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# Spatial and Gender Based Comparison of Multidimensional Poverty: Household Level Analysis from Pakistan

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**Abstract**

The present study examines the multidimensional poverty in Pakistan by using three waves of (PSLM) survey data 2001-02, 2007-08 and 2013-14. Ten indicators such as enrolment, school attendance, immunization, prenatal care, electricity connection, gas, water, sanitation, crowding and assets are used for the measurement of multidimensional poverty. Alkire Foster and binary logistic techniques are employed for the measurement of multidimensional of poverty. Multidimensional poverty is measured at national and provincial, gender and regional level. The incidence of multidimensional poverty in Pakistan is high in rural areas as compared to the urban areas. Punjab province has the lowest while Balochistan province has the highest incidence of multidimensional poverty.

**Keywords:** Multidimensional, Poverty, Gender, Headcount, Pakistan

## Introduction

Poverty is normally linked to command over commodities. Hence, poor are those who have not enough resources to put them above a minimum threshold level. But Sen (1985) views poverty in terms of individuals' "functioning and capabilities". The poor lack of key capabilities such as education, health and living standards. Poverty measurement is also important which influence the way of understanding and analyzing. In recent times, the literature on multidimensional poverty emerged in different directions. The Human Development Report (1997) determined poverty as multidimensional phenomenon. The millennium development goals (MDGs) since 2000 and Sustainable development goals (SDGs) highlighted numerous dimensions of poverty. The global monitoring report (2016) identified that progress along different indicators and across countries is not uniform which also ensure importance of multidimensional poverty. Multidimensional poverty is better to capture different dimensions of poverty and is close to reality. Whereas, the monetary poverty shows only numbers and explain only one side of the coin.

Pakistan government in order to eradicate poverty incidence and severity at all levels has embarked on different programs such as Benazir Income Support Program (BISP), vocational training and micro credit programmes are among others. However, in order to design and formulate policies for poverty alleviation, it is important enough to understand its magnitude and processes that cause and deepen it. The present study is an extension to previous studies in a number of ways. This study measure multidimensional poverty at national, provincial, spatial and gender level. This study also finds out determinants of multidimensional poverty as previous studies found determinants of unidimensional poverty in Pakistan. The main objective of the study is to investigate changes in multidimensional poverty at national, provincial and regional level from 2001-02 to 2013-14 and to determine the factors that contributes to multidimensional poverty. The rest of the paper is arranged in the following way. The literature review is presented in the second section; the third section is

fixed for the data and methodology. The results are presented in the fourth section and in the last section the paper is concluded.

**Literature Review**

As unidimensional poverty measurement has some drawbacks (Alkire and Santos 2014). Then dissatisfaction with the traditional approach to poverty measurement, fuzzy set approach emerged (Cerioli and Zani 1990). Then Chelli and Lemmi (1995) proposed a modified form of fuzzy set approach which is called Totally Fuzzy and Relative (TFR). Sen's capability approach provided basis to measure poverty multidimensionally and some institutions such as OPHI follow this approach. The MDGs as well as SDGs spur the importance of multidimensional poverty indices. Deutsch and Silber (2005) provided a comprehensive study on different multidimensional poverty measures. Tsui (2000) explored the foundation of axiomatic multidimensional poverty measure that was an extension of income approach. Poverty arises as a result of shortfall of various dimensions of poverty like health, literacy, housing, income and provision of public services, essential for a meaningful life (Bourguigon & Chakravarty, 2002). Alkire (2002) identified human development dimensions that are necessary for true measurement of poverty and wellbeing of the people. Bourguignon and Chakravarty (2003) used practical example from rural Brazil and used only two attributes education and income. Income alone cannot capture true picture of poverty (Atkinson 2003).

Alkire and Foster (2011) proposed a new approach to poverty measurement. This methodology is easy to understand and comparisons and is flexible for the selection of weights and dimensions. Baulch and Masset (2003) used monetary and non-monetary dimensions of poverty in Vietnam by using panel data in 1990s. Wagle (2005) conducted a study on multidimensional poverty in Nepal. Santos and Ura (2008) utilized the Bhutan Living Standard Survey (BLSS) 2007 data for the estimation of multidimensional poverty. Alkire and Foster (2011a) explain the limitations, strength and confusion about the AF poverty measure for further research. A cross country study from Latin American countries was conducted and used SEDLAC dataset for the period 1992 to 2006 (Battiston et al., 2013). Batana (2013) estimated multidimensional poverty in fourteen Sub Saharan countries and checked different dominance relations through stochastic dominance technique. Bennett and Mitra (2013) used AF class of measure and show that hypothesis may be checked by using the method of minimum p-value of Bennet. The application of this methodology has useful implications when applied to investigate the status of Muslims and Hindus which was impossible in univariate approach.

Alkire and Santos (2014) measured multidimensional poverty for 104 developing countries by using different data sets. The changes over time and space are measured for Uganda (Levine et al., 2014). Alkire and Seth (2015) measured changes in multidimensional poverty from 1999-2006 in India by using National Family and Health Surveys (NFHS) data set. The pattern of poverty reduction was not pro-poor as compared to income poverty among states and poorer subgroups show sluggish progress. The question asked as where the poorest people live across 108 countries (Alkire et al., 2015). The situation of a country cannot be improved without improving the conditions of the poorest and (Alkire et al., 2017) separated the poorest from moderate poor.

There are a few studies on measuring multidimensional poverty in Pakistan. Jamal (2011) compared the results of multidimensional poverty with income poverty by using two Household Integrated Economic Survey (HIES) 2001-02 and 2004-05 data sets. The study used four dimensions such as human poverty, financial poverty, poor household and physical household asset poverty. Awan, Waqas, and Aslam (2011) estimated multidimensional poverty for Punjab province by using Multiple Indicator Cluster Survey (MICS) 2003-04 data set. Khan, Saboor, Ahmad, and Ali (2011)

identified the time trends of multidimensional poverty in Pakistan by using different (HIES) datasets from 1998-99 and 2007-08. Salahudin and Zaman (2012) used PSLM datasets from 1998-99 to 2005-06. Afzal, Rafique and Hameed (2015) measure multidimensional poverty by using MICS 2007 and 2011 datasets for the province of Punjab.

**Methodology**

The data has been taken from PIHS/PSLM 2001-01, 2007-08 and 2013-14. Each data set has information regarding the individual characteristics along with the demographic view of each household in a separate data sheet. The data has information about population weights for every primary sampling unit so that the collected data can be made representative at national level. The households at national level along with the rural and urban domains have been divided into four provinces. These surveys adopted two stage stratified sampling technique. These surveys used national representative sample sizes. The data sets for the year 2001-02, 207-08 and 2013-14 have sample size of total 14565, 15512 and 17989 households respectively.

The study used multidimensional poverty index (MPI) proposes by Alkire and Foster (2011). Table shows dimensions, indicators, cut off point and weights given to each dimensions.

**Table 1. Dimensions, Indicators, Weights and Cut-offs of Multidimensional Poverty**

| Dimension | Indicator | Deprived if | W |
|---|---|---|---|
| Education | | | **1/3** |
| | Schooling | No household member has completed at least class five | 1/6 |
| | Enrolment | Any school-aged child is not attending school up to class 8 | 1/6 |
| Health | | | **1/3** |
| | Prenatal | Never go for prenatal consultation in the household | 1/6 |
| | Immunized | No child in the household is immunized | 1/6 |
| Standard of Living | | | **1/3** |
| | Electricity | Household has no electricity connection | 1/18 |
| | Sanitation | If not having flush toilet/pit latrine/digged ditch | 1/18 |
| | Water | The household does not have access to safe drinking water | 1/18 |
| | Crowding | If per-person room is equal or greater than three | 1/18 |
| | Gas | The household does not have gas connection | 1/18 |
| | Asset | The household does not having at least one asset related to access to information (radio, TV, telephone, computer) and not having at least one asset related to mobility (bike, motorbike, car) or one asset related to livelihood (refrigerator, freezer, air-conditioner, air-cooler, washing machine, fan, cooking range). | 1/18 |

Note. W, indicated weight allocated to each indicator.

***Alkire and Foster Index***

Alkire and Foster (2011) index based on Foster-Greer-Thorbecke hence FGT (1984) family of poverty measures. There are different steps involved in the measurement of multidimensional po-

verty. First, dimensions of wellbeing are defined. Second, weights are assigned to each dimension. Third, define deprivation cut-off for each household. Fourth, calculate score for each household. Fifth, define cut-off on household level deprivation score (poverty cur-off). Sixth, calculate proportion of deprived household (headcount index). Seventh, calculate intensity of poverty (average deprivation). Lastly, calculate multidimensional poverty index (MPI). The first three steps (definition, dimensions, indicators, weights and cut off) considered by the study are summarized in the Table 1. The fourth step is to calculate the deprivation score. It ranges from 0 to 1, where zero indicating no deprivation and one indicating complete deprivation. This can be written mathematically as:

$$c_i = \sum_{i=1}^{n} (\mu d)_i \qquad (1)$$

Where, $c_i$ = deprivation score of ith household, $\mu$ = weight given to $i^{th}$ dimension and $d_i = i^{th}$ dimension of wellbeing.

The poverty cutoff is the fifth step which is a benchmark above which a household is considering to be poor. It is called proportion of indicators in which a household must be deprived in shall be consider poor. If there are '*d*' dimensions, then 'k' poverty cutoff can be fixed as: $\frac{1}{d} \le k \le \frac{d}{d}$. Thus 'k' can be written as the number of dimensions in which a household is poor divided by the total number of dimensions. For example, with ten indicators 'k' can be fixed, $k = \frac{1}{10}, \frac{2}{10}, \frac{3}{10}, \frac{4}{10}, \frac{5}{10}, \frac{6}{10}, \frac{7}{10}, \frac{8}{10}, \frac{9}{10} or \frac{10}{10}$. The present study used, $k = \frac{3}{10}$, which indicated that a household is multidimensional poor is deprived in two or more out of ten indicators . The calculation of the proportion of the deprived households is the headcount index (H). It gives the proportion of the household which are multidimensional poor. It can be calculated by (2).

$$H = \frac{Q}{N} \qquad (2)$$

Where, H= headcount index, Q= number of multidimensional poor household at the given poverty cut off and N= total number of households.

The next step is to calculate the intensity of poverty. Average deprivation is calculated as the total deprivation divided by the total number of households.

$$A = \frac{\sum_{i=1}^{n} c_i[k]}{Q} \qquad (3)$$

Where, A= average deprivation, Q= number of multidimensionally poor households, $(q = 1, if c_i \ge k)$ and $c_i(k)$ = weighted deprivation, $(c_i(k) = c_i if c_i \ge k)$

The final step is the calculation of multidimensional poverty index (MPI). MPI is also known as adjusted headcount index. It combines the information on the intensity (A) and the incidence (H). It can be defined as "It reflects the proportion of weighted deprivations that poor experiences out of the total potential deprivations that a society could experience". Numerically it can be written as:

M0=HXA (4)

Multidimensional poverty index ($M_0$) reflects incidence and intensity of poverty. Suppose a population of size 'n' which is further categorized into two subgroups of sizes x and y respectively. These are mutually exclusive. This decomposition can also be generalized to several numbers of exclusive subgroups.

$$M(x,y;z)=\frac{n(x)}{n(x,y)}M(x;z)+\frac{n(y)}{n(x,y)}M(y;z) \quad (5)$$

***Logistic Regression***

Literature reveals that Logit and Probit models are used extensively to measure the determinant of poverty (Awan & Iqbal, 2011; Chaudhry et al., 2009; Siddiqui, 2009). Linear Regression (LR) technique is widely applied for impact analysis. But when the dependent variable is binary or dichotomous, some information is lost when income and consumption is converted into binary variable (Cheema & Sial, 2012). Categorical regressions are better to classify the household as poor and non-poor. The present study has analyzed the impact of household characteristics and other variables. In multidimensional poverty measurement, logit model is the best for such type of analysis. Maximum likelihood (ML) estimator of parameters is employed by the Logit approach. There is a dichotomous dependent variable with a set of continuous and discrete (dummy) independent variables in LR technique. Consider a general linear model.

$$P=\alpha_0+\alpha_1x_1+\alpha_2x_2+\alpha_3x_3+.....+\alpha_nx_n+\omega_i \quad (6)$$

With $P$ = Probability of an event ranges from zero and one.

$\alpha_0$ = indicates the intercept

$\alpha_1,\alpha_2,\alpha_3$ and $\alpha_n$ = Coefficients of independent variables and $x_1,x_2,x_3$ = explanatory variables.

$1-P$ =Probability of non occurrence. The Logit is the natural log or Logarithmic Transformation of probability or the ratio of probabilities and may be expressed as:

$$\log_{it}(P)=\ln\left[\frac{P}{1-P}\right]=\alpha_0+\alpha_1x_1+\alpha_2x_2+\alpha_3x_3+.....+\alpha_nx_n+\omega_i \quad (7)$$

The value of $P$ can be calculated by the equation by (8).

$$P=\frac{e^{\alpha_0+\alpha_1x_1+\alpha_2x_2+\alpha_3x_3+.....+\alpha_nx_n+\omega_i}}{1+e^{\alpha_0+\alpha_1x_1+\alpha_2x_2+\alpha_3x_3+.....+\alpha_nx_n+\omega_i}} \quad (8)$$

Where, $P$= probability and e= base of natural logarithms with approximate value 2.71828.

**Results and Discussion**

***National Level Analysis of Indicators***

Table 2 explains that the 'immunization' indicator has the lowest while the 'gas' indicator has the highest incidence at national and rural levels but at urban level, 'immunization', 'electricity' and 'immunization' have the lowest while 'crowding' has the highest incidence in 2001-02, 2007-08 and 2013-14 respectively. The results explain that relative reduction in indicators is higher in rural region as compared to urban areas except 'gas' and 'crowding' indicators. In schooling indicator the absolute reduction at urban level was parallel to the reduction at rural level by 7 points. The results also explicates that reduction is fast from 2001 to 2008 than 2007 to 2014.

**Table 2. Incidence of deprivation (%) in ten indicators at national level**

| **Indicator** | **2001-02** | | | **2007-08** | | | **2013-14** | | |
|---|---|---|---|---|---|---|---|---|---|
| Region | T | U | R | T | U | R | T | U | R |
| Enrollment | 33 | 20 | 40 | 25 | 14 | 32 | 23 | 11 | 29 |
| Schooling | 38 | 21 | 48 | 31 | 18 | 40 | 32 | 14 | 41 |

| Indicator | 2001-02 | | | 2007-08 | | | 2013-14 | | |
|---|---|---|---|---|---|---|---|---|---|
| Immunization | 07 | 03 | 09 | 04 | 02 | 05 | 01 | 01 | 01 |
| Prenatal care | 32 | 18 | 40 | 18 | 10 | 23 | 12 | 06 | 16 |
| Gas | 76 | 43 | 95 | 68 | 32 | 93 | 63 | 21 | 85 |
| Electricity | 21 | 04 | 31 | 11 | 01 | 18 | 10 | 03 | 14 |
| Water | 22 | 07 | 31 | 13 | 06 | 18 | 11 | 02 | 16 |
| Crowding | 58 | 51 | 62 | 53 | 45 | 58 | 56 | 46 | 62 |
| Sanitation | 45 | 23 | 58 | 35 | 22 | 43 | 32 | 21 | 37 |
| Asset | 25 | 07 | 36 | 12 | 02 | 18 | 11 | 01 | 17 |

*Note*. T, U and R indicated overall, urban and rural respectively.

***Multidimensional Poverty at National Level***

The results of multidimensional poverty at national level and regional level are presented in Table 3. After examining the changes in each indicator separately, it is imperative to see the changes in multidimensional poverty or joint incidence over time. The cutoff point is set equal to one-third of all the weighted indicators. The results show that H and $M_0$ are higher in rural region than urban region. It is revealed that 63%, 32% and 81% people were multidimensionally deprived and $M_0$ is 0.31, 0.13 and 0.42 at overall, urban and rural level respectively in 2001. The percentage of poor people (H) declined to 44%, 16% and 59% and $M_0$ 0.19, 0.06 and 0.26 at overall, urban and rural level respectively 2013-14. These results show that multidimensionally poverty declined between the study periods but do not show how these changes occurred. However, the absolute and relative changes in multidimensional poverty are not uniform over time and space. It is clear that absolute and relative changes in the first period (2001-02 to 2007-08) are fast and almost double as compared to the second (2007-08 to 2013-14) time period. It is also clear from the table that changes at rural level are swift than the urban segment of the population.

These results have same trends (e.g. Awan et al. 2011; Khan et al. 2011: Salahudin & Zaman, 2013) found almost the same trends while found same trends of multidimensional of poverty. The higher multidimensional incidence of deprivation in rural region show that agriculture sector is responsible which the key provider of employment. Other factors are inadequate health facilities, illiteracy and unawareness due to imperfection of markets and so forth (Bourguignon and Chakravarty 2002). The uneven distribution of land and assets system, the biasness in the provision of fundamental services such as education, facilities of health, housing, sanitations and large household size are the main causes. The unambiguous message derived from the results is that the issue of poverty should be taken seriously at urban and rural levels.

**Table 3. Multidimensional poverty at national level**

| | 2001-02 | | | 2007-08 | | | 2013-14 | | |
|---|---|---|---|---|---|---|---|---|---|
| | H | A | M0 | H | A | M0 | H | A | M0 |
| Overall | 63 | 49 | .31 | 48 | 44 | .21 | 44 | 43 | .19 |
| Urban | 32 | 41 | .13 | 23 | 35 | .08 | 16 | 38 | .06 |
| Rural | 81 | 52 | .42 | 65 | 45 | .29 | 59 | 44 | .26 |

Source: Authors Own Calculation

***Multidimensional poverty across gender***

Multidimensional poverty has been estimated across gender of household head in four provinces of Pakistan and results are presented in Table 4. The results show that 63%, 48% and 44%

population in Pakistan is multidimensionally deprived if head of the housed is male and if the head of household is female then 63%, 47% and 45% population in Pakistan is multidimensionally deprived in 2001-02, 2007-08 and 2013-14 respectively. If poverty index is decomposed at province level then results are different. Punjab has the lowest while Balochistan has the highest incidence of deprivation if household head is male. Whereas, the results are different across provinces if household head is male, Sindh has the lowest while Balochistan has the highest incidence of deprivation. The multidimensional poverty index ($M_0$) also has same trends as H across time and space. The results imply that multidimensionally poverty declined between the time periods. However, the highest reduction occurred across female household heads in KPK and Balochistan. The results also show that adjusted headcount ratio ($M_0$) also revealed declining trends over time in Pakistan as well as at provincial level.

**Table 4. Multidimensional poverty across gender of household head**

| | **Pakistan** | | **Punjab** | | **Sindh** | | **KPK** | | **Balochistan** | |
|---|---|---|---|---|---|---|---|---|---|---|
| H % | M | F | M | F | M | F | M | F | M | F |
| 2001 | 63 | 63 | 54 | 52 | 61 | 19 | 68 | 80 | 78 | 91 |
| 2007 | 48 | 47 | 38 | 41 | 50 | 15 | 53 | 63 | 67 | - |
| 2013 | 44 | 45 | 39 | 55 | 55 | 16 | 44 | 57 | 65 | 54 |
| $M_0$ | M | F | M | F | M | F | M | F | M | F |
| 2001 | .31 | .30 | .25 | .23 | .31 | .07 | .33 | .42 | .45 | .45 |
| 2007 | .21 | .20 | .16 | .17 | .22 | .06 | .23 | .27 | .32 | - |
| 2013 | .19 | .19 | .14 | .24 | .24 | .06 | .19 | .27 | .31 | .24 |

*Source*: Authors own calculation. *Note*. M and F, indicated male and female respectively.

***Incidence of Deprivation in each indicator across gender***

The results presented in Table 5 revealed that the 'immunization' indicator has the lowest while the 'gas' indicator has the highest incidence at gender level in 2001-2002. The reduction in each indicator has been observed over time across gender. The other important result revealed that female household head also has high incidence in education indicator which show that women should be educated so that they can educate their children. There is high incidence in toilet indicator if head of household is male.

**Table 5. Incidence of deprivation in each indicator across gender**

| **Indicator** | **2001-02** | | **2007-08** | | **2013-14** | |
|---|---|---|---|---|---|---|
| Gender | Male | Female | Male | Female | Male | Female |
| Enrollment | .335 | .192 | .251 | .134 | .232 | .121 |
| Schooling | .372 | .692 | .305 | .640 | .312 | .588 |
| Immunization | .066 | .065 | .037 | .047 | .011 | .003 |
| Prenatal care | .317 | .309 | .180 | .141 | .124 | .104 |
| Gas | .761 | .802 | .683 | .693 | .625 | .703 |
| Electricity | .212 | .144 | .114 | .052 | .104 | .076 |
| Water | .220 | .266 | .133 | .127 | .110 | .145 |
| Crowding | .450 | .451 | .347 | .328 | .576 | .298 |
| Toilet | .588 | .302 | .536 | .321 | .319 | .339 |
| Asset | .252 | .247 | .116 | .095 | .154 | .154 |

*Source*: Authors own Calculation

***Provincial level analysis of indicators***

As shown in Table 6 that the highest incidence of deprivation in 2001-02 is in 'gas', 'crowding', 'gas' and 'gas' indicators by 72, 68, 85 and 84 and the lowest was in 'immunization' indicators by 2, 2, 6 and 22 in Punjab, Sindh, KPK and Balochistan respectively. The highest incidence in 2007-08 is in 'gas', 'crowding', 'gas' and 'gas' indicator by 65, 61, 79 and 79 while the lowest was in 'immunization', 'immunization' 'electricity', and 'immunization' by 3, 1, 5 and 7 in Punjab, Sindh, KPK and Balochistan respectively. The results implies that in 2013-14, the highest incidence of deprivation was in 'gas', 'crowding', 'gas', 'gas' indicators by 59, 69, 65 and 72 and is the lowest in 'immunization' each by 1, 1, 1 and 5 in each province. The results of four provinces have also been presented in the table.

**Table 6. Incidence of deprivation (%) of population in ten indicators at provincial level**

| **H (%)** | **Punjab** | | | **Sindh** | | | **KPK** | | | **Balochistan** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001-02 | T | U | R | T | U | R | T | U | R | | U | R |
| Enrollment | 24 | 16 | 29 | 39 | 23 | 50 | 36 | 22 | 43 | 48 | 32 | 54 |
| Schooling | 34 | 19 | 45 | 35 | 21 | 44 | 43 | 25 | 52 | 47 | 27 | 56 |
| Immunize | 02 | 01 | 03 | 02 | 01 | 03 | 06 | 02 | 08 | 22 | 12 | 26 |
| Pre. care | 24 | 13 | 31 | 34 | 15 | 47 | 41 | 26 | 48 | 39 | 30 | 43 |
| Gas | 72 | 39 | 96 | 65 | 23 | 94 | 85 | 61 | 96 | 84 | 60 | 95 |
| Electricity | 17 | 03 | 26 | 25 | 03 | 41 | 14 | 02 | 19 | 41 | 08 | 56 |
| Water | 05 | 01 | 08 | 17 | 08 | 24 | 35 | 13 | 45 | 54 | 15 | 71 |
| Crowding | 55 | 51 | 58 | 68 | 54 | 78 | 61 | 53 | 64 | 55 | 56 | 55 |
| Sanitation | 51 | 21 | 72 | 40 | 20 | 54 | 31 | 23 | 35 | 54 | 42 | 59 |
| Asset | 16 | 06 | 24 | 26 | 05 | 43 | 20 | 05 | 28 | 42 | 14 | 55 |
| 2007-08 | T | U | R | T | U | R | T | U | R | | U | R |
| Enrollment | 15 | 08 | 19 | 30 | 15 | 42 | 27 | 17 | 33 | 43 | 28 | 51 |
| Schooling | 28 | 16 | 36 | 28 | 16 | 39 | 37 | 24 | 45 | 39 | 21 | 49 |
| Immunize | 03 | 03 | 04 | 01 | 01 | 01 | 06 | 02 | 08 | 07 | 04 | 09 |
| Pre. care | 14 | 08 | 18 | 16 | 07 | 24 | 23 | 15 | 28 | 27 | 20 | 31 |
| Gas | 65 | 27 | 91 | 61 | 19 | 94 | 79 | 50 | 95 | 79 | 53 | 93 |
| Electricity | 06 | 01 | 10 | 14 | 03 | 24 | 05 | 01 | 08 | 29 | 01 | 44 |
| Water | 05 | 04 | 05 | 11 | 07 | 14 | 23 | 09 | 31 | 32 | 09 | 44 |
| Crowding | 48 | 44 | 52 | 62 | 47 | 73 | 53 | 46 | 56 | 53 | 45 | 56 |
| Sanitation | 35 | 14 | 50 | 35 | 31 | 38 | 29 | 20 | 34 | 39 | 36 | 41 |
| Asset | 07 | 02 | 10 | 16 | 03 | 26 | 11 | 01 | 16 | 21 | 03 | 31 |
| 2013-14 | T | U | R | T | U | R | T | U | R | | U | R |
| Enrollment | 12 | 07 | 16 | 32 | 13 | 39 | 22 | 13 | 27 | 44 | 28 | 49 |
| Schooling | 25 | 12 | 34 | 37 | 13 | 45 | 34 | 20 | 42 | 44 | 23 | 51 |
| Immunize | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 05 | 03 | 06 |
| Pre. care | 08 | 04 | 10 | 11 | 03 | 14 | 16 | 10 | 19 | 29 | 20 | 32 |
| Gas | 59 | 22 | 84 | 64 | 07 | 85 | 65 | 27 | 87 | 72 | 37 | 83 |
| Electricity | 07 | 05 | 08 | 16 | 01 | 22 | 06 | 01 | 08 | 15 | 03 | 19 |
| Water | 02 | 01 | 02 | 10 | 02 | 13 | 24 | 03 | 36 | 31 | 06 | 39 |
| Crowding | 49 | 45 | 52 | 69 | 46 | 77 | 53 | 47 | 56 | 59 | 55 | 61 |

| H (%) | Punjab | | | Sindh | | | KPK | | | Balochistan | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sanitation | 33 | 16 | 45 | 33 | 29 | 34 | 24 | 22 | 26 | 39 | 36 | 40 |
| Asset | 04 | 01 | 06 | 18 | 01 | 25 | 16 | 02 | 24 | 15 | 04 | 18 |

*Source*: Authors own calculation

The general analysis across provinces shows that Balochistan demonstrated the highest reduction in incidence of deprivation in four indicators such as asset, electricity, water and immunization and KPK in enrollment, schooling, prenatal, gas and crowding indicators while Punjab only in 'sanitation' indicator. The results across provinces at urban level indicated that Balochistan province demonstrated the highest reduction in asset, sanitation and immunization indicators and Sindh in enrollment, schooling, and crowding while KPK in prenatal care, gas and water indicators. At rural level, Balochistan has the highest reduction in asset, electricity, water and immunization and KPK in enrollment and crowding while Punjab in schooling, gas and sanitation while Sindh in prenatal care.

***Multidimensional poverty ($M_0$) at provincial level***

The analysis of incidence of deprivation in each indicator between and within provinces highlighted that the progress in almost each indicator in all the provinces has improved but not ate same speed. As shown in Table 7, the absolute and relative changes in multidimensional poverty imply that the changes across province and at regional level are not uniform. Some of the provinces show strong progress in reducing multidimensional poverty over the study period. If changes are measured in percent annually then it is clear from 2001 to 2008 MPI declined by 8.89, 8.33, 7.94 and 7.78% per annum, by 13.33, 7.14, 11.11 and 11.54 percent per annum and by 9.52, 6.99, 6.55 and 5.42 percent per annum at overall, urban rural levels, in Punjab, Sindh, KPK and Balochistan respectively. From 2007 to 2014 at overall level MPI reduced by 4.17, 2.78 and 0.00 in Punjab, KPK and Balochistan respectively but increased by 2.17% per annum in Sindh. At urban level it reduced by 4.17, 12.5 and 8.33 in Punjab, Sindh and KPK respectively but increased by 1.19 percent annually in Balochistan while M0 reduced by 3.92, 1.5, 2 and 2.38% per annum at rural level. It is observed that H and M0 reduced swiftly from 2001 to 2008 than from 2007 to 2014.

**Table 7. Multidimensional poverty across provinces**

| Prov. | Punjab | | | Sindh | | | KPK | | | Balochistan | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T | U | R | T | U | R | T | U | R | T | U | R |
| H% | H | H | H | H | H | H | H | H | H | H | H | H |
| 2001 | 54 | 25 | 74 | 61 | 27 | 86 | 68 | 42 | 81 | 78 | 54 | 88 |
| 2007 | 38 | 16 | 54 | 50 | 21 | 73 | 54 | 30 | 67 | 67 | 40 | 81 |
| 2013 | 33 | 12 | 47 | 54 | 14 | 69 | 45 | 20 | 59 | 65 | 38 | 73 |
| | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ | $M_0$ |
| 2001 | .25 | .10 | .35 | .31 | .11 | .45 | .33 | .17 | .41 | .45 | .23 | .55 |
| 2007 | .16 | .06 | .23 | .22 | .08 | .33 | .23 | .11 | .30 | .32 | .15 | .42 |
| 2013 | .13 | .04 | .19 | .24 | .05 | .31 | .19 | .07 | .27 | .31 | .14 | .36 |
| | A | A | A | A | A | A | A | A | A | A | A | A |
| 2001 | 46 | 22 | 47 | 51 | 41 | 52 | 49 | 40 | 51 | 58 | 43 | 63 |
| 2007 | 42 | 38 | 43 | 44 | 38 | 45 | 43 | 37 | 45 | 48 | 38 | 52 |
| 2013 | 39 | 33 | 40 | 44 | 36 | 45 | 42 | 35 | 46 | 48 | 37 | 49 |

*Sources*: Authors own Calculation

The results also corroborate that across provinces KPK has the highest reduction in MPI at overall and urban levels while at rural level Punjab has succeeded in reducing the MPI poor more among other provinces. This highlighted the important implication that KPK and Punjab provinces adopted more pro poor policies which benefits the poor. These results at the provincial level do not show only poverty distribution provincial results but also highlighted spatial deprivations in each province. These days Balochistan faced political frustration and unrest in the province and this problem can be solved by the elimination of deprivations from the lives of the people.

***Changes in H and M0 at different cutoffs***

Table 8 represents that the union approach classifies 92, 87 and 86 percent of population as poor in 2001-02, 2007-08 and 2013-14 respectively while the intersection approach shows no poverty at all. If the poverty cut-off is fixed to k=2 which indicates that people are deprived in two or more than two out of ten indicators. But at k=3 it is clear that 63, 48, 45 percent of population belongs to poor the households in 2001-02, 2007-08 and 2013-14 respectively.

**Table 8. Multidimensional poverty at different cut-off**

| **Cutoff** | **2001** | **2007** | **2013** | **2001** | **2007** | **2013** | **2001** | **2007** | **2013** |
|---|---|---|---|---|---|---|---|---|---|
| K | H | H | H | A | A | A | M0 | M0 | M0 |
| 1 | 92 | 87 | 86 | 39 | 31 | 29 | 0.36 | 0.27 | 0.25 |
| 2 | 78 | 68 | 65 | 44 | 37 | 35 | 0.34 | 0.25 | 0.23 |
| 3 | 63 | 48 | 45 | 49 | 44 | 42 | 0.31 | 0.21 | 0.19 |
| 4 | 47 | 31 | 27 | 55 | 52 | 52 | 0.26 | 0.16 | 0.14 |
| 5 | 33 | 18 | 15 | 64 | 61 | 60 | 0.21 | 0.11 | 0.09 |
| 6 | 21 | 10 | 08 | 71 | 70 | 63 | 0.15 | 0.07 | 0.05 |
| 7 | 13 | 05 | 04 | 77 | 80 | 75 | 0.10 | 0.04 | 0.03 |
| 8 | 06 | 02 | 01 | 83 | 100 | 100 | 0.05 | 0.02 | 0.01 |
| 9 | 02 | 00 | 00 | 100 | 00 | 00 | 0.02 | 0.00 | 0.00 |
| 10 | 00 | 00 | 00 | 00 | 00 | 00 | 0.00 | 0.00 | 0.00 |

*Source*: Authors own Calculation

MPI is used which has useful property such as monotonicity. The present study used cut-off k=3 three out of ten dimensions. The A can be interprets as the poor being deprived in 49, 45 and 42 percent in 2001-02, 2007-08 and 2013-14 respectively of all dimensions on average. This explains that if k=9 is considered then only two percent of population is poor in all dimensions with 100% average deprivation in 2001-02 which decreased to k=8 in 2007-08 and 2013-14. The results depict a clearer picture and are also compared with Alkire and Seth (2013), when they included more dimensions then it is identified that India is free from extreme poverty by using the same definition. The H and $M_0$ are always lower in 2013 than 2001 and 2007 distributions which clearly reveal that the 2013 distribution stochastically dominated the 2001 and 2007 distributions.

***Determinants of multidimensional poverty***

Sometimes it is important to understand the relationship between poverty level and macro variables such as public expenditures, income, information technology or changes across time and regions. Regression analysis helps us to study such transmission channel by looking at the determinants of poverty. The definitions of explanatory and dependent variables are shown in Table 9.

**Table 9. Description of dependent and explanatory variables**

| | **Dependent variable, if household is poor multidimensionally=1 and 0 otherwise** |
|---|---|
| | Explanatory variables |
| HHG | Gender of head (male=1 and female=0). |
| HHA | Age of household head is a continuous variable |
| HHE | Complete years of education of household head is a continuous variable |
| HHS | Household size is continuous variable. |
| HRA | Area of residence of the household head (Rural = 1 and Urban = 0) |
| HHP | Province of residence (Punjab= 1; others = 0) |
| HHS | Province of residence is Sindh (Sindh = 1; others = 0) |
| HHK | Province of residence is KPK(KPK= 1; others = 0) |
| HHB | Province of residence is Balochistan (Balochistan = 1; others = 0) |

The results presented in Table 10 show that the estimated model is robust and all the parameters have expected signs and show significant statistically either at one, five or ten percent level of significance. The factors that increase the likelihood of being poor are rural areas, household living in Sindh, KPK and Balochistan provinces, household sizes and gender of household head. Those that decrease the probability of being poor are having age, education of household head. The odd ratio explains that for a given household, the log of the odds of being multidimensionally poor decreases with the age and education of the head of household and increases with household size, rural location and location in Sindh, KPK and Balochistan provinces. The odds ratio odds ratio of education of household head indicates that an increase of one year of education decreases the odds of being multidimensionally poor by (1-0.81=) 19 percent.

The gender of household head indicated that female household heads are more likely to be poor than their male counterpart. The reason is that women have lower education level, wage discrimination in the labor market against women and as a result they are paid lower salaries (Bastos et al. 2009). It is perceived generally that a higher return is the result of higher education and consequently educated persons have lower poverty incidence. Age is also inversely related to poverty. Research literature show that higher age is linked to more experience and productivity which as a result escort to higher earnings. The literature suggests that poverty is positively related with household size and the results support the credence (Cheema and Sial 2012). The odd ratio of residential area of the household head is 5.63 which indicated that households residing in rural region have almost five times more chances to live in poverty than those who live in urban location in 2001-02 but results varies for other distribution which verify the truth that poverty is higher in rural areas. The result indicated that a household residing in Sindh, KPK and Balochistan provinces with odd ratios of 1.38, 1.38 and 2.98 respectively in 2001-02 which show that the households living in these provinces are more likely to be poor than households residing in Punjab province which is a reference category. The marginal effects have also been presented in table.

**Table 10. Logit Estimates of Multidimensional Poverty over time in Pakistan**

| | **Odd Ratio** | | | **Marginal Effect** | | |
|---|---|---|---|---|---|---|
| | **2001-02** | **2007-08** | **2013-14** | **2001-02** | **2007-08** | **2013-14** |
| Rural | 5.43* (.307) | 3.01*(.206) | 4.21*(.217) | 0.27* | 0.06* | 0.15* |
| Hsize | 1.18* (.009) | 1.09*(.010) | 1.21*(.010) | 0.03* | 0.004* | 0.02* |
| Sindh | 1.38* (.083) | 1.39*(.107) | 2.52*(.110) | 0.06* | 0.02* | 0.11* |

| | Odd Ratio | | | Marginal Effect | | |
|---|---|---|---|---|---|---|
| | **2001-02** | **2007-08** | **2013-14** | **2001-02** | **2007-08** | **2013-14** |
| KPK | 1.38* (.094) | 1.78*(.157) | 1.73*(.121) | 0.06* | 0.03* | 0.07* |
| Baloch | 2.98* (.245) | 2.84*(.265) | 4.53*(.396) | 0.22* | 0.08* | 0.26* |
| Gender | 1.44***(.319) | 0.73 (.136) | 1.15 (.084) | 0.05** | -0.02 | 0.02* |
| Age | 0.98* (.001) | 0.99*(.002) | 0.98*(.001) | -0.003* | -0.001* | -0.002 |
| Edu | 0.81* (.006) | 0.66*(.012) | 0.69*(.005) | -0.04* | -0.02* | -0.04* |
| Pseudo $R^2$ | 0.23 | 0.25 | 0.39 | | | |

*Note*. Robust standard errors are in parenthesis. Significant at *P<0.01, **P<0.05 and ***P<0.10 respectively.

The likelihood ratio test is preferred by Menard (1995) to evaluate the model. Hence, to check the overall models robustness the likelihood ratio test is employed and has chi square statistic (Wald) with 1977, 1223 and 3887 for three years respectively, with 8 degree of freedom which has (0.000) significant p value. This indicates that the model is robust and the independent variables are related to the dependent variable significantly. The fit of a logistic model against the real outcome is expressed by the test of goodness of fit. However, $R^2$ has not the same interpretation as in the linear regression. Gujarati and Porter (2009) explain, goodness of fit test is important in logistic regression models.

## Conclusion

The study is an attempt to estimate poverty beyond the monetary dimension. This study employed AF methodology and the binary logistic poverty measurement. The results show that multidimensional poverty declined over time and space in Pakistan and incidence of deprivation in each indicator also reduced at all levels overtime. Multidimensional poverty is higher at rural level at national and provincial level. Multidimensional poverty is higher in Balochistan province and was the lowest in Punjab province followed by Sindh and KPK in 2001-02 and 2007-08 but in 2013-14 ranking changed, Punjab is the least deprived province followed by KPK, Sindh and Balochistan.

The present study suggests that the allocation of funds should be in those dimensions and areas which contributed more to multidimensional poverty. Rural areas are poorer than urban areas, special attention should be given to rural and the poorest segment of the population in Pakistan. Balochistan which is the most deprived province of Pakistan should be given preference when funds are transferred and health/education policies are formulated. More funds should be allocated to safety nets programs, specifically those that support women to take active part in economic activities.

## References

Adetola, A., and Olufemi, P. (2012). Determinants of child poverty in rural Nigeria: A multidimensional approach global. *Journal of Human Social Science, Arts and Humanities,* 12(12), 38-52.

Adetola, A. (2014). Trend and determinants of multidimensional poverty in rural Nigeria. *Journal of Development and Agricultural Economics,* 6(5), 220-231.

Afzal, M., Rafique, S., & Hameed, F. (2015). Measurement of living standards deprivation in Punjab Using AF method (periodical comparison approach). *The Pakistan Development Review. 54*(4), 739-763.

Alkire, S. (2002). Dimensions of human development. *World Development,* 30, 181-205.

Alkire, S. and Foster, E. J. 2011. Counting and multidimensional poverty measurement. *Journal of Public Economics,* 95(7-8), 476-487.

Alkire, S. and Santos, M. E. (2014). Measuring acute poverty in developing world robustness and scope of the multidimensional poverty index. *World Development*, 59, 251-271.
Alkire, S. and Seth, S. (2015). Multidimensional poverty reduction in India between 1999 and 2006: where and how? *World Development*, 72, 93-08.
Alkire, S., Roche, J. M., Seth, S. & Sumner, A. (2015). Identifying the poorest people and groups: strategies using the global multidimensional poverty index. *Journal of International Development*, 27, 362-387.
Alkire, S., Roche, J. M., and Vaz, A. (2017). Changes over time in multidimensional poverty: Methodology and results for 34 countries. *World Development*, 94, 232-249.
Atkinson, B. A. (2003). Multidimensional deprivation: contrasting social welfare and counting approaches. *Journal of Economic Inequality*, 1, 51-65.
Awan, M. S., Waqas, M., & Aslam, A. (2011). Multidimensional poverty in Pakistan: case of Punjab. *Journal of Economics and Behavioral Studies*, 2(8), 133-144.
Batana, Y. M. (2013). Multidimensional measurement of poverty in Sub-Saharan Africa. *Social Indicator Research*, 112(2), 337-362.
Battiston, D., Cruces, G., Calva, L. F. L., Lugo, M. A., & Santos, M. E. (2013). Income and beyond: multidimensional poverty in six Latin American countries. *Social Indicator Research*, 112(2), 291-314.
Bourguinon, F., and Chakravarty, R. S. (2003). The measurement of multidimensional poverty. *Journal of Economic Inequality*, 1, 25-49.
Cheli, B., and Lemmi, A. (1995). A totally fuzzy and relative approach to the multidimensional analysis of poverty. *Economic Notes*, 24, 115-134.
Decancq, K., and Lugo, M. A. (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews*, 321, 7-34.
Foster, E. J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica*, 52, 761-766.
Gujarati, N. D., and Porter, C. D. (2009). *Basic econometrics*. 5th Edition. New York: McGraw-Hill.
Jamal, H. (2011). Assessing poverty with non-income deprivation indicators: Pakistan, 2008-09. *The Pakistan Development Review*, 50(4), 913-927.
Khan, A., Saboor, A., Ahmad, S., & Ali, I. (2011). Mapping and measuring of multidimensional poverty in Pakistan: empirical investigations. *Pakistan Journal of Life and Social Sciences*, 9(2), 2-7.
Levine, Sebastian, Muwonge, James, and Batana, Yele, M. 2014. A robust multidimensional poverty profile for Uganda. *Journal of Human Development and Capabilities*, 15(4), 369-390.
Salahudin, T., and Zaman, A. (2012). Multidimensional poverty measurement in Pakistan: time series trends and breakdown. *The Pakistan Development Review*, 51(4), 493-504.
Roberto, A., Diaz, Y., and Pardo, R. (2016). The Colombian Multidimensional Poverty Index: Measuring Poverty in a Public Policy Context. *Social Indicators Research*, 127, 1-38.
Santos, M. E., and Ura, K. (2008). Multidimensional poverty in Bhutan: estimates and policy implications. *Journal of Bhutan studies*, 18, 1-49.
Sen, A. (1976). Poverty: An ordinal approach to measurement. *Econometrica*, 44(2), 219-231.
Sen, A. (1985). *Commodities and capabilities*. Amsterdam: North Holland.
Sher, F., Awan, R. U., Iqbal, T., & Javed, K. (2013). Measurement of multidimensional child poverty: A district level analysis for Punjab, Pakistan. *Business Management Dynamics*, 1(11), 6-20.
Tsui, K.Y. (2002). Multidimensional poverty indices. Social Choice and Welfare, 19, 69-93.

UNDP. (1997). Human development report 1997: Human development to eradicate poverty. Retrievedfrom http://hdr.undp.org/sites/default/files/reports/258/hdr_1997_en_complete_nostats.pdf

UNDP. (2015). Human development report 2015: Work for human development. Retrieved from http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf

Wagle, U. (2005). Multidimensional poverty measurement with economic wellbeing, capability and social inclusion: A case from Kathmandu, Nepal. *Journal of Human Development* 6, 301-328.

World Bank. (1990). World development report 1990: Poverty. Retrieved from https://openknowledge.worldbank.org/.../WDR%201990%20-%20English.pdf?

World Bank. (2016). Global monitoring report 2015/16. Retrieved from http://www.worldbank.org/en/publication/global-monitoring-report