.

METHOD OF ANALYSIS

The model above which is typical of a dynamical system does not have a closed form solution. We therefore employed some numerical methods to conduct a simulation analysis of the problem.

With assumed investment values of 1.2 million naira and 1.4 million naira for the first and second investors respectively, the system of continuous nonlinear equations were simulated over trading periods (TP) of 1 month, 40 months, 45 months, 50 months, 55 months, 60 months, 65 months and 70 months. Other scenarios witnessed variation (decrease and increase) in initial investment values for the two competing investors over the same trading periods. The results of our analysis are presented in the tables below.

RESULTS

Table 1: Old $w_1(0)$ = 1.2 million naira, old $w_2(0)$ = 1.4 million naira, new $w_1(0)$ = 120,000 naira and new $w_2(0)$ = 1.4 million naira

TP in Months	dfinv (old)	Dfinv (new)	Effect (%)	Dsinv (old)	Dsinv (new)	Effect (%)
1	1.2000	0.1200	90.00	1.4000	1.4000	0
40	3.9830	0.4454	88.82	3.7750	4.0528	7.36
45	4.5416	0.5204	88.54	4.2176	4.5980	9.02
50	5.1433	0.6056	88.23	4.6891	5.1999	10.89
55	5.7826	0.7017	87.87	5.1861	5.8595	12.99
60	6.4520	0.8092	87.46	5.7045	6.5772	15.30
65	7.1420	0.9281	87.01	6.2390	7.3515	17.83
70	7.8420	1.0585	86.50	6.7839	8.1795	20.57

Here, TP means trading period
dfinv (old) means old dividend of the first investor
dfinv (new) means new dividend of the first investor
dsinv (old) means old dividend of the second investor
dsinv (new) means dividend of the second investor

Table 2: Old $w_1(0)$ = 1.2 million naira, old $w_2(0)$ = 1.4 million naira, new $w_1(0)$ = 1.2 million naira and new $w_2(0)$ = 140,000 million naira

TP in Months	dfinv (old)	Dfinv (new)	Effect (%)	Dsinv (old)	Dsinv (new)	Effect (%)
1	1.2000	1.2000	0.00	1.4000	0.1400	90.00
40	3.9830	4.3810	10.00	3.7750	0.4092	89.16
45	4.5416	5.0864	12.00	4.2176	0.4644	89.00
50	5.1433	5.8726	14.18	4.6891	0.5251	88.80
55	5.7826	6.7386	16.53	5.1861	0.5914	88.60
60	6.4520	7.6804	19.04	5.7045	0.6631	88.38
65	7.1420	8.6902	21.68	6.2390	0.7400	88.14
70	7.8420	9.7569	24.42	6.7839	0.8216	87.89

DISCUSSION OF RESULTS

From Table 1, when the initial investment of 1.2 million naira and 1.4 million naira for the first and second investors respectively were simulated over 40, 45, 50, 55, 60, 65 70 months trading periods (TP) , we observed a monotonic increase in the dividends of both investors though with a dominant increase in that of the first investor (see columns 2 and 5). However, when we reduce the initial investment of the first investor to#120,000 (ie 0.1200 million naira) without a change in that of the second investor, our simulation results showed a lower increase in the dividends of the first investor than that of the second investor (see columns 3 and 6 of Table 1).

For instance, over 40 months trading period, the old and new dividends for the first investor and 3.9830 and 0.4454 million naira, while the second investor has 3,7750 and 4.0528 million naira respectively. Over 50 months, the first investor's old dividend is 5.1433 million naira and the new dividend is 0.5204 million naira while that of the second are 4.6891 and 5.1999 million naira respectively. Over 60 months, the first investor has old dividend as 6.4520 million naira and new dividend as 0.8092 million naira, while the second investor has old dividend as 5.7045 million naira and

new dividend as 6.5774 million naira (see columns 3 and 6 of Table 1).

From Table 2, when initial investment of the second investor is reduced to #140,000 (ie 0.1400 million naira) and that of the first remains 1.2 million naira, we observed that the new dividends of the first and second investors increased monotonically but with that of the second investor in smaller amounts. For instance, over 40 months trading period, the first and second investors has old and new dividends as 3.9830, 4.3810 and 3.7730, 0.4092 million naira respectively. Over 50 months, they are 5.1433, 5.8726 and 4.6891, 0.5251 million naira respectively.

CONCLUSION

In this paper, the effects of changes in the initial investments on the dividends of two competing investors in stock market have been quantified using a simulation method. The results of our analysis showed higher increases in the dividends of the first investor when compared to that of the second investor.

Though increase or decrease in initial investment has a resultant positive change in the dividends of both investors, the differential effect may be due to some special trading strategies on the part of one investor or the role of other exogenous factors which are capable of affecting (ie either encourage or discourage the efficient performance of an investor.

RECOMMENDATION

Since the wealth of the investors respond positively to their initial capital as indicated in Table 1 and 2, we therefore, recommend that necessary machinery be put in place to bridge the gap between low and high income investors for healthy competition.

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