INTERGENERATIONAL OCCUPATIONAL MOBILITY OF THE TRIBAL PEOPLE OF UDALGURI DISTRICT: A MARKOV CHAIN APPROACH

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Abstract: Occupation, income, education, status, gender, race, environment, culture etc are some of the determinants that help us to know the potential social mobility of a group of people. Among these occupation plays a vital role in determining social mobility. The present paper attempts to examine the intergenerational occupational mobility of the Bodo tribal people of Udalguri district under Bodoland Territorial Area District (BTAD) of Assam, with the help of Markov chain approach. The study of occupational mobility of these people has become immensely important as the newly formed autonomous district (BTAD) opened up new offices as well as new opportunities that have brought changes to the lives of the people. Again only a few studies have been carried out so far of these people living in this area. The findings from analyzing a set of primary data with the help of Markov Chain approach reveal that the occupational mobility of the Tribal community in Udalguri district in general has undergone a great change and there are reasons to believe that it occurs due to the formation of BTAD, which is supposed to fulfil the hopes and aspirations of the Bodo tribal people.

Key words: Markov Chain, Social mobility, Intergenerational Occupational mobility, Horizontal and Vertical mobility, Upward/ Downward mobility etc.

I. INTRODUCTION

Intergenerational (across generations) occupational mobility refers to changes in occupational status that occur between two generations, that is, of father and son or family members of one generation and the next. It shows the ability of a person or persons to move up or down the hierarchal structure of social stratification. Occupation along with income, education, gender, race, environment, culture etc is some of the determinants for potential social mobility. There are two types of occupational mobility, horizontal and vertical. Horizontal mobility refers to a change of occupational position or role of an individual or a group without involving any change in its position in the social hierarchy. On the contrary, vertical mobility refers essentially to changes in the position of an individual or a group along the social hierarchy. Sociologists analyse, distinguish vertical mobility in between how far an individual is mobile in his or her career, and how much his/her position differs from that of his parents (Giddens, 1997). It was Prais (1955) who first applied Markov Chain Theory to measure social mobility. Each society is characterized by transition probability matrix so most of the proposed measures were based on the elements of matrix. Matras (1960) has listed some examples of it. Measures related to occupation changes of a particular individual based on Semi Markov processes were proposed by Ginsberg (1971), Bartholomew (1982), Mukherjee   and Chattopadhyay (1989) and others. Mukherjee and Chattopadhyay (1986) and Chattopadhyay (1993) developed the measures to represent the overall pattern of association and the direction of movement when the social classes are ordered with respect to certain characters.

II. OBJECTIVES

The primary concern of this study is to investigate the intergenerational occupational mobility of the Bodo tribal people of Udalguri district with the following objectives:
A. To examine the inter-generational occupational mobility,
B. To examine the direction of movement / mobility of the tribal people,

III. DATA AND METHODOLOGY

As for Primary data, we have randomly taken 2000 respondents. All belong to 40-50 age groups. For Secondary data we take help from the websites of the district administration of Udalguri district, the Census reports of government of India, books, periodicals and some other relevant web sites.

For methodology, Markov Chain is used in this study in addition to some commonly used indices. Long run behavior of Markov chain and physical interpretation of limiting probabilities are also analyzed in this study. Markov chain is named after the Russian Mathematician Andrei Andreivich Markov. It is a stochastic process that has a countable number of possible states for which future probabilities are determined only by the present state of the process. Markov Analysis is a dependent analysis. In Markov Analysis future of a process depends on present state of the process, not on the past state of the process. Markov Analysis rests on the transition probability matrix (TPM) and the initial conditions. Social mobility is a phenomenon whose future depends on the earlier states of affairs. Again the Structure of a society or future development of society depends on initial structure (Initial probability distribution) and transition probability matrix in the first survey. Of these two features, initial distribution has a diminishing influence on the process as time passes. In the long run, therefore, the structure of society is determined by transition probability matrix. That is why the study of mobility gets cantered at the TPM. In other words study of mobility is a function of the elements of TPM.

Let $\{X_n, n = 1,2,3, . . .\}$ be the discrete time discrete state space stochastic process. It follows Markov chain of first order if

$P(X_n = k / X_{n-1} = j, X_{n-2} = i, . . .) = P(X_n = k / X_{n-1} = j) = p_{jk}$ holds,

and the Markov chain is of order h if

$P(X_n = k / X_{n-1} = j, X_{n-2} = i, . . . X_{n-h} = c, . . .) = P(X_n = k / X_{n-1} = j, …, X_{n-h} = c)$ holds true.

The transition probability matrix associated with Markov chain

$P = (p_{jk})_{N \times N}$

where $j, k \in S =$ state space of the Markov chain , $\sum_k p_{jk} = 1$ for all $j \in S$

In long run i.e. when n is large, $P^{(n)} (= P^{(\infty)})$ reduces to a stochastic matrix with identical rows and this matrix.

Indices used:

Total mobility: The amount of mobility generated by the movements of the sons from the status of his father. It is measured by

$$TM = N - \sum_l^k n_{ij}, \text{ N is the sample size} \qquad (3.1)$$

Structural Mobility:

$$SM = N - \sum_i \min(n_{i0}, n_{0i}) \qquad (3.2)$$

Pure Mobility:

$$PM = TM - SM \qquad (3.3)$$

Glass Index (for the ith category)

$$I_{G(i)} = N n_{ij} / n_{i0} \times n_{0i} \qquad (3.4)$$

Yasuda Index

$$I_y = \frac{(\sum_i n_{ii} - \sum_i (n_{i0} n_{0i} / N)}{(\sum_i \min(n_{i0}, n_{0i}) - \sum_i (n_{i0} n_{0i} / N))} \qquad (3.5)$$

IV. STUDY AREA AND THE PEOPLE

Udalguri district is one of the four districts of BTAD, Assam, which has been taken up for the present study as changes seen occurred in the lives of the tribal people after the formation of Bodoland Territorial Area District (BTAD). Udalguri is chiefly dominated by the Bodo community. The Bodos is the largest plain tribe of Assam, having nearly 14 lacs populations.

V. CLASS SCHEMA

To measure generational differences of occupations in origin and destination we need a class schema which should be stratified by occupational groups with their respective roles As the social structure of the study area i.e. Udalguri district of Assam, is predominantly agrarian, as the people belong to different ethnic or minority groups, as the people have different occupational back ground, and as the social arrangement of land is diverse, therefore, the Revised Indian National Classification of Occupations (NCO) 2004 has been used here with some modification. This modification is done with the help of Daniel Thorner's model of agrarian class structure as discussed by D.N. Dhanagare.

Revised Indian National Classification of Occupations (NCO) 2004 and the Indian classes used in this study

Revised Indian National Classification of Occupations (NCO) 2004	Indian classes used in this study
1. Legislators, Senior Official and Managers	I. High salaried (executives, administrators,
2. Professional	II. Middle salaried (lecturers, lower
3. Technicians and Associate Professionals	III. Low salaried, III & IV grade employees
4. Clerks	IV. Land lords, big farmers, Big businessmen
5. Service Workers and Shop and Market Sales	V. Medium farmers, medium businessman,
6. Skilled Agricultural and Fishery Workers	VI. Poor farmers, petty businessmen
7. Craft and Related Trades Workers	VII. Skilled labourers (drivers, carpenters,
8. Plant and Machine Operators and Assemblers	VIII. Unskilled labourers
9. Elementary Occupations	IX. Non-reported and others
x. Workers Not Classified By Occupations	

VI. FINDINGS AND DISCUSSION

Let us denote n_{ij} to mean the frequency in the $(ij)^{th}$ cell. Table 1(a) shows the number of sons in (Fathers) category j whose fathers (Grand fathers) was in category i.

Table: 1(a):

Occupational distribution of sons by occupation of their fathers (for1st to 2nd generation)

Fathers \ Sons	I	II	III	IV	V	VI	VII	VIII	IX	Total
I	0	0	0	0	0	0	0	0	0	0
II	0	0	0	0	0	0	0	0	0	0
III	0	0	0	0	0	0	0	0	0	0
IV	0	3	0	130	68	55	0	0	23	279
V	0	7	0	36	137	49	7	8	34	278
VI	4	13	12	0	15	130	0	48	0	222
VII	0	0	8	0	0	4	5	0	6	23
VIII	0	0	3	0	0	0	26	87	0	116
IX	0	0	12	0	0	24	20	16	10	82
Total	**4**	**23**	**35**	**166**	**220**	**262**	**58**	**159**	**73**	**1000**
Column %	0.4	2.3	3.5	16.6	22.0	26.2	5.8	15.9	7.3	

Table 1(b): Occupational distribution of Sons by occupation of their fathers (for 2nd to 3rd generation)

Son / Father	I	II	III	IV	V	VI	VII	VIII	IX	Total
I	4	0	0	0	0	0	0	0	0	4
II	4	16	3	0	0	0	0	0	0	23
III	0	16	7	0	0	0	4	4	4	35
IV	5	31	0	96	26	0	0	0	8	166
V	3	30	24	61	85	5	0	9	3	220
VI	0	24	16	42	51	68	20	29	12	262
VII	0	8	10	0	3	18	15	4	0	58
VIII	4	20	20	10	24	15	10	48	8	159
IX	0	15	20	11	14	13	0	0	0	73
Total	**20**	**160**	**100**	**220**	**203**	**119**	**49**	**94**	**35**	**1000**
Column %	2.0	16.0	10.0	22.0	20.3	11.9	4.9	9.4	3.5	

For analyzing the data, using n_{ij} values of Table 1(a) and 1(b) with the help of maximum likelihood method we have estimated the occupational transition probabilities in the following two Tables: 2(a) and 2(b).

Table 2(a): Estimated T.P.M from fathers category to sons category (2nd generation)

Son / Father	I	II	III	IV	V	VI	VII	VIII	IX
I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IV	0.0	0.01075	0.0	0.45695	0.24373	0.19713	0.0	0.0	0.08244
V	0.0	0.02518	0.0	0.12950	0.49280	0.17626	0.02518	0.02878	0.12230
VI	0.01802	0.05856	0.05405	0.0	0.06757	0.58558	0.0	0.21622	0.0
VII	0.0	0.0	0.34783	0.0	0.0	0.17391	0.21739	0.0	0.26087
VIII	0.0	0.0	0.02586	0.0	0.0	0.0	0.22414	0.75	0.0
IX	0.0	0.0	0.14634	0.0	0.0	0.29268	0.24390	0.19512	0.12195

Table 2(b): Estimated TPM from father category to sons category (3rd generation)

Son / Father	I	II	III	IV	V	VI	VII	VIII	IX
I	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II	0.17391	0.69565	0.13044	0.0	0.0	0.0	0.0	0.0	0.0
III	0.0	0.45714	0.2	0.0	0.0	0.0	0.11429	0.11429	0.11428
IV	0.03012	0.18675	0.0	0.57831	0.15663	0.0	0.0	0.0	0.04819
V	0.01364	0.13636	0.10909	0.27727	0.38636	0.02273	0.0	0.04091	0.01364
VI	0.0	0.09160	0.06107	0.16031	0.19466	0.25954	0.07633	0.11069	0.04580
VII	0.0	0.13793	0.17241	0.0	0.05172	0.31035	0.25862	0.06897	0.0
VIII	0.02516	0.12579	0.12579	0.06289	0.15094	0.09434	0.06289	0.30189	0.05032
IX	0.0	0.20548	0.27397	0.15069	0.19178	0.17808	0.0	0.0	0.0

To see the intergenerational and intra-generational social mobility, using equations (3.1), (3.2), (3.3), we have calculated Total mobility, Structural mobility and Pure mobility. These are placed in the Tables 3(a).

Table 3(a):
Table for TM, SM, PM (for 2nd and 3rd Generation)

Mobility / Generation		Total	Structural	Pure
2nd Generation	Value	501	180	321
	Value in%	50.1	18.0	32.1
3rd Generation	Value	661	272	389
	Value in %	66.1	27.2	38.9

From the above Table 3(a) 2nd Generation it can be inferred on the basis of the survey 50.1% sons are totally mobile with respect to their fathers. 18.0% changes from fathers to sons are due to structural change in the society and 32.1% mobility can be explained as pure mobility.

On the other hand, 3rd Generation shows that 66.1% sons are totally mobile with respect to their fathers. 27.2% changes from fathers to sons are due to structural change in the society and 38.9% mobility can be explained as pure mobility. Again using equations (3.4) and (3.5) Glass index and Yasuda index can be calculated and tabulated as follows:

Table 3(b):
Glass index (for 2nd and 3rd generation)

Group / Generation	I	II	III	IV	V	VI	VII	VIII	IX
2nd	0.0	0.0	0.0	2.81	2.24	2.24	3.75	4.72	1.67
3rd	50	4.35	2	2.63	1.90	2.18	5.28	3.21	0.0

A. **Yasuda Index =**
For 2nd generation $\quad$ $I_{y2} = 0.4893$
For 3rd generation $\quad$ $I_{y3} = 0.3385$

Again we can obtain the following intergenerational changes from the Tables 1(a) and 2(a):

Table 3(c):
Percentage distribution of father's and son's by their occupation.

Group / Generation		I	II	III	IV	V	VI	VII	VIII	IX
2nd Generation	Father's in%	0	0	0	27.9	29.8	22.2	2.3	11.6	8.2
	Son's in %	0.4	2.3	3.5	16.6	22	26.2	5.8	15.9	7.3
3rd Generation	Father's in%	0.4	2.3	3.5	16.6	22	26.2	5.8	15.9	7.3
	Son's in %	2	6	10	22	20.3	11.9	4.9	9.4	3.5

B. **Mobility measures based on TPM [Table 2(a)] for 2nd generation:** We have the TPM
P = (P$_{ij}$)

$$
=
\begin{pmatrix}
0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\
0.0 & 0.01075 & 0.0 & 0.45695 & 0.24373 & 0.19713 & 0.0 & 0.0 & 0.08244 \\
0.0 & 0.02518 & 0.0 & 0.12950 & 0.49280 & 0.17626 & 0.02518 & 0.02878 & 0.12230 \\
0.01802 & 0.05856 & 0.05405 & 0.0 & 0.06757 & 0.58558 & 0.0 & 0.21622 & 0.0 \\
0.0 & 0.0 & 0.34783 & 0.0 & 0.0 & 0.17391 & 0.21739 & 0.0 & 0.26087 \\
0.0 & 0.0 & 0.02586 & 0.0 & 0.0 & 0.0 & 0.22414 & 0.75 & 0.0 \\
0.0 & 0.0 & 0.14634 & 0.0 & 0.0 & 0.29268 & 0.23490 & 0.19512 & 0.12195
\end{pmatrix}
$$

Here

$$
P^{\infty} =
\begin{pmatrix}
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082 \\
0.0 & 0.0 & 0.0 & 0.279 & 0.278 & 0.222 & 0.023 & 0.116 & 0.082
\end{pmatrix}
$$

C. **Mobility measures based on TPM [Table 2(b)] for 3rd generation:** We have the TPM

$$
P =
\begin{pmatrix}
1 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\
0.1739 & 0.69565 & 0.13044 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\
0.0 & 0.45714 & 0.2 & 0.0 & 0.0 & 0.0 & 0.11429 & 0.11429 & 0.11428 \\
0.0301 & 0.18675 & 0.0 & 0.57851 & 0.15663 & 0.0 & 0.0 & 0.0 & 0.04819 \\
0.01364 & 0.13636 & 0.10909 & 0.27727 & 0.38636 & 0.02273 & 0.0 & 0.04091 & 0.01364 \\
0.0 & 0.09160 & 0.06107 & 0.16031 & 0.19466 & 0.25954 & 0.07633 & 0.11069 & 0.0458 \\
0.0 & 0.13793 & 0.17241 & 0.0 & 0.05172 & 0.31035 & 0.25862 & 0.06897 & 0.0 \\
0.02516 & 0.12579 & 0.12579 & 0.06289 & 0.15094 & 0.09434 & 0.06289 & 0.30189 & 0.05032 \\
0.0 & 0.20548 & 0.27397 & 0.1506 & 0.19178 & 0.17808 & 0.0 & 0.0 & 0.0
\end{pmatrix}
$$

$$
P^{\infty} =
\begin{pmatrix}
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053 \\
0.004 & 0.023 & 0.035 & 0.166 & 0.220 & 0.262 & 0.058 & 0.159 & 0.053
\end{pmatrix}
$$

VII. CONCLUSIONS

The column percentage of Table 1(a) reveals that most of the house-holds were in category IV, V, VI and VIII (Land lords, big farmers, big businessman; Medium farmers, medium businessman, pig-poultry farmers; Poor farmers, petty-businessman and Unskilled labour)

The column percentages of table 1(b) (transition from second to third generation) indicate that:
2 pc of the house-hold sampled occupied the professional category – I,
16 pc were in professional category-II,
10 pc were in professional category – III,
22 pc, 20.3pc, 11.9 pc of the house-holds (sampled) were observed occupying professional category IV, V and VI while 4.9 pc, 9.4 pc and 3.5 pc were in categories VII, VIII and IX respectively.

It is evident that most of the house-holds surveyed were in the professional categories II, III, IV, V and VI (Middle salaried, Low salaried, Big farmers/ Big businessmen, Medium farmer/businessmen/pig, poultry farmer, and Poor farmer/petty businessmen).

Considering the TPM in table 2(a), (second generation) we can say that the society that had been surveyed is mobile. But the nature of the social mobility as revealed by the TPM is not perfect on the ground that the rows of the TPM drawn/derived are not identical. At the same time it negates the nature of perfect immobility of the society as the derived TPM is not an identity matrix.
A similar conclusion holds good for the third generation house-holds as revealed by the TPM in table 2(b).

From the above discussion we can say that the tribal community of Udalguri district has an upward occupational mobility. Although the Tribal of this district is basically cultivators now a good number of them are seen occupying various occupations. The decrease of percentage in the category of poor farmers, petty businessmen (from 26.2 in the second generation to 11.9 in the third generation) tells the growing upward mobility of the Tribal community. There is also increase in almost all the higher occupational categories. Therefore, it can be said that the cause behind the upward mobility of the present generation of Tribal people may be found in the formation of the Bodoland Territorial Area District (BTAD), a separate land for the Tribal which has opened up new opportunities for the Tribal people.

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