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Likelihood of the Mode of Occupation Choices in Bangladesh

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Abstract Multinomial logistic regression models are used to explain the association between a polytomous response variable and a set of regressors. This paper presents the process of derivation and estimation of a multinomial logistic model and its application to the mode of occupational choice problem. The model finds out the factors which motivate a student after completion of graduation to choose one's profession. For derivation of multinomial logistic model for mode of occupation choices, we have considered the factor that is likely to influence choosing occupation of a student as a response variable and considered five factors such as, sex of the respondents, discipline of study of the respondents, family economic status, result obtained in honours program and place of permanent residence as determinants of the mode of occupational choices. In this study information from a sample of 800 students from each of four major faculties of five well established non-technical public universities through well defined questionnaire. Stratified random sampling technique with proportional allocation scheme has been employed in order to determine sample size under each selected faculty of each university. However, after scrutiny, 401 respondents with consistent and valid information have been finally used for analysis. The parameters of our postulated multinomial logistic models have been estimated by using maximum likelihood method. From this study it has been found that the likelihood of male respondents would choose business as occupation is 6.630 times more than female respondents. The respondents of commerce faculty would choose occupation as business is 1.369 times more likely than the respondents of Science faculty and so on. The findings of this study may be helpful to the students to build up themselves according to the likelihood of professions to be chosen on the basis of their socio-economic and academic backgrounds. This would also help the government to create job opportunity accordingly.

Keywords Choice of Occupation, Multinomial Logistic Model, Polytomous Response, Maximum Likelihood Procedure, LR Test

1. Introduction

There are thirty-four public universities in Bangladesh which are providing higher education to the bulk of students. These universities are funded by the government while managed as self-governed organizations. Occupation choice is an important factor for any student after completion of his/her graduation from University. Bangladesh is a developing country. Although most of the students cherish an occupation in mind for livelihood that they think would be better career of life, even then due to different practical constraints, after completion of their graduation from Universities, they stay in a dilemma to take decision regarding the occupation they will choose. So far no authentic research works have been done before on modeling the mode of occupation choices of these prospective graduates. Our present study will mainly emphasize on graduate students' choice of occupation. It will also help to find out the factors which motivate a student to choose his/her profession after successful completion of graduation. In this research, we have considered the M.S. students of five public non-technical Universities as population. We have considered a convenient sample of 800 students from these universities through a questionnaire method, only 401 consistent respondents have been considered in final analysis.

Multinomial logistic models "Ref.[2]"are used to explain the relationships between a polytomous response variable and a set of qualitative and/or quantitative regressors. These polytomous response models can be classified into two distinct types, depending on whether the response variable has an ordered or unordered structure. In the ordered logistic models the response variable has more than two ordered or ranked categories. But there are situations where the regressand is unordered. For example, the choice of transportation mode to an employee may be bicycle, rickshaw, car, bus, or train. Several theoretical and empirical

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works on this multinomial logistic modeling technique are available "Ref.[3, 4, 5, 6, and 7]" However, although most of the works are on other fields, but no work on the mode of occupational choices has yet been done. In this paper we have derived an unordered multinomial logistic model for mode of occupational choices for the outgoing graduate students of Bangladesh. The estimation of the parameters of our postulated multinomial logistic model has been carried out by using maximum likelihood procedure "Ref.[1]".

Objectives of the study

The main objectives of our research work are as follows:

(1) To derive a multinomial logistic model for the mode of occupational choices.

(2) To identify the factors, which motivate a graduate student to choose his/her occupation

(3) To find the likelihood of choosing different types of occupation under different types of socio-economic and academic backgrounds.

2. Data and Methodology

The area of 5 public non-technical Universities is covered by the survey. The universities are Dhaka, Chittagong, Rajshahi, Jahangirnagar and Khushtia Islamic University. The faculties considered in this study are Science, Arts, Commerce and Social Sciences. Here, sampling units are the outgoing M.S. students of public Universities. We have collected information using a stratified random sampling technique with proportional allocation[8], considering each faculty of each university as a stratum. Thus, information from a sample of 800 students has been collected through a well designed questionnaire. However, after scrutiny, only 401 valid questionnaires have been selected as the final sample of the study. The final data comprise with the students of Science faculty (24.94%), Arts faculty (20.20%), Business Administration faculty (27.43%) and Social Science faculty (27.43%).

In this study the multinomial logistic modeling technique has been employed to find the likelihood of choice of occupation of the students.

3. Derivation of Multinomial Logistic Model for Mode of Occupational Choices

Thus for derivation of a multinomial logistic model for the mode of occupational choices, we consider the factor occupational choices as a response variable and the factors which are postulated to motivate a student to choose his/her occupation as indicator variables. The variables are then categorized as below.

3.1. Categories of Response Variable Occupational Choices

Following three categories of occupational choices are considered

1) Business
2) Private farm
3) Government services

3.2. The Possible Factors that Might Influence the Occupational Choices

There are several factors that might influence the occupational choices of students. Here we have considered only five such factors.

1) Sex of the respondents.
2) Discipline (faculty) of study of the respondents.
3) Family economic status.
4) Result (in Honors).
5) Place of permanent residence.

3.3. Categories of Regressor Variables

Sex of the Respondents:
(a) Male
(b) Female

Discipline of Study:
(a) Arts
(b) Commerce
(c) Social science and
(d) Science

Family Economic Status:
(a) Lower class
(b) Middle class
(c) Upper class

Result in Honors:
(a) Not good (below GPA -3.0)
(b) Just good (GPA -3.0 to 3.5)
(c) Excellent (above GPA 3.5)

Place of Permanent Residence:

(a) Rural area
(b) Semi urban area
(c) Urban area

3.4. Operational Definition

Dependent variable

Reference category: Government Services
1= business
0= otherwise
1= private farm
0= otherwise

Independent variables

1) Sex of the respondents: Reference category female
1= male
0 = otherwise

2) Discipline of study of the respondents: Reference category : Science faculty
1= Arts
0= otherwise
1= Commerce
0= otherwise
1= Social science
0= otherwise

3) Family economic status: Reference category: Upper class family
1= lower class
0 = otherwise

1= middle class
0 = otherwise

4) Result in Honors: Reference category: Excellent result
1= not good
0 = otherwise
1= Just good
0 = otherwise

5) Place of permanent residence: Reference category: Urban area
1= rural
0 = otherwise
1 = semi urban
0 = otherwise

3.5. Selected Model

The postulated multinomial logistic model of occupational choices is as follows:

$$\ln\left(\frac{p_1}{p_0}\right) = \beta_{10} + \beta_{11}\ SEX_1 + \beta_{12}\ FACULTY_1 + \beta_{13}\ FACULTY_2 + \beta_{14}\ FACULTY_3 + \beta_{15}\ RESULT_1 + \beta_{16}\ RESULT_2 + \beta_{17}\ RESI_1 + \beta_{18}\ RESI_2 + \beta_{19}\ STATUS_1 + \beta_{1(10)}\ STATUS_2 + U_1$$

$$\ln\left(\frac{p_2}{p_0}\right) = \beta_{20} + \beta_{21}\ SEX_1 + \beta_{22}\ FACULTY_1 + \beta_{23}\ FACULTY_2 + \beta_{24}\ FACULTY_3 + \beta_{25}\ RESULT_1 + \beta_{26}\ RESULT_2 + \beta_{27}\ RESI_1 + \beta_{28}\ RESI_2 + \beta_{29} STATUS_1 + \beta_{2(10)}\ STATUS_2 + U_2$$

Here first equation is set for business vs. government service and second equation is defined for private farm vs. government service where β_{10} and β_{20} denotes the constant terms for all reference categories of respondents, such as female, study at science faculty, have excellent honors result, have upper family status, and come from urban area.

Sex_1 is a dummy variable denoting the two categories for sex: male and female.

$FACULTY_1$, $FACULTY_2$ and $FACULTY_3$ are set of three categories representing the dummy variable faculty, such as: Arts, Commerce and Social science respectively, where science faculty is considered as reference category.

$RESULT_1$ and $RESULT_2$ are set of two categories representing the dummy variable honors result of the respondents, such as: not good, just good respectively, where excellent result is considered as reference category.

$STATUS_1$ and $STATUS_2$ are set of two categories representing the dummy variable family status of the respondents, such as: lower class, middle class respectively, where upper class is considered as reference category.

$RESIDENCE_1$ and $RESIDENCE_2$ are set of two categories representing the dummy variable permanent place of residence of the respondents, such as: rural area, semi urban area respectively, where urban area is considered as reference category.

4. Estimation and Test

Here the estimation of the parameters of the multinomial logistic model has been carried out by using maximum likelihood procedure and likelihood ratio test and Wald test have been employed for testing the formulated hypothesis.

Summary of Sample Data

We have considered 401 filled-in questionnaires for final study. The summaries of sample data are as follows

Table 1. Summary of sample data

		N
Choices of Occupation:	Business	62
	Private farm	166
	Government Service	173
Sex of the respondents:	Male	255
	Female	146
Discipline of the respondents :	Arts	81
	Business Administration	110
	Social science	110
	Science	100
Result in honors :	Not good(below GPA-3.0)	67
	Just good(GPA3.0 to3.5)	227
	Excellent(above GPA-3.5)	107
Family status :	Lower class	57
	Middle class	250
	Upper class	94
Type of residence:	Rural	116
	Semi urban	161
	Urban	124
Total		401

Table 2. Case processing summary

		N
Choices of occupation	1.00	62
	2.00	166
	3.00	173
Sex of the respondents	1.00	255
	2.00	146
Discipline of study of the respondents	1.00	81
	2.00	110
	3.00	110
	4.00	100
Result in honors	1.00	67
	2.00	227
	3.00	107
Type of residence	1.00	116
	2.00	161
	3.00	124
Family status	1.00	57
	2.00	250
	3.00	94
Total		401

Model Fitting Information

By using SPSS program we get the following model fitting information

Likelihood Ratio Tests

Hypothesis:

H_0: There is no significant difference among the effects of selected variables.

Table 3. Likelihood ratio test

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	596.033			
Final	490.070	105.963	20	.000

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	490.070(a)	.000	0	.
SEX	509.747	19.677	2	.000
FACULTY	521.353	31.282	6	.000
RESULT	501.315	11.245	4	.024
RESI	501.351	11.281	4	.024
STATUS	522.832	32.762	4	.000

Here the reduced model is formed by omitting an effect from the final model. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Remarks:

Based on likelihood ratio test, it has been found that all parameters are statistically significant. However, Wald test indicates that there are some parameters those are not significant, namely: $FACULTY_1$, $FACULTY_2$ $FACULTY_3$, $RESULT_1$, $RESI_1$ and $STATUS_1$ for the first equation (business vs. government service); and SEX_1, $FACULTY_1$, $FACULTY_3$, $RESULT_1$, $RESULT_2$, $RESI_1$, $RESI_2$,$STATUS_1$ and $STATUS_2$ for the second equation (private firm vs. government service).

Estimated Model

Based on the table 4, the estimated multinomial logistic equations:

$$\ln\left(\frac{p_1}{p_0}\right) = -1.429+1.892\ SEX_1 +.834\ FACULTY_1 +.314\ FACULTY_2 - .349\ FACULTY_3 +.194\ RESULT_1 +.912\ RESULT_2 -.394\ RESI-1.307\ RESI_2 -.915\ STAUS_1 -2.033\ STAUS_2$$

and

$$\ln\left(\frac{p_2}{p_0}\right) = .125 +.174\ SEX_1 -.143\ FACULTY_1 + 1.049\ FACULTY_2 - .347\ FACULTY_3 +.420\ RESULT_1 -.084\ RESULT_2 - .241\ RESI_1 -.426\ RESI_2 -.571 STAUS_1 -.199\ STAUS_2$$

5. Interpretation of Estimated Model

The fitted model can be interpreted as follows:

5.1. Interpretation of the Intercepts

For those respondents who are female, study at science faculty, have excellent honors result, come from urban area and have upper family status, all the selected regressors will have no effect.

For the first equation we have,

$\ln(p_1/ p_0) = -1.429$
$(p_1/ p_0) = \text{Exp}(-1.429)$
$(p_1/ p_0) = 0.2395$
$P_1 = 0.2395\ p_0$

Therefore, the respondents who are female, study at science faculty, have excellent honors result, come from urban area and have upper family status, have the likelihood of choosing business as occupation is 0.2395 times than the government service. That means, this section of graduates would prefer joining in a business farm to the government service.

For the second equation we have,

$\ln (p_2/ p_0) = .125$
$(p_2/ p_0) = \text{Exp}(.125)$
$(p_2/ p_0) = 1.1331$
$P_2 = 1.1331 p_0$

Therefore, the respondents who are female, study at science faculty, have excellent honors result, come from urban area and have upper family status, have chance of choosing private farm 1.1331 times more than the government service. That means, this section of graduates would like to join in a private farm more than government service.

5.2. Interpretation of the Slope Coefficients

The slope coefficients of our estimated model based on table 4, for parameter estimates and Wald test may be interpreted in terms of odds ratio as follows:

For the first equation

For the coefficient of SEX_1, we have Exp (B) = 6.630, this suggests that respondents who are male, would choose business as occupation likely 6.630 times more than respondents who are female.

For the coefficient of $FACULTY_1$, we have Exp(B) = 2.302, this suggests that respondents who study at Arts faculty, would choose business as occupation likely 2.302 times more than respondents who study at Science faculty and so on.

For the coefficient of $RESULT_1$, we have Exp (B) = 1.214, this suggests that respondents who have not good result, would choose occupation as business likely 1.214 times more than respondents who have excellent result and so on.

For the coefficient of $RESI_1$, we have Exp(B) = 0.675, this suggests that respondents who come from rural area, would

choose occupation as business likely 0.675 times more than respondents who come from urban area and so on.

For the coefficient of $STATUS_1$, we have Exp(B) = 0.400, this suggests that respondents who come from lower class family, would choose occupation as business likely 0.400 times more than respondents who come from upper class family and so on.

For the second equation

For the coefficient of SEX_1, we have Exp (B) = 1.190, this suggests that respondents who are male, would choose occupation in a private farm likely 1.190 times more than respondents who are female.

For the coefficient of $FACULTY_1$, we have Exp(B) = 0.867, this suggests that respondents who study at Arts faculty, would choose occupation in a private farm likely 0.867 times more than respondents who study at Science faculty and so on.

For the coefficient of $RESULT_1$, we have Exp (B) = 1.523, this suggests that respondents who have not good result, would choose occupation in a private farm likely 1.523 times more than respondents who have excellent result and so on.

For the coefficient of $RESI_1$, we have Exp(B) = 0.785, this suggests that respondents who come from rural area, would choose occupation in a private farm likely 0.785 times than respondents who come from urban area and so on.

For the coefficient of $STATUS_1$, we have Exp(B) =0.565, This suggests that respondents who come from lower class family, would choose occupation in a private farm likely 0.565 times more than respondents who come from upper class family and so on.

Table 4. Estimation and Wald test

Occupation (a)		B	Std. Error	Wald test statistic	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
1.00	Intercept	-1.429	.662	4.660	1	.031			
	[SEX=1.00]	1.892	.493	14.720	1	.000	6.630	2.523	17.426
	[SEX=2.00]	0(b)	.	.	0	.	.	.	.
	[FACULTY=1.00]	.834	.481	3.001	1	.083	2.302	.896	5.913
	[FACULTY=2.00]	.314	.503	.390	1	.532	1.369	.511	3.670
	[FACULTY=3.00]	-.349	.483	.522	1	.470	.706	.274	1.818
	[FACULTY=4.00]	0(b)	.	.	0	.	.	.	.
	[RESULT=1.00]	.194	.625	.096	1	.757	1.214	.356	4.133
	[RESULT=2.00]	.912	.428	4.542	1	.033	2.489	1.076	5.758
	[RESULT=3.00]	0(b)	.	.	0	.	.	.	.
	[RESI=1.00]	-.394	.429	.840	1	.359	.675	.291	1.565
	[RESI=2.00]	-1.307	.411	10.134	1	.001	.271	.121	.605
	[RESI=3.00]	0(b)	.	.	0	.	.	.	.
	[STATUS=1.00]	-.915	.523	3.064	1	.080	.400	.144	1.116
	[STATUS=2.00]	-2.033	.402	25.544	1	.000	.131	.060	.288
	[STATUS=3.00]	0(b)	.	.	0	.	.	.	.
2.00	Intercept	.125	.436	.082	1	.774			
	[SEX=1.00]	.174	.239	.530	1	.467	1.190	.745	1.899
	[SEX=2.00]	0(b)	.	.	0	.	.	.	.
	[FACULTY=1.00]	-.143	.355	.162	1	.687	.867	.432	1.737
	[FACULTY=2.00]	1.049	.324	10.505	1	.001	2.856	1.514	5.387
	[FACULTY=3.00]	-.347	.315	1.217	1	.270	.707	.381	1.310
	[FACULTY=4.00]	0(b)	.	.	0	.	.	.	.
	[RESULT=1.00]	.420	.355	1.401	1	.237	1.523	.759	3.055
	[RESULT=2.00]	-.084	.265	.099	1	.753	.920	.547	1.547
	[RESULT=3.00]	0(b)	.	.	0	.	.	.	.
	[RESI=1.00]	-.241	.309	.610	1	.435	.785	.428	1.440
	[RESI=2.00]	-.426	.288	2.182	1	.140	.653	.371	1.149
	[RESI=3.00]	0(b)	.	.	0	.	.	.	.
	[STATUS=1.00]	-.571	.410	1.934	1	.164	.565	.253	1.263
	[STATUS=2.00]	-.199	.306	.425	1	.514	.819	.450	1.491
	[STATUS=3.00]	0(b)	.	.	0	.	.	.	.

a The reference category is (Government service).
b This parameter is set to zero because it is redundant (Reference category).

6. Final Comments

The likelihood of choosing business as occupation for the respondents who are female study at science faculty, have excellent honors result, come from urban area and have upper family status, is 0.2395 times more than of choosing government service.

On the other hand the respondents who are female study at science faculty, have excellent honors result, come from urban area and have upper family status, have likelihood of choosing private farm 1.1331 times more than that of government service.

The likelihood that the male respondents would choose business as occupation is 6.630 times more than female respondents.

The respondents who study at Arts faculty would choose business as occupation 2.302 times more likely than respondents who study at Science faculty.

Again, the likelihood of choosing business as occupation for the respondents who study at commerce faculty is 1.369 times more than respondents who study at Science faculty.

The respondents who study at Social science faculty would choose occupation as business 0.706 times more likely than respondents who study at Science faculty.

The respondents who do not have good result would choose occupation as business is 1.214 times more likely than respondents who have excellent result.

The respondents who have just good result would choose occupation as business likely 2.489 times higher than respondents who have excellent result.

The respondents who come from rural area would choose occupation as business likely 0.675 times more than respondents who come from urban area.

The respondents who come from semi urban area would choose occupation as business is 0.271 times more than respondents who come from urban area.

The respondents who come from lower class family would choose occupation as business likely 0.400 times more than respondents who come from upper class family.

The respondents who come from middle class family would choose occupation as business likely 0.131 times more than respondents who come from upper class family.

The likelihood that the male respondents would choose occupation in a private farm likely 1.190 times more than female respondents.

The respondents who study at Arts faculty would choose occupation in a private farm likely 0.867 times more than respondents who study at Science faculty.

The likelihood of choosing occupation in a private farm likely 2.856 times more than respondents who study at Science faculty.

The respondents who study at social science faculty would choose occupation in a private farm likely 0.707 times more than respondents who study at Science faculty.

The respondents who do not have good result would choose occupation in a private farm 1.523 times more likely than respondents who have excellent result.

The respondents who have just good result would choose occupation in a private farm likely 0.920 times higher than respondents who have excellent result.

The likelihood of respondents who come from rural area would choose occupation in a private farm likely 0.785 times more than respondents who come from urban area.

The likelihood of respondents who come from semi urban area would choose occupation in a private farm likely 0.653 times more than respondents who come from urban area.

The respondents who come from lower class family would choose occupation in a private farm likely 0.565 times more than respondents who come from upper class family.

The respondents who come from middle class family would choose occupation in a private farm likely 0.819 times more than respondents who come from upper class family.

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