PAKISTAN
Strategy Support Program

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI
A member of the CGIAR Consortium

WORKING PAPER No. 026 | November 2014

The Official Estimates of Poverty in Pakistan – What is Wrong and Why? – Illustrations using the Government of Pakistan's Household Integrated Economic Survey 2010-11

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11/6/2014

TABLE OF CONTENTS

I. INTRODUCTION

This paper aims to clarify the confusion over estimates of poverty in Pakistan[1]. The paper highlights the root causes of the confusion in the existing literature, which are based on estimates from the "nationally representative" data collected by the Federal Bureau of Statistics Household Integrated Economic Surveys (HIES). The paper uses the latest available HIES 2010-11 to illustrate and clarify these issues.

The poverty estimates for Pakistan have shown a remarkable and consistent decline in the headcount of the poor with official – not formally released – estimates showing the incidence at 12 per cent for 2010-11 – down from 34.5 per cent in 2001-02. This decline in poverty is inconsistent with the observed lack of improvement in various non-money metric measures of welfare and the generally poor macroeconomic performance.

Increasingly governments and especially multilateral lenders measure economic performance in terms of poverty reduction. Lenders use these as key criteria for continued lending.[2] More importantly, the formulation of social protection and other anti-poverty programs and assessment of their implementation and eventual impact depend upon these numbers.

The official poverty line for Pakistan, which was estimated in 2001-02 based on data from the HIES of 1998-99, has been adjusted for inflation using a CPI-based extrapolation for the subsequent years. This method suffers from five problems: 1) outdated sampling frames underlying the HIES and estimation of national poverty line; 2) changes in the underlying consumption basket due to price fluctuations, which are not adequately represented in the CPI and hence in poverty estimation; 3) sensitivity of poverty estimates to the choice of consumption basket on which the poverty line is based; 4) differences in consumption patterns across rural and urban areas of all provinces and poverty estimation; 5) sensitivity of estimates to caloric threshold underlying the poverty lines.

The first problem arises from the sample frame that draws on the 1998 Population Census, with some subsequent but not publically known adjustments, and on which the HIES surveys are based. This leads to a serious underestimation of the overall population. Moreover, according to its own report the HIES does not cover transitory populations, presumably also excluding peri-urban localities (where the majority of the poor are now living in Pakistan), military cantonment areas, Azad Jammu Kashmir, the FATA and FANA. There are thus serious concerns about the representativeness of these numbers.

The second problem results from the likely change in the consumption basket due to the rising trends in food and fuel prices; especially following the price hike of 2006-08[3]. The CPI does not capture these changes adequately because of two reasons: 1) it is based only on **urban prices;** and 2) the share of food groups is based on the Family Budget Survey 2007-08 which **understates by 9 percent the overall weight of the food category** in total consumption as compared to the HIES for the same year. Details of the issues with the current CPI of Pakistan are discussed in a separate discussion paper (Malik et al., 2014).

The third problem is the sensitivity of poverty estimates to the choice of consumption basket. The selection of consumption basket to estimate poverty lines is not uniform across studies conducted for Pakistan. For example, while the official poverty line is based on the consumption basket of households that fall in the bottom three quintiles (i.e., bottom 60 percent households) (Government of Pakistan, 2003; 2009), Jamal (2012) uses the consumption basket of the households that belong to the bottom expenditure quartile only (i.e., the bottom 25 percent households). Both sources do not make this assumption very clear in their write-up, thereby seriously complicating comparison of estimates across these sources.

The fourth problem is that the existing poverty estimates assume that consumption patterns across the country are similar. However, the data of HIES show significant differences in consumption patterns, not only across provinces, but also across urban and rural areas of these provinces. These consumption patterns are reflected in the dietary intake and hence in calorie consumption that is an important indicator to measure poverty.

[1] The paper looks basically at the Government of Pakistan's reported poverty numbers generated by the Centre for Research on Poverty Reduction and Income Distribution (CRPRID) of the Planning Commission based on the official poverty line (and the World Bank endorsement of these numbers) as well as the estimates generated by Haroon Jamal of the Sustainable Policy Development Center (SPDC) Karachi using an alternative methodology.

[2] The IMF and the World Bank, for example, make poverty reduction their main criteria for lending.

[3] The world food price index increased by 39.5 percentage points during just two years between 2006 and 2008 (FAO, IFAD and WFP, 2013).

The fifth problem arises from the minimum threshold level of calories[4] selected to estimate the poverty line. Several studies conducted for Pakistan before 1998-99 used a level of 2550 per day per adult equivalent, recommended by the Nutrition Cell of the Planning Division of Pakistan (Khan and Khan, 1990). However, in 2002, the Planning Commission reduced the threshold to 2350 per day per adult equivalent[5]. In 2011, based on the dietary guidelines of FAO/WHO, the Nutrition Division of the Planning Commission recommended a least cost consumption basket providing minimum average energy of 2150 calories and about 65 gm of protein per day per person. This consumption basket was used in the Five Year Plan 2001-05 and Medium Term Development Framework (MTDF) 2005-10 (for details, see Government of Pakistan, 2011). Poverty estimates are highly sensitive to the minimum threshold level of calories and can change the estimated values significantly.

Using the latest available primary survey data from the HIES for 2010-11, this paper tests the sensitivity of the poverty estimates to the choice of consumption basket, the minimum threshold level of calories, and the assumptions based on which these threshold calories are estimated. In addition, it demonstrates the spatial differences in poverty estimates across rural and urban areas.

The paper is divided into six sections. The trends in official poverty estimates and a comparison of these estimates with those from Jamal (2012) are presented in Section 2. Section 3 is divided into five parts based on the econometric testing of the five problems identified above. Discussion on the outdated sampling frames of HIES and poverty estimation is presented in section 3.1. Section 3.2 describes how underestimation of CPI leads to an underestimation of the poverty line. Section 3.3 presents analyses of the sensitivity of poverty estimates to the choice of consumption basket. A detailed analysis of the differences in consumption patterns across rural and urban areas of all provinces and poverty estimation is presented in section 3.4 and section 3.5 measures the sensitivity of estimates to caloric threshold underlying the poverty lines. Conclusions and policy recommendations are given in the final section.

2. POVERTY TRENDS IN PAKISTAN

The official poverty estimates show a persistent decline since 2001-02 (see Table 1)[6]. Poverty increased during from 1992-93 to 2001-02, with the exception of 1996-97, and then declined sharply by 10.6 percentage points after 2001-02 through 2004-05—from 34.5 percent in 2001-02 to 23.9 percent in 2004-05. These results caused a huge uproar at that time in the national press and amongst development experts and civil society in Pakistan. The World Bank was asked to make an independent assessment, and revised the estimates using a poverty line derived from data using a Tournquist index instead of the CPI inflated poverty line used in official estimates. The Bank reported that poverty had in fact declined by only 5 percent between these two years. However, they did not highlight was that to achieve the 5 percent overall decline, the underlying numbers needed an incredible decline of 15 percentage points in poverty rates in the Sindh[7]. In 2005-06, a further decline of overall poverty in Pakistan by 1.6 percentage points was officially observed. These rapidly declining estimates became highly controversial and the Government of Pakistan stopped formally reporting official estimates after 2006. However, the recent Economic Survey of 2013-14 reported estimates of poverty headcount for 2007-08 and 2010-11 of 17.2 percent in 2007-08, which meant that the proportion of poor had declined a further 5.1 percent between 2005-06 and 2007-08. A further decline of 4.8 percentage points is observed in the official numbers in 2010-11; when the poverty headcount declined further to 12.4 percent (Government of Pakistan, 2014). The other general trend reported in Table 1 is that the incidence of poverty remained higher in rural areas as compared to urban areas[8]. But the decline in rural poverty was higher than that of urban poverty. Rural poverty declined from 34.7 percent in 1998-99 to 15.1 percent in 2010-11, whereas urban poverty declined from 20.9 percent to 7.1 percent during this period.

[4] The official poverty line was estimated using the Food Energy Intake (FEI) method, which regresses household consumption expenditure on calories consumed. The poverty line is evaluated at the minimum threshold caloric intake requirement.

[5] For example, Jamal (2012) uses different calorie norms for rural and urban areas (i.e., 2550 per adult equivalent per day and 2230 per adult equivalent per day respectively) to account for this.

[6] Using the Household Integrated Economic Survey (HIES) data of 1998-99, the government of Pakistan announced the official poverty line in 2002. This poverty line was adjusted by the CPI to provide estimates for other years (Cheema, 2005) reported in the successive issues of the Pakistan Economic Surveys till the year 2005-06.

[7] This analysis can be found hidden away in the World Bank's electronic archives at http://siteresources.worldbank.org/PAKISTANEXTN/Resources/293051-1264873659180/6750579-1279901350261/PakistanCPSJuly2010.pdf.

[8] This could result in large part from the use of the urban-based CPI, which sets a higher threshold for the rural consumption cut-off.

Table 1: Trends in Poverty Indicators (based on the official poverty line)

	Poverty headcount			Poverty gap			Severity of poverty		
	Urban	Rural	Pakistan	Urban	Rural	Pakistan	Urban	Rural	Pakistan
1992-93	20.0	27.6	25.5	3.4	4.6	4.3	0.9	1.2	1.1
1993-94	15.9	33.5	28.2	2.7	6.3	5.2	0.7	1.8	1.4
1996-97	15.8	30.2	25.8	2.4	5.3	4.4	0.6	1.4	1.1
1998-99	20.9	34.7	30.6	4.3	7.6	6.4	1.3	2.4	2.0
2001-02	22.7	39.3	34.5	4.6	8.0	7.0	1.4	2.4	2.1
2004-05	14.9	28.1	23.9	2.9	5.6	4.8	0.8	1.8	1.5
2005-06	13.1	27.0	22.3	2.1	5.0	4.0	0.5	1.4	1.1
2007-08	10.0	20.6	17.2	-	-	-	-	-	-
2010-11	7.1	15.1	12.4						

Source: Cheema (2005) and Government of Pakistan (2014)

Even though the official money-metric poverty estimates show a significant decline over the years, the trends in other non-monetary measures of poverty are not consistent with the official money-metric poverty numbers. For example, reported real household consumption expenditure has remained almost stagnant since 2001[9]. Moreover, the average share of food expenditure in overall household expenditure has shown a sharp increase after 2005-06, and the food price index remained higher than the non-food price index. This is also reflected in the household's perceptions of their economic situation, which they report has worsened compared to previous years in the various HIES.

Using the data of HIES 2010-11, Jamal (2012) provides alternative estimates of the poverty lines based on calorie consumption functions for 2010-11. Applying different calorie thresholds for urban (2230) and rural areas (2550), he assumes that the consumption basket of the households in the bottom quartile of per capita consumption expenditure is an adequate representation of the consumption of the poor and hence uses estimates of calorie-consumption function obtained from a truncated regression on the bottom quartile of households. His estimated poverty line for 2010-11 is Rs 1984 per capita per month, with Rs 2,248 per capita per month for urban areas and Rs 1,854 per capita per month for rural areas. The poverty headcount, based on these poverty lines, is 36.6 percent; it is 35.5 percent in urban areas and 37.1 percent in rural areas. This is significantly higher than official estimates of 12.4 percent for this year. Using the same methodology, Jamal (2002; 2005; 2007) estimated poverty measures for 1996-97, 1998-99, 2001-02, 2004-05, and 2010-11. These estimates show higher levels of urban and lower levels of rural poverty compared to official estimates for the years 1996-97, 1998-99, 2001-02, and 2004-05 (see Table 2). This is a logical outcome of the use of more reasonable thresholds reflecting urban and rural differences. However, the overall levels of poverty are very close to the official estimates up to 2001-02. The official estimates show a sharp decline both in urban and rural poverty (by 15.6 and 24.2 percentage points, respectively) from 2001-02 to 2010-11, while Jamal observed a decline from 2001-02 to 2004-05 of only 3 percentage points, which 2 percent for urban and 4 percent for rural areas. He then observed an increase of 6.6 percentage points from 2004-05 to 2010-11, or 7.5 percentage points in urban areas and 6.1 percentage points in rural areas.

Table 2: Comparison of official poverty headcount estimates with Jamal (2012) (%)

	Urban		Rural		Pakistan	
	Official poverty estimates	Jamal (2012)	Official poverty estimates	Jamal (2012)	Official poverty line	Jamal (2012)
1996-97	15.8	25.0	30.2	30.0	25.8	28.0
1998-99	20.9	25.0	34.7	32.0	30.6	30.0
2001-02	22.7	30.0	39.3	35.0	34.5	33.0
2004-05	14.9	28.0	28.1	31.0	23.9	30.0
2010-11	7.1	35.5	15.1	37.1	12.4	36.6

Source: Jamal (2012) and Government of Pakistan (2014)

[9] For details, see the official reports on the data of various issues of HIES available at the Government of Pakistan website.

3. DATA OF THE HIES-2010-11 AND ISSUES

The discussion in the previous section raises a question: why are poverty numbers going in the opposite direction when the consumption basket is kept constant and prices are allowed to vary (as in the official estimates) as compared to a poverty line that allows both prices and consumption baskets to vary (Jamal's estimates)? Using the data of HIES 2010-11, the remaining sections of this paper demonstrate what is wrong with official poverty numbers by examining the sensitivity of poverty estimates to the five problems identified in section 1.

The HIES collects data on household characteristics, consumption patterns, household income by source, and social indicators. These data enable researchers to estimate poverty at the national and sub-national (urban-rural and provincial) levels. The sample size of HIES 2010-11 was 16,341 households, selected from urban and rural areas of all provinces. However, Military restricted areas, Azad Jammu and Kashmir, FATA and Northern Areas have been excluded from the scope of the survey.

Household expenditure and food consumption are the two most important variables used in the estimation of poverty line, and the HIES 2010-11 provides detailed information on the consumption of food and non-food items. Information on some of the food items (quantities and expenditures) is collected on a 14 day recall, while others have a recall period of one month. Most quantities are reported either in kilograms, grams or numbers. To make food consumption consistent, the consumed quantities are converted into kilograms, with quantities and expenditures converted to a monthly basis. Using the Food Composition Tables for Pakistan (2001), these quantities were then converted into calories. Because of data inconsistencies and missing values, we dropped 156 observations (i.e., 0.96 % of total observations), so the analysis presented in sections 3.3 to 3.5 is based on 16,182 households. Sampling weights were used in the estimation process.

3.1 Outdated sampling frames of HIES and poverty estimation

Raised data from the HIES seriously underestimates the total population of Pakistan. The data in Table 3 below show that the raised total population based on the HIES 2010 was 130.1 million, whereas the actual population estimate for Pakistan in the Economic Survey 2013-14 for that year is 177.1. Thus the HIES represents only **73.46 percent of the population**. The urban population for that year is reported in the same Economic Survey at 66.4 million, while the HIES raised numbers for urban population are 43.2 million or 65 percent of the urban population. Similarly, the rural population is 110.7 million; in the HIES it comes out to 86.9 million (or 78.5 percent of rural population).

Table 3: Household size, number of households, and population (2010-11)

Area	HH Size	Number of Households (millions)	Population (millions) (HIES)
Pakistan	**6.4**	**20.3**	**130.1**
Urban	6.2	6.9	43.2
Rural	6.5	13.3	86.9
Punjab	**6.2**	**12.0**	**74.5**
Urban	6.2	3.8	23.7
Rural	6.2	8.2	50.9
Sindh	**6.4**	**4.8**	**30.7**
Urban	6.0	2.5	14.9
Rural	6.9	2.3	15.8
KPK	**7.2**	**2.5**	**18.2**
Urban	7.2	0.4	3.1
Rural	7.2	2.1	15.1
Balochistan	**7.1**	**0.9**	**6.7**
Urban	7.5	0.2	1.6
Rural	7.0	0.7	5.1

Source: Computed from HIES (2010-11) and Government of Pakistan (2014)

The under-coverage of population results in a possible bias of household size that affect the variables used in poverty estimation (household income and expenditure) when conversions to a per capita basis or for estimation of per adult equivalent scale are made. The average household size reported by the 1998 Population Census is 6.8, which is 7.0 in urban areas and 6.8 in rural areas (Government of Pakistan, 2000). Contrary to the findings of 1998 Population Census, the data of HIES finds a larger household size in rural areas (6.53) compared to urban households (6.23) (see Table 3). This under coverage of the population also varies across provinces, as the relative coverage of HIES is largest in Punjab (77 percent of Punjab's population) and lowest in Sindh (73 percent of Sindh's population). There is no clear evidence of the resulting bias from this under-enumeration that this error is random. **This lends serious doubt on the representativeness of the HIES sample.** The poverty estimates computed on the basis of lower and biased population numbers do not adequately depict the situation of poverty.

In addition, the methods of cleaning data, number of dropped observations also create potential biases in the estimation of the poverty line and in the eventual estimation of poverty numbers.

3.2 Underestimation of CPI leads to an underestimation of poverty numbers

The CPI in Pakistan is computed with Laspeyre's index, which uses the budget share of essential commodities in a base year and current year prices. As mentioned earlier, the official poverty line was estimated in 2001-02 and adjusted by the inflation rate using the CPI for the subsequent years. Malik et al (2014) point out that the CPI suffers from two major problems: first is the under-coverage of data on prices, and the second is the underestimation of food shares in the total household budget[10]. In Pakistan, prices of most of the food items increased by more than 100 percent during 2000-01 to 2008-09. For example, wheat increased by 162 percent, rice by 207 percent, milk by 101 percent, ghee by 147 percent, and onions by 140 percent (Government of Pakistan, 2013). In a country like Pakistan, where a large proportion of household income is spent on food, a rise in food prices may result in shifting non-food expenditures towards food.

Using the prices of essential food items collected by the Pakistan Bureau of Statistics and quantities consumed reported in the HIES 2007-08, the Government of Pakistan (2011) calculated the cost of a consumption bundle that consists of cereals, animal products, pulses, vegetables, sugars, and oils and fats (see Table 4). The cost of this consumption bundle has increased by 67 percent from 2007-08 to 2010-11. However, the Economic Survey 2013-14 reports the value of CPI for 2010-11 at 2007-08 prices was 146, which indicates a 46 percent increase since 2007-08. This indicates that CPI is not reflecting the true cost of food basket.

Table 4: Food Expenditure based on consumption per capita/month

		Cost of consumption basket (Rs/capita/month)			
	Consumption (Kg/capita/ month)	2007-08	2008-09	2009-10	2010-11
Wheat Flour	7.8	140	205	225	235
Rice	0.9	35	45	40	45
Pulses	0.2	10	15	15	20
Sugar	1.3	40	50	75	100
Oils and fats	0.7	85	90	90	110
Meat	0.6	80	90	110	130
Milk	6.8	205	255	290	335
Vegetables and fruits	4.5	80	105	115	150
Total cost	**-**	**675**	**855**	**960**	**1125**
CPI	**-**	**100**	**117.03**	**128.85**	**146.45**

Source: Government of Pakistan (2011) and Government of Pakistan (2014)

[10] The data on prices is collected only from urban areas, and food share is estimated through the Family Budget Surveys conducted in urban areas. The Family Budget Survey is conducted after every five years and the last survey was conducted in 2007-08. The survey methodology, survey instruments, and primary data for the underlying survey conducted in 2007-08 from which the representative commodity weights are taken have never been released (for details see Malik et al., 2014).

A comparison of the food share in household budget estimated by the Family Budget Survey 2007-08 with data from the HIES 2007-08, highlights the second major problem, i.e., the underestimation of food shares. The estimated food share in the Family Budget Survey (2007-08) is 35 percent, whereas, according to the HIES (2007-08), it is 45 percent, with 37 percent in urban areas and 51 percent in rural areas. This not only indicates the underestimation of food shares by 10 percent but also points out the pronounced differences across rural and urban areas. Use of a lower food share and urban prices in the computation of CPI may result in its underestimation. Consequently, using this CPI to determine poverty levels may result in the underestimation of those rates, as it is the Family Budget Survey that is used for weights, not the HIES.

3.3 Sensitivity of poverty estimates to the choice of consumption basket

The data of HIES 2010-11 show that the mean per capita per day consumption of calories is 2263. This is less than the recommended amount of calories (2350 per capita per day). Disaggregating households by per capita expenditure quartiles, significant differences in calorie consumption and household per capita expenditure are observed (see Table 5). More than 50 percent of households consume less than the recommended calories. Only households in the top two quartiles consume, on average, more than the recommended amount. Interestingly the per capita consumption expenditure of the households in these quartiles is approximately 2 and approximately 4 times higher than those in the bottom quartile, which highlights the vast inequality in consumption expenditures not only in quantities consumed but also in the quality of food.

Table 5: Household size, per capita expenditure and calorie consumption by per capita expenditure quartile (2010-11)

	Household size	Household consumption expenditure (Rs/capita/month)	Household food expenditure (Rs/capita/month)	Calories (Adult Equivalent/day)
1st Quartile	7.86	1,541	910	1,776
2nd Quartile	6.88	2,236	1,270	2,123
3rd Quartile	6.01	3,044	1,629	2,395
4th Quartile	4.96	5,846	2,381	2,760
Overall	6.43	3,167	1,548	2,263

Source: Computed from HIES 2010-11

The data of HIES 2010-11 shows that households, in general, derive most of the calories from wheat, milk and milk products, oils and fats, and sugar. However, households in bottom quartile obtain most of the calories from wheat, and oils & fats. They consume less meat, milk, and vegetables as compared to the all other households (Table 6). This clearly indicates that the consumption basket of the household who fall in bottom quartile is different than the consumption basket of those who belong to third or fourth quartile. These differences in calorie consumption and household expenditure highlight the sensitivity of poverty estimates for the choice of consumption basket and points out that the official poverty estimates are not comparable with Jamal (2012).

Table 6: Consumption of major food items and their share in total consumed calories by per capita expenditure quartile

	1st quartile		2nd quartile		3rd quartile		4th quartile		All households	
	Quantities (kg/capita/month)	% Share in calories	Quantities (kg/capita/month)	% Share in calories	Quantities (kg/capita/month)	% Share in calories	Quantities (kg/capita/month)	% Share in calories	Quantities (kg/capita/month)	% Share in calories
Wheat	7.4	55.5	8.2	50.9	8.7	47.4	8.5	39.2	8.2	47.5
Rice	0.8	4.7	1.0	4.7	1.1	4.5	1.2	4.1	1.1	4.6
Pulses	0.3	1.3	0.4	1.4	0.5	1.4	0.6	1.5	0.4	1.4
Sugar	1.3	9.0	1.6	9.2	1.7	9.0	2.0	8.7	1.6	8.9
Fats & oils	0.7	13.3	0.9	14.1	1.1	14.4	1.3	14.9	1.0	14.1
Meat	0.3	1.1	0.6	1.7	0.8	2.1	1.6	3.4	0.8	2.2
Milk	3.5	10.8	5.1	13.2	7.2	16.1	11.8	22.5	6.8	16.3
Vegetables and fruits	3.5	3.6	4.7	4.1	5.8	4.4	7.6	4.9	5.3	4.3

Source: Computed from HIES (2010-11)

3.4 Poverty estimation and differences in consumption patterns across rural and urban areas of all provinces

The world food crisis of 2008 hurt many developing countries including Pakistan. The world food price index increased by 39.5 percentage points during just two years 2006-2008 and the prices of essential food items rose by many folds during this period (FAO, IFAD and WFP, 2013). The rising food prices have serious implications for the consumption patterns of households and especially for poor households. Rising prices may also affect the quantities consumed. It is not unrealistic to assume a significant change in the consumption basket after the food price hikes of 2006-08[11] in Pakistan. In 2011, the Nutrition Section of the Planning Division of the Government of Pakistan suggested 2150 as the minimum daily per capita calorie requirement for Pakistan. This cut off is extremely low in comparison to other countries in the region and is 200 calories per adult equivalent lower than Pakistan's own officially declared cut-off for determining the poverty line. The Government of Pakistan (2011) also developed a consumption basket commensurate with the 2150 calories per capita per day. This basket consists of cereals, pulses, animal products (milk and meat), oils and fats, sweetener, and fruits and vegetables.

The recommended quantities of this consumption basket are reported in column 1 of Table 7. The average consumed quantities for each survey year during the last decade and as reported in the surveys are given in columns 2-6. The last column of this table shows the percentage change in consumption of the listed food items from 2001-02 to 2010-11. A decline in the consumption of cereals and pulses and increases in the consumption of milk, meat, oils and fats, and vegetables are observed. The change in the consumption pattern resulted in a 10 percent decline in calorie intake. Comparing the recommended food basket, the average consumption of all important food items is less than the recommended amount.

Table 7: Recommended and actual consumption of basic food basket in Pakistan

		Actual consumption (kg/capita/month)					
		(2)	(3)	(4)	(5)	(6)	(7)
Food Items	(1) Recommended quantities (kg/capita/month)	2001-02	2004-05	2005-06	2007-08	2010-11	% change 01/02 to 10/11
Wheat	10	8.9	8.2	8.1	7.8	7.98	-10.34
Rice	2.3	1.2	1.0	1.0	0.9	1.00	-16.67
Pulses	1.0	0.4	0.2	0.2	0.2	0.27	-32.50
Sugar	1.5	1.3	1.3	1.3	1.3	1.31	0.77
Fats & Oils	1.3	0.6	0.7	0.8	0.7	0.76	26.67
Meat	1.3	0.5	0.6	0.5	0.6	0.57	14.00
Milk	4.5	5.8	6.7	6.5	6.8	6.53	12.59
Vegetables	10.5	3.9	4.2	4.8	4.5	4.50	15.38
Calories (per capita/day)	2,150	1,900	1,750	1,700	1,650	1,692	-10.95

Source: Government of Pakistan (2011), various HIES surveys

The estimation of poverty line using the calorie-expenditure function requires information on calorie intake and total expenditure. Calorie intake is determined by the consumption of food. As mentioned earlier, households spend most of their food expenditure on wheat, milk and milk products, oils and fats, and sugar. Most calories are derived from wheat consumption. However, provincial and rural-urban differences in consumption patterns result lead to varying calorie consumption. The data of HIES 2010-11 shows that wheat consumption is highest in Balochistan (9.6 kg/capita/month) and lowest in Sindh (6.5 kg/capita/month). Per capita monthly milk consumption in Punjab is 7.9 liters against 2.4 liters in Balochistan. Households in KPK consume more beef compared to households in other provinces. Therefore, ignoring provincial and regional differences and assuming one consumption basket for the whole country may give misleading poverty estimates across provinces and their rural and urban areas.

[11] Economic theory indicates that a change in the price of a commodity changes the level of utility. As a result, the consumer moves from one indifference curve to another. As price changes affect income as well, a consumer can maintain the original level of utility by making substitutions in her consumption basket. In this situation, the consumer moves along the same indifference curve to achieve a constant utility by altering her consumption basket.

In order to account for the provincial variation and variation across rural and urban sectors, the calorie-expenditure function was estimated using intercept and slope dummies. We also tested for the appropriateness of the functional form. The log-linear form of the calorie expenditure function was found to be the best fit. The results show that the calorie expenditure functions are different in both intercept and slope across provinces and by urban rural areas (see Table 8)[12]. Therefore, we estimated different poverty lines for the urban and rural areas of each province. The national and provincial poverty lines are calculated as the weighted average of these spatial lines, where spatial population is used as weights. Previous studies including Jamal (2012) do not test for the differences in functional forms across provinces, which can be the source of a serious bias.

Table 8: Estimates of calorie-expenditure functions

Dependent variable= log of expenditure per capita per day	Coefficient	t-statistics
Calories per adult equivalent per day	0.264***	16.438
Intercept Dummies		
Dummy for Rural (= 1 if observation is rural)	-0.290***	-8.559
Dummy for Sindh	0.063**	2.062
Dummy for KPK	0.080**	2.037
Dummy for Balochistan	0.141***	4.534
Slope Dummies		
Dummy for Rural*Daily Adult Equivalent Calories	0.063***	3.82
Dummy for Sindh*Daily Adult Equivalent Calories	-0.017	-1.184
Dummy for KPK*Daily Adult Equivalent Calories	-0.038**	-2.097
Dummy for Balochistan*Daily Adult Equivalent Calories	-0.057***	-4.066
Constant	3.762***	115.038
Number of observations		10,043
F(9, 16,172)		329.8
R-squared		0.317

Source: Authors' estimations using HIES 2010-11 data
Note: *** p<0.01, ** p<0.05, * p<0.1; Robust standard errors in parentheses

To demonstrate the sensitivity of poverty estimates for the choice of consumption basket, we estimated four sets of poverty lines based on differing per capita expenditure quartiles. These sets of poverty lines represent the consumption baskets of: i) the bottom 25 percent of households (PL1); ii) the bottom 50 percent of households (PL2); iii) the bottom 75 percent of households (PL3), and iv) all households (PL4) [13]. The poverty lines and poverty headcounts based on these alternatives are presented in Table 9. For comparisons, this table also reports the poverty line and headcounts estimated using the inflated official poverty line[14], along with the estimates of Jamal (2012). To remind the reader, Jamal's poverty line is based on the consumption basket of the lowest quartile, while official estimates were based on the basket of lowest three quintiles. For comparison with the official line, we estimated poverty using the consumption basket of bottom 60 percent households.

Poverty based on the consumption basket of households in the bottom quartile

The estimated poverty line using the bottom 25 percent of households is Rs 1,729 per capita per month—Rs 1804 in urban areas and Rs 1692 in rural areas. Based on these poverty lines, the incidence of poverty is 22 percent—13.6 percent in urban areas 26.1 percent in rural areas. This poverty line and poverty headcount are lower than Jamal's (2012) (Rs 1,984 per adult equivalent per month). Contrary to our finding, Jamal (2012) found a marginal difference in the poverty estimates of rural and urban areas. This may be due to using different estimation methods. As explained earlier, we controlled for the variations across the rural urban areas of all provinces while Jamal (2012) controls only for the variations across urban and rural areas nationally. This poverty line, which represents the consumption patterns of the bottom quartile, is very close to

[12] No significant difference in the slopes of Sindh is observed.
[13] We assume here that different expenditure quartiles represent different consumption baskets.
[14] Poverty line of 2007-08 is inflated using the CPI of 2010-11

the official poverty line of Rs. 1,742 per capita per month. However, the official poverty line is estimated using the consumption basket of the bottom of 60 percent of households.

Table 9: Poverty line and poverty headcount for four consumption baskets for 2010-11

	Pakistan		Urban		Rural	
	Poverty Line 1 (PL1) (Rs.)	Poverty Head-count (%)	Poverty Line 2 (PL2) (Rs.)	Poverty Head-count	Poverty Line 2 (PL3) (Rs.)	Poverty Head-count
Authors estimates (per capita per month)						
Bottom 25% households	1,729	22.0	1,804	13.6	1,692	26.1
Bottom 50% households	2,080	37.2	2,248	29.2	1,997	41.3
Bottom 75% households	2,394	49.7	2,723	44.0	2,230	52.5
All households	2,926	63.4	3,977	71.5	2,403	59.4
Comparison with Jamal (2012)						
Jamal (2012)	1,990	36.6	2,248	35.5	1,854	37.1
Bottom 25% households	1,729	22.0	1,804	13.6	1,692	26.1
Comparison with official poverty line (per capita per month)						
Inflated official Poverty Line	1,742	22.7	1,742	12.1	1,742	28.0
Bottom 60% households	2,204	42.4	2,424	34.6	2,094	46.2

Source: Jamal (2012) and own estimation using HIES 2010-11
Note: Households are grouped on the basis of per capita expenditure quartiles.
Inflated official poverty line is computed using the poverty line of 2001-02 and CPI reported in Economic Survey 2013-14.

Poverty based on the consumption basket of households in bottom two quartiles

Based on the bottom two quartiles, the estimated poverty line (PL2) is Rs 2,080 per capita per month. This poverty line is Rs 351 per capita per month (or 20%) higher than PL1. This increase pushes an additional 19.8 million population (or 15.3%) below the poverty line, so that overall poverty is 37.2 percent under this assumption. The proportion of urban population below the poverty line is 29.2 percent (an increase of 15.5 percentage points) and rural poverty increased to 41.3 percent (an increase of 15.1 percentage points).

Poverty estimates based on the consumption basket of households in bottom three quartiles

The poverty line increases to Rs 2,394 per capita per month when the consumption basket of households in the bottom three quartiles is considered. An additional increase of 12.5 percent is observed in the population falling below the poverty line. Using PL3, overall poverty is 49.7 percent; urban poverty increases to 44 percent and rural poverty increases to 52.5 percent.

Poverty estimates based on the consumption basket of all households

When all households are taken into consideration, the poverty line increases to Rs 2,926 per capita per month. The poverty incidence based on this line increases to 63.4 percent—71.5 percent in urban areas and 59.4 percent in rural areas. This may be due to the fact that the households of 4th quartile have significantly high expenditure as compared to the households in the first two quartiles. This drives the poverty line upward and may present a relative picture of poverty. Similar to the other estimates, this poverty line shows significant differences across urban and rural areas.

A comparison with official poverty line

The inflated official poverty line, which is based on the estimation from the bottom three quintiles (and subsequently extrapolated) is Rs 1,742 per capita per month which is significantly lower than the Rs. 2204 per capita that is estimated using the calorie-expenditure function on the data of HIES 2010-11 for the consumption basket of bottom 60 percent households. The poverty estimates based on the inflated official poverty line for 2010-11 is 22.7 percent. However, using the estimated poverty line based on the bottom 60 percent, the poverty estimates become almost double (42.4%).

These results show that the overall poverty estimates from the same data set can lie between 22 to 63 percent based on the assumptions made about the choice of the consumption basket that best represents the poor and the estimation technique.

We believe that the poverty line based on the consumption of the bottom two quartiles should be used to estimate poverty, since, based on our verification from ongoing assessments, all over Pakistan this best represents the consumption patterns of the poor in 2010-11. Based on this assumption, overall poverty for 2010-11 is estimated at 37.2 percent overall—29.2 percent urban and 41.3 percent rural (see Table 9).

Annexure Figure 1 displays the different poverty lines superimposed upon the distribution of the population from the HIES 2010-11 to highlight the discussion presented above. It shows how the relative position of the official poverty line versus the one by Jamal compared to our estimated line. In particular, it highlights how estimates of poverty derived from the same underlying distribution can differ so much and how sensitive these estimates are to the estimated poverty line.

Differences across Provinces

Disaggregating poverty lines and poverty incidence across provinces presents some interesting results (Table 10). First, overall poverty is highest in Sindh across all consumption baskets. Second, the gap in rural-urban poverty is highest in Sindh as well. Third, the incidence of poverty (poverty headcount) is not significantly different across rural and urban areas in KPK. Fourth, rural poverty is nearly 8 percentage points higher than urban poverty in Baluchistan, when the consumption basket of bottom 25 percent is considered. However, this difference declines as the poverty lines move upward. Fifth, as compared to rural population, a higher number of the urban population is pushed into poverty as the poverty lines move upward.

Table 10: Poverty estimates at provincial level for four consumption baskets for 2010-11

	Bottom 25% households		Bottom 50% households		Bottom 75% households		All households	
	Poverty Line 1 (PL1) (Rs.)	Poverty Head-count (P01)	Poverty Line 2 (PL2) (Rs.)	Poverty Head-count (P02)	Poverty Line 3 (PL3) (Rs.)	Poverty Head-count (P03)	Poverty Line 4 (PL4) (Rs.)	Poverty Head count (P04)
Punjab	1,718	26.4	2,077	40.5	2,391	50.1	2,866	61.6
Urban	1,850	20.4	2,288	35.4	2,740	46.9	3,826	69.4
Rural	1,656	29.2	1,978	42.9	2,228	51.6	2,420	58.0
Sindh	1,764	31.5	2,127	44.8	2,484	55.2	3,387	72.0
Urban	1,744	16.8	2,203	32.1	2,743	48.0	4,484	78.5
Rural	1,783	45.3	2,056	56.7	2,239	62.0	2,356	65.9
KPK	1,716	27.5	2,015	40.5	2,280	51.8	2,558	61.5
Urban	1,778	23.8	2,153	36.9	2,552	51.1	3,231	70.1
Rural	1,703	28.3	1,987	41.3	2,225	52.0	2,420	59.7
Balochistan	1,735	26.5	2,083	42.4	2,320	53.7	2,477	60.1
Urban	1,729	19.8	2,247	41.7	2,609	54.7	2,945	65.1
Rural	1,737	28.6	2,033	42.6	2,232	53.4	2,334	58.6

Source: Estimated from HIES 2010-11

These results show clear differences not only across provinces but also within provinces across rural-urban areas. In KPK and Balochistan, most of the urban population is concentrated in a few urban areas. Growing slum areas may be a contributing factor in the higher incidence of urban poverty in these provinces. An increase in urban poverty with an increase in poverty lines indicates that a considerable portion of the urban population is vulnerable. Any negative economic shock can push them below poverty line.

Annexure Figure 2 shows the estimates of poverty across provinces and by rural areas.

3.5 Sensitivity of estimates to caloric threshold underlying the poverty lines

A comparison of poverty headcount based on PL1, PL2, PL3, and PL4 indicates that poverty measures are extremely sensitive to the selection of a threshold level of expenditure, which in turn depends on the minimum calorie norms. The poverty line moves upward (downward) by increasing (lowering) the threshold level of expenditure. This results in a higher

(lower) proportion of poor. In this section, we demonstrate the sensitivity of poverty estimates for the threshold level of minimum calorie level.

As mentioned earlier, the Government of Pakistan set the minimum calorie threshold at 2350 per capita per day for the estimation of official poverty line in 2002. Recently Government of Pakistan (2011) suggests a consumption basket required to fulfill 2150 calories per capita per day. Jamal (2012) used 2550 for rural areas and 2250 for urban areas. To illustrate the sensitivity of the poverty estimates to the caloric cut-off chosen for the estimation of poverty line, we estimate the poverty line for different threshold levels of calories ranging from 1600 to 2700 for four consumption baskets (see Table 11).

Table 11: Sensitivity of Calorie Intakes to poverty lines expenditures (2010-11)

	Expenditure required to meet the per day calories requirement (Rs/capita/month)				
	(1)	(2)	(3)	(4)	(5)
Calorie per adult equivalent per day	Bottom 25% house-holds	Bottom 50% house-holds	Bottom 60% house-holds	Bottom 75% house-holds	All households
1600	1,479	1,698	1,770	1,872	2,036
1700	1,510	1,744	1,822	1,934	2,136
1800	1,542	1,792	1,876	1,999	2,242
1900	1,574	1,841	1,932	2,065	2,353
2000	1,607	1,892	1,989	2,134	2,469
2100	1,641	1,944	2,048	2,205	2,592
2200	1,676	1,997	2,109	2,279	2,720
2300	1,711	2,052	2,172	2,355	2,856
2350	**1,729**	**2,080**	**2,204**	**2,394**	**2,926**
2400	1,747	2,109	2,236	2,433	2,998
2450	1,766	2,138	2,269	2,474	3,071
2500	1,784	2,167	2,303	2,515	3,147
2550	1,803	2,197	2,337	2,556	3,224
2600	1,822	2,227	2,371	2,599	3,304
2700	1,860	2,288	2,442	2,686	3,469

Source: Computed from HIES 2010-11

The results show that the level of minimum expenditure set by the inflated official poverty line (Rs. 1742 per capita) is not enough to buy even 1600 calories if the consumption basket of the bottom 60 percent is used (see Table 11, column 3). However, using the consumption basket of bottom 25 percent, households are able to buy the recommended amount of calories for Rs 1729 per capita. We have discussed that the consumption basket of the bottom 25 percent is composed mostly of wheat and fats. This basket is affordable by most Pakistani households. However, with the consumption basket of the bottom 50 percent of households, the official poverty line expenditure can buy only 1700 calories per adult equivalent per day. This amount is even less than the minimum dietary energy requirement (1740 kcal/capita/day) recommended by the FAO (2008).

Changing the calorific norms on an ad hoc basis has the potential for creating further confusion in the inter-temporal comparison of poverty levels. Such changes should be based on detailed and sophisticated analysis by considering the demographics and distribution of population across different regions, climate and geographic terrain, and the levels of physical activities involved in the lifestyles.

4. CONCLUSIONS

Using the latest household survey data of HIES 2010-11, this paper highlights issues surrounding the accurate estimation of poverty measures. The poverty line is estimated using the calorie-expenditure function for different food baskets and

different calorie norms. The results show that using the CPI to extrapolate the official poverty line leads to seriously underestimated levels of poverty. The results also indicate that there are statistically significant differences in the calorie-expenditure functions not only across provinces but also within provinces and across rural and urban areas. The results show significant changes in the poverty estimates when either the consumption basket is changed or the minimum threshold level of calories is changed.

Modifications in the sampling frame of HIES to represent the entire population of Pakistan are essential. The urban sampling frame of HIES was revised after the introduction of the Pakistan Social and Living Standards Measurement Survey (PSLM) in 2004-05. The household income and consumption part of the HIES has gone through several improvements. However, the current official poverty line does not capture these changes and the raised numbers from **the HIES show a serious underestimation/underrepresentation of the true population of the country**.

Removing the urban bias from the computation of CPI is crucial for inflation adjustments. The urban bias in CPI and exclusion of some areas from the sampling frame of the HIES can also under or over-estimate poverty numbers. Similarly the under-coverage of food expenditures in the underlying weights also biases the CPI. We recommend an immediate review of the biases in these indices and how these can best be removed.

The choice of appropriate consumption basket is crucial for the accuracy of poverty numbers. These results show that the poverty estimates fall **between 22 to 63 percent** when the consumption basket used to estimate the poverty line is varied, as an entirely different poverty line and associated poverty estimates emerge when the line is estimated from a different consumption cohort. The value of the poverty line in Rupees per capita needed to meet the same level of calories increases by 69 percent and the resulting estimate of the poor increases by three times[15] as we move up the expenditure quartiles. The official poverty line is estimated for households in the bottom three quintiles, i.e., bottom 60 percent of households. The data of HIES 2010-11 show that household in the bottom two quartiles are on average consuming less than even the recommended minimum calorie intake per day of 2350 used in the estimation of official poverty line.

Using separate poverty lines to account for the differences across provinces and rural urban areas is critical. The estimated calorie-expenditure function that controls for provincial and rural urban differences shows significant differences in intercepts and slopes. Therefore, we estimated different poverty lines for the urban and rural areas of each province. The national poverty line is calculated as the weighted average of these spatial lines, where spatial population is used as weights. Based on these results, we strongly recommend a revision of the official poverty line taking into cognizance the differences across provinces and rural urban sectors. We recommend estimation of the poverty lines separately for the urban and rural areas of all provinces.

Setting a country based, scientifically approved minimum calorie requirement is important for accurate poverty estimates. We find that the minimum expenditure suggested by the CPI inflated official poverty line is not enough to even buy 1700 calories per adult equivalent. The method of extrapolating the 2001-02 poverty line using the CPI is clearly NOT reasonable. It is interesting to note that the official poverty line was estimated on the sample of households fall in the bottom three quintiles of per capita expenditure (the bottom 60% of households). Estimating a new poverty line on bottom 60 percent household gives a much higher proportion of the poor that the official estimates. In this regard, we suggest the use of different calorie norms for rural and urban areas and greater sensitivity analysis. A study to set these norms is clearly warranted.

Consistent use of the same methodology is crucial for inter-temporal comparisons. Estimates of poverty vary significantly with the assumption underlying the methodology. It is therefore crucial to use the same methodology and assumptions for inter-temporal comparisons. Annexure Figure 2 highlights how the use of the more sophisticated and accurate methodology leads to much higher than trend values of poverty for Pakistan in 2010-11.

[15] Increase in the urban poor is more pronounced (58 percentage points) than increase in the rural poverty (33 percentage points).

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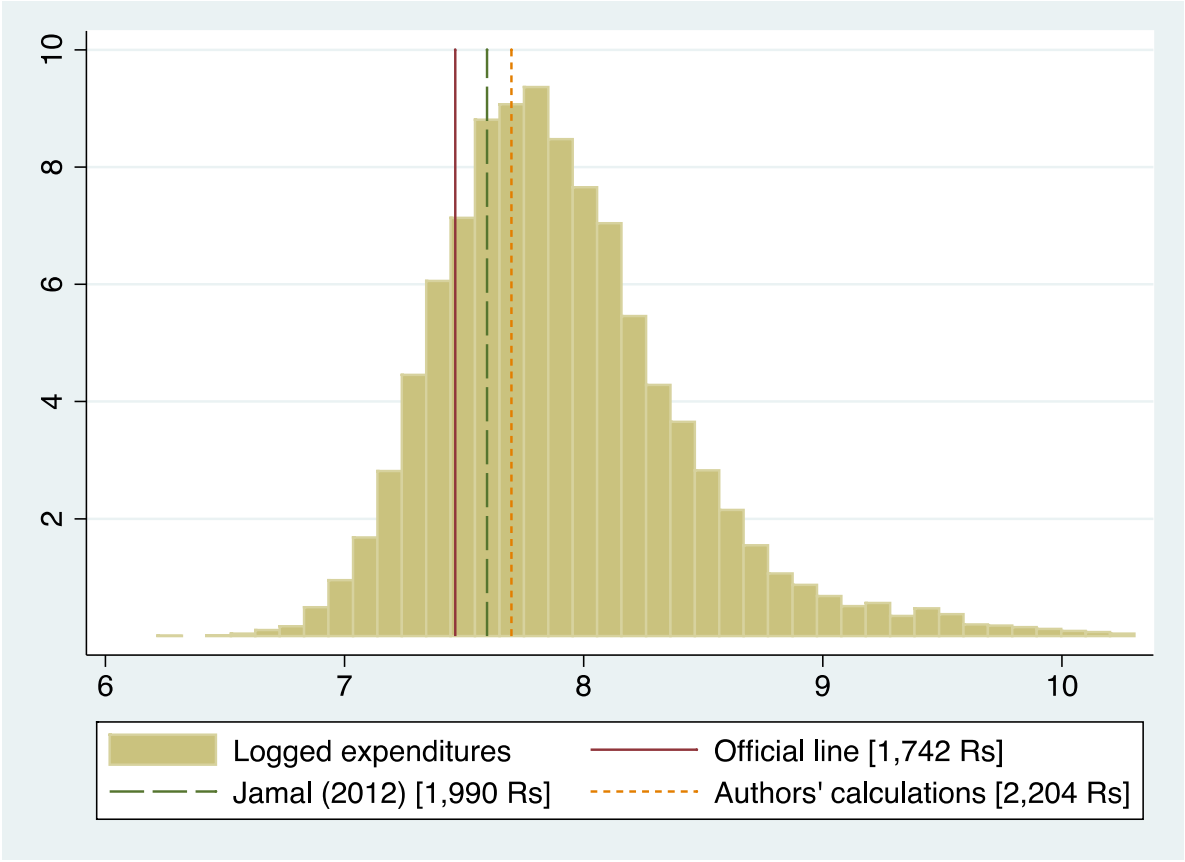
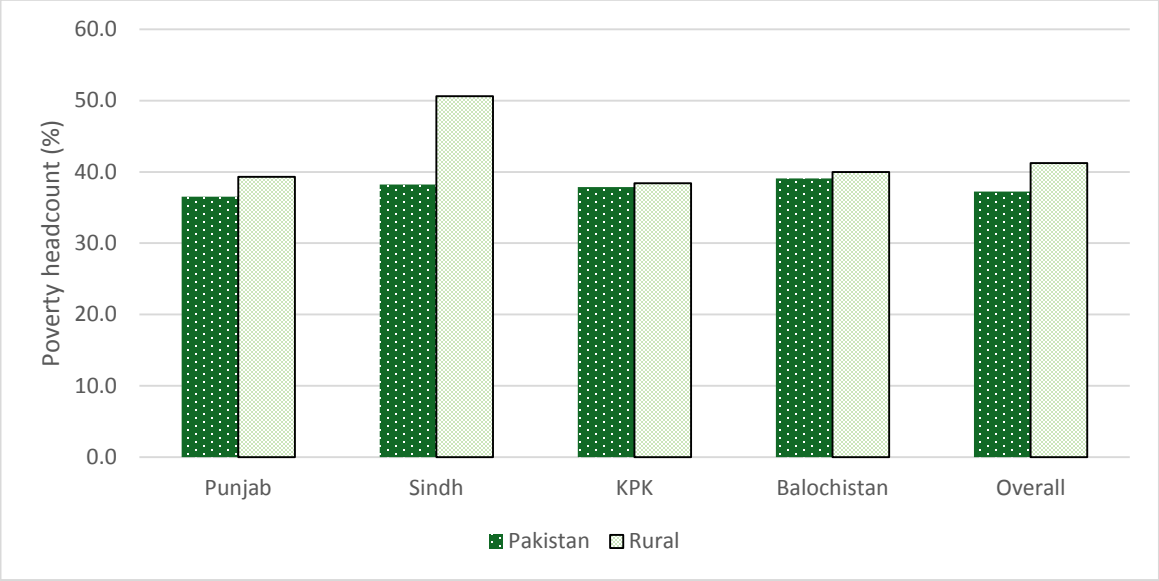
Annexure Figure 1: Monthly Per Capita Expenditures and Poverty Lines



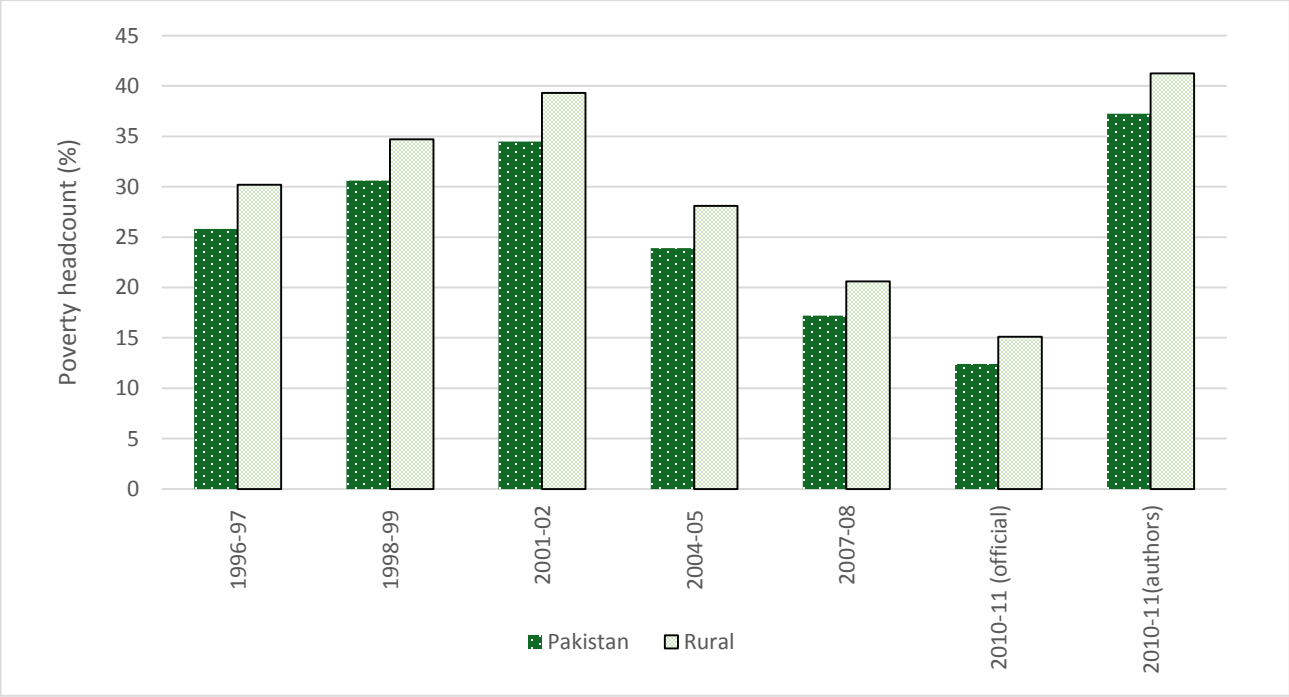
Source: Prepared from HIES 2010-11

Annexure Figure 2: Poverty Incidence 2010-11: Rural and All Pakistan by Province (Based on Consumption Basket of Bottom 50% of Households)



Source: Prepared from HIES 2010-11

Annex Figure 3: Trends in Official Poverty Estimates 1997 to 2004 and Authors Estimates 2010-11



Source: Government of Pakistan (2008; 2014) and author's estimation for 2010-11

APPENDIX: METHODOLOGY FOR THE ESTIMATION OF THE POVERTY LINE

To estimate the poverty line, we follow the methodology outlined in the PRSP-1 (2003). This procedure uses the consumption aggregates as a welfare indicator. The consumption aggregate includes food items, fuel and utilities, housing (rent, imputed rent and minor repair), frequent non-food expenses (household laundry and cleaning personal care products and services) and other non-food expenses (clothes, footwear, education, and health related expenses). However, some expenses such as taxes, fines and expenses on marriage or funeral and durable items are not included in the consumption aggregate because these are not related to living standards. An adjustment in the aggregate consumption expenditure is made by using the nutrition based adult equivalent scales, which differentiate, between households on the basis of gender and age and therefore transform the number of persons in a household to adult equivalents. The minimum calorie threshold is set at 2350 per adult equivalent per day. To estimate the poverty line, we estimate the calorie-expenditure function that computes a monetary value of the poverty line at which "basic needs" are met (Ravallion 1998). The calorie-expenditure is written as:

$$lnEi = \alpha + \beta Ci + \varepsilon \qquad (1)$$

where *lnE* is the log of per capita expenditure, *C* is the calories per adult equivalent per day for person i, and ε is the error term, which is assumed to be to be normally distributed, with mean zero and variance σ^2. Using the minimum calorie threshold and estimated coefficients of equation 1, the poverty line can be estimated as:

$$z = \exp(\hat{\alpha} + \hat{\beta} C_{min})$$

Where z is the poverty line, $\hat{\alpha}$ and, $\hat{\beta}$ are the estimated coefficients and C_{min} is the minimum threshold of required calories.

Estimation of poverty measures

After estimating the poverty line, the Foster-Greer-Thorbecke (FGT) (1984) measures of poverty can be computed. The Foster-Greer-Thorbecke (1984) measure of poverty, is $P_\alpha = \frac{1}{N}\sum_i \left[\frac{z-y_i}{z}\right]^\alpha$, where P_α is the poverty measure, *N* the total number of all households, *z* the poverty line, and y_i the income or expenditure of poor household *i* (the summation occurs only over poor households defined as those where $y_i < z$). Different values of α (α = 0, 1, and 2) yield different measures of poverty, by giving different weights to the degree of poverty and inequality among the poor. When α = 0, the poverty measure P_0 is the incidence of poverty, i.e., the proportion of households whose income is below the poverty line (or headcount ratio). When α = 1, the poverty measure P_1 is the poverty-gap measure. The poverty-gap is equal to the headcount ratio multiplied by the average gap between the poverty line and the income of a poor household, expressed as a percentage of the poverty line. Thus, it takes into account the depth of poverty as well as the percentage of households that are poor. If α = 2, then the poverty measure P_2 takes into account the degree of inequality among poor households, as well as the depth of poverty and the number of poor households. This 'poverty-gap squared' provides a measure of the severity of poverty.

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Acknowledgements

The authors would like to thank Madeeha Hameed of IFPRI and Zunaira Mughal of the Innovative Development Strategies (Pvt.) Ltd. Pakistan for research assistance. This paper has been prepared under the IFPRI-USAID Pakistan Strategy Support Program. All errors of omission or commission are the responsibility of the Authors

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This Working Paper has been prepared as an output for the Pakistan Strategy Support Program, funded by USAID, and has not been peer reviewed. Any opinions stated herein are those of the author(s) and are not necessarily representative of or endorsed by the International Food Policy Research Institute.