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Ordered Logit Regression Models of Women's Empowerment with Comparison to Ordinary Least Square Models

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ABSTRACT

Despite the ordinal nature of the phenomenon of women's empowerment, researchers usually prefer to use Ordinary Least Squares (OLS) technique for measuring its determinants without sufficient reasoning. This study was planned to apply OLS at first and then use Ordered Logit Model-OLM on the same data so that it could be established which technique was better suitable for ordered data on women's empowerment as a dependent variable. A sample of 1000 women of age between 21 to 49 years was attained. The Composite Women's Empowerment Index (Batool, 2017) was used to measure women's empowerment. The analyses showed that the results attained via OLM validated the results of OLS and reinforced the notion that OLM was a suitable technique to be applied on ordered data as supported by Menard (2002). The study recommends that in future studies, despite using OLS, the OLM should be used in the prediction of any phenomenon that is ordered in nature.

***Keywords*:** Ordered Logit Model, Ordinary Least Squares, ordered data, women's empowerment, and determinants of women's empowerment.

JEL Classification: J11, J12, J16, J24, K38, O15, Z13

INTRODUCTION

Empowerment has been observed to be one of the major concerns when addressing the issue of human rights and development (Tripathi, 2011). The human development approach revolves around growing the quality of human life despite the wealth of a country. This approach focuses on individuals, their prospects, and choices (Sen, 1999). Women's empowerment is one of the priorities of the proponents of development approach, and has been a major area of investigation in human development research in the last two decades (e.g. Acharya, Bell, Simkhada, van Teijlingen, & Regmi, 2010; Ahmed & Bould, 2004; Khan & Awan, 2011; Khan & Maan, 2008; Mostofa, Tareque, Haque, & Islam, 2008; Nayak & Mahanta, 2009; Parveen & Leonhauser, 2005; Tareque, Haque, Mostofa, & Islam, 2007; Wiklander & Thede, 2010).

Due to the prevailing gender differences and gender gaps, the 'empowerment approach' in the case of women in the process of development can prove to be decisive in lessening the gender gaps. Numerous policymakers and academicians recurrently highlight the vigorous role of women's participation in economic development (Khan & Awan, 2011). Giving importance to women means that women must be considered integral, not the peripheral to other growth engines (Economist, 2006). The statistics are shown by governments, transnational organizations and companies indicate that the economic power of women is crucial for moving countries to get economic growth and development (Malhotra, Kanesathasan, & Patel, 2012). A wide range of researches has been carried out on the different dimensions of women's empowerment around the globe. However, the major part of this work has been taken up in Asia.

Development practitioners believe that unless the determinants of women's empowerment are assessed empirically, we will not be in a position to devise a policy on empowering women. Though assessing the underlying factors of women's empowerment through a valid and reliable measure is of significant importance, however, unless an appropriate statistical technique to find out such factors is employed, the outcomes may mislead the researchers and policymakers. In the course of efforts to examine the phenomenon of women's empowerment, studies that have been carried out to explain the phenomenon of women's empowerment, in addition to assessing determinants of women's empowerment, are focusing on the issues of using appropriate statistical methodologies to assess these determinants.

Discussing on the availability of different techniques to treat the dependent variables measured on an ordinal scale, Menard (2002) viewed that such variable is treated as continuous so Ordinary Least Squares (OLS) regression. Technique for such continuous variables can be used to attain the outcomes.

But using OLS alone may mislead the researchers in case of ordinal data. Hence some additional methodologies should also be tried in order to confirm that the findings are not seriously distorted by application of OLS. One of such techniques that Menard recommends is to treat the variables as nominal by ignoring its ordinal nature and use multinomial logit technique but the problem is that efficiency is lost by so doing. When the fact that the categories are ordered is ignored, one fails to use some of the information available and may estimate many different parameters that are required. The risk of getting insignificant results increases in such a case. So the remedy is that treat the dependent variable as if it was measured on an actual ordinal scale or treat the variable as if it was measured on an ordinal scale, however, the ordinal scale signifies crude measurement of basic interval/ratio scale. Ordered logit models can be used in such cases.

The use of a multiple regression model by OLS is sometimes improper, as the features of the concerned dependent variable can carry a lot of unwanted results so much so that, estimates

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of parameters might be inefficient or inconsistent (Fox, 1997; Long, 1997; Nunnally & Bernstein, 1994).

Similar to most of the studies related to empowerment, the data used in the present study were of ordinal nature, so following Menard's (2002) recommendations we planned and aimed to apply:

i- The OLS (stepwise) technique;
ii- The Ordered Logit Model (OLM) technique to validate the results attained by the OLS (stepwise) regression. We did it as the similarity of the results attained by the two techniques (OLS and OLM) might validate the results attained via OLS and vice versa. Hence to prove which technique is more suitable.

The need to conduct the present study aroused to get it reconciled to the future investigators to use the proper technique to attain the reliable outcomes in case of ordered dependent variables. So the present study would open new vista to handle the ordered dependent variables to offer reliable outcomes.

REVIEW OF LITERATURE

Different statistical techniques have been used by the researchers to find out the determinants of women's empowerment. Most of the researchers preferred to use descriptive statistics and multivariate regression analyses. Khan and Maan (2008) in a study conducted in Pakistan used a descriptive statistic (viz., Somer's d, Chi-square, and gamma statistic) to assess the association between the study variables. Multiple linear regression models using stepwise regression was applied to observe the contribution of sociocultural factors affecting women's empowerment. Nayak and Mahanta (2009) in a study, analyzed the determinants of women's empowerment in India by using descriptive method by taking into account its different dimensions: decision making power within family, economic autonomy, independence of mobility, political involvement, recognition of unjust gender role, media exposure, access to education, experiencing fierceness at home.

Acharya et al. (2010) in a study in Nepal found the positive association between household's status of women and their decision making autonomy by using multivariable logistic regression. Khan and Awan (2011) explicated the sociological and economic bargaining determinants of women's empowerment. Ordinal logistic regression was applied to assess the relative vitality of the determinants of the study in frameworks of both economic decision making of women within family and family planning. Haque et al. (2011) in a study in Bangladesh used multiple linear regression analysis to scrutinize the impact of diverse socio-demographic variables on women's empowerment in major dimensions: economic decision making, decision making within the household, and physical mobility. Sheikh et al. (2015) used both descriptive and Ordinary Least Squares to find out the factors affecting women's empowerment in Pakistan. Parveen and Leonhauser (2005) conducted a study in three separate villages of Bangladesh. The effects of variables of the study were evaluated by using tabular and multiple regression analyses.

Wiklander and Thede (2010) studied women's empowerment in a couple of provinces of India and found diverse outcomes. A binary Probit Model was used and estimated marginal effects of the determinants on the different empowerment variables. Ahmad and Sultan (2004) found the status of women, in reproductive health and family planning in Pakistan. The outcomes of the study were based on one-way analysis of variance (ANOVA) technique rather than multivariate regression analysis.

To analyze the effect of household ownership of mobile phones on the status of women in India, Lee (2009) used four proxies for the dependent variable (women's status): domestic violence, autonomy, son and total children preferences, and economic independence. Lee used simple regression technique for continuous dependent variables, the linear probability model for binary dependent variables, and ordered Probit models for the ordinal multinomial distribution of the dependent variables, where multinomial responses were ordered. Rahman et al. (2009) explained the determinants of women empowerment at domestic and non-domestic levels in Chapai, Nawabganj District of Bangladesh. A logistic regression model was used to predict the decision making the power of women at homes as a dependent variable. Aslam (2013) studied the determinants of women's empowerment in Pakistan, India, and Bangladesh to explain the role of education. The empowerment indicators comprised women's control over resources, lives, mobility, contribution to public life and attitudes, and insights and beliefs. Descriptive analysis of the data followed by logit models was used to analyze the relationship between women's labor force participation and variables: completed levels of education and other independent variables.

In order to investigate the economic and psychosocial predictors of psychological empowerment of Pakistani women, Batool, Ahmad, and Qureshi (2016) used a sample of 500 women of reproductive age ranged between (21-49) years selected from Lahore city. Psychological Empowerment Scale for Women (GPESW: Batool, 2017) was used as a dependent variable. Stepwise regression technique was utilized to attain the relative strength of the study variables.

Batool, Ahmad, and Qureshi (2018) examined the role of demographic variables to determine women's economic empowerment on a convenient sample of 500 married women selected from district Multan (Pakistan). The control over economic resources was used as a women's economic empowerment variable. Ordered Probit regression technique was used to attain the impact of demographic factors on economic empowerment of the least empowered, moderately empowered, and highly empowered women.

Batool (2018) using a sample of 302 non-working married women aged between 21 and 49 years (*Mage*= 27.34 year, *S. D* = 12.32) conveniently selected from city district Lahore (Pakistan). The control over economic resources was used as a women's economic empowerment variable. Hierarchical regression technique was used to quantify the predictive

strength of the 'use of mobile phones' in the economic empowerment of women by controlling age and education.

The women's empowerment as a dependent variable in most of the above-listed studies were measured as an ordinal variable either on a 5-point scale (1=*strongly disagree* to 5= *strongly agree*) or as (1= *least empowered* to 5= *highly empowered*). Despite the ordinal nature of women's empowerment variable, the extant literature indicates that the statistical approaches to analyze this ordinal data, are either binary logit regression (e.g., Avanath & Kleinbaum, 1997; Pohlmann & Leitner, 2003) or Ordinary Least Squares (OLS) model (e.g., Haque et al., 2011; Khan and Maan ,2008; Sheikh et al., 2015) for this dependent variable. The researchers used these techniques to find out the determinants of women's empowerment, without giving justification to use a particular method for particular data analysis. Whereas, some of the researchers do not support the use of Binary Logit Regression as it restricts the dependent variables (e.g., women's empowerment) to dichotomous categories: least empowered and highly empowered that would result in a loss of very vital information about the dependent variable (Avanath & Kleinbaum, 1997). The reason might be that only a small number of women are least empowered and highly empowered and all the rest between these two limits would be ignored while estimating empowerment through Binary Logit Regression. On the other hand, the econometricians (e.g., Menard, 2002) suggest that once OLS is used, the results should be validated via some other statistical technique as OLS gives misleading or biased results. Whereas, some of the econometricians (e.g. McKelvey & Zavoina, 1975; Menard, 2002) recommend Ordered Logit Model (OLM) to be the most suitable technique to find out the determinants of the phenomenon that is ordered in nature (e.g., women's empowerment).

Given that the important information is lost in Binary Logit Regression and the above arguments in the favor of two approaches: OLS and OLM, the present study aimed to assess the determinants of women's empowerment via OLS first and then validate the results by running OLM on the same set of data and compare the results drawn from both the analyses. To the best of our knowledge, no study has ever applied both OLS and OLM on the same data set to compare their outcomes for the same groups of dependent variables (women's empowerment) and independent variables to validate of the results of OLS via using OLM to deal with the ordered dependent variable.

METHODOLOGY

Sample

A convenient sample was attained from two purposively selected city districts of Punjab province of Pakistan: Multan and Lahore. The sample consisted of 1000 married women (500 from each district, of age between 21 and 49 years (M_{age} =35.55, *SD*= 7.80), excluding widows, divorced and never married women. The women from various educational levels, belonging to nuclear and joint family systems, employed in different professions and housewives were given representation in the sample to ensure the generalizability of results. A larger sample was approached to control statistical biases (Fitzgibbon & Morris, 1987).

Measures

Measures of the independent variables: The independent variables in the present study were categorized into three groups: individual/personal, familial/interpersonal, and socio-cultural (as recommended by Parveen & Leonhauser (2005).

Individual-level determinants: Chronological age in years, the age of women at marriage in years, the levels of education of the respondents (school, college, and university), paid job: the working status of the women, personal income: the woman's total earnings from all sources per month, and the current value of assets were measured via demographic data sheet.

In order to measure gender awareness perception, five questions were asked (e.g., women should be given equal rights to that of men; There is a need to provide opportunities of higher education for women; A woman should be helped by her husband in household chores), followed by a stem: to what extent do you agree with the statement? A 5-point Likert scale was used ranging from 1= *strongly disagree,* to 5= *strongly agree.* The value of the variable was attained by adding the scores of a respondent to all 5 statements. The Cronbach's alpha of the measure was found to be .84 in the present study.

An index of 'legal awareness about rights' was generated to measure legal awareness. It was constructed by using six items (e.g. The legal rights that Islam has given to a woman regarding the choice of her husband; The legal share of a daughter in the property of her parents; The legal share of a wife in the property of her husband; The legal rights of a woman regarding divorce/khula) followed by a stem question: to what extent are you aware of the rights stated below? A 4-point Likert scale was used from 1= *not at all aware* to 4= *to great exten*t *aware.* The Cronbach's alpha for this measure was .89 in the present study.

Political awareness of women was measured by an index which contained 5 items (e.g., Do you know about the political system of Pakistan? Are you a registered voter? followed by a stem question: do you agree with the following statement? The responses were coded as *yes=1* and, *No=0.*

The Rosenberg self-esteem scale (Rosenberg, 1965) was used to assess self-esteem. It consisted of 10 items(e.g., I feel that I am a person of worth, at least on an equal plane with others; I am able to do things as well as most other people). The instrument has good psychometric properties (Cheng & Furnham, 2003; Quilty, Oakman, & Risko, 2006). The responses were measured on a four-point Likert scale ranging from 1= *strongly disagree* to 4= *strongly agree.* Higher scores indicate higher self-esteem and vice versa. The Cronbach's alpha of the scale was .79 in the present study

The internal locus of control: a sub-scale of the scale of Self-Control by Reid and Ware (1974) was used to measure internal locus of control. It consisted of eight items (e.g., I always feel in control of what I am doing; Self-regulation of one's behavior is always possible) followed by a stem question: to what extent do you agree with the following statements? The responses were measured on a 6 point Likert scale ranging from 1=

strongly disagree to 6= *strongly agree.* The higher score represented a higher level of internal locus of control. The value of Cronbach's alpha for this variable in the present study was 0.88.

Familial determinants: Husband's education was the years of education representing the school, college, and university education. Husband's income was taken in Pakistani rupees. Family system was a nuclear family system and joint family system. The family head (husband or other: father-in-law, brother-in-law, and mother-in-law, etc.). Conjugal age: the difference of the chronological age and age at marriage of the respondents. Age difference from husband, number of brothers, number of children, and number of sons, and family expenditures in Pakistani rupees were measured via demographic data sheet.

Husband's support was measured with six items (e.g., He gives me unconditional respect; He shares his emotions with me and makes me feel that I am very important for him) questionnaire followed by a stem question: how does your husband behave with you? A four-point Likert scale was used ranging from 1= *rarely to* 4= *very often.* The *a*ggregate of all the responses for six items constituted the value of the husband's support variable. Cronbach's alpha of this variable in the present study was 0.87.

Socio-cultural determinants: Dowry: the total approximate present value of the dowry/gifts given by parents to the women in Pakistani rupees, and observing veil (Pardah) were measured via demographic datasheet.

The 'role of media' was related to the role of mass media in women's empowerment. The respondents were asked 4 questions regarding the impact of T.V programs on women (TV programs about women's issues have changed the mind of my husband about me in a positive way; TV programs about women's issues have made me aware of my rights). A 4-point Likert scale ranging from 1= *Not at all* to *4= to great extent*. The higher score indicated the stronger impact of media. The value of Cronbach's alpha for this variable in the present study was 0.79.

The 'use of mobile phone' was measured with five questions (e.g. The use of mobile phone has enhanced my social support; The use of mobile phone has increased my choices) generated following literature at hand (Handapangoda & Kumara, 2012; Lee, 2009; Malhotra et al., 2012; Schuler et al., 2010). A four-point Liker scale was used ranging from 1= *Not at all* to 4= *to great extent.* The smaller score indicated the lower impact of the use of a mobile phone. The value of Cronbach's alpha for this variable in the present study was 0.81.

Berlin Social Support Scales (BSSS) by Schwarzer & Schulz (2003) was used to measure social support by adding 8 items scores of the participants on two subscales of the BSSS (Perceived Emotional Support, and Perceived Instrumental Support). The items included (e.g., There are some people who truly like me; There are people who offer me help when I need it). A four-point Likert scale was used ranging from 1= *strongly disagree* to 4= *strongly agree.* The Cronbach's alpha for this variable was .80 in the present study.

The social networking was attained by asking a stem question: To what extent do you agree with the following statements? Followed by 5 items (I am involved in social welfare activities (fundraising or helping others etc.; I arrange parties for my friends and relatives). A Four-point Liker scale was used ranging from 1= *not at all* to *4= to great extent.* The Cronbach's alpha for this variable was .78 in the present study.

Measures of the dependent variables: Four dimensions of Composite Women's Empowerment Index (CWEI) by (Batool, 2017) were used:

Economic empowerment. It consisted of 5 items (Purchasing of items of everyday use, grocery, vegetable etc., Purchasing of gifts for friends/relatives on events of weddings and birthdays etc.) with a stem question: to what extent do you participate in taking decisions on following economic matters at home. A five-point Likert scale was used (1=*not at all,* 2 = *to some extent,* 3= *indecisive,* 4= *to a moderate extent,* 5= *to great extent*). The higher score meant a higher level of economic empowerment and vice versa. The Cronbach's alpha for the measure was 0.75 in the present study.

Familial empowerment. It consisted of two sub-dimensions: i). Decision Making within Family, ii) Participation in Family's Discussion containing 5 and 3 items, respectively (e.g., Family planning /size of family; Educational issues of child/children). The responses for both the sub-scales were measured on a 5-point rating scale ranged from *1= rarely to 5= always.* The aggregate of these two indicators constituted the familial empowerment. The Cronbach's alpha for this index in the present study was found to be 0.78.

Socio-cultural empowerment. This dimension was related to the autonomy of the respondents to go to different places and it consisted of 5 items (e.g., Local market for the purchase of household goods; Places of religious gatherings) with the stem question: how frequently do you go to the following places independently? With options: (1= *rarely* to 5= *always*) Cronbach's alpha for this measure was 0.79.

Psychological empowerment: A shorter version of Global Psychological empowerment scale developed by Batool (2017) was used to measure the psychological empowerment. The scale contained 5 subscales named: meaningfulness, competency/self-efficacy, impact, self-determination, and Problem-focused coping with 3 items in each subscale (e.g., Whatever I have done in my life was important to me; I am capable of solving my personal problems; I am independent in spending money; My opinion is valued in my family; I find some way out to deal with difficult situations), respectively. A Five-point Likert scale was used (1= *strongly disagree,* to *5= strongly agree*). The Cronbach's alpha of this scale for the present study was 0.83.

Table 1: *Abbreviation of the Study Variables and Expected Relationship of the Dependent Variables with Independent Variables*

Abbreviation	**Explanation**	**Expected Sign**
OAGE	Own Age	+
MAGE	Age at Marriage	+
OEDU	Own Education	+
PJOB	Paid Job	+

PINCOME	Personal Income	+
OPROP	Own Property	+
SES	Self-Esteem	+
GAP	Gender Awareness Perception	+
LAWARE	Legal Awareness	+
APOL	Political Awareness	+
ILOC	Internal locus of Control	+
HEDU	Husband's Education	+/-
HINCOME	Husband's Income	+
FAMSYS	Family system	+
FAMHEAD	Family Head	+
CAGE	Conjugal Age	+
AGEDIFF	Age Difference From Husband	+
NOCHILD	Number of Children	+
MCHILD	Number of Male Children	+/-
NOBROTH	Number of Brothers	+/-
HSUPP	Husband's support	+
FAMEXP	Family Expenditure	+/-
DOWRY	Dowry	+
OVEIL	Observing veil	-
ROMED	Role of Media	+
UOMOB	Use of Mobile	+
SOCSUPP	Social Support	+
SOCNET	Social network	+

Source: Author's own description.

Procedure

The data were collected through a survey. Initially, 1500 participants were approached at their homes or at their workplaces. Most of the questionnaires were returned on the same day by most of the respondents, some took two to three days, and few of them sent the questionnaires via surface mail. Out of 1500 questionnaires, 1102 (73.47%) were returned, and 1000 (66.67%) were found complete in all dimensions. So the data of 1000 participants were used in subsequent analysis.

ANALYSES AND RESULTS

In order to attain the objective of the present study, the OLS analysis was carried followed by OLM analysis. The analyses were carried out by using the SPSS 18, and STATA 11. Four regression analyses were run with both OLS and OLM each. For OLS, the dependent variables: dimensions of women's empowerment (economic, familial, socio-cultural, and psychological) was taken as ordered on five-point Likert scale ranging from 1= *strongly disagree*, to 5= *strongly agree*. And for OLM the dependent variable was categorized into three categories (1=least, 2= moderate, and 3=high).

The following ordered logit model was constructed (as recommended by Diebold, 2014):

$$y_t^* = x_t'\beta + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (i)$$

Where yt* is titled as unobserved.

The εi is distributed as follows:

$$\varepsilon i \sim logistic 0,1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (ii)$$

We consider the underlying latent variable and suppose that there are N ordered outcomes. We have an indicator with a finer gradation:

$Ityt *= 0 \; if \;\; yt *< c1 \quad 1 \, if \, c1 < yt *< c2 \;\; 2 \, if \, c2 < yt *< c3 \dots N \, if \;\; cN < yt *.$ .... (iii)

The c's are unknown threshold parameters to be assessed with β. Threshold parameters determine the estimations for different observed value of y. Such threshold parameters can be interpreted as intercepts in the equation. In questionnaires for such sort of models, the intensity of the feelings of the respondents is expressed, which is determined by certain factors that can be quantified, and a small number of unobservable dynamics denoted by ε. An ordinal scale of say 1-5 represents a range of subjective sentiments with 1 indicating the worst (the least empowered) and 5 being the best (the most empowered). The respondents are expected to select the cell most strictly representing their sentiments or perceptions on a specific question.

Maximum likelihood can be utilized to estimate the ordered logit model (as it is used in the standard logit model). It is very difficult to determine and/or interpret both the marginal effects and the R^2 directly in logit regression. As the logit marginal effects, ∂E (y|x)/∂xi is very difficult to determine directly specifically, they are not simply given by the β_i's. As an alternative we have

$$\partial Eyx \partial xi = fx'\beta\beta i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (iv)$$

Where f(x) = DF(x)/dx is the density corresponding the cumulative distribution function (cdf) f. So the marginal effect is not just βi; as an alternative, it is βi weighted by f (x' β), which depends on all values of β's and xs. However, the signs of the β's are the signs of the effects, as f must be positive. Moreover, ratios of the β's do give ratios of the effects, because of the f's cancel.

It's not clear how to define or interpret R^2 in case of ordered data. Different variants have been suggested by different econometricians (McFadden as cited in Diebold, 2016). McFadden's R^2 is:

$$R2 = 1 - lnL1\hat{}lnL0\hat{} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (v)$$

Where $lnL1\hat{}$the maximized is restricted log likelihood (here only the intercept is included) and $lnL0\hat{}$ is the maximized unrestricted log likelihood. McFadden's R^2 tries to uphold the interpretation of R^2 as an improvement from restricted to unrestricted model. The above presented systematic structure is applied to the data to assess the key determinants of women's empowerment.

Table 2: *Comparison of the Results of Ordinary Least Squares (stepwise) and Ordered Logit Regression Models (N=1000)*

	Independent Variables	Techniques of Analyses: Ordinary Least Square		Ordered Logit Models	
		Coefficients	T	Coefficients	Z
Model 1 Economic Empowerment	FAMSYS	.224***	6.7	.99***	6.31
	PJOB	.156***	4.6	.56***	3.59
	OAGE	.114***	3.6	-	-
	HSUPP	.069*	2.3	.26**	2.82
	LAWARE	.065*	2.1	.25*	2.49
	OVEIL	-.089**	-2.9	-.30**	2.65
	OPROP	.061*	2.0	-	-
	PINCOME	.060*	2.0	-	-
	UOMOB	-	-	.18*	2.57
		F= 28.825*** Adjusted R^2= .19		LR Chi2= 204.40*** Pseudo-R^2= .11	
Model 2 Familial Empowerment	LAWARE	.083***	5.0	.40**	.26
	FAMSYS	.072*	2.5	.30*	.10
	SES	.070*	2.5	.20*	.14
	PJOB	.073**	2.7	.34*	2.36
	HSUPP	.064**	2.6	.19**	2.21
	NOBROTH	.182*	2.3	-	-
	GAP	.107*	2.1	-	-
	CAGE	.104*	2.2	-	-

	ILOC	.113*	1.9	.21***	.27
	OPROP	-	-	.15*	.11
		F=17.467***		LR Chi2=	
		Adj. R^2= .14		Pseudo-R^2= .07	
Model 3 Socio - cultural Empowerment	PJOB	.158***	5.4	.70***	4.48
	FAMSYS	.148***	5.1	.73***	.77
	LAWARE	.106***	3.9	.33**	.26
	HSUPP	.075**	2.9	.23*	.48
	FAMEXP	.452*	2.5	-	-
	OEDU	-	-	.21*	2.13
	CAGE	-	-	.16*	.26
	GAP	.45***	-	1.77***	
	-	F=98.258***		LR Chi^2=154.09	
	-	Adj. R^2= .37		Pseudo-R^2= .07	
Model 4 Psychological Empowerment	HSUPP	.141***	5.8	.45**	4.26
	SES	.097***	4.0	.31*	2.79
	SOCNET	.087***	3.6	.32*	2.30
	PJOB	.077**	3.3	.47*	2.14
	ROMED	.072**	3.1	.19*	2.46
	FAMEXP	.057*	2.3	-	-
	AGEDIFF	.074**	3.2	.27*	2.76
	ILOC	.062*	2.5	-	-
	DOWRY	.051*	2.1	-	-
	UOMOB	-	-	.22*	2.78
	GAP	.532***	2.9	2.24***	13.61
	-	F=101.841***		LR Chi^2=47.25***	
	-	Adj. R^2=.51		Pseudo-R^2= .22	

Source: Author's own calculations using primary data. Note: ***p <.001, **p<.01 & *p <.05

DISCUSSION

The study was designed to validate the results obtained from OLS: stepwise regression by running OLM on the same set of ordered data afterward. As recommended by Menard (2002), OLM is an additional technique to confirm that the findings are not seriously distorted by the application of OLS on ordered data. A series of four regression analyses on four dimensions of women's empowerment (economic, familial, socio-cultural, and psychological) were run. The results of all four models of OLS were compared with its corresponding models of OLM (see Table 2). The analyses show that most of the results drawn from the OLM were similar to those from the OLS however, some differences appeared (see Table 2).

As the dimension of economic empowerment (first model) concerned, eight significant determinants appeared through the OLS model, and six determinants appeared in OLM. Five determinants were found alike in both models (viz., PJOB, LAWARE, FAMSYS, OVEIL, and HSUPP). Variables OAGE, PINCOME, and OPROP appeared in OLS but not in OLM. One variable: UOMOB was found as significant predictor exclusively in OLM. A slight discrepancy appeared in the results of OLS and OLM.

In the case of the second model (familial empowerment), nine and eight determinants appeared through OLS and OLM respectively. Out of these, six turned to be the common determinants (viz., PJOB, SES, LAWARE, ILOC, FAMSYS, and HSUPP). Three determinants namely, GAP, CAGE, and NOBROTH appeared exclusively in the OLS model. On the other hand, one variable namely OPROP appeared as determinant only in OLM. Again we can infer that the two analyses showed a slight difference in the determinants of women's familial empowerment.

In the case of socio-cultural empowerment, six and seven determinants appeared in OLS and OLM models, respectively. Five variables were found as common determinants (PJOB, GAP, LAWARE, and FAMSYS, and HSUPP). The variable FAMEXP appeared only in the OLS model, and variables OEDU and CAGE appeared only in OLM. Again we found a slight discrepancy in the determinants of both the models.

In the case of psychological empowerment, ten and eight determinants appeared in OLS and OLM models respectively. Seven variables were inclusively found in both models (viz., PJOB, SES, GAP, AGEDIFF, HSUPP, ROMED, and SOCNET). The variables namely, ILOC, FAMEXP, and DOWRY exclusively appeared as determinants in the OLS model. On the other hand, only UOMOB was exclusively found in OLM. We again infer that there was a slight difference in the results of OLS and OLM analyses.

Results of both stepwise (OLS) and ordered regression models (OLM) of four dimensions of women's empowerment showed that from all the models, twenty-one variables collectively appeared as significant determinants of women's empowerment. Ownage, own education, paid job, personal income, internal locus of control, gender awareness perception, legal awareness, self-esteem, and own property appeared as individual level determinants; family system, family head, husband's support, conjugal age, age difference from husband, family expenditures, and number of brothers appeared as familial determinants, and use of mobile phone, role of media, observing veil, social network, and dowry appeared as socio-cultural determinants of women's empowerment. Out of twenty-one determinants, own age, personal income, family head, number of brothers and dowry exclusively appeared in OLS, whereas, own education appeared exclusively in OLM, and all the rest determinants appeared as the common determinants both in OLS and OLM collectively in all four models. The results of all dimensions show that some of the variables that appeared as significant determinants of women's empowerment in OLS, dropped in the OLM analysis, which shows that OLS overestimates the strength of contribution of independent variables in predicting the dependent variable and misguides (Menard, 2002).

In the OLM, marginal effects of individual variables were calculated, as the coefficients in OLM are not directly interpretable. This is one element of the superiority of OLM over OLS that it makes the analysis more detailed as the effect of predictor variables reveals the outcomes of each category of the dependent variable in terms of their marginal effects. All the sets of the intercepts of all the models of women's empowerment in OLM were found significantly different from each other which suggested that the three categories of women's empowerment (least, moderate, and high) were justified, hence they should not be combined as we do for OLS (Katchova, 2013). This justifies the preference of OLM over OLS in the present study.

To sum up, we may conclude that although in all the models, most of the determinants appeared as common through both the

regression analyses and the results derived from OLM validated the results derived from OLS.

Because the use of OLS technique alone may mislead the researcher in case of ordinal data. Hence in order to validate that the findings are not seriously distorted by application of OLS, some other methodology should also be used followed by OLS (Menard, 2002).

In line with this proposition (in order to validate the results attained via OLS), Menard (2002) recommends treating the variables as nominal by ignoring their ordinal nature and use multinomial logit technique. But the problem is that efficiency is lost by so doing. Because when the fact that the categories are ordered is ignored, one fails to use some of the information available and may estimate many different parameters that are required. The risk of getting insignificant results increases in such a case. So the remedy is that treat the dependent variables as if they were measured on an actual ordinal scale or treat the variables as if they were measured on an ordinal scale, however, the ordinal scale signifies crude measurement of basic interval/ratio scale. Ordered logit models can be used in such cases.

Some econometricians (Fox, 1997; Long, 1997; Nunnally & Bernstein, 1994) reiterate on not to use the OLS in case of multiple regression as sometimes it becomes improper because the features of the concerned dependent variable might carry many unwanted outcomes so much so that, estimates of parameter might be inefficient or inconsistent

So it justifies concluding that OLM should be directly applied to the ordered data instead of using it as a supplementary analysis to validate the results driven by OLS. The results also suggest that OLS can be applied on ordered data, yet it is more appropriate to use OLM as suggested by (Greene & Hensher, 2010) to get more precise results and avoid the over/underestimated effects of some variables caused by the use of OLS (McKelvey & Zavoina, 1975).

The outcomes of the present study are not comparable with the existing literature because some of the studies used simple regression technique for continuous dependent variables, linear probability model for binary dependent variables, and ordered Probit models for ordinal multinomial distribution of the dependent variables (Lee,2009), binary Probit model (Wiklander & Thede , 2010), ordered Probit model (Batool, Ahmad, & Qureshi, 2018) OLS (Batool, Ahmad, & Qureshi, 2016) Hierarchical regression technique (Batool, 2018). No study was found to use OLS along with ordered Logit or Probit model techniques. The present study was conducted to compare the OLS and OLM models following the suggestions put forth by (Menard, 2002; Greene & Hensher, 2010). So it is the pioneer study to give new insight to the future researches not only for ordered dependent variable of women's empowerment but also all ordered dependent variables in different areas of researches.

Recommendations

The comparison of the two statistical methods: OLS and OLM illustrate that OLS and OLM models showed more or less similar pictures. The results suggest that the application of only ordered logit model will be invaluable appropriate analytical method for the future studies not only on women's empowerment but also on any study with an ordered dependent variable.

Among possible limitations of the present study, one is that we compared the outcomes of the OLS and OLM only. So it is recommended that in future studies other techniques can also be applied to compare and validate the outcomes attained via OLS. Similarly, we used different dimensions of women's empowerment as ordered dependent variables (viz., economic, familial, social and psychological) so in future studies composite women's empowerment ordered dependent variable can also be used for such comparison.

REFERENCES

Acharya, D. R., Bell, J. S., Simkhada, P., van Teijlingen, E. R., & Regmi, P. R. (2010). Women's autonomy in household decision-making: A demographic study in Nepal. *Reproductive Health*, *7*(15), 1-12.

Ahmad, F. & Sultan, M. (2004). Women's empowerment and mobility in Pakistan: Result from a National Survey. Paper presented at *Fifth Annual Research Conference* on 14-16 December 2004, Karachi, Pakistan.

Ahmed, S. & Bould, S. (2004). One able daughter is worth 10 illiterate sons: Reframing the patriarchal family. *Journal of Marriage and Family*, *66*(5), 1332-1341.

Aslam, M. (2013). *Empowering women: education and the pathways of change*. Background paper for the EFA Global Monitoring Report, 4.

Avanath, C. V., & Kleinbaum, D. G. (1997). Regression models for ordinal responses: A review of methods and applications. I*nternational Journal of Epidemiology*, *26*, 1323-1333.

Batool, A. B. (2017). Determinants of women's empowerment in Punjab, Pakistan. A Ph.D. dissertation submitted to the department of economics, University of the Punjab, Lahore.

Batool, S. A., Ahmed, H. K., & Qureshi, S. N. (2016). Economic and psycho-social determinants of psychological empowerment in Women. *Pakistan Journal of Social and Clinical Psychology*, *14*(1), 21-29.

Batool, S.A., Ahmed, H. K., & Qureshi, S. N. (2018). Impact of demographic variables on women's economic empowerment: An ordered Probit model. *Journal of women & aging*, *30*(1), 6-26.

Batool, S. A. (2018). Does the use of mobile phones predict women's economic empowerment at the household level in Pakistan? *Pakistan Journal of Social and Clinical Psychology*, *16*(1), 39-46.

Cheng, H., & Furnham, A. (2003). Personality, self-esteem, and demographic predictions of happiness and depression. *Personality and individual differences*, *34*(6), 921-942.

Diebold, F. X. (2014). *Streamlined, Applied and e-Aware*. Retrieved from http ://www.ssc. up enn.e du/~fdie b o l d/Teaching104/Econometrics.pdf

Fitzgibbon, C. T., & Morris, L. L. (1987). How to design a program evaluation? Newbury Park, CA: Sage.

Fox, J. (1991). Regression diagnostics: an introduction. 1st ed. Sage Publications, Inc.

Greene, W. H. (2000). *Econometric Analysis 4th(ed). International edition*, New Jersey: Prentice Hall.

Greene, W. H. (2007). *Econometric Analysis* 6th(ed). Upper Saddle River, New Jersey, USA: Pearson Education, Inc.

Greene, W. H., & Hensher, D. A. (2010). *Modeling ordered choices: A primer*. New York, USA: Cambridge University Press.

Haque, M., Islam, T. M., Tareque, M., & Mostofa, M. (2011). Women empowerment or autonomy: A comparative view in Bangladesh context. *Bangladesh e-Journal of Sociology*, *8*(2), 17-30.

Kankocha .A. (2013). Probit and Logit models. Retrieved from https: //www .youtube.com/watch? v=cC19I3v RlIo#t=125.1586888

Khan, M. T., & Maan, A. A. (2008). Socio-Cultural Milieu of Women's Empowerment in District Faisalabad. *Pakistan. Journal of Agricultural Science,* 45(3), 78-90.

Khan, S. U., & Awan, R. (2011). Contextual assessment of women empowerment and its determinants: Evidence from Pakistan. *Bond University-Australia. MPRA*, (30820) Retrieved from: http s://c ore.ac .uk/d own l oa d/files/432/12028224.pdf

Lee, D. (2009).The impact of mobile phones on the status of women in India. Retrieved from http://scholar.google.com.pk/ scholar? q=Lee%2C +D.+%282009 %29. + The+Impact +of+Mobile+Phones+on+the+Status+of+Women+in+India. +Retrieved+&btnG=&hl=en&as_sdt=0%2C5.

Malhotra, A., Kanesathasan, A., & Patel, P. (2012). Connectivity: How mobile phones computers and the Internet can catalyze women's entrepreneurship. India: a case study. Retrieved from http://www.icrw.org/wp-content/uploads/2016/10/Connectivity-how-mobile-phones-computers-and-the-internet-can-catalyze-womens-entrepreneurship.pdf

McKelvey, R. D., & Zavoina, W. (1975). A statistical model for the analysis of ordinal level dependent variables. *Journal of mathematical sociology*, *4*(1), 103-120.

Menard, S. (2002). *Applied logistic regression analysis* (No. 106). USA: Sage.

Mostofa, G., Tareque, I., Haque, M., & Islam, T. M. (2008). Mathematical modeling of women empowerment in Bangladesh. *Research Journal of Applied Sciences*, *3*(6), 416-420.

Nayak, P., & Mahanta, B. (2009). Women empowerment in India. . Retrieved from https://mpra.ub.uni-muenc hen .d e/24740/1/MPRA_paper_24740.pdf

Nayak, P., & Mahanta, B. (2009). Women empowerment in India. *A Journal of North-Eastern Hill University*, 1-32. Retrieved from: http://mpra.ub.uni-muenchen.de/24740/

Nunnally, J. C., & Bernstein I. H. (1994). Psychometric Theory. New York: McGraw-Hill.

Parveen, S., & Leonhäuser, I. U. (2005). *Empowerment of rural women in Bangladesh: A household level analysis* (Vol. 72). Berlin: Margraf.

Pohlmann, J. T., & Leitner, W.W. (2003). A comparison of ordinary least squares and logistic regression. *Ohio Journal of Science,* 103(5), 118-125.

Quilty, L. C., Oakman, J. M., & Risko, E. (2006). Correlates of the Rosenberg Self-esteem Scale method effects. Structural Equation Modeling, 13, 99-117. Retrieved from http://dx.doi.org/10.1207/s15328007sem1301_5

Reid, D., & Ware, E. E. (1974). Multidimensionality of internal versus external control: Addition of a third dimension and non-distinction of self-versus others. *Canadian Journal of Behavioral Science 6*, 131-142.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ, Princeton University Press.

Schuler, S. R., Islam, F., & Rottach, E. (2010). Women's empowerment revisited: a case study from Bangladesh. *Development in practice*, *20*(7), 840-854.

Schwarzer, R., & Schulz, U. (2003). Berliner Social Support Scales. Retrieved from http://ww w.midss.org/sites/default/file s/berlin_ socialsupport_scales_e nglish_items_by_scale.pdf

Sen, A. (1999). Development as freedom (1st.ed.). New York: Knopf.

Sheikh, A.Q., Meraj, M., & Sadaqat, B.M. (2015). Gender equality and socio-economic development through women's empowerment in Pakistan. *Ritsumeikan Journal of Asia Pacific Studies*, *34*, 124-140.

Tareque M. I., Haque, M.M., Mostofa, M. G. & Islam, T. M. (2007). Age, Age at Marriage, Age Difference between Spouses & Women Empowerment: Bangladesh Context. *Middle East Journal of Age & Ageing*, 4 (6), 8 - 14.

The Economist (2006, Apr 12): Forget China, India, and the Internet: economic growth is driven by women. Retrieved from http:/ /www.economist.com/node/ 6800723

Tripathi T. (2011). Women's Empowerment: Concept and Empirical Evidence from India, paper presented at the annual *conference ('Winter School') of the Centre for Development Economics*, Delhi School of Economics, December 10-13, 2011.

Wiklander, J. & Thede, S. (2010). *Determinants of Women's Empowerment in Rural India: An intra-household study* (Master's thesis). Lunds Universitet, Lund Sweden: Department of Economics.