RESEARCH REPORT

An Exploratory Analysis of Inter-Temporal Multidimensional Poverty

SOCIAL POLICY AND DEVELOPMENT CENTRE

Research Report No.83

An Exploratory Analysis of Inter-Temporal Multidimensional Poverty

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June, 2012

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Abstract:

The approach to measure poverty in terms of financial deprivation has been widely criticised in the literature of welfare and well-being. It is argued that to understand the complex phenomenon of poverty or to evaluate household or individual well-being, a multidimensional exercise is imperative. This research quantifies the level of multidimensional poverty in Pakistan using latest available household data of the Pakistan Social and Living Standard Measurement Survey.

Multidimensional poverty in terms of the popular FGT (headcount, poverty gap, poverty severity) indices is estimated for the year 2011. Indicators of human poverty, poor housing and deprivation in household physical assets are included in estimating poverty in a multidimensional context. For assessing the inter-temporal consistency in the methodology, poverty indices are also developed for the years 2009 and 2005.

JEL Classification: I32, I31

Keywords: Pakistan, Poverty, Multidimensional, Categorical Principal Component Analysis, Poverty Indices

1. Introduction[1]

The multidimensional approach of assessing household or individual welfare or well-being is derived from Amartya Sen's Capability Theory. According to Sen[2], economic and social arrangements should be evaluated in terms of capabilities enjoyed by those who live in them. In this way, Sen shifts the terms of the poverty debate away from a reliance on income and consumption poverty measures alone, to the consideration of multiple dimensions of people's lives. This conceptual shift is worthy even in instances where the income or consumption approaches prove most useful. For policy perspectives, it is worth highlighting that unidimensional measures only advocate the case for transfer policies that alleviate poverty in the short term, whereas multidimensional measures permit the recommendation of structural socio-economic policies that could alleviate the intergenerational poverty in the long term.

The traditional unidimensional approach, which considers only one variable such as income or consumption, is widely used due to its practicality. The methodology of measuring unidimensional poverty has developed considerably and according to Bourguignon (2003) "has reached today a high level of sophistication and operationality". There has also been progress in defining and measuring the multidimensional nature of poverty and ample literature is now available on the conceptual and measurement issues. However, "… challenges remain quite serious if the objective is to reach a degree of operationality (for multidimensional paradigm) comparable to that enjoyed by the income poverty paradigm" (Bourguignon, 2003).

Despite difficulties and arbitrariness in the measurement and aggregation of household multiple deprivations, a multidimensional approach to define poverty has been adopted in many developed and developing countries. The United Nations Development Programme (UNDP) has since 1990 challenged the primacy of GDP per capita as the measure of progress by proposing the Human Development Index (HDI), which combines income with life expectancy and educational achievement. Similarly, the Millennium Development Goals

[1] This research paper is the updated, revised and modified version of the paper titled "Assessing Poverty with Non-Income Deprivation Indicators: Pakistan, 2008-09" presented at 27th Annual General Meeting & Conference of the Pakistan Society of Development Economists (PSDE). Due to the revised methodology, poverty numbers of this research are not comparable with the paper of the Conference.

[2] A summary of Amartya Sen's views and the development of that literature over the last 20 years may be found in Sen (1997).

(MDGs), which now dominate the development agenda of almost all developing countries, also emphasise multidimensionality in measuring progress in alleviating poverty.

Recently a global exercise was carried out by Oxford Poverty and Human Development Initiative (OPHI) to develop Multidimensional Poverty Index[3] (MPI) for more than 100 countries with the help of 10 non-income deprivation indicators of education, health and standard of living. The results in terms of countries ranking and magnitude of poverty have been published in UNDP Human Development Report 2010[4]. However, there are some concerns regarding the subjectivity in selecting cut-off points for individual indicators as well as for overall index. Moreover, weights to indicators and sectors are also arbitrarily assigned for developing a composite index[5].

In the context of Pakistan, first attempt to quantify the extent of multidimensional poverty in terms of the popular poverty measures was made by Jamal (2009). He developed poverty indices (headcount, poverty gap, poverty severity) with the help of 15 deprivation indicators of education, housing and household consumption. The author used household data and employed Principal Component Analysis (PCA) technique to develop a composite index of poverty. PCA is a multivariate statistical technique which is used to reduce the number of relationships by grouping or clustering together all those variables which are highly correlated with each other into one factor or component. It is, however, criticised that traditional PCA is not appropriate technique[6] of data reduction for categorical or binary (have, have not) qualitative variables due to not-normal and highly skewed distribution. The use of household financial poverty level as a component in multidimensional approach was also objected due to the rising debate on the methodology as well as reliability of household consumption data for estimating monetary poverty incidence. These shortcomings were addressed in Jamal

[3] Very brief description of the methodology used in the estimation of Multidimensional Poverty is provided in Appendix–B. For detail see Alkire and Santos (2010) and Alkire and Foster (2007).

[4] A country briefing for Pakistan's MPI is available at http://www.ophi.org.uk/wp-content/uploads/Pakistan.pdf

[5] See Appendix–B of this paper and Technical Note 4 of UNDP Human Development Report, 2010, Page 230.

[6] Naveed and Islam (2010) discussed this issue and also developed multidimensional poverty for two provinces of Pakistan. For detail see, Arif Naveed and Tanweer-ul-Islam, "Estimating Multidimensional Poverty and Identifying the Poor in Pakistan: An Alternative Approach" RECOUP Working Paper No. 28, Research Consortium on Educational Outcomes and Poverty, DFID.

(2011) by combining non-income[7] deprivation indicators through Categorical Principal Component Analysis (CATPCA)[8] for the year 2008-09.

This research not only provides updated estimates of household poverty for the year 2010-11 but also proposes a slight modification[9] in the methodology to achieve inter-temporal consistency in the estimates of multidimensional poverty indices.

The study uses unit record household level data of PSLM survey conducted during the year 2010-11 which covers 77500 households across all provinces of Pakistan. National PSLM surveys collect household information on socio-economic indicators and the sample size of these surveys has been considered sufficient to produce reliable estimates at district level in respect of all provinces. Multidimensional poverty measures are also estimated from household unit record data of PSLM 2008-09 and PSLM 2004-05 which also have similar sample size for the purpose of comparison and tracking.

The next section discusses measurement and aggregation issues and the methodology adopted for this study. The multiple dimensions of deprivation, considered in the estimation of multidimensional poverty are briefed in section 3. Section 4 presents the empirical estimates of multidimensional poverty, while the last section is reserved for some concluding remarks.

2. Methodology for Measuring Multidimensional Poverty

The multidimensional nature of poverty refers to the situation when an individual or household experiences a number of cumulative deprivations. These multiple deprivations represent different dimensions (economic well-being, education, health, social exclusion etc.) of human life.

There are two options available to decide when a household or individual is said to be poor in term of multiple deprivations. In the first option, each single indicator is assigned its own

[7] Indicators of human poverty, poor housing and deprivation in household physical assets were included.

[8] Standard Principal Components Analysis assumes linear relationships between numeric variables. On the other hand, the optimal-scaling which is used in CATPCA approach allows variables to be scaled at different levels. Categorical variables are optimally quantified in the specified dimensionality. As a result, nonlinear relationships between variables can be modeled.

[9] Instead of using factor scores of all principal components, score ascribed by the first component is preferred because it explains the maximum amount of variation in the data.

threshold value. For instance, Bourguignon and Chakravarty (2003) take as their fundamental and starting point in the development of multidimensional poverty measures that poverty consists of a shortfall from a threshold on each dimension of an individual's well-being. They argue that "the issue of poverty arises because individuals, social observers or policy makers want to define a poverty limit on each individual attribute: income, health, education, etc….".

The concern here is whether a household should be considered poor if it falls short of the thresholds for all attributes, or only falls short of one[10]. In the two attributes case, if attribute 1 (x1) is less than its threshold (z1) and attribute 2 (x2) is also less than its threshold (z2), the status of the household is unambiguously 'poor'. Alternatively, the shortfall might be only in one dimension, in which case the determination would depend on the nature of the relationship between the two attributes. If the attributes are substitutes and an individual has a sufficiently high level of the first attribute above the threshold to more than compensate in terms of welfare for the shortfall in the second attribute, than the person cannot be classified as poor[11].

The second option refers to the case where to measure multidimensional poverty, a composite indicator incorporating the information from the selected deprivation dimensions or variables is constructed. The studies adopting this methodology combine the individual indicators into one index variable and assign a threshold. If the value of index variable is below this threshold, the household or individual is considered poor. The advantage of this approach is that it is compensatory: a low score on a certain indicator may be neutralised by a high score on another[12].

[10] For instance, Bourguignon and Chakravarty (2003) suggest that an alternative way to take into account the multi-dimensionality of poverty is to specify a poverty line for *each* dimension of poverty and to consider that a person is poor if he/she falls below *at least one* of these various lines.

[11] In the literature of multidimensional poverty, the distinction between being poor in more than one and in only one dimension has been referred to as the *intersection* and *union* definitions of poverty. For instance, if well-being is measured in terms of x1 and x2 then a person could be considered poor if x1falls below z1*or* if x2 falls below z2. This case would be defined as a *union* definition of poverty. In contrast, an *intersection* definition would consider an individual as poor only if x1 and x2 both fall below their thresholds.

[12] A good example is the UNDP's Human Development Index (HDI), constructed from indicators of life expectancy, education and standard of living. HDI has received a great deal of attention in the development context.

Here, two important decisions have to be made. The first decision concerns the weights of the indicators in the composite index, and the second concerns defining the threshold value of the composite indicator used to distinguish between poor and non-poor individuals or households. The weighting problem can be approached in a number of different ways. Besides equal weighting or subjective judgment of experts regarding the importance of each component, the weight structure may be empirically based on relative frequencies of components. However, in most quantitative research on multidimensional poverty and multiple deprivations, the importance of each dimension is computed using different multivariate statistical techniques.

Use of Principal Components Analysis (PCA) for indexing multidimensional phenomena has been well established. Principal component analysis is simply a variable reduction procedure that (typically) results in a relatively small number of components that account for most of the variance in a set of observed variables. This technique reduces the number of relationships by grouping or clustering together all those variables which are highly correlated with each other into one factor or component. PCA produces components in descending order of importance, that is, the first component explains the maximum amount of variation in the data, and the last component the minimum. Thus, the first few components (Principal Components) account for a sizeable part of the variation in the data and subsequent components contribute very little.

However, traditional PCA is best for continuous and normally distributed data as the technique assumes linear relationship between numeric variables. For category indicator variables, a team of Leiden University has developed Categorical Principal Components Analysis (CATPCA)[13]. The technique is now available in SPSS and may be applied for data reduction when variables are categorical (e.g. ordinal) and the researcher is concerned with identifying the underlying components of a set of variables (or items) while maximising the amount of variance accounted by the principal components. The primary benefit of using CATPCA rather than traditional PCA is the lack of assumptions associated with CATPCA. CATPCA does not assume linear relationships among numeric data nor does it require assuming multivariate normal data. Furthermore, optimal scaling is used in SPSS during the CATPCA analysis and allows the researcher to specify which level of measurement (nominal, ordinal,

[13] Data Theory Scaling System Group (DTSS), Faculty of Social and Behavioral Sciences, Leiden University, The Netherlands.

interval/ratio, spline-nominal, & spline-ordinal etc.) in the optimally scaled variables is required.

Having a representation of the data in the component form, every household is ascribed a 'score' on each derived principal components/object using factor loading (variance in the individual attribute) as a weight and then multiplying this score with the standardised value of variables. The 'factor score' (FS) of the first component which explains the maximum amount of variation in the data is preferred for assessing household multidimensional poverty.

Once the composite indicator in terms of factor score is obtained for each household, one still has to define a procedure to identify the poor. To determine threshold or poverty cut-off point, another multivariate statistical technique is used. Cluster Analysis allows the classification of similar objects into groups, or more precisely, the partitioning of an original population into subsets (clusters) according to some defined distance measure. On this basis, the score of two clusters representing household status (poor and non-poor) is developed. It is found that households are grouped around positive and negative values of the factor score. Therefore, mean value of the distribution of the composite index is chosen as the cut-off point or as a poverty threshold.

After having a poverty threshold and the household status in terms of score with respect to multiple deprivations, the task then is how to aggregate this information into a single index to proxy the status of a group of individuals. Various poverty aggregates (indices) are used to proxy the status of a group of individuals. A class of functional forms, which has been suggested by Foster, Greer, and Thorbeke (1984); i.e. poverty incidence, poverty gap and poverty severity are widely used in the literature of poverty[14]. Thus, these three aggregate indices are estimated to give a picture of the extent and severity of multidimensional poverty in Pakistan.

[14] These indices/measures are defined in Appendix-C.

3. Dimensions and Components of Multidimensional Poverty

The technique presented in the above section is applied to PSLM survey data enumerated during 2010-11, 2008-09 and 2004-05. Therefore, the selection of dimensions or components to derive multidimensional poverty is purely based on the appropriate data available in these household surveys. The selected dimensions and components in constructing indices of multidimensional poverty are briefly described below, while a schematic view of component variables[15] is furnished in Table 1.

Table–1
Variables Used to Assess Multi-Dimensional Poverty

Dimensions	Variables
Human Poverty	
	Illiterate Head of Household
	Illiterate Spouse
	No child of primary age (5-9 cohort) is in school
	No household member has completed five years of schooling
Poor Housing	
	Congested Household (Households with only one room)
	Congested Household (Person per room greater 2)
	Household with Inadequate Roof Structure
	Household with Inadequate Wall Structure
	Households with no electricity
	Households using unsafe (not covered) water
	Households with no telephone connection (landline or mobile)
	Households using inadequate fuel for cooking (wood, coal, etc.)
	Households without latrine facility
Economic and household Assets Poverty	
	Households with no home ownership
	Households with no physical household assets
	Unemployed Head of Household

The extent of human poverty in the household is represented by current and future levels of education deprivations. Two measures, illiteracy (head of household and spouse) and children out of school are included in this dimension[16]. Children between the ages of 5 to 9, who are not attending school, are taken to compute out-of-school children at the primary level. Moreover, following UNDP-MPI, another indicator of education deprivation is included. Households in which no household member has completed five years of schooling are considered poor.

[15] All these variables are binary. A value of 1 is assigned to poor household and 2 to non-poor households.

[16] Literacy is defined as the "ability of a person to read and write in any language with understanding"

No information regarding infant or child mortality and malnourishment is available in PSLM surveys. The dimension of health deprivation is therefore missing from the multidimensional poverty analysis due to absence of required information.

The housing quality dimension identifies people living in unsatisfactory and inadequate housing structures. It is represented by a series of variables. The housing structure is treated as inadequate if un-baked bricks, earth bound materials, wood or bamboo are used in the construction of a wall or the roof. Housing congestion is represented by households with only one room and number of person per room is greater than 2. Access to basic utilities is an important aspect of everyday lives of people. Deprivation in this respect includes households with no electricity, households using wood or kerosene oil as cooking fuel, households with no safe drinking water availability and households with no landline or mobile telephone facility. Households which are lacking essential facilities such as kitchens, bathrooms and toilets are also seen as an important poverty dimension. Due to data constraints, only households lacking a toilet facility are included in the 'poor housing' dimension of f multidimensional poverty.

To capture the poverty in endowments, non-ownership of house and non-ownership of essential household assets[17] are added to the list of variables used to assess the household multidimensional poverty. Further, category of households with unemployed head is also treated as poor and included in this dimension.

4. Major Findings

Table 2 presents the national, regional and provincial estimates of multidimensional poverty[18] for the year 2011, while poverty measures for districts are provided in Appendix-A (Table A.1 to A.4 for Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan provinces respectively). In the year 2010-11, 48 percent (about 90 million) of the people of Pakistan were in the state

[17] These assets are Iron, Fan, Sewing Machine, Radio, TV, Chair/Table and Watch/Clock.

[18] Multidimensional poverty is estimated with the help of component/object scores. These scores are derived after adjusting with mean and standard deviation (standardising). Thus, the estimates are reflecting relative poverty (or inequality) with reference to mean and should not be interpreted as an absolute poverty.

of multiple deprivations[19] and living in desperate condition and eventually being socially excluded.

Table–2
Multi-Dimensional Poverty Estimates – 2011

	Poverty		
	Incidence	**Gap**	**Severity**
Pakistan	48.17	12.34	5.24
Urban	14.32	2.14	0.59
Rural	64.89	17.38	7.54
Punjab	43.67	10.60	4.55
Urban	13.37	1.88	0.51
Rural	57.69	14.64	6.42
Sindh	46.79	12.62	5.26
Urban	12.26	2.01	0.57
Rural	78.96	22.49	9.63
Khyber Pakhtunkhwa	58.32	13.49	4.91
Urban	20.26	2.83	0.66
Rural	66.12	15.67	5.78
Baluchistan	76.76	27.45	13.87
Urban	36.11	6.04	1.76
Rural	89.50	34.16	17.67

Source: Estimates are based on PSLM (2011) household level data

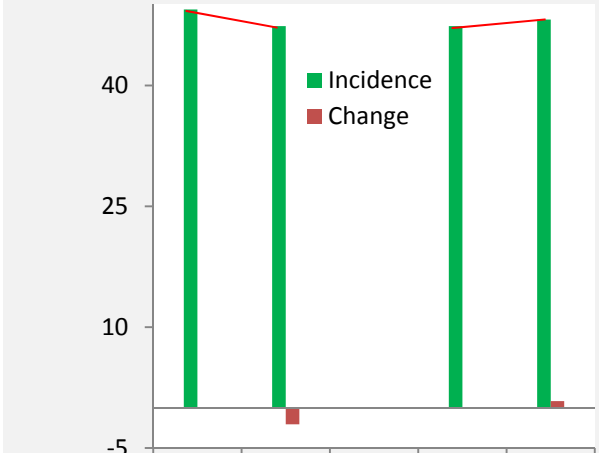
The magnitudes of multidimensional poverty incidence, poverty gap and poverty severity are substantially high in rural areas. According to the table, rural incidence is about 65 percent against the urban incidence of 14 percent. Similarly, the magnitudes of equity-sensitive poverty indices (poverty gap and poverty severity) for rural areas are almost eight times higher when compared to their urban counterparts. Rural multidimensional poverty gap and poverty severity are estimated as seventeen and eight percent respectively, while comparative figures for urban areas are 2 and 1 percent respectively.

The table also reveals provincial multidimensional poverty estimates for the year 2010-11. As expected, the lowest and highest incidence of multidimensional poverty is estimated for Punjab and Balochistan provinces respectively. About 77 percent of the population of Balochistan is categorised as poor in the context of multidimensional poverty. It is also noted that incidence of rural poverty in Sindh province is higher than rural poverty estimates of Khyber Pakhtunkhwa province.

[19] These deprivations are listed in Table 1.

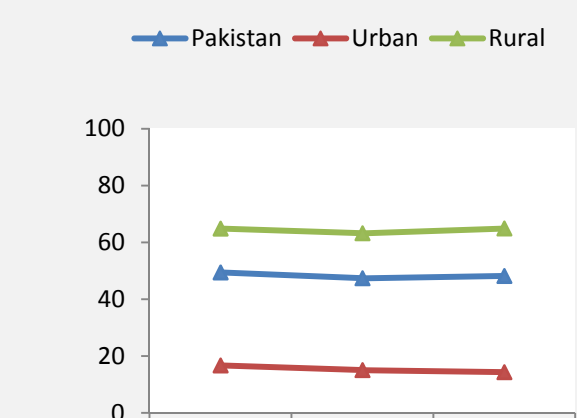
Figure-1 show inter-temporal changes in the incidence of multidimensional poverty. The estimates show a slight decline (-2.06) and then a rise (+0.81) in multidimensional poverty during 2005-09 and 2009-11 periods respectively. Similar trends are observed in terms of rural multidimensional poverty incidence (Figure-2), while urban poverty incidence is showing a declining trend throughout the period of analysis (2005-2011).

Figure–1
National Multidimensional Poverty Incidence [Pakistan]



	2005	2009		2009	2011
Incidence	49.42	47.36		47.36	48.17
Change		-2.06			0.81

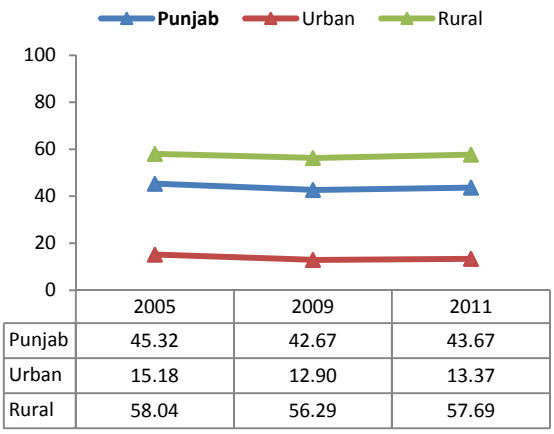
Figure – 2
Regional Multidimensional Poverty Incidence [Pakistan]



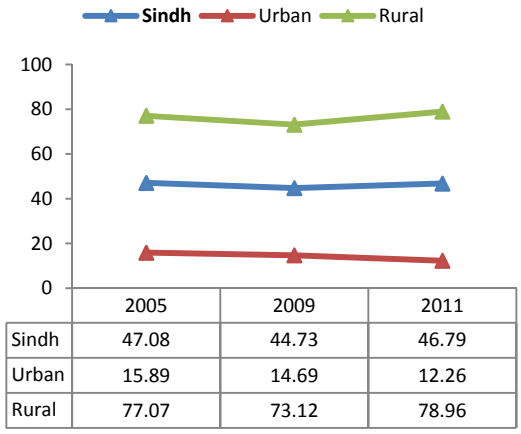
	2005	2009	2011
Pakistan	49.42	47.36	48.17
Urban	16.66	15.03	14.32
Rural	64.86	63.21	64.89

The provincial picture of changes in multidimensional poverty during the period 2005-2011 is portrayed in Figure-3. Few important observations emerge from the figure. Inter-temporal trend in Punjab and Sindh provinces are similar to the national trend. Multidimensional poverty has shown a decline in the poverty incidence during the period 2005-2009 and has recorded a rise in the period 2009-20011 in these provinces. However, a continuous decline in the poverty incidences is observed in case of Khyber Pakhtunkhwa and Balochistan provinces. The figure also reveals a sharp urban-rural divide in case of Sind province. Overall poverty estimates are quite close to the level of rural poverty incidence in Punjab, Khyber Pakhtunkhwa and Balochistan provinces, while the phenomenon is quite opposite in Sindh province.

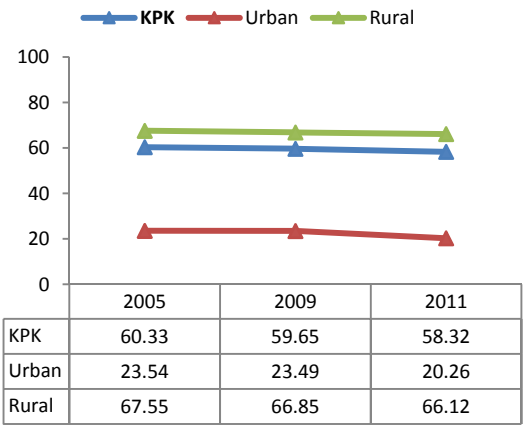
Figure – 3
Dynamics of Provincial Multi-dimensional Poverty Incidences



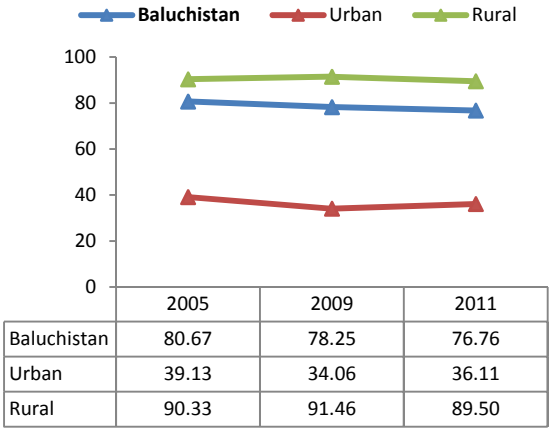
	2005	2009	2011
Punjab	45.32	42.67	43.67
Urban	15.18	12.90	13.37
Rural	58.04	56.29	57.69



	2005	2009	2011
Sindh	47.08	44.73	46.79
Urban	15.89	14.69	12.26
Rural	77.07	73.12	78.96



	2005	2009	2011
KPK	60.33	59.65	58.32
Urban	23.54	23.49	20.26
Rural	67.55	66.85	66.12



	2005	2009	2011
Baluchistan	80.67	78.25	76.76
Urban	39.13	34.06	36.11
Rural	90.33	91.46	89.50

5. Concluding Remarks

The operational emphasis of poverty is understood in terms of deprivation of food and other 'basic' commodities, and therefore, on private income or private consumption shortfalls, mainly due to the advancement and the level of sophistication in measuring and assessing financial poverty. However, vast literature is now available on conceptual and measurement issues of multidimensionality of poverty. Due to this advancement and technical development, non-income indicators of well-being and the multidimensionality of poverty have recently received much attention, especially in developing countries.

This research quantifies the extent of multidimensional poverty in Pakistan in terms of the popular FGT indices (headcount, poverty gap and poverty severity) and using latest available rich household data. Indicators of human poverty, poor housing and lack of physical assets are combined to get a composite index of poverty across multiple deprivations. These non-

income indicators are developed using PSLM Surveys for the years 2010-11, 2008-09 and 2004-05. Multivariate statistical tools; Categorical Principal Component Analysis and Cluster Analysis are used to construct the composite scores and to ascertain multidimensional poverty threshold respectively.

The empirical findings reveal that about 48 percent of the people of Pakistan were in the state of multiple deprivations in the year 2010-11. Rural incidence was about 65 percent, while 14 percent of urban population faced extreme poverty in terms of indicators used in the construction of multidimensional poverty. Inter-provincial comparisons regarding the multidimensional poverty incidence reveals lowest poverty incidence in the Punjab province. Balochistan has the highest multidimensional poverty incidences in both urban and rural areas. About 77 percent of the population of Balochistan is categorised as poor in terms of multiple deprivations. Inter-temporal exercise indicates a slight decline and then rise in the multidimensional relative poverty during the period 2005-09 and 2009-2011 respectively.

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APPENDIX – A

Table A.1
Multi-Dimensional Poverty Indices – 2011
[District of Punjab Province]

Districts	Poverty		
	Incidence	Gap	Severity
Attock	31.28	4.58	1.35
Bahawalnagar	61.93	15.92	6.66
Bahawalpur	61.79	19.61	9.65
Bhakhar	64.04	16.11	6.42
Chakwal	18.69	1.87	0.35
Chiniot	59.70	13.67	5.15
D.G.Khan	80.63	32.74	19.20
Faisalabad	31.13	5.66	1.94
Gujranwala	15.54	1.77	0.37
Gujrat	22.84	2.59	0.62
Hafizabad	38.25	6.48	1.78
Jehlum	25.30	3.12	0.79
Jhang	63.70	16.43	6.69
Kasur	49.18	7.45	2.06
Khanewal	54.57	13.66	5.57
Khushab	42.75	6.20	1.65
Lahore	10.58	1.50	0.37
Layyah	69.22	21.85	11.24
Lodhran	68.76	17.07	7.15
Mandi Bahuddin	38.31	5.25	1.31
Mianwali	50.31	10.08	3.83
Multan	47.13	12.46	5.57
Muzaffar Garh	78.33	26.43	12.93
Nankana Sahib	42.84	8.14	2.61
Narowal	45.09	5.91	1.45
Okara	58.08	12.54	4.38
Pakpattan	73.02	20.12	8.55
RahimYar Khan	65.17	20.22	9.50
Rajanpur	84.20	37.97	22.99
Rawalpindi	15.04	1.73	0.39
Sahiwal	52.38	11.63	4.44
Sargodha	45.25	8.86	2.90
Sheikupura	33.95	5.57	1.78
Sialkot	24.00	2.49	0.64
T.T.Singh	34.06	5.77	1.83
Vehari	60.35	13.99	5.91

Table A.2
Multi-Dimensional Poverty Indices – 2011
[District of Sindh Province]

Districts	Poverty		
	Incidence	**Gap**	**Severity**
Badin	80.30	27.79	12.91
Dadu	53.59	11.06	3.61
Ghotki	71.67	14.58	5.09
Hyderabad	18.02	3.36	1.07
Jaccobabad	79.94	20.13	7.45
Jamshoro	66.47	21.56	10.29
Karachi	6.06	1.17	0.46
Kashmore	71.88	21.71	9.74
Khairpur	66.08	14.23	5.27
Larkana	60.21	11.69	3.41
Maitari	56.09	15.52	6.32
Mir Pur Khas	60.87	18.18	7.78
Nawabshah	62.47	14.65	5.47
Nowshero Feroze	55.21	13.46	5.29
Sanghar	63.62	15.42	5.94
Shahdadkot	71.71	15.85	4.80
Shikarpur	65.68	15.02	5.05
Sukkur	51.89	10.68	3.34
Tando Allah Yar	59.28	15.79	6.06
Tando Muda khan	75.69	24.40	10.67
Tharparkar	93.28	39.28	20.80
Thatta	82.02	31.59	15.86
Umer kot	79.87	25.75	12.84

Table A.3
Multi-Dimensional Poverty Indices – 2011
[District of Khyber Pakhtunkhwa Province]

Districts	Poverty		
	Incidence	Gap	Severity
Abbottabad	41.74	9.14	2.80
Bannu	64.32	9.42	2.24
Batagram	64.92	10.82	3.15
Bonair	72.18	21.33	9.03
Charsada	56.31	10.37	2.99
Chitral	82.47	16.50	4.53
D.I.Khan	85.72	23.74	9.29
Hangu	53.07	8.82	2.25
Haripur	32.91	5.90	1.69
Karak	73.91	17.12	6.40
Kohat	59.69	12.41	4.33
Kohistan	97.26	47.25	26.29
Lakki Marwat	79.32	16.52	5.06
Lower Dir	60.62	10.89	3.29
Malakand	62.89	11.64	3.14
Manshera	58.85	17.73	8.09
Mardan	56.03	12.17	4.26
Nowshera	43.96	7.43	1.88
Peshawar	30.41	5.50	1.51
Shangla	77.79	21.72	8.58
Swabi	43.69	10.40	4.33
Swat	57.29	12.90	4.59
Tank	87.11	21.60	7.19
Upper Dir	89.70	20.27	6.08

Table A.4
Multi-Dimensional Poverty Indices – 2011
[District of Balochistan Province]

Districts	Poverty		
	Incidence	Gap	Severity
Awaran	94.84	29.27	11.63
Barkhan	95.94	46.91	28.51
Bolan/Kacchi	86.72	25.60	10.73
Chagi	92.16	48.97	32.56
Dera Bugti	98.54	59.75	39.04
Gwadar	79.15	25.76	12.03
Harnai	95.70	15.29	4.30
Jafarabad	86.08	25.53	10.03
Jhal Magsi	89.28	27.70	11.25
Kalat	85.53	23.76	9.76
Ketch/Turbat	87.72	39.69	22.24
Kharan	96.14	31.25	13.61
Khuzdar	86.25	24.36	9.60
Kohlu	94.01	39.51	20.06
Lasbilla	78.72	35.50	20.82
Lorali	93.69	43.72	25.19
Mastung	70.23	16.45	5.37
Musakhel	98.58	48.63	26.85
Nasirabad	93.00	31.07	14.47
Nushki	82.76	45.43	32.26
Panjgur	94.81	38.19	18.88
Pashin	37.28	4.41	0.82
Qillah abdullah	61.03	9.76	2.75
Qillah Saifuallh	91.42	33.43	16.09
Quetta	20.90	2.98	0.73
Sherani	98.14	37.14	17.51
Sibbi	40.62	11.43	5.23
Washuk	95.52	34.02	16.61
Zhob	89.05	35.29	19.57
Ziarat	75.91	10.92	2.63

APPENDIX – B

Multidimensional Poverty Index: UNDP Human Development Report, 2010

Alkire and Santos (2010) developed Multidimensional Poverty Index (MPI) for the 2010 *Human Development Report* (UNDP, 2010). They constructed MPI for more than 100 countries and choose 10 variables for their MPI under the same three headings—health, education and living standards similar to the dimension of UNDP's *Human Development Index* (HDI).

Poverty is measured separately in each of these 10 components. The equally-weighted aggregate poverty measures for each of these three main headings are then weighted equally (one-third each) to form the composite index, also echoing the HDI. A household is identified as being poor if it is deprived across at least 30% of the weighted indicators. While the HDI uses aggregate country-level data, the Alkire-Santos MPI uses household-level data, which are then aggregated to the country level.

For the convenience, the methodology as narrated in the Technical note of HDR, 2010 is reproduced below:

"Each person is assigned a score according to his or her household's deprivations in each of the 10 component indicators. The maximum score is 10, with each dimension equally weighted (thus the maximum score in each dimension is 3⅓). The health and education dimensions have two indicators each, so each component is worth 5/3 (or 1.67). The standard of living dimension has six indicators, so each component is worth 5/9 (or 0.56). The health thresholds are having at least one household member who is malnourished and having had one or more children die. The education thresholds are having no household member who has completed five years of schooling and having at least one school-age child (up to grade 8) who is not attending school. The standard of living thresholds relate to not having electricity, not having access to clean drinking water, not having access to adequate sanitation, using "dirty" cooking fuel (dung, wood or charcoal), having a home with a dirt floor, and owning no car, truck or similar motorised vehicle, and owning at most one of these assets: bicycle, motorcycle, radio, refrigerator, telephone or television. To identify the multidimensionally

poor, the deprivation scores for each household are summed to obtain the household deprivation(c). A cut-off of 3, which is the equivalent of one-third of the indicators, is used to distinguish between the poor and nonpoor. If *c* is 3 or greater, that household (and everyone in it) is multidimensionally poor. Households with a deprivation count between 2 and 3 are vulnerable to or at risk of becoming multidimensionally poor".

APPENDIX – C

Poverty Indices:

Various poverty aggregates (indices) are used to proxy the status of a group of individuals. A class of functional forms, which has been suggested by Foster, Greer, and Thorbeke (FGT), uses various powers of the proportional gap between the observed and the required expenditure as the weights to indicate the extent of and level of intensity of poverty. The higher the power the greater the weight assigned to a given level of poverty. Therefore, it combines both incidence and intensity.

The following formula is used for measuring various poverty aggregates.

$$P^{\alpha} = (1 / N) \sum [(Z - Score) / Z]^{\alpha}$$

where;

P^{α} = Aggregation measure

N = Total number of households

Score = Observed household Score

Z = Poverty threshold or Poverty Line

$\sum$ = Summation for all individuals who are below the poverty line

Putting $\alpha = 0$, the formula shows the proportion of households whose consumption falls below the poverty line. The poverty incidence (headcount) is the most popular measure used. The formula assigns equal weights to all of the poor regardless of the extent of poverty. Putting $\alpha = 1$, the Proportionate Gap Index or Poverty Gap (PG) is calculated. The PG measures the average distance from the poverty line. Although the PG shows the depth of poverty, it is insensitive to distribution among the poor. Putting $\alpha = 2$, FGT2 index is calculated. This index takes into account inequality amongst the poor and shows the poverty severity by assigning greater weights to those households who are far below the poverty line. Thus, these three aggregate indices (Headcount, Poverty Gap, and Poverty Severity) are computed to give a picture of the extent and severity of multidimensional poverty in Pakistan.

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