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Using Markov Chains to Predict the Probability of Change in Cumulative Rates for Students of the College of Administration and Economics / University of Basrah

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ABSTRACT

The Markov chains are of great importance for predicting future situations, and the advantages of this method is that it does not depend on the causes of the phenomenon, but rather takes it as it is, to be analyzed and predict its future state, The aim of the research is to assess the cumulative rates of students of the College of Administration and Economics, University of Basra, by estimating the probability of change in the current time and predict the probability of change in the case of stability. And we reached a decline in the probability of higher cumulative rates in the future for all sections, especially in the departments of economy, accounting and statistics by 6%.

1. Introduction

There is no doubt that the low rate of cumulative students is one of the most important factors of educational waste, in universities and this means that students stay in the university for a longer period of normal, for the years of graduation from the bachelor's degree in order to raise the cumulative rates of minimum required for graduation, and this reduces the output of university education and contributes to the slow movement of universities in meeting the development needs of qualified national cadres [5].Considering that the cost of university education is generally higher than other social and economic activities, and that any successful institution must monitor the validity of its plans according to an objective methodology , And evaluate the performance of this strategy from time to time. This study was designed to evaluate this policy towards the cumulative rates of students by estimating the probability of change in the rate of cumulative students (acceptable, average, good, very good, excellence) Which can be calculated

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by calculating the transition from one estimate to another, or predicting the state of stability of the estimates in the future.

This research consists of two chapters: the theoretical side, which contains the scientific methodology of research and previous studies. It also includes Markov's method of analysis, definition and types, how to form a transitional matrix and how to reach the stability that is the core of this subject.

As for the practical aspect, it includes the collection of data representing the cumulative rates of students of the College of Administration and Economics / University of Basra for the academic years (2013-2014),(2014-2015), (2015-2016) and (2016-2017). Analyze data and obtain results to achieve the research objective, and make recommendations based on our findings.

2. Theoretical side of research

2-1. Scientific methodology of research

2-1-1. Research problem:

The success of any organization is measured by controlling its capabilities in a way that achieves its objectives as the best way and how to achieve its plans and monitor them periodically, as the low cumulative rates of students is a big problem resulting in their stay longer in the university study than the period specified for graduation, Which may in most cases lead to their separation from the university and thus the loss of human and material resources allocated to them.

2-1-2. Research objective:

The research seeks to use the Markov Series method to predict the cumulative rates of students of the Faculty College of Administration and Economics / University of Basrah, with the aim of optimizing the preparation of accepted students and improving the educational policy in the college.

2-1-3. Research Hypothesis:

Research does not depend on the causes of the phenomenon of low cumulative rates of students, which can be through this research to assess the prospects for improvement or low cumulative rates of students in addition to predicting the stability of the phenomenon in the future.

2-1-4. Importance of research:

The research is important because the phenomenon of academic stumbling has become a tangible phenomenon in the Iraqi universities. It suffers from large numbers of students. It focuses on the university student, which is a basic pillar in the society and has many responsibilities in the future of the country.

2-1-5. Research Sample:

The research was limited to the data available in the students' affairs at the College of Administration and Economics / University of Basrah, which is the cumulative rates of students according to the estimates (acceptable, average, good, very good, excellence)

2-1-6. Research Limits:

Temporal Limits: The research was limited to the four academic years from 2013 to 2017.

Spatial Limit: Applied research in the College of Administration and Economics / University of Basrah.

The human limit: Students of the College of Administration and Economics who obtained cumulative rates ranging from 50 to 100.

2-1-7. Terminology:

Annual rate = total number of hours multiplied by grade / total number of credit ho urs in this year.
Cumulative average = (10%) for the annual rate of the first stage +(20%) for the annual rate of the second stage + (30%) for the annual rate of the third stage + (40%) for the annual rate of the fourth stage.
The following table shows the value for each estimate

Estimate	value
excellent	90-100
Very good	80-89
good	70-79
Average	60-69
Accepted 50-59	50-59

The College of Administration and Economics was established in the University of Basrah in 1970-1971. The College has six departments: Business Administration, Economics, Accounting, Statistics, Finance and Banking.

2-2. Previous studies

The studies on this topic have varied, including the study of (Alaajis,2002),which aimed to identify the factors affecting the low cumulative rates of some students of the Islamic University in Gaza, has been used. The researcher used the descriptive and analytical method. The study concluded that the most important factors affecting the low cumulative rate Are the social and economic factors of students, followed by personal factors and finally educational factors. The study of(Tiafha,2006) also aimed to identify the reasons behind the low cumulative rates of inciters students at Mu'tah University by sex and type of college. The researcher used some different statistical treatments which resulted in several results, the most important of which is the lack of previous preparation of the subjects and the methods of university teaching focused on Rationalization and parenting are the most important reasons for the low cumulative rates of student inciters. The study of (Abu Hashim and Abu El-Ela Shalaby ,2009) aimed to identify the statistical characteristics of the academic performance rates of the students of the College of Education, King Saud University. The study showed statistically significant differences between the average of the cumulative average of the students of each department and the overall average of the cumulative average of the college students as a whole Except the Department of Psychology. The study of (Barakat ,2009) aimed to identify the relationship of self-concept to the level of ambition among the students of Al-Quds Open University in the light of gender variables, specialization and academic achievement. The study showed that the level of self-concept and the level of ambition among the sample are at the average level. In addition to the study of (Professor and Sabah ,2010), which aimed to identify the level of academic stumbling and its causes among students of Al-Aqsa University in Gaza, as well as the role of Information and Communication Technology in addressing this stumbling. The study of(Mensoor ,2010) aimed to identify the factors affecting the achievement of Birzeit University students in Palestine in order to improve the university's acceptance. Showed that there is a weak positive correlation between the psychological and self-factors affecting students' academic achievement and the average academic achievement of students. And finally the study of (Morsi ,2017), which aimed to identify the most important cognitive processes that are expected to achieve academic achievement in both the students and students of the Jouf University, and the results revealed that there is a related relationship Positive and functional between the self-control and the organization of tools and the cumulative rate of female students, and the study showed that the organization of tools is the only process of pre-eminence and academic stumbling.

2-3. Markov chains analysis

The method of analyzing Markov is a method that deals with the probability of a particular event in the future based on the analysis of some possibilities, that is, a scientific method to study and analyze the phenomenon in the current period in order to predict its behavior in the future, and renaming the analysis of chains Markov proportion to the world Russian Andriavich Markov, This analysis at the beginning of the twentieth century. [4]

2-4. Definition of Markov chains

The Markov chains is defined as a series of random variables with discrete values X1, X2, X3, X4, ... which represents the conditional distribution of X_{n+1} by achieving the values of random variables X1, X2, X3, X4, ... It depends only on the Xn value and the explicit mathematical expression

$P_{jk}=Pr\{X_{n+1}=k \mid X_n=j, X_{n-1}=j_1, X_{n-2}=j_2, X_{n-3}=j_3, \ldots, X_0=j_{n-1}\}$

This equation can be written according to Markov's logic as follows:

$P_{jk}=Pr\{X_{n+1}=k \mid X_n=j\}$ [6]

2-5. Types of Markov chains

a - Discrete Markov chains: If a system is observed at regular intervals such as an hour, a day, a month ... then the random prediction procedure can be described from one case to another by a matrix representing the probability of moving to each case under study over a period of time By assuming that this matrix does not change over time, this procedure is known as the discontinuous Markov series.

b - Continuous Markov chains: These chains contribute to the continuous random motion estimation process, where the duration of each variable state is distributed in the form of the exponential distribution curve. Time is a continuous factor and the wage earners are a markov condition. , Not on the series of cases that occurred prior to the immediate situation). This is called the continuous Markov series and its matrix represents the rate of transition from each case to all other cases under study.

2-6. Transition Matrix

The transition matrix or the Markov matrix consists of a square matrix, ie, the number of rows equals the number of columns, and their elements contain probability ratios, usually labeled P, and are characterized by two capacities:

- Each element of the matrix must be represented by a probability value, ie$0 \le P_{ij} \le 1$
- The sum of the elements of each row of rows of the matrix equals the correct one.

In general, Markov's matrix is as follows:

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & \cdots & p_{1n} \\ p_{21} & p_{22} & \cdots & \cdots & p_{2n} \\ \vdots & \vdots & \cdots & \cdots & \vdots \\ \vdots & \vdots & \cdots & \cdots & \vdots \\ p_{n1} & p_{n2} & \cdots & \cdots & p_{nn} \end{bmatrix} \ldots\ldots \quad (1)$$

To calculate the probability of the transition from case i to case j by a number of steps or time units of m using the following formula:

$$P_{ij}^{m} = (X_{n+m} = j / X_n = i) \ldots\ldots \quad (2)$$

These are called transition probabilities during m of time units. [3]

2-7. Stationary and Steady State

The concept of stationary means, in general, that the statistical characteristics of the coincidental process do not change in one degree or another over time.

The steady state is shown when the long-term process continues, as the ratio of the number of transitions to each case is determined at a given value and is called the stationary probability of that condition, ie, the behavior of $P^{m}_{(i,j)}$

When m→∞ therefore, the stable distribution is defined as follows:

The probable vector $u^{s} = [u_1^s, u_2^s, \dots, u_n^s]$which achieves

$$U^s * P^m = U^s$$ Called stationary distribution when the P

The matrix of transitional probabilities of Markov chains and m of finite cases are:

$$\lim_{m\to\infty} P^{m} = U = \begin{pmatrix} u \\ u \\ \vdots \\ u \end{pmatrix} \dots\dots \quad (3)$$

Whereas:

$u = (u_1 \quad u_2 \quad \dots \quad u_n)$ the constant and only probability vector.

$$\sum_{j=1}^{m} u = 1 \ , \quad 0 \le u \le 1$$

It is also possible to find a stationary distribution for the coming period through the following formula:

$$UP = U \dots\dots (4)$$

If m is close to ∞, the probability of a m-step transition to P_{ij} will depend on the latter case rather than on the initial case, meaning that after a large number of attempts the chain will reach stationary and steady.[9]

3. The Applied Side of Research

3-1. Data collection

The data of this research were obtained from the cumulative rate data in the Student Affairs Unit of the College of Administration and Economics, University of Basrah. The data are in the form of a four-year time series from the academic year (2013-2014) to the academic year(2016-2017). (Decrease, Stability, Increases). Data can be represented as in Figure 1 for the Economics, Administration, Accounting, Statistics and Finance and Banking Departments.

3-2. The composition of the Markov matrix and the Initial distribution vector

Markov transition matrix P is created by observing the time series of cumulative rates and counting the number of case-to-case transitions of the studied cases (decrease, stability, increases), and then dividing the elements of each row into a total and for all rows to obtain the Markov matrix, table (1) shows the number of transfers of cases under study to the scientific sections of the Department of Economics, Administration, Accounting, Statistics, and finally Finance and Banking.

Figure (1)
Cumulative rates for scientific departments

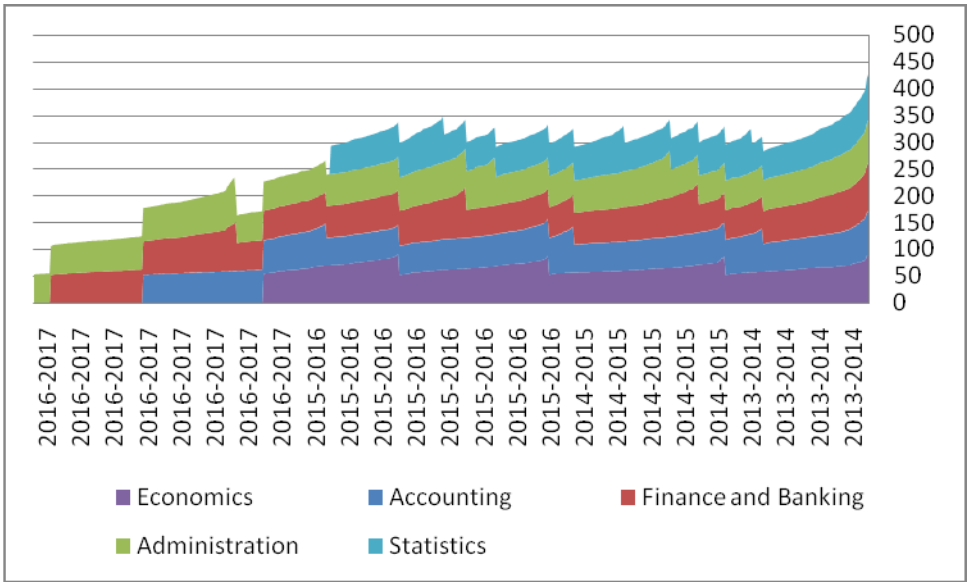

Table (1)
The number of transfers between decreases, increases and stability of cumulative rates for (2013-2017)

Total	*decreased to decreased*	*decreased to stable*	*decreased to increased*	*Scientific Divisions*
4	*1*	*2*	*1*	*Economics*
6	*1*	*3*	*2*	*Administration*
5	*1*	*3*	*1*	*Accounting*
7	*3*	*1*	*3*	*Statistics*
5	*1*	*3*	*1*	*Financial and Banking*
Total	*Stable to decreases*	*Stable to stable*	*Stable to increases*	*Scientific department*
4	*0*	*2*	*2*	*Economics*
2	*1*	*0*	*1*	*Administration*
4	*1*	*1*	*2*	*Accounting*

2	*1*	*1*	*0*	*Statistics*
2	*0*	*0*	*2*	*Financial and Banking*
Total	*increases to decreases*	*increases to stable*	*increases to increases*	*Scientific Department*
4	*4*	*0*	*0*	*Economics*
4	*4*	*0*	*0*	*Administration*
4	*4*	*0*	*0*	*Accounting*
4	*4*	*0*	*0*	*Statistics*
4	*4*	*0*	*0*	*Financial and Banking*

Using Table (1), the initial probability of cumulative rates can be calculated as shown in Table (2)

Table (2)
Probabilities of rising, declining and stable cumulative rates for 2013-2017

decreases	*stable*	*increases*	*Scientific Department*
0.33	*0.33*	*0.34*	*Economics*
0.50	*0.17*	*0.33*	*Administration*
0.38	*0.31*	*0.31*	*Accounting*
0.54	*0.15*	*0.31*	*Statistics*
0.46	*0.18*	*0.36*	*Financial and Banking*

3-3. Analysis of the results

Table(2) shows that the probability of stability and decreases in the cumulative rates of the economics department is equal to(0.33), while the cumulative rate of increase is equal for both the accounting and statistics departments equal to (0.31). The highest probability is recorded in the Statistics department of the decreases in cumulative rates is(0.54), Followed by the administration department(0.50) followed by the financial and banking(0.46)followed by the accounting followed by the economics(0.38) and (0.33). It is also possible to observe the highest increase in the cumulative rates recorded in the finance and banking department with a probability of (0.36) followed by the economics and then administration(0.34) and(0.33). The highest probability of stabilization of cumulative rates was recorded in the economics department then(0.33) followed by Accounting department(0.31), and the probability of stabilization of the cumulative rates in next period(0.15) which is the lowest. Applying

formula (4) to obtain the stationary probability of the increases, stability and decreases of cumulative and long-term rates or so-called stationary distribution for the coming period as shown in Table (3)

Table (3)
The long-term Expected probability of increasing, decreasing and stabilizing cumulative rates

decreases	*stable*	*increases*	*Scientific department*
0.36	*0.36*	*0.28*	*Economics*
0.48	*0.24*	*0.28*	*Administration*
0.42	*0.33*	*0.25*	*Accounting*
0.59	*0.16*	*0.25*	*Statistics*
0.42	*0.25*	*0.33*	*Financial and Banking*

Table (3) shows the stationary probability of the cumulative and long-term rate of the next period. We observe the highest probability is (0.59) which is the case of the cumulative decrease of the statistics department and the lowest probability (0.16) which is also the stability of the Statistics Department. 6%, and the probability of a decrease in cumulative rates is improved by 2% and 4% respectively in the administration, financial and banking departments. The probability of stability in cumulative rates increases in both the administration and finance departments and banking by 7%.

4. Conclusions

From the time series data for the cumulative rates on which the study was prepared for the period from(2013) to(2017) we have reached:

a - We noticed through the study that the highest decreasing in cumulative rates recorded in the Department of Statistics and by 54%, and the rate of stability was 15% for the same department.

b - The highest increasing in cumulative rates recorded in the Department of Finance and Banking was 36%.

c - In the long run, it is possible that there will be a decline in the probability of a cumulative increase in the cumulative rates in all scientific departments in the college, especially in the departments of economics and accounting by 6%, while the administration, finance and banking departments will improve by 2% and 4%, respectively. The probability of stabilization of the cumulative rates is likely to increase by 7% in the administration, finance and banking departments.

5. Recommendations

Based on the above conclusions, we recommend the following:

a - The College of administration and Economics / University of Basra to make more efforts to raise the level of education in the college through the change of education policy, and the chose of qualified staff.

b - To identify the causes of low cumulative rates in relation to the student of the possibilities available to him and the circumstances surrounding him, whether in college or community, and his real desire in the specialization he is studying.

c - The work of studies simulating the two points above, taking advantage of the results of this research.

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