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## Region-wise comparative analysis of multi-dimensional poverty in Khyber Pakhtunkhwa

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### Abstract

*While there is no specific definition of poverty, it is now increasingly being considered as a multi-dimensional phenomenon instead of a unidimensional concept such as lack of income. This study delves into a region-wise comparative analysis of poverty in the north-western province of Pakistan, Khyber Pakhtunkhwa, which borders Afghanistan and has been witnessing drastic implications of the war against terrorism in Afghanistan. PSLM/HIES 2018-19 data from the Pakistan Bureau of Statistics has been used in the study which has a sample size of 4464 households from the province of Khyber Pakhtunkhwa. The study incorporates ten key dimensions of poverty into the construction of multi-dimensional poverty index as per the Alkire-Foster methodology. The findings of the study reveal that the average poverty rate in the province is about 50 percent. The divisions of Bannu, Malakand, and D. I. Khan are the poorest regions in the province, whereas, as expected, the divisions of Peshawar and Mardan are the least poor. Our results also indicate that rural areas of the province have more severe poverty as compared to urban areas of the province.*

**Keywords:** Multi-dimensional poverty, Alkire-Foster, Khyber Pakhtunkhwa and Pakistan

### Introduction

Poverty is a global phenomenon, present in almost every part of the world. Considering the importance of poverty reduction in realizing the fruits of development in modern times, the United Nations (UN) has set poverty alleviation as the first goal among its Sustainable Development Goals (SDGs) of 2015. According to United Nations, South Asia is a region of primary concern as it

accounts for 33 percent of the world's extreme poverty (Islam et al., 2021). Pakistan is the second most populated country of South Asia. Its economy has been lagging the regional peers since the last few decades, one of the main reasons for which is the security situation in the country due to war against terrorism in Afghanistan (Malik et al., 2019). Within Pakistan, the region of specific concern is Khyber Pakhtunkhwa which borders Afghanistan, as it has been the most affected region due to the war against terrorism. Besides, poverty is widespread in the region due to a lack of industry and the weak performance of local agriculture compared to other provinces.

Poverty is traditionally defined as the lack of money or income to satisfy life's basic needs, such as a certain amount of caloric intake (Christaensen et al., 2005). This is, however, a narrow approach towards understanding poverty as money alone cannot truly measure human well-being (Alkire et al., 2017). Sen (1976) presents a broader definition of poverty as being deprived of multitude of capabilities and thus, besides money, it also depends on factors such as food, housing, education, public goods, empowerment etc. that are closely related to the Human Development Index (HDI) of UN. Alkire and Foster (2011) presented a statistical methodology of measuring such multi-dimensional poverty, assume that that poverty is a multi-dimensional phenomenon. United Nations (UN, 2004) calculated global Human Poverty Index, which is based on macro-level data on three dimensions i.e., the probability at birth of not surviving till the age of 40, adult literacy rate, and standard of living (access to safe water and health services). In 2010 the United Nations also calculated Multidimensional Poverty Index (MPI) for 104 countries by using household level micro-data and individually identifying individuals depriving in multiple dimensions. Thus, it could measure both the poverty rate in a country and its depth (UNDP, 2010). Inspired by the UN's work, several studies have studied and estimated multi-dimensional poverty (such as Bourguignon and Chakravarty, 2003; Jenkins and Micklewright, 2007; Alkire and Santos, 2010; Antony and Rao 2007).

MPI has been estimated for many individual countries to understand the with-in country dynamics and factors affecting poverty. For instance, Aristei and Bracalente (2011) measure multi-dimensional poverty in various Italian regions. Similarly, Batana (2008) presented estimates of multi-dimensional poverty in Sub-Saharan Africa. Metha and Shah (2003) studied multi-dimensional poverty in India, whereas Justino (2005) studied multi-dimensional poverty in Brazil. Battiston et al. (2013) used Alkire-Foster and Bourguignon-Chakravarty based multi-dimensional poverty measures to derive the estimates of multi-dimensional poverty in six countries in Latin America.

In the case of Pakistan, several studies have estimated the multi-dimensional poverty on regional basis. Javed and Awan (2020) use data from three waves of PSLM and ten different poverty indicators data from three waves of PSLM and ten different poverty indicators such as schooling, immunization, electricity, water, gas, assets, and crowding. They find that the poverty rate is higher in rural areas. In contrast, the province of Balochistan had the highest rate of poverty than urban areas and the province of Punjab had the lo. In contrast, the province of Balochistan had the highest poverty rate than urban areas and that the province of Punjab had the lowest whereas the province of Balochistan had the highest poverty rate. Likewise, Khan and Shah (2020) take four dimensions of poverty, i.e., expenditure, education, health, and housing, into the multi-dimensional poverty index and use PSLM/HIES data from 1998 to 2013 to analyze the trend of poverty in sub-regions of the province of Punjab. They find that poverty has declined considerably in the province over the decade. Khan et al. (2014) studied the multi-dimensional poverty in the Rawalpindi region using three dimensions of education, health and housing. The study reveals that the region's poverty has been declining; however, educational deprivation showed a significant net increase.

This paper uses the methodology of Alkire and Foster (2011) to estimate multi-dimensional poverty as this methodology is most acceptable in the literature due to its suitability for application to categorical data. Unlike other studies, we consider additional dimensions of poverty that might

measure the capabilities of the poor and the opportunity available or deny to them. These dimensions are women empowerment, environment, and access to information and communications technologies (ICT). These dimensions make our analysis unique and more relevant in the context of Khyber Pakhtunkhwa, which is characterized by the weak representation of women in the political and economic spheres due to cultural norms. Besides, there are areas in the province where internet and other ICT services are still absent. Thus, such indicators need to be included in a study that measures poverty on several dimensions.

## Data

Data for this study was obtained from the Household Integrated Economic Survey 2018-19 (hereafter referred to as HIES 2018-19). The data set contains household demographic characteristics, income and employment, education, health, housing, water and sanitation, and consumption patterns across Pakistan. Information regarding the primary sampling units (enumerations blocks) and secondary sampling units throughout Pakistan are given in table 01 below.

Administrative Units	Rural/Urban	Primary Sampling Units	Secondary Sampling Units
Punjab	Rural	500	7836
	Urban	350	3945
Sindh	Rural	220	3497
	Urban	248	2719
Khyber Pakhtunkhwa	Rural	194	3035
	Urban	125	1450
Baluchistan	Rural	99	1568
	Urban	66	759
Azad Jammu and Kashmir	Rural	64	979
	Urban	35	397
Gilgit Baltistan	Rural	49	637

	Urban	25	240
Total		1975	27062

Table 1: Primary and Secondary Sampling Units of the HIES 2018-19

Source: HIES 2018-19

The data set contains 4485 households from different parts of Khyber Pakhtunkhwa. However, essential information on 21 households were missing, and hence the data set collected for this study contains 4464 households only. The administrative division-wise, district-wise (rural only), and rural-urban-wise distribution of the selected households are given in table 2 below.

## Sampling Units (Khyber Pakhtunkhwa)

Administrative Divisions	Urban	Rural	Total	
	SSU	District		SSU
Malakand		Chitral	79	
		Dir Upper	125	
		Dir Lower	170	
		Swat	92	
	196			959
		Shangla	63	
		Buner	80	
Hazara		Malakand Protected Area	47	
		Bajaur	107	
		Kohistan	223	
	164			844
		Mansehra	126	

		Batagram	48	
		Abbottabad	126	
		Haripur	111	
		Torghar	46	
Mardan	174	Mardan	157	472
		Swabi	141	
		Charsadda	142	
		Peshawar	187	
Peshawar	653	Nowshera	123	1225
		Khyber	72	
		Mohmand	48	
		Kohat	79	
		Hangu	30	
Kohat	105	Karak	61	369
		Kurram	62	
		Orakzai	32	
Bannu	46	Bannu	86	265
		Lakki Marwat	58	

		North Waziristan	75	
		D.I.Khan	127	
D.I. Khan	108	Tank	31	330
		South Waziristan	64	
Total	1446		3018	4464

Table 2: Division and District-wise Distribution of the selected Secondary

Source: HIES 2018-19

### Dimensions of Poverty and Indicators Within Each Dimension

In the current study, 10 dimensions of poverty were used as listed in table 3 below. The dimension of household living standards is measured with 9 indicators: overcrowding, availability of electricity, gas, and telephone in the house, residence status (whether residents in own house), garbage collection from the house, and material used in the house. The dimension of water and sanitation has been measured with four indicators, i.e., source of drinking water, type of toilet facility in the house, sharing of a toilet with others, and whether the sewerage is connected to a drainage or not. The environment/air quality dimension is measured with a single indicator, namely the type of fuel used by the household for cooking.

In this dimension of ownership of durable assets, two types of durable consumption items are included: livelihood-related and mobility-related. The livelihood-related items include ownership of the refrigerator, washing machine, fans, stove, sewing machine, iron, chairs, and tables owned by the household. In the mobility-related items, ownership of bicycles, motorcycles, and cars are taken as the indicators of private mobility. The education dimension is measured with two indicators: male households' average years of schooling and female households' average years of schooling. The health dimension is measured with four indicators: immunization, the prevalence of diseases (malaria, hepatitis, and tuberculosis), health habits, and child mortality. The economic activity dimension is measured with two indicators: household employment and monthly household income. Access to the computer and information technology (CIT) is measured with three indicators. The first indicator is the number of household members having laptops. Likewise, the second and third indicators are the number of household members having mobiles/smartphones and access to internet facilities, respectively. The food security dimension is measured with eight Yes/No answers related to questions about food insecurity. The women empowerment dimension is measured with 10 statements recorded by the female members of the household about their say in matters related to education, employment, marriage, birth control, purchase of food items and clothing, medical treatment and recreation, and travel.

S.no.	Dimension	$w_j$	Indicators	Measures	Indicators Weights
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			Overcrowding	Number of Persons per room		1/90
					Electricity	1/90
			Availability of Utilities	Monthly expenditure on electricity, gas, and telephone	Gas	1/90
					Telephone	1/90
1	Living Standards	1/10	Residence	Occupancy (Dummy)	Status	1/90
			Garbage	Garbage collection facility		1/90
					Floor	1/90
					Roof	1/90
			Housing Material	Material used in floor, roof and walls	Walls	1/90
			Purity of Drinking Water	Sources of Drinking Water		1/40
2	Water and Sanitation	1/10	Toilet Facility	Type of toilet, Shared or not		1/40
			Sewerage	Connection with drainage/sewerage system		1/40
3	Environment	1/10	Air Quality	Type of cooking fuel used		1/10
4	Assets				Refrigerator	1/110

						Washing Machine	1/110
						Fans	1/110
						Stove	1/110
		1/10		Livelihood Assets	Related	Sewing Machine	1/110
			Ownership of durable consumption items			Iron	1/110
						Chairs	1/110
						Tables	1/110
						Bicycle	1/110
				Mobility Assets	Related	Motorcycle	1/110
						Car	1/110
5	Education	1/10	School Attainment	Household average years of schooling (male and female)	average	Average HH Education Male	1/20
						Average HH Education female	1/20
			Immunization	Proportion of children immunized			1/ 60
6	Health		Prevalence of diseases	HH members having suffered from Malaria, TB and Hepatitis		Malaria	1/ 60
						Hepatitis	1/ 60
						TB	1/ 60

		1/10		Health Habits	Monthly expenditure on tobacco and chewing products		1/ 60
				Child Mortality	Number of children died after live birth		1/ 60
7	Economic Activity	1/10		Employment Status	Proportion of adult HH members employed		1/20
				Income	HH per capita income/consumption	Income	1/20
						Laptops	1/30
8	ICT	1/10		Access to ICT	Number of HH having mobile, laptop and internet access	Mobiles/smart phones	1/30
						Internet	1/30
9	Food Security	1/10	Scale		Including 8 items <sup>a</sup>		1/80 (each)
10	Women Empowerment	1/10	Scale		Including 10 items <sup>b</sup>		1/100 (each)

Table 3: Dimensions of poverty and indicators within each dimension

Note: a. The 8 items can be seen in section 5 of PSLM/HIES 2018/19 male questionnaire online. b. The 10 items related to women empowerment are given in the female questionnaire of PSLM/HIES 2018/19 in section 4F part E.

## Methodology

The Alkire and Foster (2011) methodology were used to compute various indexes of multi-dimensional poverty. To outline the methodology, let there be  $n$  ( $=4464$ ) individuals whose poverty/deprivations are assessed through  $d$  ( $=10$ ) dimensions each year. The 10 dimensions used in this study are outlined in section 2 above. Let  $x_{ij}$  be individual  $i$ 's achievement on dimension  $j$  represented in a  $n \times d$  matrix  $X$ . Let  $z_j$  be the deprivation cutoff level for each  $j^{\text{th}}$  indicator, which a vector  $z$  can represent. Information regarding various deprivation cutoff points used in this study are given in table 4 below. The  $i^{\text{th}}$  individual in indicator  $j$  would be considered deprived if  $x_{ij} < z_j$  and vice versa. Table 4 below contains the cutoff points used in each indicator. For simplicity, we take

the mean of the sample as the cutoff point in a continuous or numerical indicator, and in case of dummy variables, we use 1 for deprived and 0 otherwise. If for individual  $i$ , the condition that  $x_{ij} < z_j$  holds in an indicator, then his/her deprivation status in that indicator (denoted by  $S_{ij}$ ) equals 1 and zero otherwise. The matrix that contains information on the deprivation status of the  $n$  individuals in  $d$  dimensions is denoted by  $g^0$  and is called the deprivation matrix. Since the Alkire and Foster (2011) method is a two-stage poverty identification method, the deprivations cutoff used ( $z_j$ ) to convert the achievement matrix to the indicator deprivation matrix is known as the first stage calculations to identify the indicators on which a household is poor.

Dimension	Indicator/Measures	Cutoff (mean)
Living Standards	Number of persons per room	>3.18
	Monthly Expenditure on Electricity (Rs)	≤1252.1
	Monthly Expenditure on Gas (Rs)	≤297.97
	Monthly Expenditure on Telephone (Rs)	≤604.96
	Occupancy Status	=1
	Garbage Collection	=1
	Material used in floor, roof and walls	=1
Water and Sanitation	Sources of drinking water	=1
	Type of toilet and shared or not	=1
	Connection with drainage/sewerage	=1
Environment	Air quality	=1
Assets	No. of refrigerators owned	<1
	No. of washing machines owned	<1
	No. of fans owned	<3.05

	No. of stove owned	<1
	No. of sewing machines owned	<1
	No. of Irons owned	<1
	No. of Chairs owned	<2.32
	No. of tables owned	<1.36
	No. of Bicycles owned	<1
	No. of motorcycles owned	<1
	No. of Cars owned	<1
Education	Male education	$\leq 6.67$
	Female education	$\leq 2.74$
Health	Proportion of children immunized	$\leq 32.37$
	Malaria	>0
	Hepatitis	>0
	Tuberculosis	>0
	Health habits	>232.84
	Child Mortality	>0
Economic activity	Employment	<41.21%
	Income (Rs.)	<4077.22

ICT	Laptops	<1
	Mobiles/Smart Phones	<2.43
	Internet	<1
Food Security	8 items	=1
Women Empowerment	10 items	=1

Table 4: Deprivation Cutoff in each dimension

**Note:** <, =, and > implies, respectively, that a household is considered deprived in the indicator if it scores less than, equal to or greater than the specified value.

To convert the deprivation matrix to the weighted deprivation matrix (denoted by  $\bar{g}^0$ ), one needs to assign relative weights ( $w_j$ ) to each dimension such that each  $w_j > 0$  and that  $\sum_{j=1}^{10} w_j = 1$ . The weight assigned to each indicator is shown in table 3 above. The relative weight of each dimension is 1/10, and the sum of the weight to 1. The study assumes that each dimension of poverty is equally important in measuring multi-dimensional poverty. Hence, equal weights are assigned to each of the 10 dimensions. Weights assigning is a major controversy in the literature about multi-dimensional poverty, whereby some studies recommend weights according to the importance of each dimension. In contrast, others treat all the dimensions equally to avoid subjectivity. In this study also used the equal weighting scheme, which is also the recommendation of Alkire and Foster (2011).

The MPI is constructed by summing the weighted deprivation scores over all the dimensions. Mathematically, the index is created by  $c_i = \sum_{j=1}^{10} w_j s_{ij}$ . By construction, the index ranges from 0 to 1 for all the households in the sample. After creating the poverty index, we use an aggregate poverty cutoff point of 0.33, which differentiates between poor and non-poor. Hence the Alkire and Foster (2011) methodology use dual cutoffs. This way, for each region of the Khyber Pakhtunkhwa, a certain number of poor people and a certain number of non-poor in the sample. Using this information, the compute poverty indices like poverty headcount ratio ( $H$ ), average deprivation amongst poor ( $A$ ), also called poverty intensity, and the adjusted headcount ratio ( $M_0$ ) for region-wise comparative statistics of poverty.

Mathematically,

$$H = \frac{q}{n}; A = \frac{\sum_{i=1}^q c_i}{q}; M_0 = H * A$$

where  $q$  is the number of multi-dimensional poor people in the sample,  $n$  is the sample size, and  $c_i$  is the total deprivation score depicting the number of dimensions on which a poor household is poor.

### Reliability of Dimensions and Indicators

Dimensions	No of items in scale	Average inter item covariance	Scale reliability
Living standard	9	0.04	0.697
Water and Sanitation	4	0.01	0.251
Environment	1	NA	NA
Assets	11	0.042	0.753
School Attainment	2	0.076	0.483
Health	6	0.004	0.143
Economic activity	2	0.035	0.254
ICT	3	0.067	0.599
Women empowerment	10	0.052	0.788
Food security	8	0.033	0.759

Table 5: Cronbach Alpha test of the reliability of dimensions

When using multiple-item measures of a concept, Cronbach's alpha (Cronbach, 1951) has become common practice in research (Tavakol and Dennick, 2011). The alpha measures the extent to which all the items in a measure relate to each other and its value ranges from zero to 1, whereby 1 indicates best reliability. Another useful way of using the Cronbach's alpha is to square it and subtract it from 1 which produces an index of measurement error (Kline, 2014). Hence, the higher value of Cronbach's alpha is lower than the measurement error in the concept measured. However, it is also important to note that a lower Cronbach alpha value does not necessarily mean lower internal consistency. The value is directly related to the number of items measuring a concept (Streiner, 2003). Table 5 reports the values of Cronbach alpha for each of the dimensions of poverty used in the study.

For instance, the living standard dimension is measured with 9 items (called indicators) and the Cronbach alpha value for this dimension is approximately 0.70, representing excellent reliability of the dimension.

### Division-Wise Estimates of Poverty in KP

The MPI estimates for each of the seven individual divisions of KP are shown in table 6 below. Two poverty indices, i.e. headcount ratio  $H$  and the adjusted headcount ratio  $M_o$ , are displayed in the table. The ranking of divisions is done based on the estimated poverty level in that division and shown in the last column of table. Both the  $H$  and  $M_o$  produce almost similar division rankings according to poverty. We can see that the division of Bannu is the poorest division among all the seven divisions of the province, where almost 54 percent of the people are multi-dimensional poor. It should point out that the division of Bannu contains the district of North Waziristan which borders Afghanistan and has been severely affected by the war against terrorism. This might be the reason behind the high rate of poverty in the entire division of Bannu. The second poorest division in the province is Malakand, located in the province's northern region. Likewise, according to our estimates, the third poorest division in the province is D.I. Khan where the adjusted headcount ratio is 51 percent. As far as the least poor division of the province are concerned, Mardan and Peshawar have the smallest proportion of poor people i.e. 45 percent and 39 percent, respectively. This is as per the expectations because these two divisions are urban in nature, have considerable industry, and have highly productive agricultural lands.

Division	Poverty Indices		Proportion population division	in of the Poverty Rankings
	$H$	$M_o$		
Malakand	0.918	0.538	0.208	2
Hazara	0.839	0.479	0.193	5
Mardan	0.824	0.455	0.106	6
Peshawar	0.726	0.392	0.274	7
Kohat	0.855	0.487	0.083	4
Bannu	0.931	0.539	0.059	1
D I Khan	0.858	0.511	0.075	3
Total	0.831	0.471	1	

Table 6: Division-wise estimates of poverty in KP

Source: Authors' calculations from PSLM/HIES 2018/19

### Rural-Urban Wise Estimates of Poverty in KP

Table 7 contains the estimates of poverty across the rural and urban areas. We can see that in both  $H$  and  $M_o$ , rural areas of the province have more multi-dimensional poor people than urban areas. According to the adjusted Headcount ratio  $M_o$  the proportion of poor in rural areas is 55 percent whereas in urban areas it is 30 percent. These results indicate the severity of poverty in rural areas and call for specific rural interventions to eradicate multi-dimensional poverty.

Area	Poverty Indices	
	$H$	$M_o$
Rural	0.936	0.554
Urban	0.613	0.3
Total	0.831	0.472

Table 7: Rural-urban wise estimates of poverty in KP

Source: Authors' calculations from PSLM/HIES 2018/19

### Conclusion and Policy Recommendations

Poverty alleviation is the first goal among the Sustainable Development Goals of the United Nations. South Asia is one of the two regions of the world where extreme poverty still exists and is widespread, Sub-Saharan Africa being the other region. Pakistan is the second most populated country in South Asia, and therefore, poverty reduction efforts in the country will manifest clearly in global efforts toward poverty eradication. In Pakistan, Khyber Pakhtunkhwa, which borders Afghanistan, has been facing the main brunt of the war against terrorism in Afghanistan is home to some of the world's poorest regions, such as the newly merged districts ex-FATA and the geographically disconnected areas of the Malakand division.

This study especially focuses on the poverty rate in the province of Khyber Pakhtunkhwa. For this purpose, we measure multi-dimensional poverty motivated by the fact that poverty is related to income and expenditure and other capabilities and functionalities such as education, health, women empowerment, and the environment.

We find that the division of Bannu is the poorest division of the province. This might be since the district of North Waziristan is part of the Bannu division. The North Waziristan district is bordering with Afghanistan and has been severely impacted by the war against terrorism. The second poorest division of the province is the Malakand division which is home to some of the geographically disconnected areas of the province, such as Chitral, Upper Dir and Bajaur. These semi-mountainous areas neither have industry, services nor agriculture and thus it is not surprising that the division of Malakand has the second highest proportion of poor in the province. Moreover, as per our expectations the divisions of Peshawar and Mardan have the smallest ratio of poor people in the province. While Peshawar is the provincial capital and the most urbanized division of the province, the district of Mardan is fast urbanizing and is also home to some of the most fertile agricultural lands of the province with abundant irrigation.

Finally, we saw that rural areas are poorer than urban areas. This calls for rural areas specific policy interventions to reduce poverty on multiple dimensions such as education, health, women empowerment, and ICT access.

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