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Stochastic Analysis of Markov Chain in Finite State: Empirical Evidence on Nigerian Current Account Net Movements

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Abstract:

Purpose:
The Current Account is an essential indicator of an economy's speed. It is because it is defined as the sum of trade balance, net income from abroad, and net current transfers. Therefore, the impression of the Markov chain is a viable instrument for investigating the Nigerian Current Account (NCA) formation in finite since each finite state interconnects for suitable decision-making. Thus, this dissertation studied the stochastic analysis of the Markov chain on NCA data (2004-2022).

Methodology:
The NCA data were transformed into a 3-step transition probability matrix solution to cover independent years. The future NCA data changes were known by introducing a time interval of three years as row vectors.

Findings:
The solution matrix of the stochastic analysis showed that 2004-2012 has the highest probability of reducing payments by 72%, the year 2005-2013 has the highest probability of reducing by 66%, and finally, 2014-2022 has the highest probability of no-change in payments of goods and services by 3.3%.

Implication:
Finally, other statistical variations were also considered and discussed in this paper. All this informs the Nigerian economy on the proper way to make vital decisions effectively and are hopeful for future investment plans both short and long term respectively.

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INTRODUCTION

The concept behind applying stochastic analysis of stock market price changes is that changes in stock market prices are random and unpredictable. They appear to be stochastic processes in discrete times, which only take discrete values. Hence, stochastic analysis is one of the tools that can be used to analyze stock trends. It begins with conditional probability under probability theory, which involves a random process based on chance. Various statistical models can be applied to analyze stock price changes. It is a stochastic process in discrete time, which takes only discrete values. We have the Markov chain approach, the Wiener process, the Brownian motion, and the Monte Carlo process. When the price starts from zero, the increments are independent, and stationery is on a continuous path, the stochastic process is said to have a Brownian motion. The increments here are usually distributed depending on their size. When the stock price changes are based only on the present state and not the previous state, the process is said to have a Markov property. Hence, it is a Markov process. The Monte Carlo process generates samples of random variables, which it analyses using a performance function to extract probabilistic information. Thus, it is a random Markov process. The applications of stochastic models to stock market prices aim to predict random behavior and the most accurate path for optimal profitability. The key to building accurate stochastic models remains to suit the intended purpose and not uniqueness, as more than one

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model can represent a specific event, but each model has a specific purpose. Various researchers have gone into creating models that can be used to make the best forecasts or predictions. Studies have shown that the Markov Chain-based test helps analyze stock market trends.

Nevertheless, in finance generally, a country's current account records the value of exports and imports of both goods and services and international transfers of capital. It is one of the two components of the balance of payments, the other being the capital account (also known as the financial account). The current account measures the nation's earnings and spending abroad. It encompasses the balance of trade, net primary income or factor income (earnings on foreign investments minus payments made to foreign investors), and net unilateral transfers that have taken place over a given period. The current account balance of one of two primary measures of a country's foreign assets (i.e., assets fewer liabilities) grew over the period in question, and a current account deficit indicates that it shrank; both government and private payments are included in the calculations. It is termed the current account because goods and services are generally consumed in the current period.

However, the NCA market routine and its processes have been accepted as a substantial workable investment field within the financial market. The issue of stochastic price fluctuations has been addressed by the following scholars.

Investments can be made in stocks, bonds, and mutual funds. So, an increase in the price of stocks in the stock market indicates an increase in investments. However, the nature of stock prices has been unstable, seasonal, time-dependent, highly volatile, and unpredictable. It is primarily due to uncertainties that arise from natural disasters, global trends, and socio-political policies, which may have unprecedented impact on the demand and supply of stocks. Thus, because of this, investors now have to go beyond studying the company's history, performance, and development prospects of such fundamentals and also be familiar with the variety of technical analyses in order to win a massive return on investment and become a successful investor. Stock trend analysis plays a vital role in practical stock trading. Fundamental factors affect the stock price depending on a company's earnings and profitability from producing and selling goods and services. These include The level of the earnings base (represented by measures such as earnings per share, cash flow per share, and dividends per share), the expected growth in the earnings base, the discount rate, which is itself a function of inflation and the perceived risk of the stock.

On the other hand, the price development of risky assets is typically demonstrated as the route of risky assets that are of a Markov process defined on some underlying transition probability state space. However, the scholar has written a lot on modeling stock prices using the Markov chain, and results are obtained in various ways. For example, measured stochastic analysis of share prices. Results showed the precise conditions for determining the expected mean return time for stock price, improving investment decisions based on the highest transition probabilities. In the same manner, examined stock market prices due to their fluctuations and influences on the financial lives and economic health of a country. Their discoveries showed that stock price is a random work and no investor can alter the fairness and unfairness of a stock price as defined by expectation.

More so, in the works of, the stock market behavior using Markov chain. The study reveals that regardless of the bank's current share price, steady-state probabilities of share price remain the same throughout the iteration. Introduced a Markov chain model for stock market trend forecasting. The study revealed that the Markov chain model was more effective in analyzing and predicting the stock market index and closing stock price under the market mechanism. Studied long-run prospects of security prices in Nigeria, where the data were collected from the randomly selected banks from the banking sector of Nigeria. The analysis suggested that the price level of Nigerian bank were likely to remain relatively stable in the long run, irrespective of the current situation. Examined the long-run behavior of the closing price of shares of eight Nigerian banks using the Markov chain model. They computed a limiting distribution transition probability matrix of the share price and found that despite the current situation in the market, there is hope for Nigerian bank stocks. It was concluded that the results derived from the study will be helpful to investors. Many scholars have written extensively on issues of Markov chain modeling, such as.

Finally, due to the instability in the value of goods and services on Nigerian's earnings and spending, this can be linked to stochastic formation. For that reason, the method of the Markov chain was used to study the Nigerian Current Account net from 2004 to 2022. The NCA data replicated a 3-state transition probability matrix solution for each independent year, and a time interval was introduced and used as a column vector to determine the effect of changes. From the stochastic analysis, the means, standard deviations, and other variations were

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obtained. Finally, the correlation matrix was used to determine the degree of relationship between goods and services of exports and imports levels of Nigerian deficit over the periods. This paper extends the [16] by assessing the movements of NCA, stating their future stock price changes. It is the first we have applied the Markov chain model to the NCA net.

METHODS

Mathematical Preliminaries. A stochastic process $X(t)$ is a relation of random variables $\{X_t(\gamma), t \in T, \gamma \in \Omega\}$, i.e., for each *t* in the index set $T, X(t)$ is a random variable. Now, we understand *t* as time and call $X(t)$ the state of the procedure at time *t*. Because a stochastic process is a relation of random variables, its requirement is similar to that for random vectors.

It can also be seen as a statistical event that evolves according to probabilistic laws. Mathematically, a stochastic process may be defined as a collection of random variables ordered in time and defined at a set of time points, which may be continuous or discrete.

Definition 1: A stochastic process *X* is said to be a Markov chain if the Markov property is satisfied:

$$P(X_{n+1} = j / X_0, X_1, \cdots, X_n) = P(X_{n+1} = j / X_n)$$

For all $n \geq 0$ and $i, j \in S$ (state space)

It is sufficient to know that the Markov property given (3.1) is equivalent to the easy of the following for each $j \in S$.

$$P(X_{n+1} = j / X_{n1}, X_{n2}, \cdots, X_{nk}) = P(X_{n+1} = j / X_{nk})$$

(for any $n_1 < n_2 <, \cdots, n_k \leq n$)

Assuming $X_n = i$ implies that the chain is in the ith state at the nth step. It can also be said that the chain' having the value i' or 'being in state i'. The idea behind the chain is described by its transition probabilities:

$$P(X_{n+1} = j / X_n = i)$$

They are dependent on i, j and n.

Definition 2: The chain is said to be homogeneous if the following are stated below:

$$P(X_{n+1} = j / X_n = i) = P(X_1 = j / X_0 = i)$$

For all n, i, j.

The transition matrix $P = (P_{ij})$ is $n \times n$ a matrix of transition probabilities.

$$P_{ij} = P(X_{n+1} = j / X_n = i)$$

Hence, the transition probabilities with a homogenous Markov chain are always stationary at a point.

Probabilities of Sample Paths. When analyzing the structure of a stochastic process, it is essential to describe its finite-dimensional distributions. We will show that a Markov Chain distribution X_n is a product of its transition probabilities and the probability distribution of the initial state X_0.

Proposition 1: Given that X_n it is a Markov Chain on S with transition probabilities P_{ij} and initial distribution $a_i = P\{X_0 = i\}$. Then, for any $i_0, \ldots, in \in S$ and $n \geq 0$.

$$P\{X_0 = i_0, \ldots, X_n = i_n\} = \propto_{io} P_{io}, i, \ldots P_{in-1,in} P_{in}, i_{n+1}$$

Where $P = \{X_{n+1} = x_{n+1} / A_n\} = P_{in}, i_{n+1}$ by the Markov Property.

It implies that the probability of the Markov Chain to traverse a path $i_0, i_1, \ldots, i_n$ is the multiplication $P_{to,i1,} \cdots P_{in-1,in}$ of the probabilities of these transitions.

Hence, the probability that the Markov Chain up to time n has a sample path in a subset P of S^{n+1} is

$$p\ \{(X_0, \ldots, X_n) \in P = \Sigma\, P\{X_0 = i_0\}\, P_{i_0, i_1 \ldots\ldots} P_{in-1,in}\ i_0, \ldots, i_n \in P$$

In this study, Xn represents the daily profits of one of the selected companies, then the probability that there will be an increase in profits in …. number of days is $P\{X_0 \le X_1 \le \cdots \le X_n / X_0 = i_0\}$

$$= \sum_{i_1 i_0}^{\infty} P_{io,i_1 \ldots} \sum_{i_n = i_{n-1}}^{\infty} P_{i_{n-1},in}$$

These we will do for all the selected companies, as most probabilities like these for the Markov Chain can be expressed in terms of the transition matrix P= (P_{ij}) and its n^{th} product P^n, $n \ge 0$;

By definition, P^0= 1 (identity matrix), and $P^n = P^{n-1}$, for $n \ge 1$.

Given that P_{ij}^n is the (i, j) the entry of P^n, then by matrix multiplication.

$$P_{ij}^n = \sum_{i_1,\ldots,i_{n-1} \in s^{n-1}} P_{i,} i_1 P_i, i_2 \ldots P_{in-1,j}$$

N-step probabilities. The probability $P\{X_n = j/X_0 = i\}$ is the sum of the probabilities of all paths of the form. $i, i_1, \ldots, i_{n-1}, j$.

Consequently, $P\{X_n = j/X_0 = i\} = P_{ij}^n$

It can be obtained by computing P^n.. We donate the initial distribution $\propto i = P\{X_0 = i\}$ as a row vector $\propto = (a_i)$,, and then we have $P\{X_n = j\} = (\propto P^n)j$, which is the j^{th} value of the row vector $\propto P^n$.

Then, the multiplication property of matrices $P^{m+n} = P^m P$ for m, n = 1 yields the Chapman-Kolmogorov equations.

$$P_{ij}^{m+n} = \sum_{K \in S} P_{ik}^m P_{kj}^n, i, j \in S.$$

Thus, the probability of the chain moving from state i to j in m+n steps equals the probability that it moves from i to any K ∈ S in m steps and then from K to j in n more steps.

Theorem 1: Suppose is a stochastic matrix, which implies the following:

i) has non-negative entries or $P_{ij} \ge 0$ (ii)

$$\sum_j P_{ij} = \sum_j P(X_{n+1} = j / X_n = i) = \sum_j P(X_1 = j / X_0 = i)$$

Please clarify whether it refers to stationarity or the point of convergence.

Proof:(i) Each associated entry in P is a transition probability P_{ij} and is probability $P_{ij} \ge 0$.

(ii) $\sum_j P_{ij} = \sum_j P(X_{n+1} = j / X_n = i) = \sum_j P(X_1 = j / X_0 = i)$

Which is stationarity.

$P(X_i \in S / X_0 = i) = 1.$

Theorem 2: (Chapman-Kolmogorov Equations).

$P_{ij(m+n)} = \sum_{r=i}^{n} P_{ir(m)} P_{rj(n)}$ Since $P_{m+n} = P_m P_n$ and so on $P_n = P^n$, the nth power P.

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Proof:
$$P_{ij(m+n)} = P\left(X_{m+n} = j / X_0 = i\right)$$
$$\sum_r P\left(X_{m+n} = j, X_m = r / X_0 = i\right)$$
$$\sum_r P\left(X_{m+n} = j / X_m = i / X_0 = i\right)P\left(X_m = r / X_0 = i\right)$$

Using the following probability rule:

$P\left(A\cap B / C\right) = P\left(A / B\cap C\right)P\left(B / C\right)$ and setting $A = \left\{X_{m+n} = j\right\}, \mathrm{B} = \left\{X_m = r\right\}$, and $\mathrm{C} = \left\{X_0 = i\right\}$

Using Markov property yields
$$P_{ij(m+n)} = \sum_r P\left(X_{m+n} = j / \mathrm{X}_m = r\right)P\left(X_m = r / \mathrm{X}_0 = i\right)$$
$$\sum_r P_{rj(n)}P_{ir(\mathrm{m})}$$
$$\sum_r P_{1r(\mathrm{m})}P_{r1(\mathrm{n})}$$

Hence $\mathrm{P}_{m+n} = \mathrm{P}_m\mathrm{P}_n$ and so $\mathrm{P}_n = \mathrm{P}^n$, the power *of* P.

Problem Formulation. Let $S_i(\mathrm{t})\ (i = 1, 2, ..., N, t = 1, 2, ..., n)$ the yearly NCA data selected years at time *t* be defined as three-state Markov processes in finite states. Let $N \times n$ the data matrix be associated $S_i(t)$ *be* X_{it}. We consider $t = 1, 2, 3$ a row vector that multiplies each independent transition matrix to obtain NCA payment changes. Hence, we have an estimate of the transition probability as follows:

$$P_{ij} = P\left(X_t = j / X_{t-1} = i\right),\ for\ \ j = 0,1,2,3,\cdots,N$$

$$P_{ij} = \begin{cases} P \text{ if } \ j = 1 + j \\ q = 1 - P \text{ if } \ j = i - j \\ 0 \ \text{ otherwise} \end{cases}$$

Where $k+1$ is the number of states?

$$\left.\begin{aligned} n_{ij} &= \sum_{i=1}^{n} P_{ij} \ \text{ for i j=0,2,3} \\ &\frac{n_{ij}}{n_i} \ \text{ for } i\ j = 0,1,\cdots k \end{aligned}\right\}$$

However, it is an estimate of the transition matrix.

$$\hat{P}ij(\mathrm{NCA})_{2004-2012} = \begin{pmatrix} \hat{P}_{00} & \hat{P}_{01} & \hat{P}_{03} \\ \hat{P}_{10} & \hat{P}_{11} & \hat{P}_{12} \\ \hat{P}_{20} & \hat{P}_{21} & \hat{P}_{22} \end{pmatrix}$$

$$\hat{P}ij(\mathrm{NCA})_{2005-2013} = \begin{pmatrix} \hat{P}_{00} & \hat{P}_{01} & \hat{P}_{03} \\ \hat{P}_{10} & \hat{P}_{11} & \hat{P}_{12} \\ \hat{P}_{20} & \hat{P}_{21} & \hat{P}_{22} \end{pmatrix}$$

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$$\hat{P}ij(\text{NCA})_{2014-2022} = \begin{pmatrix} \hat{P}_{00} & \hat{P}_{01} & \hat{P}_{03} \\ \hat{P}_{10} & \hat{P}_{11} & \hat{P}_{12} \\ \hat{P}_{20} & \hat{P}_{21} & \hat{P}_{22} \end{pmatrix}$$

Setting $i \;\; j = 0,1,2$ for $k = 3$
Introducing time to see the effect of change on (3.10-3.12) gives the following:

$$\hat{P}ij(\text{NCA})_{2004-2012} = (t_1, t_2, t_3)\begin{pmatrix} \hat{P}_{00} & \hat{P}_{01} & \hat{P}_{03} \\ \hat{P}_{10} & \hat{P}_{11} & \hat{P}_{12} \\ \hat{P}_{20} & \hat{P}_{21} & \hat{P}_{22} \end{pmatrix} = (\varphi_1, \varphi_2, \varphi_3)$$

$$\hat{P}ij(\text{NCA})_{2005-2013} = (t_1, t_2, t_3)\begin{pmatrix} \hat{P}_{00} & \hat{P}_{01} & \hat{P}_{03} \\ \hat{P}_{10} & \hat{P}_{11} & \hat{P}_{12} \\ \hat{P}_{20} & \hat{P}_{21} & \hat{P}_{22} \end{pmatrix} = (\varphi_1, \varphi_2, \varphi_3)$$

$$\hat{P}ij(\text{NCA})_{2014-2022} = (t_1, t_2, t_3)\begin{pmatrix} \hat{P}_{00} & \hat{P}_{01} & \hat{P}_{03} \\ \hat{P}_{10} & \hat{P}_{11} & \hat{P}_{12} \\ \hat{P}_{20} & \hat{P}_{21} & \hat{P}_{22} \end{pmatrix} = (\varphi_1, \varphi_2, \varphi_3)$$

Developing Markov Chain Model for Stochastic Analysis of NCA Movement. For proper accuracy of the Markov chain model for future events, it must be developed to predict NCA payment movement. The initial payment needs to be in three finite states as follows:
R: represents the probability of NCA payment reducing shortly
I: represents the probability of NCA payment increasing shortly
NO-change: represents the probability of NCA payment not changing shortly

However, the probability of the transition matrix shows the proper explanation of the Markov chain. Every element in the matrix communicates. In order to form three states of the Markov process, we need to have the following table below:

Table 1. Transition Probability Matrix

State	1	2	3	Total of Row
1	P_{11}	P_{12}	P_{13}	T_1
2	P_{21}	P_{22}	P_{23}	T_2
3	P_{31}	P_{32}	P_{33}	T_3

Each entry P_{ij} indicates the number of times a transition is made from one state *i* to state *j*. The transition matrix is computed by simply dividing every element in each row through the total of each row. Nevertheless, this dissertation studies NCA payment data collected from statistical bulletins.

RESULTS AND DISCUSSION

The data for this paper is obtained from the statistical bulletin. I understand that you need to showcase the performance of the Nigerian Current Account in a finite state. Please let me know if there is any specific information or data that you want me to include in the demonstration. The secondary data from 2004-2022, every independent year, was used to form a transition probability matrix.

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Table 2. Nigerian Current Account (NCA) from 2004-2012

NCA movements	Reducing(R) its imports and exports payments	Increasing(I) its imports and exports payments	No(N) change in its imports and exports payments	Row totals of NCA
R	331429.7	263295.7	376024	970749.4
I	186084.8	52304.3	19488.7	257877.8
N	39422.8	12655.4	44731.2	96809.4

Table 3. Nigerian Current Account (NCA) from 2005-2013

NCA movements	Reducing(R) its imports and exports payments	Increasing(I) its imports and exports payments	No(N) change in its imports and exports payments	Row totals of NCA
R	3455650.31	3478374.82	4698047.08	11632072.21
I	4891744.45	2056326.3	704560	7652630.75
N	117037.3	242901.3	713023.9	1072962.5

Table 4. Nigerian Current Account (NCA) from from 2014-2022

NCA movements	Reducing(R) its imports and exports payments	Increasing(I) its imports and exports payments	No(N) change in its imports and exports payments	Row totals of NCA
R	2064890.16	1970592.13	1641463.22	5676945.51
I	2736448.26	2996626.99	687906.39	6420981.64
N	-3033484.84	3174745.44	1630072.89	1771333.49

Transition probability matrix for Nigerian Current Account (NCA) from 2004-2012

$$NCA_{2004-2012}(P) = \begin{pmatrix} 0.3414 & 0.2712 & 0.3874 \\ 0.7216 & 0.2028 & 0.07557 \\ 0.4072 & 0.1307 & 0.4621 \end{pmatrix}$$

Transition probability matrix for Nigerian Current Account (NCA) from 2005-2013

$$NCA_{2005-2013}(P) = \begin{pmatrix} 0.2971 & 0.2990 & 0.4039 \\ 0.6392 & 0.2687 & 0.09207 \\ 0.1091 & 0.2264 & 0.6645 \end{pmatrix}$$

Transition probability matrix for Nigerian Current Account (NCA) from 2014-2022

$$NCA_{2014-2022}(P) = \begin{pmatrix} 0.3637 & 0.3471 & 0.2891 \\ 0.4262 & 0.4667 & 0.1071 \\ -1.7125 & 1.7923 & 0.9203 \end{pmatrix}$$

Introducing time $t = 1,2,3$ to each independent transition probability matrix to see the effect of changes in (NCA) gives the following:

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$$NCA_{2004-2012}(P) = (1,2,3)\begin{pmatrix} 0.3414 & 0.2712 & 0.3874 \\ 0.7216 & 0.2028 & 0.07557 \\ 0.4072 & 0.1307 & 0.4621 \end{pmatrix} = (3.0062 \;\; 1.0689 \;\; 1.9248)$$

$$NCA_{2005-2013}(P) = (1,2,3)\begin{pmatrix} 0.2971 & 0.2990 & 0.4039 \\ 0.6392 & 0.2687 & 0.09207 \\ 0.1091 & 0.2264 & 0.6645 \end{pmatrix} = (1.9028 \;\; 1.5156 \;\; 2.5815)$$

$$NCA_{2014-2022}(P) = (1,2,3)\begin{pmatrix} 0.3637 & 0.3471 & 0.2891 \\ 0.4262 & 0.4667 & 0.1071 \\ -1.7125 & 1.7923 & 0.9203 \end{pmatrix} = (-3.9214 \;\; 6.6574 \;\; 3.2639)$$

The summary of the row vectors, which are changes in the Nigerian Current Account (NCA) with their various years:

$$NCA_{CHANGES} = \begin{pmatrix} 2004-2012 \\ 2005-2013 \\ 2014-2022 \end{pmatrix} = \begin{pmatrix} 3.0062 & 1.0689 & 1.9248 \\ 1.9028 & 1.5156 & 2.5815 \\ -3.9214 & 6.6574 & 3.2639 \end{pmatrix}$$

In order to gain perspective on the overall nature of the larger market on Nigerian Current Account, we, therefore, find the correlation of the above matrix of change, which gives:

The correlation matrix for the Nigerian Current Account (NCA) changes from 2004-2022.

$$Corr = \begin{pmatrix} 1.0000 & -0.9971 & -0.9346 \\ -0.9971 & 1.0000 & 0.9045 \\ -0.9346 & 0.9045 & 1.0000 \end{pmatrix}$$

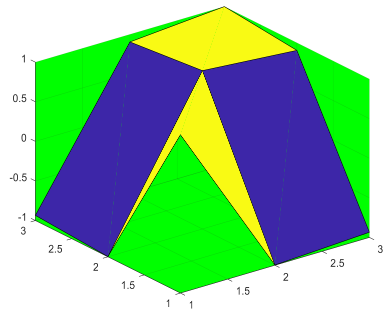

Figure 1. The profile of correlation matrix surface view of the overall transition probability matrix of changes in NCA

Table 5. Transition probability summary and other statistical variations

Year	Size	P_{redu}	P_{incr}	P_{No-ch}	Mean	Std	Max	Min	Overall
2004-2012	9	0.3414	0.2712	0.3874	0.3333	0.0585	0.3874	0.2712	
		0.7216	0.2028	0.07557	0.3333	0.3422	0.7216	0.07557	0.7216*
		0.4072	0.1307	0.4621	0.3333	0.1776	0.4621	0.1307	
2005-2013	9	0.2971	0.2990	0.4039	0.3333	0.0611	0.4039	0.2971	
		0.6392	0.2687	0.09207	0.3333	0.2792	0.6392	0.09207	0.6645*

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		0.1091	0.2264	0.6645	0.3333	0.2927	0.6645	0.1091	
2014-2022	9	0.3637	0.3471	0.2891	0.3333	0.0392	0.3637	0.2891	
		0.4262	0.4667	0.1071	0.3333	0.1970	0.4667	0.1071	3.2639*
		-1.7125	1.7923	3.2639	1.1146	2.5565	3.2639	-1.7125	

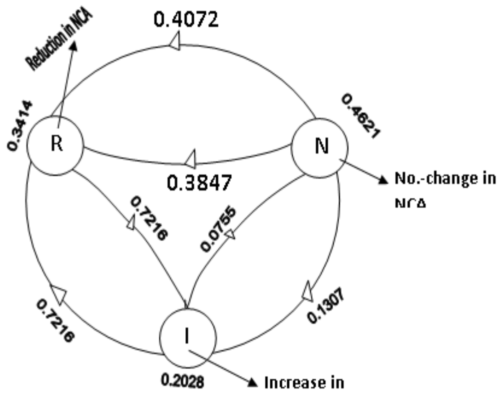

Figure 2. Diagraph Movement of Nigerian Current Account for 2004 – 2010

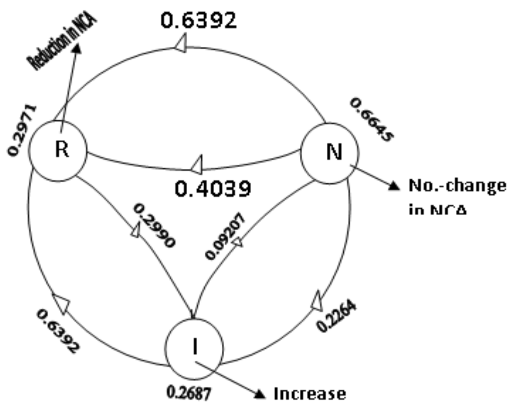

Figure 3. Diagraph Movement of Nigerian Current Account for 2004 – 2010

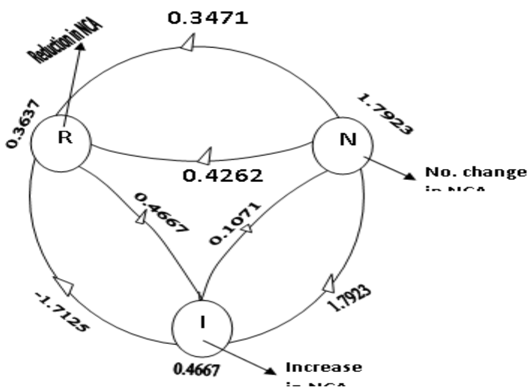

Figure 4. Diagraph Movement of Nigerian Current Account for 2005 – 2013

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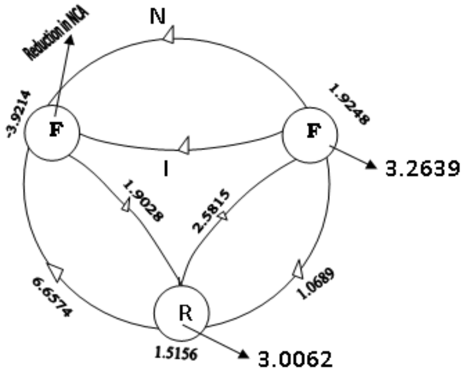

Figure 5. Diagraph Movement of Nigerian Current Account for 2005 -2013

The stochastic analysis of the transition probability matrices of each independent year of NCA tells about predicting from one state to another as follows:

NCA (2004-2012): predicts the probability of imports and export payments to reduce by 34%; 27% chance of increasing its imports and export payments shortly; 20% chance of no change in imports and export payments. Also, in the same circumstances, there is a 72% chance of reducing imports and exports payments, a 20% chance of increasing imports and exports payments, and a 7% chance of no change in imports and exports payments.

Finally, there is a 41% chance of reducing its imports and export payments, a 13% chance of increasing its imports and export payments, and a 47% Chance of no change in imports and export payments.

NCA (2005-2013): shows the probability of imports and export payments reducing by 30%; 30% chance of increasing its imports and exports payments shortly; 40% chance of no change in imports and exports payments. Similarly, in the same situations, there is a 64% chance of reducing imports and exports payments, a 21% chance of increasing imports and exports payments, and a 9% chance of no change in imports and exports payments.

To conclude, there is an 11% chance of reducing its imports and export payments, a 23% chance of increasing its imports and export payments, and a 66% Chance of no change in imports and export payments.

The results of NCA (2014-2022) describe the probability of imports and export payments reducing by 36%, a 35% chance of increasing imports and export payments shortly, and a 29% chance of no change in imports and export payments. Equally, in the same situations, there is a 43% chance of reducing imports and exports payments, a 47% chance of increasing imports and exports payments, and an 11% chance of no change in imports and exports payments.

Overall, there is a 1.7% chance of reducing its imports and export payments, a 1.8% chance of increasing its imports and export payments, and a 3.3% Chance of no change in imports and export payments.

The above assessments tell the level of surplus made in imports and exports of goods and services, payments made to foreign investors, and transfers such as foreign aid. The -1.7% indicates shortages in the goods and services in NCA. Hence, the predicted results provide an eye-opener for this stochastic analysis that will enhance their investment decisions.

The summary of the row vectors, which is the changes in the Nigerian Current Account (NCA) with their various years, stipulates payment changes after three-year intervals for both short and long-term business plans.

Table 1 shows the comparisons of transition matrices of different years, which are as follows:

2004-2012 has the highest probability of reducing payments by 72%. The year 2005-2013 has the highest probability of reducing by 66%, and finally, 2014-2022 has the highest probability of no-change in payments of goods and services by 3.3%. All this informs the Nigerian economy on how to make vital decisions effectively.

The correlation matrix for Nigerian Current Account (NCA) changes from 2004-2022 shows that the import and exports of goods and services are negatively highly correlated. The negatives describe a deficit in NCA within the periods.

Figure 1, which is the surface view of the correlation matrix, also shows a degree of relationship between imports and exports of goods and services involved and levels of deficit in NCA.

Figures 2-5 show the state transition digraph of NCA for each year, implying that each state communicates effectively; hence, it is a Markov chain that the past and future are independent when the present is known.

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CONCLUSION

A suggestion of the Markov chain is a precise instrument for investigating the Nigerian Current Account formation since each finite state communicates for suitable decision-making. Therefore, this dissertation studied the stochastic analysis of the Markov chain on NCA data (2004-2022). The NCA data were transformed into a 3-step transition probability matrix solution to cover independent years. The future NCA data changes were known by introducing a time interval of three years as row vectors. The solution matrix of the stochastic analysis showed that 2004-2012 has the highest probability of reducing payments by 72%, the year 2005-2013 has the highest probability of reducing by 66%, and finally, 2014-2022 has the highest probability of no-change in payments of goods and services by 3.3%. Finally, other statistical variations were also considered and discussed in this paper. All this informs the Nigerian economy on how to make vital decisions effectively. This study investigated 3- the state's case; the stochastic differential equation problem is suggested as an exciting area of further study.

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