Middle-East Journal of Scientific Research 8 (2): 440-449, 2011
ISSN 1990-9233


# Determinants of Fertility: A Neural Network Approach

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**Abstract:** Fertility is the major determinant of population growth rate. In the early 1960's Pakistan was the pioneer country which focused on the family planning issues to control the fertility rate so that population growth would be controlled. But it has been observed that the population growth could not be controlled at the desired level yet. The main objective of this study is to explore the factors those are affecting fertility and helps in the prediction of its levels. Analysis of this study is based on the data of 2006 and 2007 (PDHS) Pakistan Demographic and Health Survey. Multilayer Perceptron Neural Network Model is used to predict the effect of Region, status of education, wealth index, current age of respondent and contraception method on fertility. In classifying the fertility we could have achieved a rate of correct classification of 70.3% in training sample and 70.1% in holdout sample. Age is the most important determinant for predicting the levels of fertility.

**Key words:** Fertility · Determinants · Multilayer Perceptron Neural Network Analysis

## INTRODUCTION

The constant high fertility and swift growth of population has made Pakistan the sixth most populous country in the world with a population of 169.9 million at the end of June 2009 and an annual growth rate of 2.05 percent. It is believed that Pakistan is going to become the fourth largest country in the world by the year 2050 [1]. It is important to recall that Pakistan was a pioneer among developing countries in supporting family planning activities in early 1950's [2]. The need for the study of fertility can be overstressed because of its great impact on both population growth rate and on other social, economical and cultural parameters. Fertility is the major yard stick of population growth. Various studies conducted since early seventies and to date reveal that fertility began to decline in Pakistan [3]. Results from the 2006-07 Demographic and Health Survey (DHS) show that Pakistan's fertility rate has remained persistently high over the past decade. The total fertility rate (TFR) in Pakistan is now 4.1 children per woman. Women in urban areas have an average of 3.3 children compared to their rural counterparts, who have an average of 4.5 children [4].Various factors have been associated with the high fertility .Some of these factors have been selected and discussed in this study.

Various studies have documented that age at marriage is significantly related with fertility level. But very limited studies might have found that current age of women is also significant in analysing fertility level. It is well known that fecundity period of women lie between 14-49 years of age. To measure fertility level at a specific point of time it is always useful to have an estimate of current age of women. If majority of women at a specific point of time has age bracket of mid thirties there are chances that in subsequent year's fertility level may not be increased to high level. The argument is that in mid thirties women have relatively less numbers of reproductive years. Also there are chances that they have completed their family size. Thus increase in marriage age can play a crucial role in reducing fertility levels, as it reduces the period of experience to child bearing [5]. On the other hand if majority of women at a specific point of time when survey is conducted are in the mid thirties, obviously they may have more number of reproductive years at the end. It could also be assumed that they may not have completed their family size and still want to add some male children to their family. [6] Age is the most important and fundamental determinant, which has great impact on fertility. Age is inversely related to the fertility. i.e. the fertility rate is decreased as the married women age is increased and vice versa. The Total Fertility Rate (TFR) turn down during the 1990s was caused by the increase in female's age at first marriage rather than decrease in marital fertility rate. However, the rapid decline in Total Fertility Rate (TFR) during the period of 1999 - 2004 was

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attributable to both increase of female's age at first marriage and decrease of marital fertility rate [7]. Therefore in the present study it is assumed that current age of women in a given period, when demographic survey was conducted, be analysed to examine whether current age of women may affect on fertility level.

Contraceptive is debatably the main modifying factor of fertility in modern societies. Despite the fact that Pakistan was among the vanguard countries in Asia in starting a family planning program more than five decades ago, the use of contraceptive is very low. One plausible explanation of low use of contraception is low income. There are evidence that the poor women have high fertility rate because of less frequent use of contraceptives and unawareness about contraceptive methods [8].

Education is one of the most important socioeconomic factors, which have great influence on fertility. Education creates an awareness regarding the benefits of small family. The educated people, on the basis of awareness, try to maintain a balance between their resources and family size. They also visualize the harms of having a large family, keeping in view various socio- economic factors. Most of the analysts consider education the most important reason behind the whole thinking about family size. That is why the educational factor is discussed with perfect isolation from other factors, working in this regard. Education of adults is the dominant predictor of their reproductive behavior and thus length of education has been related with the start of reproductive life [6, 10].

Region is also an important factor regarding the family size. In almost every country, the human priorities, thoughts, behaviors and inclinations vary from region to region. In terms of family size also, the thoughts, reasons and planning's not the same everywhere. So that if we examine the different regions of Pakistan the fertility seems to be different. Total fertility rate in Pakistan is 3.17% (2011 est.). Fertility levels varied widely in the four regions of Pakistan (Punjab, Sindh, NWFP, Balochistan) having fertility rate 3.9 %, 4.3%, 4.3% and 4.1% respectively (2006-2007).

Wealth index is another factor which is seemed to be an important determinant of fertility level. Wealth index is a composite index of housing characteristics. Income is one of the major components of this index. It is assumed that wealth index may significantly affect the fertility level. Wealth index may influence the orientation of parents and they might have high aspiration about their children's future particularly with reference to children education and equality of life. These aspirations may restrict them to increase their family size as giving attention to child needs lot of time and energy. Therefore they may tend to limit their family size. Wealth index is also analyzed with reference to fertility level of DHS data 2006-2007. The trend of fertility is dwindling according to the increasing education level and status of wealth index [9].

This study is about the determinants of fertility which is significant cause of increasing population. Its prevalence is increasing day by day. In Pakistan no study has been conducting regarding this issue by using such a large data set of Demographic and Health Survey (DHS) of Pakistan.

**Objectives of the Study:**

- To investigate the association of different factors affecting fertility.
- To built a Neural Network model in determining the factors those are affecting fertility.

## MATERIAL AND METHODS

In this study, Pakistan Demographic and Health Survey 2006-2007 data is used to explain the factors of fertility on which basis we can predict the phenomenon. Target population of the study is the population of Pakistan consisting of four provinces Punjab, Sindh, NWFP and Balochistan. The sample size was 39049 women from the four mentioned provinces. There were five variables: region (V024), wealth index (V190), status of education, contraception method and current age of respondent (V012) whose effect on the fertility was measured. In order to evaluate fertility levels, trends and determinants Multilayer Perceptron Neural Network model is used.

**Data Analysis Technique:** Chi-square test of association and Neural network Technique was used for analysis purpose.

**Neural Network:** The term neural network applies to a loosely related family of models, characterized by a large parameter space and flexible structure, descending from studies of brain functioning. As the family grew, most of the new models were designed for non biological applications, though much of the associated terminology reflects its origin. Specific definitions of neural networks are as varied as the fields in which they are used. While no single definition properly covers the entire family of

models. A neural network is a massively parallel distributed processor that has a natural propensity for storing experiential knowledge and making it available for use. It resembles the brain in two respects:

- Knowledge is acquired by the network through a learning process.
- Interneuron connection strengths known as synaptic weights are used to store the knowledge.

**Multilayer Perceptron Neural Network (MLPNN):** Multilayer Perceptron Neural Network known as feed forward architecture because the connection in the network flow forward from the input layer to the output layer without any feedback loops. A multilayer feed forward neural network is an interconnection of perceptrons in which data and calculations flow in a single direction, from the input data to the outputs. The number of layers in a neural network is the number of layers of perceptrons. This network has an input layer (on the left), one hidden layer (in the middle) and an output layer (on the right). There is one neuron in the input layer for each predictor variable ($x_1 \ldots x_p$).

Activation Functions. The activation function "links" the weighted sums of units in a layer to the values of units in the succeeding layer.

a) Softmax. This function has the form: $\gamma(c_k) = \exp(c_k)/\Sigma_j \exp(c_j)$. It takes a vector of real-valued arguments and transforms it to a vector whose elements fall in the range (0, 1) and sum to 1. Softmax is available only if dependent variable is categorical. When automatic architecture selection is used, this is the activation function for units in the output layer if the dependent variable is categorical.

b) Hyperbolic tangent. This function has the form: $\gamma(c) = \tanh(c) = (e^c - e^{-c})/(e^c + e^{-c})$.

It takes real-valued arguments and transforms them to the range (-1, 1). [11]

## RESULTS AND DISCUSSION

**Descriptive Statistics:** For qualitative variables percentages for the different categories of different variables: Region, Wealth index, Status of education and Contraception method is given in Table A1, A2, A3 and A4.

First table shows the percentages of respondents with respect to Region: Punjab, Sindh, NWFP and Baluchistan those are 41.8%, 27.1%, 19.5% and 11.6% respectively. It shows that significant sample proportion was selected from Punjab according to its population density and size. Table A-2 shows percentages for Wealth index in which 21% respondents who are Poorest, 21.4% Poorer, 20.4% Middle, 20.0% Richer and 17.3% Richest. Table A-3 shows Percentages for Status of Education and Contraception method in which 25.4% respondents are educated and 76.4% are uneducated. 34.5% respondents are using any contraception method and 65.5% respondents not using any type of contraception method at the time of survey.

The frequency distribution for Number of living children is given in Table A-4. This table shows that most of the respondents have more than 5 living children's. Descriptive statistics for Age of respondents is calculated in Table A-5 in which minimum value is 15, maximum value is 49, mean value is 36.48 with standard deviation is 7.722.

**Appendix**

Table A-1: Percentages for Region

| | Categories | | | |
|---|---|---|---|---|
| Variable | | | | |
| Region | Punjab | Sindh | NWFP | Balochistan |
| % | 41.8 | 27.1 | 19.5 | 11.6 |

Table A-2: Percentages for wealth index

| | Categories | | | | |
|---|---|---|---|---|---|
| Variable | | | | | |
| Wealth index | Poorest | Poorer | Middle | Richer | Richest |
| % | 21.0 | 21.4 | 20.4 | 20.0 | 17.3 |

Table A-3: Percentages for Status of Education and Contraception Method

| Variables | Categories | |
|---|---|---|
| Status of education | Yes | No |
| % | 25.4 | 74.6 |
| Contraception method | Used | Not used |
| % | 34.5 | 65.5 |

Table A-4: Frequency distribution for Number of living children

| Number of living children | Frequency | Percentage |
|---|---|---|
| <= 2 | 4992 | 12.784 |
| 3-4 | 10390 | 26.608 |
| 5+ | 23667 | 60.608 |

Table A-5: Descriptive statistics for Age of Respondents

| Variable | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Age | 39049 | 15 | 49 | 36.48 | 7.722 |

Table A-6: Association between Region, Wealth index, Status of education and Contraception method with Number of living children.

| Sr# | Variables | Number of living children | | | | Chi-square | p-value |
|---|---|---|---|---|---|---|---|
| 1 | Region | <=2 | 3-4 | 5+ | Total | 249.4227 | .000 |
| | Punjab | 2133 | 4726 | 9444 | 16303 | | |
| | Sindh | 1439 | 2957 | 6201 | 10597 | | |
| | NWFP | 826 | 1772 | 5018 | 7616 | | |
| | Baluchistan | 594 | 935 | 3004 | 4533 | | |
| | Total | 4992 | 10390 | 23667 | 39049 | | |
| 2 | Wealth index | <=2 | 3-4 | 5+ | Total | 730.6396 | .000 |
| | Poorest | 1018 | 1888 | 5285 | 8191 | | |
| | Poorer | 1031 | 1912 | 5402 | 8345 | | |
| | Middle | 867 | 1996 | 5094 | 7957 | | |
| | Richer | 940 | 2129 | 4739 | 7808 | | |
| | Richest | 1136 | 2465 | 3147 | 6748 | | |
| | Total | 4992 | 10390 | 23667 | 39049 | | |
| 3 | Status of education | <=2 | 3-4 | 5+ | Total | 1780.7955 | .000 |
| | No | 2960 | 6770 | 19396 | 29126 | | |
| | Yes | 2032 | 3620 | 4271 | 9923 | | |
| | Total | 4992 | 10390 | 23667 | 39049 | | |
| 4 | Contraception method | <=2 | 3-4 | 5+ | Total | 578.2724 | .000 |
| | Not used | 4022 | 6549 | 14990 | 25561 | | |
| | Used | 970 | 3841 | 8677 | 13488 | | |
| | Total | 4992 | 10390 | 23667 | 39049 | | |

Multilayer Perceptron Neural Network (MLPNN)

Results of Table A-6 shows the test of association between Region, Wealth index, Status of education, Contraception usage with Number of living children. The results show that all the variables have significant association with Number of living children or fertility level. This study suggested that contraceptive usage has significant effect on determining the fertility [12]. Education is proved an important factor for fertility; higher the level of education lower will be the fertility level [13]. Region and wealth index also play significant role in predicting the fertility level and have strong association [14, 15].

Table 1: Case Processing Summary

| | | N | Percent |
|---|---|---|---|
| Sample | Training | 27264 | 69.8% |
| | Holdout | 11785 | 30.2% |
| Valid | | 39049 | 100.0% |
| Excluded | | 0 | |
| Total | | 39049 | |

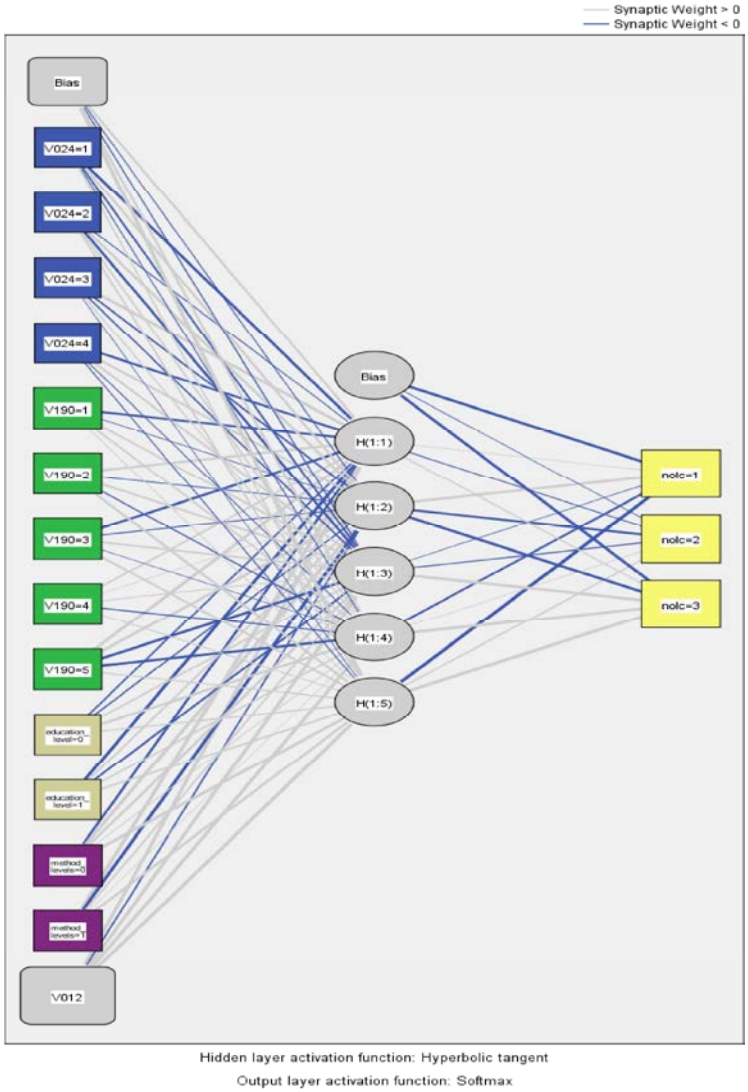


Fig. 1: MLPNN Architecture

**Results of Multilayer Perceptron Neural Network (MLPNN):** Multilayer perceptron method was applied in which the dependent variable is Number of living children and the independent variables were current age of respondent, status of education, wealth index, Region and any type of contraception method. The objective of the study is to predict the number of living children's on the basis of Region, status of education, wealth index, current age of respondent and contraception method. The tables and figures of the analysis Multilayer perceptron are given in Appendix.

Table 1 shows the model summary of Multilayer perceptron. The model partitioned the data into two samples Training and Holdout. Total cases are 39049 in which 27264 cases were selected in training sample and 11785 in the holdout sample.

Figure 1 and Table 4 show the structure of Multilayer Perceptron Neural Network known as feed forward

architecture because the connection in the network flow forward from the input layer to the output layer without any feedback loops. A multilayer feed forward neural network is an interconnection of perceptrons in which data and calculations flow in a single direction, from the input data to the outputs. The number of layers in a neural network is the number of layers of perceptrons. The input layer contains the predictors (Region, status of education, wealth index, current age of respondent and contraception method). The hidden layers contain unobservable nodes, or units. The value of each hidden units is some function of the predictors. The output layer contains the responses. Since Number of living children is a categorical variable with three categories, it is recoded as three indicator variables. Each output unit is some function of hidden units. The figure is the aggregation of the input layers, hidden layers and output layers. Behind the figure the hidden layers and the output layers uses some mathematical activation functions. In this model the hidden layer activation function is hyperbolic tangent and output activation function is soft max. Figure for MLP is constructing by using these two activation functions.

Cross entropy error is an alternate to the square error; network tries to minimize error during training. The value of Cross entropy error is 19445.173.

Number of units in the input layer are 14. The figure depicts that category first (<=2) children has strong positive relationships with 2nd unit of first hidden layer and strong negative relationships with 4th and 5th unit of first hidden layer. Category second (3-4) children has positive relationships with 4 and 5 unit of first hidden layer and strong negative relationships with 2nd unit of first hidden layer. Category third ($5^+$) children have strong negative relationships with 2 units of first hidden layer and strong positive relationship with 3, 4 and 5 units of first hidden layer. Grey lines show positive weights and blue lines show negative weights. Thickness of the lines shows the strength of relationship.

The classification table provides a comprehensive picture of the classification performance of the model. The ideal classification matrix is the one in which the sum of diagonal is equal to the number of samples. Cells on diagonal of cross-classification are correct classification. Cells off the diagonal of the cross classification are incorrect classification.

Table 2. Shows the classification results of analysis. In which 1467 females out of 3528 who actually belong to group 1 are classified correctly in training sample. 2306 respondents out of 7262 who actually belong to the group 2 are classified correctly in training.15384 females out of 16474 who actually belong to the group 3 are classified correctly in training sample. Overall 70.3% of the training cases are correctly classified. 616 out of 1464 who actually belong to group 1 are correctly classified in holdout sample. 1003 out of 3128 who actually belong to group 2 are correctly classified in holdout sample. 6643 out of 7193 who actually belong to group 1 are correctly classified in holdout sample. Overall 70.1% of the holdout cases are correctly classified. The table shows that for training and holdout the percentage of correct classification is 70%. It means this model explain 70% variation in the dependent variables on the basis of given variables.

Figure 2. Shows box plots of Predicted Pseudo Probabilities. For categorical dependent variable, the predicted-by-observed chart displays clustered box plots of predicted pseudo-probabilities for the combined training and testing samples. The x-axis corresponds to the observed response categories and the legend corresponds to predicted categories. The portion of the box plot above the 0.5 mark on the y-axis represents correct predictions. The portion below the 0.5 mark represents incorrect predictions. The 1st box plot of

Table 2: Classification of fertility for Training and Holdout Sample

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | Observed | <=2 | 3-4 | 5+ | Percent Correct |
| Training | <=2 | 1467 | 1083 | 978 | 41.6% |
| | 3-4 | 672 | 2307 | 4283 | 31.8% |
| | 5+ | 84 | 1006 | 15384 | 93.4% |
| | Overall Percent | 8.2% | 16.1% | 75.7% | 70.3% |
| Holdout | <=2 | 616 | 449 | 399 | 42.1% |
| | 3-4 | 311 | 1003 | 1814 | 32.1% |
| | 5+ | 55 | 495 | 6643 | 92.4% |
| | Overall Percent | 8.3% | 16.5% | 75.1% | 70.1% |

Dependent Variable: fertility

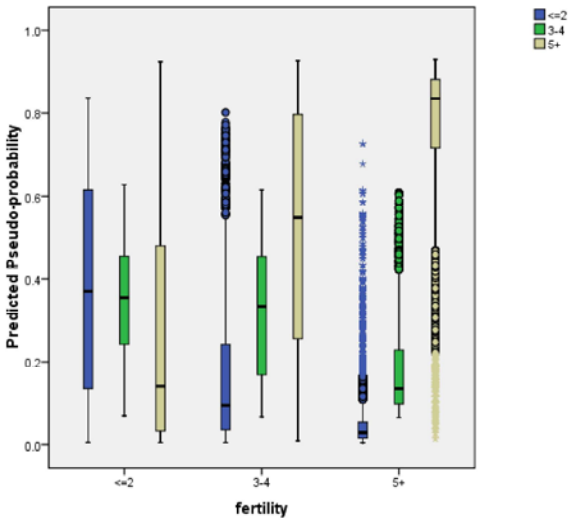


Fig. 2: Chart of Predicted Pseudo Probability

predicted-by-observed chart provides the same information as the first diagonal of the classification table. The 2nd box plot shows for cases that have observed category first (<=2), the predicted pseudo-probability of category second (3-4). It is representing incorrect classification because box plot is low the 0.5 mark and the case above the box plot are misclassified, the 3rd box plot shows for cases that have observed category first (<=2), the predicted pseudo-probability of category third ($5^+$). The first box plot of second category shows for cases those have observed category second, the predicted pseudo-probability of category first (<=2). The second box plot of second category shows for cases those have observed category second, the predicted pseudo-probability of category second (3-4). The third box plot of second category shows for cases those have observed category second, the predicted pseudo-probability of category third ($5^+$). The first box plot of third category shows for cases those have observed category third, the predicted pseudo-probability of category first (<=2). The second box plot of third category shows for cases those have observed category third, the predicted pseudo-probability of category second (3-4). The third box plot of third category shows for cases those have observed category third, the predicted pseudo-probability of category third ($5^+$). In this case, we say that the first box-plot of first category and second box-plot of second category shows misclassifications because the cut point of box plots is below the 0.5 mark but third box-plot of third category shows correct classification because this box plot is above the 0.5 mark. Remember from classification table that third category shows 93.4% and 92.4% correct classification for both training and holdout samples respectively.

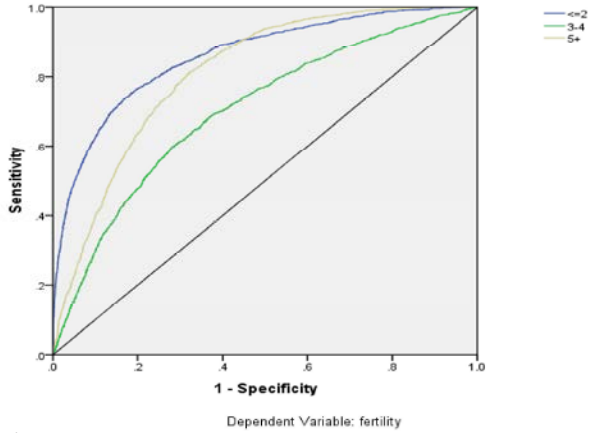


Fig. 3: ROC Curve

The Receiver Operating Characteristic (ROC) curve in figure 3 gives a visual display of the sensitivity and specificity for all possible cut offs in a single plot, which is much cleaner and more powerful than a series of tables. ROC curve shows the trade-off between the true positive rate or sensitivity (portion of positive cases those are correctly identified) and the false negative rate (portion of negative cases that are incorrectly identified as positive) for a given model. The chart shown in the figure displays three curves, one for the each category of the dependent variable.

To assess the accuracy of the model, area under the curve is u sed. If the area is 1 then it is an ideal test, because it achieves both 100% sensitivity and 100% specificity. If the area is 0.5, then it has effectively 50% sensitivity and 50% specificity. The closer the area is to 1, the better the test is and the closer the area is to 0.5, the worse the test is. Since from Table 3. The area under the curve is close to 1 for three categories of dependent variable, so it is better predicted model.

The Cumulative Gains chart in figure 4 shows the percentage of the overall number of cases in a given category "gained" by targeting a percentage of the total number of cases. Cumulative gains are used to predict the model performance. It contains a lift curve and a baseline. The greater the area between the lift curve and the baseline, the better the model is. The first point on the curve for the 1st category is at (10%, 46%), meaning that if we score a dataset with the network and sort all the cases by predicted pseudo-probability of 1st category, we should expect the top 10% to contain approximately 46% of all the cases that actually take the category 1st.

Table 3: Area under the curve

| | | Area |
|---|---|---|
| Fertility | <=2 | .859 |
| | 3-4 | .702 |
| | 5+ | .812 |

Table 4: Parameter estimates of Neural Network

| | | Parameter Estimastes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Predicted | | | | | | | |
| | | Hidden Layer 1 | | | | | Output Layer | | |
| Presitor | | H(1:1) | H(1:2) | H(1:3) | H(1:4) | H(1:5) | [nolc=1] | [nolc=2] | [nolc=3] |
| Input Layer | (Bias) | 0.328 | -0.065 | -0.098 | 0.335 | 1.246 | | | |
| | [Vol 24 = 1] | -0.484 | 0.369 | -0.262 | -0.051 | 0.138 | | | |
| | [Vol 24 = 2] | -0.078 | -0.261 | -0.390 | 0.211 | 0.233 | | | |
| | [Vol 24 = 3] | 0.633 | 0.348 | -0.197 | 0.122 | -0.004 | | | |
| | [Vol 24 = 4] | -0.399 | -0.040 | 0.320 | -0.059 | -0.076 | | | |
| | [Vol 190 = 1] | -0.403 | -0.098 | 0.302 | 0.283 | 0.044 | | | |
| | [Vol 190 = 2] | 0.471 | -0.098 | 0.353 | -0.136 | 0.401 | | | |
| | [Vol 190 = 3] | -0.466 | -0.110 | 0.315 | -0.066 | 0.340 | | | |
| | [Vol 190 = 4] | 0.293 | 0.003 | 0.106 | -0.168 | 0.107 | | | |
| | [Vol 190 = 5] | 0.775 | 0.495 | -0.550 | -0.546 | 0.175 | | | |
| | [education_level = 0] | -0.220 | -0.171 | 0.297 | 0.494 | 0.220 | | | |
| | [education_level = 1] | -0.602 | 0.286 | -0.308 | 0.264 | 0.314 | | | |
| | [method_level = 0] | -0.372 | 0.823 | 0.445 | 0.044 | 0.658 | | | |
| | [method_level = 1] | 0.940 | -0.657 | 0.273 | 0.002 | 0.443 | | | |
| | Vol 12 | 0.769 | -0.205 | 0.827 | 0.871 | 1.590 | | | |
| Hidden Layer 1 | (Bias) | | | | | | -0.607 | -0.031 | -0.578 |
| | H(1:1) | | | | | | 0.014 | -0.079 | 0.155 |
| | H(1:2) | | | | | | 0.562 | -0.404 | -0.587 |
| | H(1:3) | | | | | | -0.022 | -0.123 | 0.675 |
| | H(1:4) | | | | | | -0.335 | 0.019 | 0.788 |
| | H(1:5) | | | | | | -0.982 | 0.225 | 1.476 |

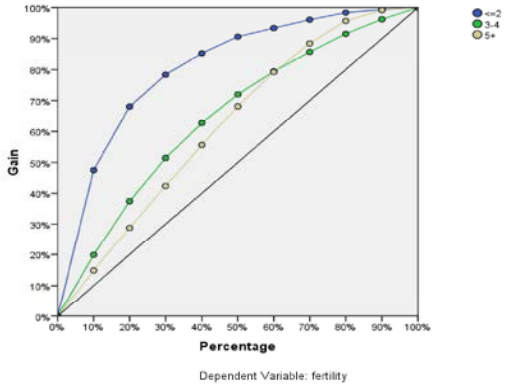


Fig. 4: Gain Chart

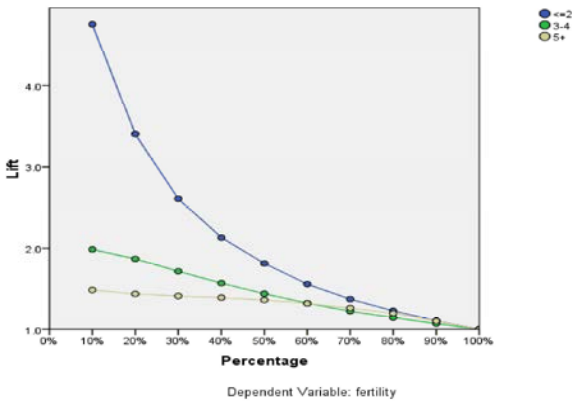


Fig. 5: Lift Chart

Likewise, the top 20% would contain approximately 68% of the 1st category. The top 30% would contain approximately 78% of the 1st category and so on. If the first point covers more percentage of randomly selected cases then we get the more percentage of correct classification. Similarly other categories can be interpreted.

The Lift Chart in figure 5 Shows for three categories (≤2), (3-4) and (5+) children's. Lift is a measure of the effectiveness of a predictive model calculated as the ratio

Table 5: Importance of Variables

| | Importance | Normalized Importance |
|---|---|---|
| Region | 0.060 | 9.0% |
| Wealth index | 0.101 | 15.1% |
| status of education | 0.063 | 9.4% |
| contraception method | 0.110 | 16.4% |
| Current age of respondent | 0.667 | 100.0% |

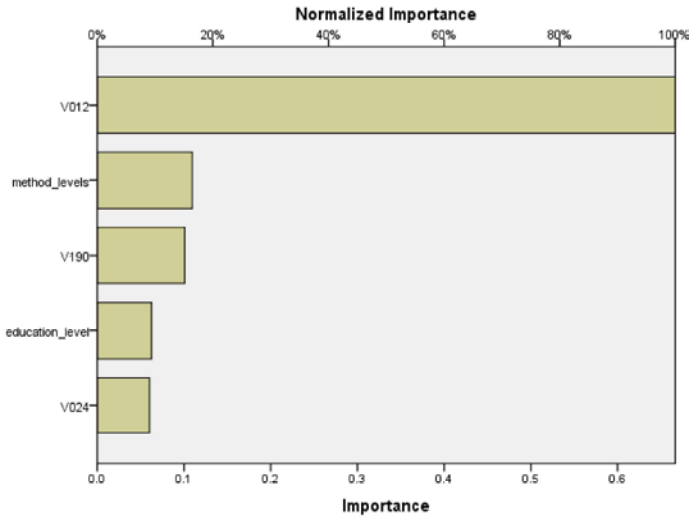


Fig. 6: Importance of variables

between the results obtained with and without the predictive model. The lift chart is derived from the cumulative gain chart; the values on the y-axis correspond to the ratio of the cumulative gain for each curve to the baseline. Thus the lift at 10% for the category (<=2) children is 48%/10% = 4.8. Similarly, the lift at 20% for the category (<=2) children is 3.4, the lift at 30% for the category (<=2) children is 2.6 and so on.

Table 5 and Figure 6 show the importance of independent variables importance. It is noted that more the normalized importance % more will be the importance of that variable in the predictive model. Age of respondent has 100% normalized importance. Contraception Method has 16.4%, Wealth Index has 15.1%, Status of Education has 9.4% and Region has 9% normalized importance. These results have shown that age is the most important factor for determining fertility. Contraception usage is getting second importance in the study for predicting the fertility level and so on.

## CONCLUSION

Fertility is always an important phenomenon for demographer's and policy makers. There are many factors which affect the fertility. Different prior researches have investigated and evaluated many factors in different regions of the world. In the present research, Region, Status of education, Wealth index, current age of respondent and Contraception method has strong relationship with Fertility (Number of living children) and help in the prediction of fertility level.

## REFERENCES

1. World Bank Report, 2007. United Nations
2. Gubhaju, B., 2006. Fertility transition in ASIA: An overview of levels and trends. United Nations.
2. Iqbal, H., T.W. Pullum and M. Irfan, 1986. Fertility in Pakistan during the 1970s. J. Biosocial Sci., 18: 215-229.
3. Karen, H. and E. Leahy, 2008. Population, Fertility and Family Planning in Pakistan: A Program in Stagnation. Research Commentary. 3(3). Washington, DC: Population Action International.,
4. Aziz, A., 1994. Proximate determinants of fertility in Pakistan (demographic analysis). Article from Pakistan Development Rev., 33(4): 727-742.

5. Khraif, R.M., 2001. Fertility in Saudi Arabia: levels and determinants. *XXIV* General Population Conference Salvador-Brazil, 18: 24.
6. Sam-Sik, L., 2009. Low Fertility and Policy Responses in Korea. The Japanese J. Population, 7: 1.
7. Ebrahim, Z., 2009. Pakistan to promote birth spacing among women. One world south Asia, 26 March 2009.
8. Islam, S. and M.K. Nesa, 2009. Fertility transition in Bangladesh: the role of Education. Proc. Pakistan Acad. Sci., 46(4): 195-201.
9. Cleland, J., 2002. Education and future fertility trends, with special reference to mid- transitional countries. Proceedings of expert Group Meeting on Completing the Fertility Transition. Population Division. United Nations (also forthcoming in UN Population Bulletin).
10. Haykin, S., 1998. Neural Networks: A Comprehensive Foundation, 2nd ed. New York: Macmillan College Publishing.
11. Boadu, K., 2002. The Effect of Contraceptive Practice on Fertility in Ghana: A Decade of Experience. Canadian Studies in Population, 29(2): 265-291
12. Akmam, W., 2002. Women's Education and Fertility Rates in Developing Countries, With Special Reference to Bangladesh. Eubios Journal of Asian and International Bioethics. 12: 138-143.
13. Gabrielli, G., A. Paterno and M. White, 2007. The impact of origin region and internal migration on Italian fertility. Demographic Res., 17: 705-740.
14. Weerasinghe, D.P. and N.J. Parr, 2002. Effect of Wealth on Marital Fertility in Sri Lanka. Journal of Health Population Nutrition, 20(2): 112-119.