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Return on Invested Capital as a Determinant for Future Investment [a Case Study of Three Subsidiaries of Dangote Group.]

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Abstract : This research, return on invested capital as a determinant for future investment is devoted to study application of quadratic programming in portfolio management of three of the Dangote group subsidiaries namely: Dangote sugar refinery plc, Dangote flour plc and Dangote cement plc. The trio is quoted in Nigeria stock market. The data was extracted from abstraction of published sources . The data was formulated as a quadratic programming problem and Lindo software was used to analyse the data. From the analysis, the increment that yields the minimum variance with mixed investment opportunity is 24%. Hence the optimum solution to model one is f_1 = 19.21%, f_2 = 24.62% and f_3 = 56.16% Which made use of return on capital invested on Dangote three viable subsidiaries. This implies that allocation of fund to these three subsidiaries in future should be done as follows; 19.21% to be allocated to Dangote flour, 24.62% to Dangote sugar and 56.16% to Dangote cements. (Ceteris Paribus). This will in turn gives an average increase of 24% on return on capital invested.

Keywords: invested, capital, refinery, determinant, subsidiaries

I. INTRODUCTION

In every investment, there is tradeoff between risk and returns on such investment. An investor therefore must be willing to do a thorough investigation and analysis if we want to obtain maximum expected returns. There must be a balance between investments and returns that suits individual investors[1]. The main purpose of investment of money in portfolio of share capital is to provide a maximum return better than that of if the same money were retained as cash in bank deposits. The returns come in form of a regular income by way of dividends or interest or by way of growth in capital value which the companies give bonuses or sometimes a combination of dividend and bonuses [3]. A portfolio manager must be careful in allocating invertible funds to a list of investments open to investors in order to minimize the total cost and maximize the returns. A portfolio mix is a set of investments that an investor can invest in. [4,5] showed that the evaluation of portfolio performance should take place through a complete stock market cycle because of difference in performance during the market cycle. [2,6] demonstrates that switching between relative strength and relative value strategies can increase problem is a quadratic programming problem. A mathematical model to suit a problem of this nature is quadratic programming model for portfolio education was developed by [5].

Dangote group is rated as one of the largest conglomerate in Africa. The group is also rated as the best and the largest in West Africa. The group started as a trading business in cement in 1981 from there they veered into conglomerate business of cement, salt, fish, flour and sugar. By 1990 Dangote group has become a force to reckon with in trading business providing for the nation Nigeria basic home needs. Hence Dangote became house hold name in Nigeria even in West Africa. The group is response to the lease of life as a result of transition to civil rule in Nigeria visited Brazil to under study manufacturing sector. As a result of the visitation to Brazil, the Dangote group shifts its focus from trading to manufacturing. The step taking by the group is a step in the right direction in changing Nigeria from consumer goods country to a manufacturing operation country. The Dangote group has a unique aim and objective that promise local, value added services and products which will meet the “basic needs” of the teaming over 167 million Nigeria. It is of interest to note that the spread of Dangote group both in subsidiaries and over and across the nation of African countries. It has over 10 subsidiaries spread over Nigeria to include cement, sugar, real estate, telecommunication, steel food and beverages. This research is devoted to study of application of quadratic programming in portfolio management of three of the Dangote group subsidiaries namely: Dangote sugar refinery plc, Dangote flour plc and Dangote cement plc. The trio is quoted in Nigeria stock market.

II. METHOD OF DATA COLLECTION

For the purpose of this research work, abstraction from established published sources method was used to collect data. The data used in this study has already been in existence but were extracted by this researcher for the purpose of this research work and it is explained briefly below

The table below shows the **Percentage Return on Invested Capital** on Dangote sugar, Dangote flour and Dangote cements.

Table: 1

YEAR					
PRODUCT	2008	2009	2010	2011	2012
FLOUR	11	21	20	20	19
SUGAR	58	43	15	15	0
CEMENT	10	18	20	37	48

Source: Company financial, Vetiva Research and Thisday live

III. DATA ANALYSIS

The management of Dangote group has a fixed sum of money **K** to invest in three of its subsidiaries, Dangote sugar, Dangote flour and Dangote cements. The portfolio problem is to determine how much money should be allocated to each investment so that total expected return is greater than or equal to some lowest acceptable amount say, **T** and so that the total variance of future payments in minimized.

Let $\mathbf{f_1}$, $\mathbf{f_2}$, $\mathbf{f_3}$ designate the amount of money to be allocated to Dangote flour, Dangote sugar and Dangote cement respectively and let $\mathbf{f_i}$ denote the return per Naira invested from investment **í(í = 1, 2, 3)** during the **S** period of time in the past (**S = 1, 2, …, 5**). If the past history of payments is indicative of future performance, the expected future return per Naira from investment **1, 2, 3** is

$$E_í = \frac{\sum_{S=1}^{5} f_{is}}{5} \text{ ----------------- (1)}$$

And the expected return from three investments combined is

$$E = E_1f_1 + E_2f_2 + E_3f_3 \text{ -------------------- (2)}$$

The portfolio problem modeled as quadratic programming is

Minimize $R = A^TCA$

Subject to: $f_1 + f_2 + f_3 = K$

$E_{f1}f_1 + E_{f2}f_2 + E_{f3}f_3 \geq T$

$f_1 \geq 0$, $f_2 \geq 0$, $f_3 \geq 0$, where **C** is the covariance matrix which is positive semi – definite

$$\text{Matrix C} = \begin{bmatrix} \sigma_{11}{}^2 & \sigma_{12}{}^2 & \sigma_{13}{}^2 \\ \sigma_{21}{}^2 & \sigma_{22}{}^2 & \sigma_{23}{}^2 \\ \sigma_{31}{}^2 & \sigma_{32}{}^2 & \sigma_{33}{}^2 \end{bmatrix}$$

E is the mathematical expectation

$$\text{Column Matrix A} = \begin{bmatrix} f_1 \\ f_2 \\ f_3 \end{bmatrix}$$

This can be translated as follows

$$\text{Minimize } R = (f_1\ f_2\ f_3) \begin{bmatrix} \sigma_{11}{}^2 & \sigma_{12}{}^2 & \sigma_{13}{}^2 \\ \sigma_{21}{}^2 & \sigma_{22}{}^2 & \sigma_{23}{}^2 \\ \sigma_{31}{}^2 & \sigma_{32}{}^2 & \sigma_{33}{}^2 \end{bmatrix} [f_1\ f_2\ f_3]^T$$

Subject to: $f_1 + f_2 + f_3 = K$

$E_{f1}f_1 + E_{f2}f_2 + E_{f3}f_3 \geq 0$

Hence we have

Minimize $R = f_1^2\sigma_{11}^2 + f_2^2\sigma_{22}^2 + f_3^2\sigma_{33}^2 + f_1f_2(\sigma_{21}^2 + \sigma_{12}^2) + f_1f_3(\sigma_{31}^2 + \sigma_{13}^2) + f_2f_3(\sigma_{32}^2 + \sigma_{23}^2)$

s. t

$f_1 + f_2 + f_3 = K$

$E_{f1}f_1 + E_{f2}f_2 + E_{f3}f_3 \geq T$

$f_1 \geq 0$, $f_2 \geq 0$, $f_3 \geq 0$.

We consider the **Percentage Return on Invested Capital** to advise the managements of the Dangote group.

IV. THE COVARIANCE MATRIX FROM GBSTAT

$$\text{MATRIX C} = \begin{bmatrix} 16.7 & -60.8 & 20.94 \\ -60.8 & 557.7 & -223.69 \\ 20.94 & -223.69 & 117.99 \end{bmatrix}$$

The expected returns for each product are 18.2%, 26.2%, 26.6% respectively. The budget constrained investments portfolio optimization problem has three candidate assets ($f_1\ f_2\ f_3$) for our portfolio.

A. The Model:

We shall determine what fraction should be devoted to each asset, so an expected return of at least 19% (equivalency, a growth factor of 1.19) is obtained while minimizing the variance in return and not exceeding budget constraints.

We also impose a restriction that any given asset can constitute at most 70% of the portfolio. The variance of the entire portfolio is

$R = 16.7f_1^2 + 557.7f_2^2 + 117.99f_3^2 – 121.6f_1f_2 + 41.88f_1f_3 - 447.38f_2f_3$

Since variance is a measure of risk, we need to minimize,

Hence minimize $R = 16.7f_1^2 + 557.7f_2^2 + 117.99f_3^2 – 121.6 f_1f_2 + 41.88f_1f_3 -447.38f_2f_3$

Subject to:

! We start with **₦1**

$f_1 + f_2 + f_3 = 1$

! We want to end with at least **₦1.19**

$1.182f_1 + 1.262f_2 + 1.266f_3 \geq 1.19$

! No asset may constitute more than 70% of the portfolio

$f_1 < 0.70$

$f_2 < 0.70$

$f_3 < 0.70$

The research employs LINDO software. We create the lagrangean expression. The impute procedure for LINDO requires this model be converted to true linear form by writing the first order conditions. To do this we introduce Lagrange multiplier for each constraint.

There are 5 constraints, we shall use 5 dual variables denoted respectively as, UNITY, RETURN, F_1 FRAC, F_2 FRAC and F_3 FRAC. The lagrangean expression corresponding to this model is now.

Min R ($f_1\ f_2\ f_3$) = $R = 16.7f_1^2 + 557.7f_2^2 + 117.99f_3^2 – 121.6 f_1f_2 + 41.88f_1f_3 -447.38f_2f_3$

+ ($f_1 + f_2 + f_3$ - 1) UNITY

+ [1.19 – ($1.182f_1 + 1.262f_2 + 1.266f_3$)] RETURN

+ (f_1 – 0.70) f_1 FRAC

+ (f_2 – 0.70) f_2 FRAC

+ (f_3 – 0.70) f_3 FRAC

Next we compute the first order conditions.

$\frac{\partial R(f_1,f_2,f_3)}{\partial f_1} = 33.4f_1 – 121.6f_2 + 41.88f_3$ + UNITY – 1.182RETURN + f_1 FRAC > 0

$\frac{\partial R}{\partial f_2} = 1115.4f_2 – 121.6f_1 – 447.38f_3$ + UNITY – 1.262RETURN + f_2 FRAC > 0

$\frac{\partial R}{\partial f_3} = 235.98f_3 + 41.88f_1 – 447.38f_2$ + UNITY + 1.266RETURN + f_3 FRAC > 0

Adding the real constraints

$f_1 + f_2 + f_3 = 1$

$1.182f_1 + 1.262f_2 + 1.266f_3 \geq 1.19$

$f_1 \leq 0.70$

$f_2 \leq 0.70$

$f_3 \leq 0.70$

THE FINAL MODEL IS THUS

MIN $f_1 + f_2 + f_3$ + UNITY + RETURN + f_1 FRAC + f_2 FRAC+ f_3 FRAC

ST.

! First order condition for f_1:

$33.4f_1 - 121.6f_2 + 41.88f_3$ + UNITY – 1.182RETURN + f_1 FRAC > 0

! First order condition for f_2:

$- 121.6f_1 + 1115.4f_2 - 447.38f_3$ + UNITY – 1.262RETURN + f_2 FRAC > 0

! First order condition for f_3:

$41.88f_1 - 447.38f_2 + 235.98f_3$ + UNITY + 1.266RETURN + f_3 FRAC > 0

! ----------------- Start of “real” constraints --------------------

! Budget constraint, multiplier is UNITY:

$f_1 + f_2 + f_3 = 1$

! Growth constraints, multipliers in RETURN:

$1.182f_1 + 1.262f_2 + 1.266f_3 > 1.19$

! Max fraction of f_1, multiplier is f_1 FRAC:

$f_1 < 0.70$

! Max fraction of f_2, multiplier is f_2 FRAC:

$F_2 < 0.70$

! Max fraction of f_3, multiplier is f_3 FRAC:

$F_3 < 0.70$

END

QCP

V. THE SOLUTION OF THE MODEL FROM LINDO SOFTWARE

LP OPTIMUM FOUND AT STEP 0 FOR T = 1.18, 1.19, 1.20, 1.21, 1.22, 1.23, 1.24.

OBJECTIVE FUNCTION VALUE

1) 1.000000

VARIABLE	VALUE	REDUCED COST
F1	0.192182	0.000000
F2	0.246209	0.000000
F3	0.561609	0.000000
UNITY	0.000000	1.000000
RETURN	0.000000	1.000000
F1FRAC	0.000000	1.000000
F2FRAC	0.000000	1.000000
F3FRAC	0.000000	1.000000

NO. ITERATIONS= 0

LP OPTIMUM FOUND AT STEP 1 FOR T = 1.25

OBJECTIVE FUNCTION VALUE

1) 1.314132

VARIABLE	VALUE	REDUCED COST
F1	0.178627	0.000000
F2	0.248834	0.000000
F3	0.572539	0.000000
UNITY	0.314132	0.000000
RETURN	0.000000	2.189628
F1FRAC	0.000000	0.095347
F2FRAC	0.000000	0.904653
F3FRAC	0.000000	1.000000

NO. ITERATIONS= 1

LP OPTIMUM FOUND AT STEP 0 FOR T = 1.26

OBJECTIVE FUNCTION VALUE

1) 4.098741

VARIABLE	VALUE	REDUCED COST
F1	0.058472	0.000000
F2	0.272100	0.000000
F3	0.669428	0.000000
UNITY	3.098741	0.000000
RETURN	0.000000	2.189628
F1FRAC	0.000000	0.095347
F2FRAC	0.000000	0.904653
F3FRAC	0.000000	1.000000

NO. ITERATIONS= 0

VI. DISCUSSION

The summary of the results yields the table below for purpose of comparison and decisions

Table: 2

T	F1	F2	F3	Variance
1.18 – 1.24	0.192182	0.246209	0.561609	1.000000***
1.25	0.178627	0.248834	0.572539	1.314132
1.26	0.058472	0.272100	0.669428	4.098741

The increment that yields the minimum variance with mixed investment opportunity is 24%. Hence the optimum solution to model one is f_1 = 19.21%, f_2 = 24.62% and f_3 = 56.16%

Which made use of return on capital invested on Dangote three viable subsidiaries result implies that allocation of fund to these three subsidiaries in future should be done as follows; 19.21% to be allocated to Dangote flour, 24.62% to Dangote sugar and 56.16% to Dangote cements. (Ceteris Paribus). This will in turn gives an average increase of 24% on return on capital invested.

VII. RECOMMENDATION

Based on the available data on return on capital invested on Dangote three viable subsidiaries namely, Dangote flour, Dangote sugar and Dangote cement. Dangote group should allocate fund to Dangote flour, Dangote sugar and Dangote cement as follows: 19.21%, 24.62% and 56.16% respectively with the arm of average increase of 24% on return on capital invested. It is also recommended that the company management should employ the help of portfolio manager with a good knowledge of operations research and keep a good and proper data bank for research for good decision making.

VIII. CONCLUSION

The purpose of this research work shows how allocation of available fund by investors should be allocated to available investment open to investors. The research has answered the quest of how much an investor should allocate to each investment to minimize risk and maximize return.

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