

ANALYZING ACADEMIC STAFF PROMOTION CRITERIA IN NIGERIAN UNIVERSITIES USING A NONERGODIC MARKOV CHAIN MODEL

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Abstract

In this paper promotion criteria for some Nigeria Universities are presented. Based on certain assumptions, a Markov chain model that is not irreducible has been formulated. The model is applied to analyze two aspects of promotion criteria in Nigerian Universities namely: the expected number of years an academic staff can stay in a cadre in which he was initially employed and prediction for future years the percentage of academic staff in each cadre. These analyses were numerically carried out using the data obtained from one of the universities.

Keywords: Markov chain, promotion criteria, irreducible Markov chain, ergodic.

Introduction

In Nigeria, a university is established and owned by either, the Federal Government, State Government or Private individuals including religious bodies. Though the National Universities Commission (NUC) is the body that regulates the academic standard and accredits degree programmes in all Nigerian Universities, the commission does not formulate promotion criteria for academic staff in any University. Academic staff promotion criteria are set up and approved by the Governing Council of the respective Universities. And this is the reason why academic staff promotion criteria differ from one University to another. For example, as can be seen in UNIBEN ASUU (2004), that is Fig. 1, ten papers are among the requirements for promotion of academic staff to the rank of professor in two Federal Universities namely: University of Ilorin, Ilorin and Ahmadu Bello University Zaria while twenty seven papers are among the requirements for promotion to the same professorial rank in the University of Benin City, which is also a Federal University. More details about the twenty seven papers required by the University of Benin can be found in UNIBEN (2003) .

It could be remarked that there is only one University System in Nigeria that produces graduates for the same labour market, yet the number of publications for promotion of academic staff at the various levels in some Universities are undoubtedly lower than the number in some other universities be it Federal, State or Private. In fact, Moye (2004). puts it this way. "To the average Nigerian, a professor is recognized as such irrespective of the standard of attaining the position or the University that gave the chair. This kind of reasoning has constantly brought accusations and counter accusations between Universities Management and their corresponding branches of labour unions, Academic Staff Union of Universities (ASUU). While University Managements may argue that the work force is becoming top heavy with too many professors evolving at a rate much higher than financial increment from government subventions, ASUU believes that the present duties and number of students an academic staff has to cope with has been on the increase in geometric proportion for over ten years now. The unions wonder why those who became professors with less than half of the present number of publications should confiscate or throw away the ladder with which they climbed to the top so that others do not find the means of reaching them. There is hardly any ASUU branch union and its University Management that has not had conflict due to this "publish or perish syndrome." Many of such cases have resulted in union strikes before settling issues through dialogue.

Comparative Analysis of Promotion Criteria of Some Nigerian Universities

	123	45	67	8	9	10 11					
Post	UNI LAG	ABU	UI	UNI PORT	UNI LORIN	UNN (1 paper = 0-3 Pts)	NNA. AZIK UNIV	UNAAB	UNIABUJA	OAU IFE	UNIBEN
Asst. Lect. To Lect.	NA	3 Conf. Papers/Sem	1-2 Papers	NA	NA	15 Points	NA	Ph.D, with No. Paper, MSc. With 1 Journal Paper or 2 Edited Conference Papers'	1 Journal Paper (5 points)	NA	Ph.D or M. Sc 1 Journal Paper
Lect. II To Lect. I	NA	3 Jour. Papers for Non-Ph.D 2 Jour. Papers/ or 3 Conf Papers for Ph.D	5-7	3 Jour. Papers Ph.D is Desired	4 Jour. Papers (12 Pts)	25 Points	4 pts	Ph.D with 4 Journal Papers or 3 Journal Papers and Edited Conference Papers M. S. with 3 Journal Papers and Edited Conference Paper.	Ph.D with 2 Papers (8 Points) M.Sc. with 3 Papers or (12 Points)	4 Papers	Ph.D. or M.Sc. 3 Publications 2 must be Journals
Lect. 1 To Sen. Lect	15 Points	Ph.D Desired 6 Jour. Paper 5 Conf Papers.	10-15 Papers Depending on the faculty e.g. Social Science which also emphasizes Foreign* Component from S.	17 Jour. Papers or 20 Points	7 Jour. Papers (20 Pts)	30 Points	10 Pts	Ph.D with 10 Papers. 6 of which must be Journal Papers or 11 Papers. 5 of which will be Journal and 6 Conference Papers	Ph.D with 5 papers or (25 points) M. Sc. With 7 papers (35 points)	7 Papers	Ph.D or recognized Professional Qualification. 8 Publications. 6 must be Journal Articles plus 12 pts
Sen. Lect To Assoc. Lect.	21 Points	Ph.D 10 Jour. Papers 5 Conf. Papers (15 Public)	15-20 Papers, 25 Papers (e.g. Social Science) Depending on Faculty (General, best 10 that reflect the totality of their Contribution to Scholarship in their	17 Papers (50 Points)	8 Jour. Papers (24 Pts)	60 Points	20 Pts	Ph.D with 5 Journal Articles with i i in Print and 4 in Press or 14 Journal Articles, 2 Conference Papers or 13 Journal Papers and 4 Conference Papers (75% in print)	Ph.D with 9 papers (45 Points)	8 Papers	Ph.D or Recognized Profession « Qualification. 18 Publications 75% in Print. 3 in 2 Different Indexed Journals 3 Refereed Proceedings Plus 24 pts.

Key : NA means information not available

	1	2	3	4	5	6	7	8	9	10	11
Post	UNI LAG	ABU	UI	UNI PORT	UNI LORJN	UNN (1 paper = 0-3 Pts)	NNA. AZIK UN IV	UNAAB	UNI ABUJA	OAU IFF	UNIBEN
Assoc. Prof. To Prof.	24 Points	Ph.D 22 Public i.e. 15 Jour Paper & 7 Conf Paper	22-25 Papers (e.g. Agric, Art): 30-40 Papers (e.g. Social Sciences with emphasis on Foreign) Component Depending on Faculty. (Generally, best 10 that reflect the totality of their Contribution to Scholarship in their	22 Papers or 65 Points	10 Journal Papers (28 pts)	Ph.D Requi. (65 pts) at least 15 Pts via Jour.	30 Pts	20 Journal Papers, 15 must be in Print or 19 Journal Papers and 2 Conference Papers or 18 Journal Papers and 4 Conference Papers of which 75% in Print	Ph.D with 12 Papers or 60 Points	10 Papers	Ph.D 27 Publications. 75% in Print. 5 in 3 Indexed Journals. Not more than 3 Proceedings Plus 30 Pts
Ph.D	Prefer. Higher Deg. e.g. Ph.D or its Profess Equiv, after Good Hon. Deg.	Desired form S. L.	NA	Desired from L. 1	NA	Required from A. P.	NA	Required from S. L. but Six Years of Grace Period from 2003	Required feom A. P.	1 or 2 extra Papers without Ph.D from A. P.	Required from S. L.
Foreign' Index Publ/ j Spread	Nil	Nil	*(Please see below	Nil	Nil	Nil	Nil	15% and 20% for A. P. and Prof. Respectively; Spread Not Required	Nil	Nil	Required plus Spread

* Ibadan: Each faculty should determine which Journals are learned Journals and which are not. What is more important is the contribution of the candidate to scholarship than the Journal in which it is published. It is not to make a distinction between local and international Journals: for a Journal, which is local in one place, may be international in another.

Fig 1: Comparative Analysis of Promotion Criteria of Some Nigerian Universities. Source: UNIBEN ASUU (2004).

Strikes are counter productive and often evolve from a critical, strained labour relation. Many research work including Lilien and Rao (1975), Carey and Sherr (1974), and Grinold (1976), on Manpower Management are focused on labour relations especially the aspect of resolving conflicts that arise between management and union. The scientific research papers often use models of Markov chain as could be found in Schachtman and Hogue (1976), Simmons (1971), and Villiant and Milkovich (1977). Markov Chain models are stochastic processes where the processes move from one outcome (or realization) to another outcome according to set of probabilities. Stochastic processes are collection of random variables whose values are observations at certain points in time. Such processes are very general in nature and some specific assumptions must be imposed in order to yield a tractable model. Specific illustrations of such tractable models can be found in Dinkel et al (1978), Hillier and Lieberman (2001), and Taha (2002). A Markov Chain has been derived in the following section to assist in analyzing the problem of academic staff promotion criteria in Nigerian Universities.

Nonergodic Markov Chain Model

Before discussing the model, it is necessary to define some terms as follows:

Definitions

- Irreducible:** A Markov is said to be irreducible if it is possible to start from state i and reach state j in some finite number of transitions \forall states i and j i.e. $P_{ij}^{(n)} > 0$ for some n , $\forall i$ and j .
- Periodic:** A state, i is said to be periodic with period $t > 1$ if it is possible for the chain to be in state i only for multiples of t . in other words $P_{ii}^{(n)} = 0$, whenever n is not a multiple of t . If $t = 1$, the Markov chain is said to be **aperiodic**. The idea of periodicity relates to a cyclic nature with which the process returns to certain states.
- Ergodic:** If a finite markov Chain is irreducible and aperiodic then it is ergodic. Ergodic Chains are important because for such a chain it can be shown that the long-run probability exist and are uniquely determined. That is

$$\lim_{n \rightarrow \infty} P_{ij}^{(n)} = \pi_j, j = 1(1)N$$
 where the π_j satisfy the Steady State Equations

$$\pi_j \geq 0 \tag{2}$$

$$\sum_{j=1}^N \pi_j = 1 \tag{3}$$

$$\pi_j = \sum_{l=1}^N \pi_l P_{lj}, j = 1(1)N \tag{4}$$

These probabilities, π_j are called steady state probabilities for they are the probability of finding the process in state j after the process has gone through a large number of transitions.

- Absorbing State:** A state is said to be absorbing if whenever you enter it you cannot come out of it. That is $P_{ii} = 1$. If at least one of the states in transition matrix is absorbing then the Markov is not **irreducible** and it cannot be ergodic. It is not possible to complete the long-run probabilities π_j ($j = 1(1)N$) for a nonergodic Markov chain.

Assumption of the Model

The following are the assumptions of the model:

- The transition matrix ensures that an academic staff who is due for promotion can only move to the next rank at the one step transition.
- Demotion is not allowed.
- Each time period is one calendar year.
- The stationarity property of Markov chain holds.

e. Let the transition matrix of order N (having two absorbing states) of the model that satisfy the above assumptions be denoted by:

$$P = \begin{array}{c} \text{Transition States} \\ \text{Absorbing States} \end{array} \begin{array}{c} 1 \quad 2 \quad 3 \quad \dots \quad N-2 \quad N-1 \quad N \\ \left(\begin{array}{ccccccc} P_{11} & P_{12} & & & & P_{1,N-1} & P_{1,N} \\ & P_{22} & P_{23} & & & P_{2,N-1} & P_{2,N} \\ & & P_{33} & P_{34} & & P_{2,N-1} & P_{3,N} \\ & & & \dots & & \vdots & \vdots \\ & & & & P_{N-2,N-3} & P_{N-2,N-2} & P_{N,N-1} & P_{N,N} \\ & & & & & & 1 & \\ & & & & & & & 1 \end{array} \right) \end{array} \quad (5)$$

Where $\sum_{k=1}^N P_{ik} = 1, (\text{for } i = 1(1)N)$ (6)

and $P_j^N = P_j^{N \times N}$ is the probability of an academic staff remaining in cadre j after N years. It can be proved that for the transitions matrix (5) of the Markov model in which demotion is not allowed the expected number of years an academic staff can remain in cadre j given that he started in cadre j is denoted by

$$\sum_{n=1}^{\infty} n P_j^n = \frac{P_j}{(1 - P_j)^2} \quad (7)$$

f. Apart from computing the expected number of years an academic staff can remain in a cadre using equation (7), the nonergodic Markov model can also be used to aid in predicting the number of academic staff persons in each of the cadre in future years. This is explained as follows: If at time t ,

g. there are $n_i(t)$ academic staff in cadre $i, i < j$ with P_{ij} probability of moving from cadre i to cadre j , then the total number of academic staff in cadre i at time $(t + 1)$ is denoted by

$$\left. \begin{array}{l} \text{(a) } n_j^{(t+1)} = \sum_{i=1}^j P_{ij} n_i^{(t)} + n_j, \quad \leq j \text{ and } j = 1 \\ \text{(b) } n_j^{(t+1)} = \sum_{i=1}^j P_{ij} n_i^{(t)}, \quad i \leq j, \quad j \leq 2 \end{array} \right\} \quad (8)$$

where $t = 0, 1, 2, 3, \dots, j = 1(1)N$

and H_j in (a) is the number of academic staff that are constantly recruited into cadre j annually. If recruitment is done only at the lowest cadre $j = 1$, then (a) of equation (8) is used for only the first cadre while (b) is used for other cadres $j < 2$. However, if each cadre j has a constant number n_j of staff that is recruited into the cadre then in place of equation (8) we use equation (9) as follows:

$$n_j^{(t+1)} = \sum_{i=1}^j P_{ij} n_i^{(t)} + n_j, \quad \leq j \text{ and } j = 1 \quad (9)$$

h. Using the same transition probability matrix, we only need to substitute $n_j(t+1)$ for $n_j(t)$ to obtain $n_j(t+2)$ and so on.

Using the same transition probability matrix, we only need to substitute $n(t+1)j$ for $n(t)l$ to obtain $n_j(t+2)$ and so on.

.Model Application

Using five-year data obtained XYZ University in Nigeria, the transition matrix in (10) was obtained. The actual name of the University in Nigeria is being withheld because of the confidential

		Transient States				Absorbing States	
		Ju	Sn	As	Pr	LBBRD	LBRC
Transient States	Ju	0.57	0.27	0.0	0.0	0.16	0.0
	Sn	0.0	0.57	0.17	0.0	0.26	0.0
	AS	0.0	0.0	0.81	0.05	0.14	0.0
	Pr	0.0	0.0	0.0	0.96	0.0	0.04
Absorbing States	LBBRD	0.0	0.0	0.0	0.0	1.0	0.0
	LBRC	0.0	0.0	0.0	0.0	0.0	1.0

consideration of the University.

(10)

(10) is the partitioned transition matrix of Academic Staff Promotion in XYZ University. In collecting the data from XYZ University, the various ranks of academic staff were classified and denoted as follow:

Ju - Junior lecturers made up of Asst. Lectures, Lecturers 11 and Lecturers 1.

Sn - Senior Lectures
As - Associate Professors

LBBRD - Those who could leave by resignation/dismissal
LBRC - Those who could leave by retirement/contract appointment.

Using equation (7), the expected number of years to remain at each of the first three cadres, for each starting cadre j namely; Junior Lecturers ($j = 1$), Senior Lecturers ($j = 2$) and Associate Professors ($J = 3$) are 3.08 years, 3.08 years and 22.44 years respectively. By this model someone who enters the academic profession newly as Associate professor is expected to remain at that cadre without promotion for 22 years. It implies that the model discourages someone entering the profession newly from top without commensurate experience which is very vital in the teaching profession. This shows that it is better to start the academic profession in the XYZ University from the lower cadre and acquire the experiences gradually.

The model's use in predicting the number of academic staff in each cadre in future years is numerically illustrated for XYZ University as follow: XYZ University presently in 2006 (considered as the zero year) has 930 (62%) Junior Lecturers, 270 (18%) Senior Lecturers, 180 (12%) Associate Professors, and 120 (8%) Professors. With up to 48% of its academic staff being Senior Lecturers and above, the XYZ University was able to have all its degree programmes accredited by the National University Commission (NUC) last year. Consequently, the present policy of XYZ University is to employ academic staff only into the Junior Lecturer cadre. And the policy fits into the equation (8) of the Markov model.

Starting with the above present number of academic staff in each cadre with constant employment of 30 academic staff annually into the Junior Lecturers cadre, the number of academic staff in each cadre at the end of the first year is given using equation (8) as follows: 560 (44%) Junior Lecturers, 405 (31%) Senior Lecturers, 192 (15%) Associate Professors and 124 (10%) Professors. At the end of the first year the total number of academic staff observed in XYZ University is 1,281 instead of 1530. the difference of 242 is the number of academic staff that left the XYZ University through the two absorbing

states.

Continuing this way, the results for the first five years are recorded in Table 1.

Table 1: Showing the percentage of academic staff to be in each cadre of XYZ University in the first. live years with constant annual employment of .30 academic staff into the Junior Lecture cadre.

Year	Ju (%)	Sn (%)	As (%)	Pr (%)	Expected No. in the Year	Observed No. in the year	No. lost through Absorbing states
2006	62	18	12	8	1500	1500	0
2007	44	31	15	10	1530	1281	249
2008	32~	35	21	12	1311	1084	227~
2009	25	34	27	14	1 114	922	192
2010	20	31	31	18	952	788	164
2011	18	26	35	21	818	690	128

Recommendations

The second assumption of this model states that demotion is not allowed, which was exactly what happened for the years in XYZ University. However, in many real situations both promotion and demotion can occur in a given year. That is in annual appraisal exercise some staff may experience promotion or remain in their level if they have not met the requirements for promotion while others may be reprimanded by demotion. By modifying the second assumption of this model to include cases of demotion and possibly double promotion the model can be made more relevant and applicable to many establishments. These cases can be good extension of this research work.

Conclusion

It should be encouraged that the nonergodic Markov chain model be applied to determine the expected number of years an academic staff employed at a certain cadre will remain in that cadre. This was illustrated using XYZ University. The second use of this model is in determining the percentage of academic staff in each cadre in future years. In (b) of equation (8) the quantity $y p to$ is made up of those who after the promotion exercise were not promoted to cadre j and those i that were promoted from other lower cadres i , ($i < j$) to cadre j . As can be seen in Table 1, in the long run (despite the H_j constant addition to the Ju cadre) the higher cadres tend to be top heavy because more of the academic staff would have been promoted to these cadres which is the reverse of the initial spread. Also in the long run the number of academic staff that will resign, be dismissed, retire, or take up contract appointment (i.e. to be found in the absorbing states) will reduced.

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