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Poverty and Vulnerability Estimates: Pakistan, 2016

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ABSTRACT

The main objective of this research is to provide poverty and vulnerability statistics estimated from the latest available Household Integrated Economic Survey (HIES) data. Poverty estimates show that close to 38 percent population of Pakistan was living below the poverty line during the year 2015-16. The incidence, depth and severity of rural poverty are relatively higher as compared to urban areas.

Inter-temporal changes in poverty incidence for various years during the period 1988-2016 are also furnished by using the consistent methodology for defining and computing national and regional poverty lines and poverty incidences. The research reveals that the national poverty incidence in terms of percentage of population is similar to that estimated for the year 2010-11. However, in terms of absolute number of poor, 74 million persons were estimated poor during the year 2015-16, while the estimated poor population was 61 million in the year 2010-11.

This research note also furnishes estimates of household vulnerability to poverty in Pakistan. The estimates show that close to 51 percent population was vulnerable to poverty during 2015-16. The vulnerability of rural households is significantly high as compared to the vulnerability incidence in urban areas.

JEL Classification: I3, C31, D3

Keywords: Poverty, Vulnerability, Cross-Section Data, Pakistan

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1. BACKGROUND

According to Pakistan Economic Survey (PES) 2015-16, "the government demonstrated the difficulty in presenting lower official poverty estimates of around 17 percent[1] in the wake of global financial crisis and domestic economic meltdown. The figure of 12.4 percent for the year 2010-11 furthered skepticism". It was also highlighted in PES that using the old methodology of poverty estimation, only 9.3 percent people were found below poverty line in 2013-14.

The technical committee, which was formed in 2012 by Planning Commission of Pakistan to review the official methodology, pointed out the following limitations to estimate poverty from household consumption data collected through Household Integrated Economic Surveys (HIES):

1. The poverty line and basket estimated in 2001 on the basis of 1999 data has become outdated and no more fully reflect changes in income and consumption patterns of society;
2. The official methodology does not fully comprehend the variation in consumption patterns especially in non-food segment;
3. The adjustment of poverty line by using Consumer Price Indices (CPI) is likely to create an urban bias which is misrepresenting the poverty situation.

The poverty document of PES indicates that three decisions were made to overcome the problems in the old methodology; change in reference group, keeping calorie requirements constant and adopting the Cost of Basic Need (CBN) methodology instead of calorie-consumption framework. Let us examine these revisions in turn.

In the revised methodology, the reference group covers households that lie in the 10^{th} to 40^{th} percentile of the distribution of per adult equivalent consumption expenditure. Although it is a usual practice to consider consumption patterns of the bottom of the population distribution (lowest quartile or quintile) for the poverty estimation, the choice of reference group in this manner casts doubts over the whole exercise of poverty estimation and it seems that the methodology is adjusted to obtain a required poverty number by trial and errors.

Minimum requirement is kept at 2,350 calories per adult equivalent per day as it was in the old methodology. However, the rural lifestyle in general requires a greater consumption of calories than the urban lifestyle. It is not irrational to assume that for any given level of

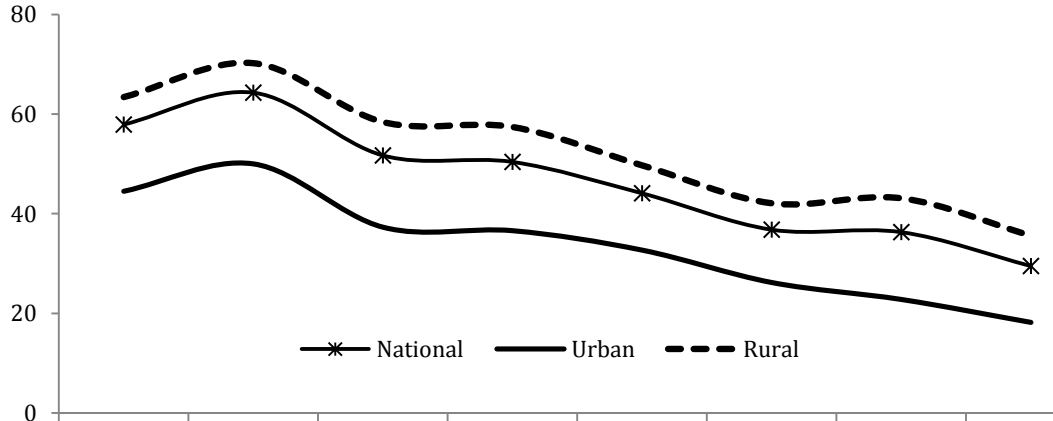
[1] For the year 2007-08

income, rural households are likely to consume more calories, on average, than their urban counterparts. Thus the poverty estimates derived from this methodology using a unique calorie threshold for both urban and rural areas seems inappropriate.

In the standard CBN methodology[2]; a basic food basket of items is selected, the quantities in the basket are adjusted for the minimum nutritional requirements; and then the cost of acquiring the basket is calculated. In contrast, the Annexure-III of the PES reveals that to obtain a food poverty line, the average spending on food of households in the reference group is translated into a certain level of calorie intake. The worrying factor in this exercise however is the non-adjustment of regional and provincial differences in the cost of living (food and non-food expenditure). The PES estimates one national poverty line, while the poverty document is silent regarding the adjustment of regional consumption differences.

According to the new methodology adopted by the Planning Commission of Pakistan for poverty estimation, 29.5 percent[3] of the population (55 million) is estimated to live below the poverty line in the year 2013-14; The urban incidence for 2013-14 is estimated at 18.2 percent, while 35.6 percent of rural population was designated as poor (Chart-1).

Chart-1
Pakistan's Official Poverty Estimates
[*Percentage of Population Living Below the Poverty Line*]



	1998-99	2001-02	2004-05	2005-06	2007-08	2010-11	2011-12	2013-14
National	57.9	64.3	51.7	50.4	44.1	36.8	36.3	29.5
Urban	44.5	50.0	37.3	36.6	32.7	26.2	22.8	18.2
Rural	63.4	70.2	58.4	57.4	49.7	42.1	43.1	35.6

Source: Pakistan Economic Survey (2015-16), Annexure III, Table-1, Ministry of Finance, Government of Pakistan

[2] For methodological choices, see Jamal (2002)

[3] Using the old official methodology, the poverty incidence for the year 2013-14 was estimated at 9.3 percent (17 million persons).

It is however surprising that despite many criticisms on using CPI for updating poverty headcounts; the Planning Commission used it to monitor inter-temporal changes in poverty estimates[4]. According to Chart-1 which furnishes inter-temporal official poverty estimates with the new methodology, approximately a reduction of 7 percentage points (23 percent) in poverty incidence is observed from 2010-11. It is however difficult to believe that 52 percent of the population was poor in 2004-05 which was the period of high GDP growth and very low inflation. Overall the chart indicates that poverty reduction phenomenon does not have any link with the performance of economy. For instance, poverty is continuously decreasing (7 to 8 percentage points) since 2001-02 irrespective of the trends in GDP growth and macroeconomic indicators. Interestingly, the reduction of rural poverty is almost 50 percent (from 70 to 36 percent) during this period, while the urban poverty has dropped from 50 to 18 percent.

According to official estimates, poverty reduction phenomenon does not have any link with the performance of economy. For instance, poverty is continuously decreasing – 7 to 8 percentage points – since 2001-02 irrespective of the trends in GDP growth and macroeconomic indicators.

Against this backdrop, this research note provides alternative estimates of poverty using household level data of various waves of HIES. Inter-temporal changes in poverty incidence are furnished by using a consistent and identical methodology[5] for defining and computing national and regional poverty lines and poverty measures. In the absence of any appropriate price index for inflating the previous poverty line, the poverty line is re-estimated from the latest survey to circumvent the problems associated with the CPI. Thus the methodology adopted in this research takes care of the flaws highlighted by the Technical Committee in the old official methodology.

This research note provides alternative estimates of poverty using household level data of various waves of HIES.

[4] The PES 2015-2016 says that "Back-casting this new poverty line to 2001-02, using the CPI, shows that the headcount rate using this new higher line would have been 64.3 percent in 2001-02—more than double the rate while using the old poverty line".

[5] Constant and identical methodology (see Jamal 2002, 2005 and 2013) is applied to estimate poverty for the years 1987-88, 1996-97, 1998-99, 2000-01, 2004-05 and 2010-11. Similar methodology is applied in this paper for the latest year 2015-16.

Traditional poverty measures often neglect several important dimensions of household welfare; therefore it is recommended by the poverty analysts that risk and vulnerability should be conceptualized as a component of poverty. However, the notion of vulnerability in the context of poverty is not as developed as the meaning and measurement of poverty[6]. For the purpose of empirical assessments and quantifications, the working concept of vulnerability developed by Alwang et al. (2001) is cited by several authors. They narrate "a household is said to be vulnerable to future loss of welfare below socially accepted norms caused by risky events. The degree of vulnerability depends on the characteristics of the risk and the household's ability to respond to risk. The outcome (vulnerability level) is defined with respect to some benchmark—a socially accepted minimum reference level of welfare (e.g., a poverty line)".

Traditional poverty measures often neglect several important dimensions of household welfare; therefore it is recommended by the poverty analysts that risk and vulnerability should be conceptualized as a component of poverty. Thus, besides estimating the poverty headcounts, this research also attempts to assess the extent of household vulnerability to poverty in Pakistan.

Thus, besides estimating the poverty headcounts, this research also attempts to assess the extent of household vulnerability to poverty in Pakistan. Preferably, household panel data of sufficient length should be used to measure the incidence of vulnerability. However, this data is rare in developing countries and, if available, is not nationally or regionally representative. As a second-best option, this study estimates the extent of vulnerability as "expected poverty" using cross-sectional HIES data for the year 2015-16.

The paper is organized as follows. Next section describes a brief methodology for estimating poverty line, while estimates of poverty indices and aggregates for the year 2015-16 are provided in section 3. An inter-temporal comparison is also furnished in this section. Estimates of vulnerability to poverty are presented in section 4, followed by few concluding remarks in the last section.

[6] There are differences in the interpretation of vulnerability and its relationship with different aspects of poverty. For instance, many practitioners describe vulnerability to poverty in relation to chronic poverty as the potential for people to enter into poverty. The notion of vulnerable to poverty is also reflected in the context of 'transient poor'. The transient poor are both the 'churning poor', who fluctuate above and beneath the poverty line and the 'occasionally poor', who occasionally dip into poverty due to an extreme decline in income. In this context, 'vulnerability' does not focus on those already in poverty – the chronically poor. Vulnerability to shocks is also considered an important aspect and is seen as being a cause of poverty. For a detailed discussion, see Prowse (2003).

2. ESTIMATION OF POVERTY LINE

To compute the poverty line by applying Food Energy Intake (FEI) approach[7], calorie norms (cut-off points) and estimated coefficients of the Calorie-Consumption Function (CCF) are required. The idea is to get the estimates of household expenditure required to obtain the minimum required calories. Consistent with the earlier poverty estimates by this author, this paper also follows the 2,550 and 2,230 calories per day per adult as calorie norms (minimum requirement) for rural and urban areas, respectively. Household food consumption is translated into calories using Food Consumption Tables for Pakistan (GoP, 2001).

The CCFs are estimated separately[8] for urban and rural areas. It is argued that consumption behavior, purchasing patterns, dietary habits, taste and ecology are significantly different for urban and rural groups. Again, to make the poverty numbers comparable with earlier poverty research by this author, these functions are estimated from the lowest quartile of distribution after ranking households with respect to per capita expenditure. Household per adult[9] daily calorie consumption is regressed on household expenditure. The results of these functions for the year 2015-16 are furnished in the Appendix-B. The estimated coefficients of calorie-consumption functions are applied to derive the poverty line for urban and rural areas.

Once a poverty line is defined, and the household poverty status is determined through relating poverty line and household consumption, the task is how to aggregate this information into a single index to proxy the status of a group of individuals. The issues in this regard primarily relate to assigning weights to differing intensities of poverty. The most popular measure, namely the Head Count Index (HCI) assigns equal weights to all the poor regardless of the extent of poverty. There are several other measures which are sensitive to distribution among the poor. 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 level of intensity of poverty. A brief description of poverty indices or poverty aggregates is provided in Appendix-C.

[7] Detail methodology of poverty line estimation is available in Jamal (2002), while a schematic view is reproduced in the Appendix-A.

[8] It is worth to remind hear that Government of Pakistan did not estimate separate urban and rural poverty lines. Thus poverty estimates derived from official methodology underestimate rural poverty and overestimate urban poverty as calorie requirement are generally low for urban habitants.

[9] Adult equivalent unit is estimated with the help of minimum requirement with respect to age and sex of member in household.

To monitor changes in the poverty level over time, poverty line for the latest survey year may either be updated by utilizing previous estimated poverty line after adjusting with some appropriate index of inflation or it may be re-estimated with the help of new available survey data. There are many criticisms on using Consumer Price Index (CPI) for updating previous poverty line due to its very low geographical coverage. CPI only covers major urban centers for tracking inflation and ignores price movement in rural areas and small urban locations. Therefore, as an alternative survey based price index, the Tornqvist Price Index (TPI) is suggested. However, it is not a problem-free option, since TPI can only incorporate homogenous goods like specific food items. Further, the household survey does not report the consumption of non-food quantities and provides only expenditures. These complications make TPI an inappropriate measure of inflation. The extent of adjustment in TPI can be ascertained from the fact that TPI includes only 75 items, whereas CPI includes more than 300 items.

Re-estimation of the poverty line is also criticized on the ground that for monitoring and tracking poverty numbers, the bundle of goods and services should remain the same and one should adjust the magnitude of the poverty line with price movement[10]. However, this criticism does not seem valid if the 'calorific approach' is used in deriving the poverty line. With fixed calorie thresholds or norms, the calorific approach estimates the amount of rupees required to obtain minimum required calories with the observed consumption pattern for the particular year.[11] Thus, in the absence of any appropriate price index for inflating the previous poverty line, it is perhaps reasonable and is also preferred for this research to re-estimate the poverty line from the latest survey to circumvent problems associated with price indices.

3. POVERTY UPDATES

Table-1 displays computed poverty lines from estimated calorie consumption functions. According to the table, rupees 4,250 and 3,792 per adult equivalent unit (or Rs. 3,627 and Rs. 3,153 per capita) per month were required for urban and rural areas respectively to consume minimum calories during the year

Table-1
Estimated Poverty Lines for the year 2015-16

	Urban	Rural
Per Day Calorie Requirements – Per Adult Equivalent Unit	2230	2550
Poverty Line – Rupees Per Adult Equivalent	4250	3792
Poverty Line – Adjusted for Per Capita Per Month**	3627	3153

** In order to ease in interpretation, minimum calorie requirements & converted into per capita term using household demographic data & proportionate minimum requirements. The minimum requirements by age & sex are available in Food Consumption Table for Pakistan (GoP 2001).

Source: Estimated from household level date of HIES, 2015-16.

[10] Ravallion (2016: 8) states, 'as long as there is substitutability, the poverty bundles must vary with prices'.

[11] For more discussion on this issue, see Jamal (2015).

2015-16. A population weighted average national poverty line, however, turns out as Rs. 3,928 per adult equivalent unit (or Rs. 3,294 per capita) at the prices of HIES 2015-16.

The estimated poverty lines for urban and rural areas are then mapped on household per adult equivalent total expenditure for computing various poverty measures or aggregates. Table-2 displays these poverty indices. Overall, 38 percent of the population was poor during the year 2015-16. The incidence, depth and severity of urban poverty are relatively lower as compared to rural areas.

Table-2
Estimates of Poverty Indices, 2015-16
[*Percentage of Population*]

	Pakistan	Urban	Rural
Head Count Index [Incidence]	37.9	31.9	41.2
Poverty Gap Index [Severity]	8.2	6.7	9.0
FGT2 Index [Depth]	2.5	2.1	2.8

Source: Estimated from household level date of HIES, 2015-16

Table-3 portrays the trend in poverty incidence since 1987-88. All these poverty numbers are estimated using unit record household level HIES data and by applying throughout a consistent and identical methodology for estimating poverty line and poverty indices. The table indicates that the latest national poverty incidence in terms of percentage of population for the year 2015-16 is similar to that estimated for the year 2010-11. Changes (rise and fall) are however observed in urban and rural poverty headcounts, leaving national poverty estimates unchanged. It is pertinent to note that in terms of absolute numbers, 74 million persons were estimated poor during the year 2015-16, while the estimated poor population was 61 million in 2010-11.

According to estimates of this research, close to 38 percent of the population (74 million approximately) was poor during the year 2015-16.

The table reveals a relatively higher incidence in rural poverty during the period 1987-88 and 2015-16. A comparison of 2001-02 and 2004-05, shows a decline of 3 percentage point in poverty incidence. Moreover, the decline in urban poverty is relatively less than the rural poverty. Rural poverty in this period has dropped with an annual growth rate of 4 percent, while the decline is about 2 percent in the case of urban poverty incidence. On the contrary, during 2004-05 and 2010-11, estimated poverty incidences are showing again an upward trend. Further, the rate of growth in rural poverty in this period is relatively higher (4.3 percent) than the increase in urban poverty incidence (3.6 percent).

An important finding of this study is that national poverty incidence in terms of percentage of population is similar to that estimated for the year 2010-11. Changes are observed in urban and rural poverty incidences, leaving national poverty estimate unchanged. However, in terms of absolute numbers, 74 million persons were estimated poor during the year 2015-16 as against 61 million in the year 2010-11.

Table-3
Trends in Poverty Incidence
[*Percentage of Population Living Below the Poverty Line*]

	1987– 88	1996–97	1998–99	2001–02	2004-05	2010-11	2015-16
Pakistan	23	28	30	33	30	38	38
		(2.4)	*(3.6)*	*(3.3)*	*(-3.0)*	*(4.4)*	*(0.0)*
Urban	19	25	25	30	28	34	32
		(3.5)	*(0.0)*	*(6.7)*	*(-2.2)*	*(3.6)*	*(-1.2)*
Rural	26	30	32	35	31	39	41
		(1.7)	*(3.3)*	*(3.1)*	*(-3.8)*	*(4.3)*	*(1.0)*

Note: Annualized Growth Rates (percent) from previous period are given in parenthesis.

Source: Latest estimates are based on HIES 2015-16. The poverty incidences for other years are taken from Jamal (2013). Consistent methodology and calorie norms are applied for all years.

In order to get an idea regarding reasons behind the stagnant poverty numbers after 2010-11, Table-4 is developed which shows the performance of Pakistan's key structural and stabilization indicators during the period 2011-15. The information in the table reveals that the inflation rate (CPI) – a major determinant of poverty – has been crashed from 14 to 5 percent. This trend in CPI with the improvement in budget deficit perhaps restricted the rise in the poverty level. Conversely, the growth in real GDP has slightly improved from 3.6 to 4.0 percent which was not enough to cause drop in the level of consumption poverty. Significant rupee depreciation as well as worsening current account balance are also observed during this period.

An important reason behind the stagnant poverty number during the period 2011-14 is the trend in the inflation rate (CPI), which is a major determinant of poverty. CPI has been crashed from 14 to 9 percent during this period. This trend in CPI with the improvement in budget deficit perhaps restricted the rise in the poverty level. Conversely, the growth in real GDP has slightly improved from 3.6 to 4.0 percent which was not enough to cause drop in the level of consumption poverty.

Table-4
Performance of Pakistan's Key Structural and Stabilization Indicators

	2010-11	2011-12	2012-13	2013-14	2014-15
Real GDP Growth Rate (Base Year, 2005-06)	3.6	3.8	3.7	4.1	4.0
• Agriculture	2.0	3.6	2.7	2.7	2.5
• Manufacturing	2.5	2.1	4.6	4.5	3.9
• Service Sector	3.9	4.4	5.1	4.4	4.3
Domestic Saving – Percent of GDP	9.7	7.8	8.7	7.5	8.4
Private Investment – Percent of GDP	9.3	9.7	9.8	8.9	10.2
Rate of Inflation – CPI	13.7	11.0	7.4	8.6	4.5
Budget Deficit – Percent of GDP	6.5	8.8	8.2	5.5	5.3
Capital Market – KSE 100 Index (1991 = 1,000)	12,496	13,801	21,006	29,653	33,729
Current Account Balance – Percent of GDP	0.1	-2.1	-1.1	-1.2	-1.0
Exchange Rate (Rupees per US Dollar)	85.5	89.2	96.7	102.9	101.3

Sources: Pakistan Economic Survey, 2015-16 | Statistical Supplement, 2013-14

4. ESTIMATES OF VULNERABILITY TO POVERTY

In general, there are three approaches to measure vulnerability in the literature: vulnerability as expected poverty (VEP), vulnerability as expected low utility (VEU) and vulnerability as uninsured exposure to risk (VER). Irrespective of different approaches, vulnerability is a function of expected mean and variance of household's consumption. The expected mean is determined by various individual and community characteristics while the variance is affected by idiosyncratic and covariate shocks as well as individual's capacity to use different strategies against these shocks (Gunther and Harttgen, 2009).

The utility based approach (VEU) proposed by Ligon and Schechter (2003) is based on the concept of risk aversion. It provides a clear disaggregation of vulnerability due to either poverty or uninsured risk. The risk component can be further divided into idiosyncratic, covariate and unexplained components. When a household faces with comparable returns, it is likely to use the less risky alternative with same utility. In contrast, VER which is developed by Glewwe and Hall (1998) differs from VEP in that it compares future consumption with an internal threshold set at the person's current consumption level. Using primarily panel data, VER makes an ex-post assessment of the extent to which welfare losses is caused by negative shocks. VER analyses 'change' in well-being due to uninsured risk and estimate vulnerability as the inability to smooth consumption in the presence of shocks.

The measurement of VEU and VER approaches however require panel or pseudo panel data, as these approaches deal with changes in household well-being. The appropriate panel data, however, is rarely available in developing countries, thus the VEP which can be calculated with cross-section data[12] is the most suitable approach to estimate vulnerability. According to this approach, vulnerability is measured by comparing future consumption with an exogenously given poverty threshold that is essentially a socially defined poverty line. The methodology first estimates a consumption function using household characteristics. Then, the mean (expected value) and variance of the consumption function is used to estimate the probability of a household becoming poor (vulnerable to poverty) in near future with a threshold of vulnerability. In general, VEP is the probability that a household will fall below the poverty line (typically defined by a threshold of income or consumption) in future if the household is currently 'non-poor'. It is also the probability

[12] For detail methodology, bibliography of studies on vulnerability and justification for using VEP, see Ratul and Daisy (2015).

that a currently 'poor' household will remain in poverty or will fall deeper into poverty in future.[13]

In the absence of appropriate panel or pseudo panel data in the context of Pakistan, this study uses VEP approach proposed by Chaudhuri et al. (2002) to measure vulnerability[14] from the latest available nationally representative household survey (HIES) data for the year 2015-16. These estimates are furnished in the Table-5, while final specifications of the selected consumption functions for rural and urban areas with the FGLS estimation results provided in the Appendix–E.

Table-5
Estimates of Vulnerability to Poverty – 2016
[*Percentage of Population*]

	Poor Population	Population Vulnerable to Poverty		
		Overall	Poor	Non-Poor
National:				
Overall	37.90	50.97	79.51	33.66
Urban	31.85	38.79	73.01	22.96
Rural	41.16	57.48	82.19	40.30

Source: Estimated from HIES (2015-16) data.

According to the table, close to 39 and 57 percent of urban and rural population respectively was vulnerable[15] to poverty in 2016, while the national estimate was 51 percent. As expected, vulnerability to poverty is higher amongst the rural households as compared to the urban. The vulnerable households not only include those that are already poor but also those who are currently above the poverty line and are subject to possible risk with little resources to mitigate such risk. The table also depicts the distribution of vulnerable population among poor and non-poor categories. It is disturbing that even 40 percent of rural non-poor population was vulnerable to poverty which

In terms of vulnerability to poverty, this research estimates that close to 39 and 57 percent of urban and rural population respectively was vulnerable in 2016, while the national estimate was 51 percent. As expected, vulnerability to poverty is higher amongst the rural households as compared to the urban.

[13] VEP is an ex-ante position i.e. the knowledge about the actual shocks beforehand while poverty is the ex-post situation where outcome is observed after the experience of the shocks (Holzmann and Jørgensen, 2001).

[14] A brief methodology of measuring vulnerability to poverty as proposed by Chaudhuri et al. (2002) is reproduced from Jamal (2009) in the Appendix-D. Jamal (2009) also adopted this approach for deriving vulnerability estimates for the year 2005 and 2001.

[15] Two options are available to set vulnerability threshold in the relevant empirical literature. Relative to observed poverty incidence, i.e., probability of being vulnerable is greater than the poverty incidence (headcount) and secondly, probability of being vulnerable is greater than 0.5. In most studies, vulnerability is estimated assuming 0.50 as the vulnerability threshold and consumption follows a log-normal distribution. Zhang and Wan (2008) show that the use of 50 percent as the vulnerability line is a better identification of vulnerability rather than the head count ratio. Besides, they find that, with the assumption of log-normal distribution, weighted average of past incomes is preferred to instrumented income as an estimate of permanent income. This study presents estimates based on 50 percent (0.5) as the vulnerability threshold.

suggests that in near future it is probable that these rural non-poor would become poor. The estimates also suggest that it is unlikely that close to 82 and 73 percent of rural and urban poor households respectively would be moved up.

A vulnerability profile by selected household characteristics is displayed in Table 6. The table depicts a positive correlation between vulnerability and household size. According to the table, about 77 percent of households with more than 9 members are vulnerable to poverty. The most vulnerable age group of head of household is less than 25 years after which a decrease in vulnerability is noted. The education level and literacy of head/spouse of household are an important determinant of vulnerability to poverty. As evident from the table, increase in the level of education significantly affects the incidence of vulnerability. For instance, only 6 percent of the population is vulnerable in households where head of the household has tertiary level of education against a 68 percent incidence in case of an illiterate head of the household. Moreover, the educational attainment of a spouse is a relatively stronger factor than the educational attainment of the head of the household in reducing vulnerability. The relationship between vulnerability to poverty and the economic activities in which households are engaged is also important from policy perspectives. In the agricultural sector, sharecroppers are the most vulnerable to poverty (84 percent), while vulnerability for wage employees (mostly in urban areas) is estimated at 58 percent.

Table – 6
Vulnerability Estimates for Selected Household Characteristics– 2016
[*Percentage of Vulnerable Population*]

Overall Vulnerable Population	50.97
Family Size	
1-5	25.16
6-9	52.92
More than 9	76.68
Age of Head of Household	
< 25	57.93
25-50	47.71
50 plus	42.57
Schooling of Head of Household	
Illiterate	67.54
Primary	58.31
Matric	38.16
Inter	22.61
Higher	6.11
Schooling of Spouse	
Illiterate	62.55
Primary	42.03
Matric	19.41
Inter	8.23
Higher	3.43
Occupational Status of Head	
Employer	13.08
Self Employed	46.28
Wage Employed	58.46
Own Cultivator	42.58
Sharecropper	83.85
Livestock Holder	55.84

Source: Estimated from HIES (2015-16) data.

The education level and literacy of head/spouse of household are an important determinant of vulnerability to poverty. Increase in the level of education significantly affects the incidence of vulnerability. Moreover, the educational attainment of a spouse is a relatively stronger factor than the educational attainment of the male head of the household in reducing vulnerability to poverty.

5. CONCLUDING REMARKS

This research note provides poverty updates, estimated from the latest available household survey of 2015-16. The estimates show that poverty headcount in terms of percentage of population is almost stagnant at the level of 2011. Overall, 38 percent of the population was poor during 2015-16. Changes (rise and fall) are however observed in urban and rural poverty headcounts, leaving national poverty estimates unchanged. In terms of absolute numbers, 74 million persons were estimated poor during the year 2015-16, while the estimated poor population was 61 million in the year 2010-11.

The percentage of rural poor is higher (41 percent) as compared to urban poverty incidence which is estimated as 32 percent. Similarly, the depth and severity of rural poverty are relatively higher as compared to urban areas.

Risk and vulnerability should be conceptualized as a component of poverty because traditional poverty measures neglect several important dimensions of household welfare. Assessment of vulnerability appraises household welfare incorporating both average expenditure and the risks that households bear. Thus, an attempt has also been made in this research to estimate vulnerability to poverty using the latest available household cross-sectional data. The vulnerability in the risk-response-outcome framework is best assessed or quantified with a rich panel or longitudinal data of households. Nonetheless, due to the non-availability of a nationally representative panel in Pakistan, methodology to compute vulnerability from cross-sectional data is adopted. Therefore, the vulnerability estimates are a ballpark figure and should be interpreted accordingly. Vulnerability estimates show that close to 51 percent population of Pakistan was vulnerable to poverty during 2015-16. As expected, probability of being vulnerable to poverty in the rural areas was relatively higher than the vulnerability incidence for urban counterpart.

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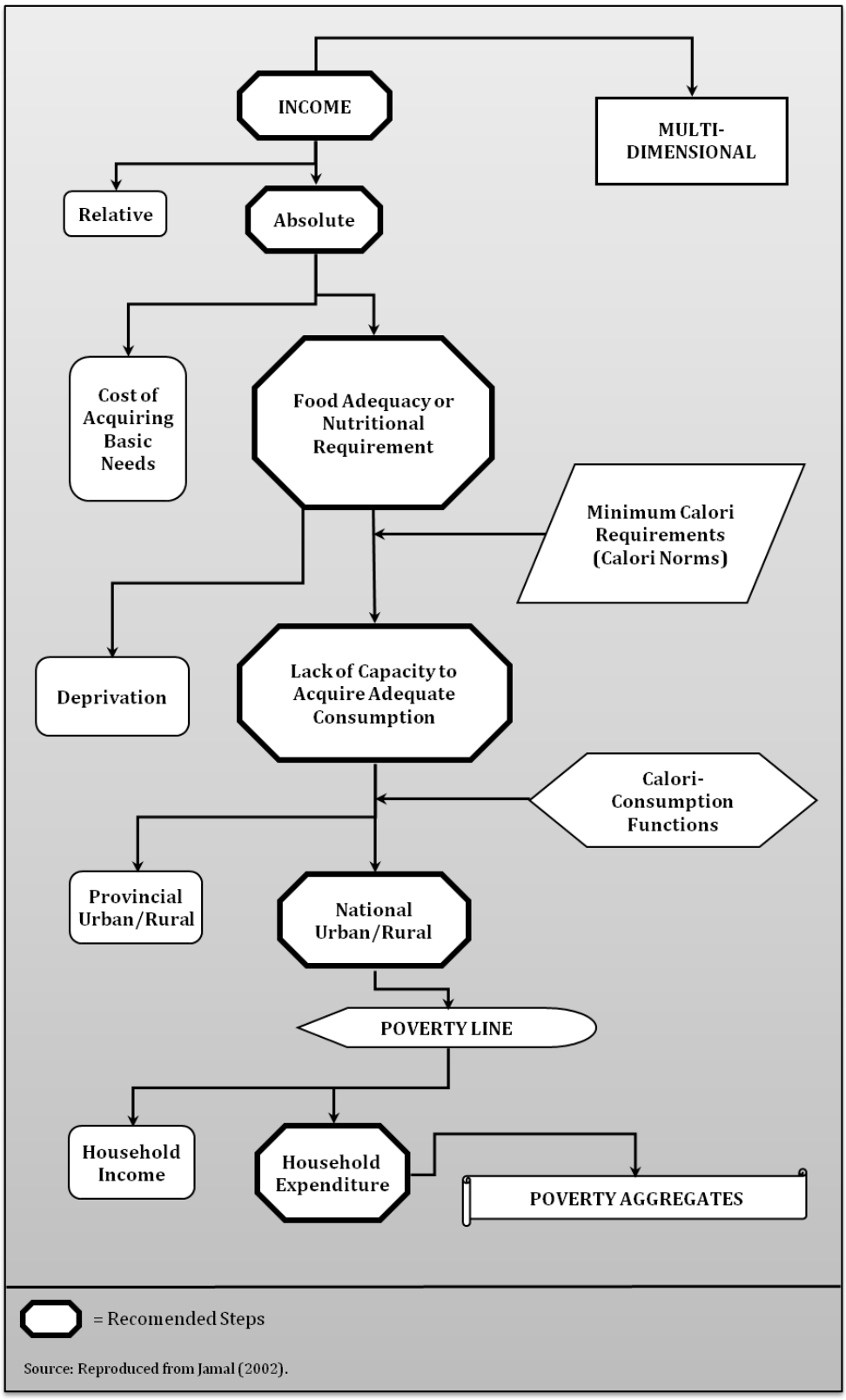
APPENDIX – A
APPROACHES TO ESTIMATE POVERTY LINE



Source: Reproduced from Jamal (2002).

APPENDIX – B
ESTIMATED PARAMETERS OF CALORIE-CONSUMPTION FUNCTIONS

[Dependent Variable = *Log (Calorie Consumption Per Adult Equivalent Unit)]*

	Estimated Coefficients	t-Value	R^2	F-Value
RURAL AREAS				
			0.22	69.783
(Constant)	7.25228616	201.532		
Per Adult Expenditure	.00016578	14.547		
Sindh Province	-.06865626	-4.659		
Khyber Pakhtunkhwa Province	-.07498276	-3.512		
Balochistan Province	-.19980216	-8.618		
URBAN AREAS				
			0.18	228.855
(Constant)	6.9261454	323.896		
Per Adult Expenditure	.00018447	29.113		
Sindh Province	-.0115511	-.978		
Khyber Pakhtunkhwa Province	.06406830	5.072		
Balochistan Province	-.0194403	-1.534		

Source: Estimated from household unit recode data of HIES, 2015-16.

APPENDIX – C
POVERTY INDICES

Once a poverty line is defined and the household poverty status is determined through relating poverty line and household consumption, the task is how to aggregate this information into a single index to proxy the status of a group of individuals. The issues in this regard primarily relate to assigning weights to differing intensities of poverty. The most popular measure, namely the Head Count Index (HCI) assigns equal weights to all the poor regardless of the extent of poverty.

There are several other measures which have been suggested. These measures are sensitive to distribution among the poor. A class of functional forms, which has been suggested by Foster, Greer, and Thorbeke (FGT) (Foster et.al., 1984) uses various powers of the proportional gap between the observed and the required expenditure as the weights to indicate the level of intensity of poverty. The higher the power the greater the weight assigned to a given level of poverty. It therefore, combines both the incidence and intensity. The following formula is used for measuring various poverty aggregates.

$$\boldsymbol{P^{\alpha}} = \left[\frac{\mathbf{1}}{\boldsymbol{N}}\right] \sum [(\boldsymbol{Z} - \boldsymbol{EXP}) \,/\, \boldsymbol{Z}]^{\alpha}$$

Where;

P^{α}	=	Aggregation measure
N	=	Total number of households
EXP	=	Household total expenditure
Z	=	Poverty line
$\sum$	=	Summation for all individuals who are below the poverty line

Putting α=0, the formula shows the HCI, i.e., proportion of households whose consumption fall below the poverty line. This simple measure ignores the depth of poverty.

Putting α=1, the Proportionate Gap Index or Poverty Gap Index (PGI) is calculated. It measures the average distance from the poverty line. Although, PGI shows the depth of poverty, it is insensitive to the distribution among the poor.

Putting α=2, FGT2 index is calculated. The index takes into account inequality amongst the poor and shows the severity of poverty by assigning greater weights to those households who are far from the poverty line.

APPENDIX – D
METHODOLOGY FOR ESTIMATING VULNERABILITY TO POVERTY[16]

The vulnerability should ideally be assessed with a longitudinal (panel) data of sufficient length and necessary information. The reason for using panel data is that without following households for several years, it is difficult to quantify the volatility faced by households and their responses to it. Household consumption variability may be estimated using cross-sectional or repeated cross-sectional information without panel. Nonetheless, it is argued that a focus on consumption variability (instead of volatility) will understate the true risk and perhaps the true vulnerability to risk (Morduch, 1994). Such a focus may lead analysts to ignore the adverse consequences of risk management strategies for permanent income or long-term improvements in well-being.

Nonetheless, panel data are rare in developing countries. Due to costs of data collection, panel data often suffer from small sample sizes and hence lack of representativeness. Panel data sets in developing countries also tend to be of shorter durations and therefore not as comprehensive as required for vulnerability assessments. Therefore, the second-best option to assess vulnerability to poverty is to use cross-sectional household surveys with detailed data on household characteristics, consumptions and incomes.

Chaudhuri et al (2003) developed a methodology[17] for estimating vulnerability to poverty using cross-sectional data. A household's vulnerability to poverty can be expressed as a probability statement reflecting its inability to attain a certain minimum level of consumption in the future. Formally, the vulnerability level of a household h at time t is expressed as the probability that the household will find itself consumption poor at time $t+1$ as:

$$V_{h,t} = \Pr\left(c_{h,t+1} \leq z\right) \qquad (1)$$

where $c_{h,t+1}$ measures the household's per capita consumption at time $t+1$ and z is an appropriate consumption benchmark (poverty line).

The probability that a household will find itself poor depends not only on its expected (mean) consumption but also on the volatility (i.e., variance, from an inter-temporal perspective) of its consumption stream. Therefore, both estimates (household expected

[16] This appendix is reproduced from Jamal (2009), section 2.

[17] Chaudhuri (2003) applied this methodology to Indonesia. Several authors also applied this methodology to estimate vulnerability in developing countries. For instance, Appiahi-Kubi et al (2008) and Jha and Dang (2008) used this methodology to assess vulnerability in Ghana and Papua New Guinea respectively.

consumption and the variance of its consumption) are required to quantify the level of household's vulnerability to poverty.

Assuming that the stochastic process generating the consumption of a household h is given by:

$$\ln c_h = X_h\beta + e_h \qquad (2)$$

where c_h is per capita consumption expenditure, X_h represents observable household characteristics such as household size, dependency ratio, educational attainment of the household head, etc., β is a vector of parameters, and e_h is a mean-zero disturbance term that captures idiosyncratic factors (shocks) that contribute to different per capita consumption levels for households that are otherwise observationally equivalent.

Two assumptions are necessary to make because vulnerability is estimated from a single cross-section[18]. First, it is assumed that the idiosyncratic shocks to consumption are identically and independently distributed over time for each household. This implies that unobservable sources of persistence (arising for example, from serially correlated shocks or unobserved household-specific effects) over time in the consumption level of an individual household are ruled out. It is also necessary to assume that the structure of the economy (captured by the vector β) is relatively stable over time, ruling out the possibility of aggregate shocks (i.e., unanticipated structural changes in the economy). By assuming a fixed β over time, it implies that the uncertainty about future consumption stems solely from the uncertainty about idiosyncratic shock, e_h, that the household will experience in the future.

The variance e_h however is not identically distributed across households and depends upon observable household characteristics. A simple functional form is used to relate variance of the consumption function and household characteristics.

$$\sigma^2_{e,h} = X_h\theta \qquad (3)$$

A three-step feasible generalized least squares (FGLS) procedure, suggested by Amemiya (1977) is used to estimate β and θ. First, equation (2) is estimated using an Ordinary Least Square (OLS) procedure. The residuals e_h from equation (2) are then regressed on X_h using OLS as follows:

[18] Without longitudinal data, the identification of parameters driving persistence in individual household consumption levels is not possible.

$$e^2_{OLS,h} = X_h\theta + n_h \quad (4)$$

The predicted values $X_h\hat{\theta}$ from this auxiliary regression are then used to transform equation (4).

$$\frac{e^2_{OLS,h}}{X_h\hat{\theta}} = \left\{\frac{X_h}{X_h\hat{\theta}}\right\}\theta + \frac{n_h}{X_h\hat{\theta}} \quad (5)$$

This transformed equation is estimated using OLS to obtain an asymptotically efficient FGLS estimate (θ_{FGLS}). It can be shown that θ_{FGLS} is a consistent estimate of $\sigma^2_{e,h}$ which is the variance of the idiosyncratic component of household consumption. Equation (2) is also transformed with the standard error of (θ_{FGLS}).

$$\hat{\sigma}_{e.h} = \sqrt{X_h\theta}FGLS \quad (6)$$

$$\frac{\ln c_h}{\hat{\sigma}_{e.h}} = \left(\frac{X_h}{\hat{\sigma}_{e.h}}\right)\beta + \frac{e_h}{\hat{\sigma}_{e.h}} \quad (7)$$

OLS estimation of equation (7) yields a consistent and asymptotically efficient estimate of β. The estimated β_{FGLS} and θ_{FGLS} symbolize expected log consumption and variance of log consumption respectively.

$$\hat{E}[(\ln c_h|X_h] = X_h\beta \quad (8)$$

$$\hat{V}[(\ln c_h|X_h] = e^2_h = X_h\theta \quad (9)$$

Assuming that the consumption is log normally distributed, the probability of a household vulnerability is now estimated as follows:

$$v_h = \widehat{Pr}(\ln c_h < \ln z|X_h) = \varphi\left[\frac{\ln z - X_h\beta}{\sqrt{X_h\hat{\theta}}}\right] \quad (10)$$

where φ is the cumulative density of the standard normal distribution and z is vulnerability threshold.

Following Chaudhuri et al. (2002), two threshold measures are estimated for this study. First is the relative vulnerability (i.e., those households who have an estimated vulnerability level greater than the observed incidence of poverty in the population but less than 0.5), and second is the high vulnerability of households or population (households that have an estimated vulnerability coefficient greater than 0.5). The choice of 0.5 is

justified for two reasons. The first reason is that it makes intuitive sense to say that a household is vulnerable if it faces a 0.5 (50%) or higher probability of falling into poverty in the next period. The second reason is that as argued by Pritchett et al. (2000), when a household whose current level of consumption is equal to the poverty line faces a zero mean shock it has a one period ahead vulnerability of 0.5. In the limit, as the time horizon approaches zero, then being currently poor and being vulnerable to poverty coincide.

The selection of appropriate predictors of per capita household consumption is the next step. The set of initial regressors includes a host of explanatory variables which are both discrete as well as continuous. These regressors are essentially household-level variables focusing on: household assets, education levels and literacy, employment, household amenities, household structure, demographic characteristics and geographical location[19]. Optimal predictors are selected using a combination of traditional regression statistics and test for correlation, prediction and multi-collinearity. Separate urban and rural consumption functions are estimated for the vulnerability assessment[20].

[19] The choice of variable, however, is restricted and depends on the availability of data in these household surveys.

[20] Final specifications of the selected consumption functions for rural and urban areas with the FGLS estimation results (Equation–7) are provided in the Appendix–E.

APPENDIX-E
ESTIMATED CONSUMPTION FUNCTIONS
FOR VULNERABILITY ESTIMATES

FGLS Estimates for *Rural* Areas – [Equation – 7, Appendix-D]
[*Dependent Variable – Logarithm of Per Capita Household Expenditure*]

	Standardized Coefficients	t-Statistics
Household Demography:		
Family Size	-.449	-43.358
Dependency Ratio	-.188	-20.793
Household Education:		
Out of School Children – Primary	-.029	-3.282
Out of School Children - Secondary	-.029	-3.386
Highest Education Level in Family – Female	.149	15.902
Highest Education Level in Family – Male	.146	14.292
Head of Household:		
Age of Head	.012	1.282
Female Headed Household (Widow)	-.024	-2.872
Education Level – Higher Secondary	.058	6.943
Education Level – Tertiary	.132	15.059
Occupation – Wage Employment	-.087	-6.521
Occupation – Non-farm Household	-.035	-2.354
Occupation – Owner Cultivator	.060	6.161
Occupation – Share Cropper (HARI)	-.017	-1.802
Occupation – Livestock	-.016	-1.911
Household Assets:		
Value of Agricultural Land	.050	6.154
Ownership of Non-Agricultural Land	.041	5.101
Ownership of Non-Residential Buildings/House	.024	3.024
Other Household Characteristics:		
Number of Rooms	.288	29.046
Household Receiving Remittances	.029	3.308
Locational Variables:		
Residence of Sindh Province	-.060	-6.463
Residence of Balochistan Province	-.041	-4.898
Intercept (Constant)	--	411.61
Summary Statistics:		
Adjusted R-Square 0.50	Condition Index 18.15	
F-Value 359.58	Durbin-Watson 1.65	

Note: A statistically significant D-W statistics, when one is estimating a model based on cross-sectional data, can be an indication of specification error (such as omitted variables or incorrect functional form). For this model the estimated D-W value rejects the hypothesis of model misspecification. Moreover, the value of Condition Index is less than 30 which indicates the absence of heteroscedasticity.

Source: Estimated from HIES data for the year 2015-16.

FGLS Estimates for *Urban* Areas – [Equation – 7, Appendix-D]
[*Dependent Variable – Logarithm of Per Capita Household Expenditure*]

	Standardized Coefficients	t-Statistics
Household Demography:		
Family Size	-0.438	-70.618
Dependency Ratio	-0.098	-17.408
Household Education:		
Out of School Children – Primary	-0.029	-5.538
Out of School Children - Secondary	-0.037	-7.075
Highest Education Level in Family – Female	0.091	13.16
Highest Education Level in Family – Male	0.130	19.78
Head of Household:		
Age of Head	0.034	5.987
Education Level – Tertiary	0.187	30.927
Occupation – Wage Employment	-0.079	-14.24
Occupation – Employer (including self-employment)	0.086	16.69
Household Assets:		
Ownership of Non-Agricultural Land	0.045	8.967
Value of Non-Residential Buildings/House	0.060	11.961
Value of Residential Buildings/House	0.122	22.408
Other Household Characteristics:		
Number of Rooms	0.279	44.409
Household Receiving Remittances	0.020	3.941
Education of Spouse	0.050	7.257
Locational Variables:		
Residence of Large cities	0.085	16.445
Residence of Balochistan Province	-0.056	-10.257
Residence of Punjab Province	-0.011	-2.039
Intercept (Constant)	--	494.194
Summary Statistics:		
Adjusted R-Square	0.61	Condition Index 19.422
F-Value	1292.39	Durbin-Watson 1.60

Note: A statistically significant D-W statistics, when one is estimating a model based on cross-sectional data, can be an indication of specification error (such as omitted variables or incorrect functional form). For this model the estimated D-W value rejects the hypothesis of model misspecification. Moreover, the value of Condition Index is less than 30 which indicates the absence of heteroscedasticity.

Source: Estimated from HIES data for the year 2015-16

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