Updating Pakistan's Poverty Numbers for the Year 2019

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5 January 2021

Draft Research Report

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Abstract

The objective of this research is to provide estimates of poverty and vulnerability to poverty by using the latest available household survey data of eleventh round of Pakistan Social and Living Standards Measurements (PSLM) 2018-19. Coincidently these estimates also provide the benchmark or baseline levels of poverty and vulnerability in the country for the present Government of Pakistan Tehreek-e-Insaf (PTI); Prime Minister Imran Khan has held the office since 18th August 2018.

Poverty estimates show that close to 37 percent population of Pakistan was living below the poverty line during the year 2018-19. The incidence, depth and severity of rural poverty are relatively higher as compared to urban areas. However, a decline is observed in the current level of rural poverty as compared with the poverty estimates for the year of 2015-16.

Poverty incidences for various years during the period 1988-2019 are also furnished in the paper. These estimates are developed by using the consistent methodology for defining and computing national and regional poverty lines.

This research note also furnishes incidence of vulnerability to poverty in Pakistan. The estimates show that close to 52 percent population was vulnerable to poverty during 2018-19. This incidence of vulnerability is slightly higher than the estimated vulnerability level for the year 2015-16. It is also observed that the level of vulnerability of rural population is significantly higher as compared to the vulnerability incidence in urban areas.

JEL Classification: I3, C31, D3
Keywords: Poverty, Vulnerability, Pakistan

1. Background

In Pakistan, Federal Bureau of Statistic and Planning Commission provide national poverty threshold and estimated incidences of poverty. Household consumption data of Household Integrated Economic Survey (HIES) is used to estimate national, provincial, and regional poverty headcounts[1]. According to National Poverty Report 2015-16 (Pakistan, 2018), 24.3 percent of population was poor during the year 2016. Recently these estimates are updated by Iqbal (2020) using HIES survey data and inflation adjusted official poverty line for the year 2018-19. According to his estimates, 21.5 percent of population is below official poverty line, while estimated urban and rural poverty incidences respectively are 10.7 and 27.6[2]. The trend in official poverty estimates reveals a continuous decline in poverty incidence since 2001-02. The reduction of rural poverty is almost 40 percent (from 70 to 28 percent) during 2001-2019, while the urban poverty has dropped from 50 to 11 percent. The Pakistan Economic Survey 2018-19 declares that "Over the last decades, Pakistan's poverty headcount has witnessed a persistent decline both at national and regional levels as well as in urban and rural areas. In Pakistan, Cost of Basic Needs (CBN) approach is being used as the official measure of poverty. According to this approach, percentage of people living below poverty line has declined from 50.4 percent in 2005-06 to 24.3 percent in 2015-16 on the basis of well targeted poverty reduction programs". However, economists and civil society do not endorse this huge drop in poverty number and question the creditability of estimates. The official estimates clearly indicate that the poverty reduction phenomenon does not have any link with the performance of the economy. Poverty is continuously decreasing (on average 5 percentage points) since 2001-02 irrespective of the trends in GDP growth[3], inflation and other macroeconomic indicators. Official poverty estimates demonstrate that GDP growth and poverty incidence were both showing declining trend during the period 2005-06 and 2013-14; the phenomenon which is not supported by the relevant theory.

Due to this major flaw in the official poverty estimates, an alternative methodology is followed in the Social Policy and Development Centre (SPDC) for estimating poverty line and poverty indices. SPDC also keeps track records of inter-temporal changes in poverty by applying the consistent methodology for defining and computing national and regional poverty lines. This research note provides the latest estimates of poverty by using unit record HIES survey data for the year 2018-19 accompanied with the poverty trend since 1987-88. Updated estimates of vulnerability to poverty are also furnished using the latest data of HIES.

The paper is organized as follows. Section 2 provides updated poverty numbers supplemented by an inter-temporal poverty comparison. The estimates of vulnerability to poverty are presented in Section 3, followed by few concluding remarks in the last section.

[1] HIES is a part of Pakistan Social and Living Standards Measurements (PSLM) survey which consists of detailed consumption and income modules. HIES data is gathered at National, Provincial, and regional (urban/rural) levels, while PSLM surveys provide district-level information. The estimation of poverty at district level is not thus feasible using information in HIES.

[2] Appendix-A provides the trend in official poverty incidence, described in National Poverty Report (2016) and Iqbal (2020); see Exhibit-A1 in the Appendix-A.

[3] Graphically, this phenomenon is presented in the Exhibit-A2 of the Appendix-A.

2. Poverty Updates

This research follows the methodology used by Jamal (2002) for estimation of poverty through Food Energy Intake Approach. Various options for estimating level of poverty are provided in the paper, while a brief description of the major steps to compute the poverty line and poverty indices is furnished in the Appendix-B.

Exhibit-1 furnishes three poverty indices (aggregates) which are estimated using urban and rural poverty lines for the year 2018-19. Overall, 37 percent population was poor during the year 2018-19. The Exhibit also reveals that magnitude of incidence, depth and severity[4] of urban poverty are relatively lower as compared to the poverty in rural areas.

Exhibit – 1
Estimates of Poverty Aggregates – 2019
[Percentage of Population]

		Pakistan	Urban	Rural
Poverty Incidence	Head Count Index	36.63	32.05	39.26
Poverty Severity	Poverty Gap Index	7.82	7.06	8.25
Poverty Depth	FGT2 Index	2.40	2.23	2.49
Source: Estimated from HIES 2018-19 microdata				

Exhibit – 2
Comparative Incidence of Poverty
[2019 v/s 2016]

	2018-19	2015-16	Change	Percentage Change
Pakistan	36.6	37.9	-1.3	-3.4
Urban	32.1	31.9	0.2	0.6
Rural	39.3	41.2	-1.9	-4.6
Punjab	31.6	34.8	-3.3	-9.3
Urban	27.4	28.8	-1.4	-4.8
Rural	34.0	37.7	-3.8	-10.0
Sindh	43.7	47.9	-4.2	-8.7
Urban	34.2	34.9	-0.7	-2.0
Rural	54.0	60.9	-6.9	-11.4
KPK	36.1	27.2	8.9	32.7
Urban	40.1	29.0	11.1	38.2
Rural	35.3	26.8	8.5	31.7
Balochistan	56.8	53.1	3.8	7.1
Urban	58.5	50.5	8.0	15.7
Rural	56.2	54.0	2.2	4.1
Source: Estimated from HIES, 2015-16 and 2018-19 microdata.				

The comparison between the latest estimates of poverty incidences and the estimates for the year 2015-16 is furnished in the Exhibit-2. Few observations emerge. A decline of close to 2 percentage points (5 percent) in the rural poverty is evident during 2015-16 and 2018-19. This was mainly

[4] Appendix-B provides the definition of these poverty indices.

due to the significant (4 and 7 percentage points) decrease in the magnitudes of rural poverty in Punjab and Sindh provinces. According to Pakistan Economic Survey 2019-20, a growth rate of 4 percent has described in GDP agriculture in the year 2017-18, while growth in agriculture GDP for the year 2015-16 was only 0.15 percent. Thus, a record (highest in the last five years) agriculture growth has contributed significantly to rural poverty reduction in Punjab and Sindh provinces. A reduction in the urban poverty in these provinces is also observed although with a relatively lower magnitude (close to one percentage point).

Interestingly, the phenomenon is entirely different in the other two provinces where rise in poverty is evident. Close to 9 and 4 percent rise in poverty incidence are observed respectively for KPK and Balochistan. The KPK case however is different and the poverty data cannot be compared with the poverty estimates of 2015-16 due to the merger of Federally Administered Areas (FATA) into districts of KPK.

In terms of absolute numbers, five million persons has been added in the population below the poverty line during the period 2015-16 and 2018-19. Close to 73 million persons were estimated poor during the year 2015-16, while the estimated poor population was 78 million in 2018-19.

Exhibit–3 portrays the trend in poverty incidence since 1987-88. All these poverty numbers were estimated using unit record household level HIES data and by applying throughout a consistent and identical methodology for estimating poverty line.

Exhibit – 3
Trends in Poverty Incidence
[*Percentage of Population Living Below the Poverty Line*]

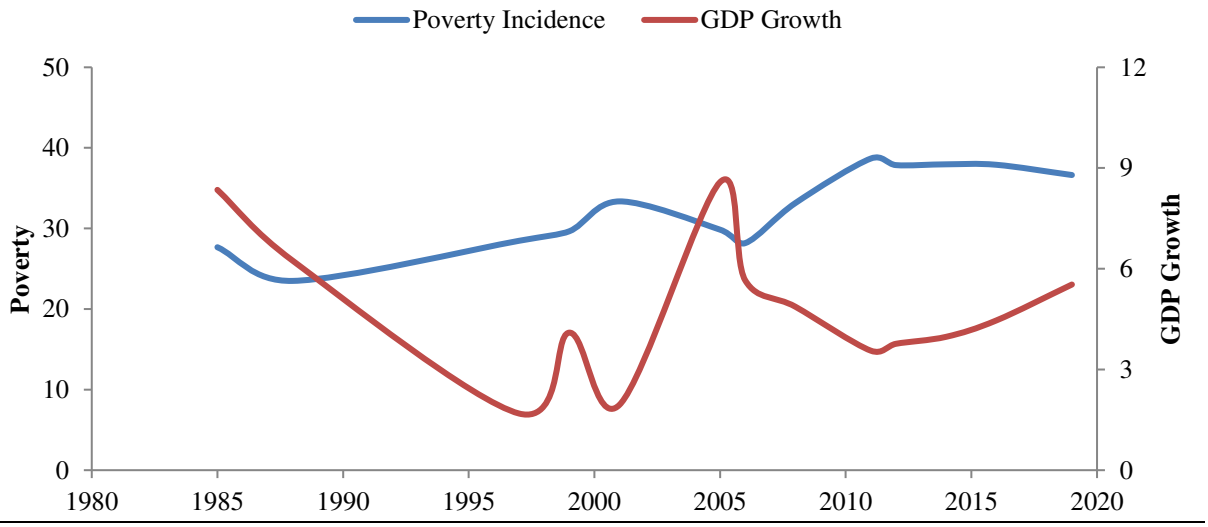
	1987– 88	1996–97	1998–99	2001–02	2004-05	2010-11	2015-16	2018-19
Pakistan	23	28	30	33	30	38	38	37
		(2.4)	*(3.6)*	*(3.3)*	*(-3.0)*	*(4.4)*	*(0.0)*	-1.7
Urban	19	25	25	30	28	34	32	32
		(3.5)	*(0.0)*	*(6.7)*	*(-2.2)*	*(3.6)*	*(-1.2)*	0
Rural	26	30	32	35	31	39	41	39
		(1.7)	*(3.3)*	*(3.1)*	*(-3.8)*	*(4.3)*	*(1.0)*	*-2.3*

Note: Annualized Growth Rates (percent) from previous period are given in parenthesis.
Source: Estimated from HIES microdata, various years

The Exhibit reveals a relatively higher incidence in rural poverty through the period 1987-88 and 2018-19. A comparison of 2001-02 and 2004-05, shows a decline of 3 percentage point in poverty incidence; 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. However, poverty incidences are again showing an upward trend after 2004-05.

Economic researchers and analysts believe that economic growth may not always be a sufficient condition for poverty reduction; but it certainly is a necessary one. To illustrate the point in the context of Pakistan, the growth in Gross Domestic Product (GDP) and poverty incidence are plotted in the Exhibit-4. In general, the exhibit clearly suggests an inverse relationship between poverty and economic growth.

Exhibit – 4
Estimated Poverty Incidence and GDP Growth



Sources: 1. Exhibit-3
2. Pakistan Economic Survey 2019-20; Statistical Supplement, 2019-20

It is also evident from the Exhibit-3 that the poverty estimates are almost stagnant after 2010-11. To get a crude idea regarding reasons behind this stagnancy, Exhibit – 5 is developed which shows the performance of Pakistan's key structural and stabilization indicators during the period 2013-18. The information in the Exhibit reveals that the inflation rate (CPI) has been dropped from 7 to 4 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 3.7 to 5.5 percent which was not enough to cause the drop in the level of consumption poverty. It is noteworthy to mention that average 7 to 8 percent GDP growth was observed during the period 2002-2005 which ultimately resulted in the drop of poverty in 2004-05. Moreover, significant rupee depreciation as well as worsening current account balance are also observed during the period 2016-2018.

Exhibit – 5
Performance of Pakistan's Key Structural and Stabilization Indicators

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Real GDP Growth Rate (%)	3.68	4.05	4.06	4.56	5.22	5.53
• Agriculture	2.68	2.50	2.13	0.15	2.18	4.00
• Industrial Sector	0.75	4.53	5.18	5.69	4.55	4.61
• Service Sector	5.13	4.46	4.36	5.72	6.47	6.35
Domestic Saving – % of GDP	8.7	7.7	8.6	7.8	6.5	5.9
Private Investment – % of GDP	9.8	9.9	10.4	10.3	10.1	10.5
Rate of Inflation – CPI	7.36	8.62	4.53	2.86	4.16	3.92
Budget Deficit – % of GDP	8.2	5.5	5.3	4.6	5.8	6.5
Current Account Balance – % of GDP	-1.1	-1.3	-1.0	-1.7	-4.0	-6.1
Exchange Rate – Rupees per US Dollar	96.72	102.86	101.29	104.23	104.69	109.84

Sources: Pakistan Economic Survey 2019-20; Statistical Supplement, 2019-20

3. Estimates of Vulnerability to Poverty

Well-known approaches to empirically assess the household's vulnerability in terms of monetary poverty include vulnerability as expected poverty (VEP), vulnerability as expected low utility (VEU) and vulnerability as uninsured exposure to risk (VER). However, irrespective of these three different approaches, vulnerability is assumed a function of expected mean and variance of household's consumption. The expected mean is determined by various household and community features while the variance is affected by idiosyncratic and covariate shocks as well as household'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 household'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 for estimating vulnerability to poverty however require panel or pseudo panel household data, as these approaches deal with changes in household well-being. In contrast, VEP can be calculated with cross-section data[5] and thus it is the most appropriate approach to estimate vulnerability in the absence of panel data. 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 and community 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. Essentially, 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 that a currently 'poor' household will remain in poverty or will fall deeper into poverty in future[6]. Chaudhuri et al (2003) developed and applied a methodology which is based on VEP approach and uses cross-sectional data[7] for estimating vulnerability to poverty for Indonesia.

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

[6] 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 Jorgensen, 2001).

[7] Several other authors also used this methodology for estimating vulnerability to poverty for 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.

In the absence of appropriate panel or pseudo panel data in the context of Pakistan, this study also replicates VEP approach proposed by Chaudhuri et al. (2003) to measure vulnerability[8] from the latest available nationally representative household survey (HIES) data for the year 2018-19. These estimates are furnished in the Exhibit-6.

According to the Exhibit, close to 58 and 41 percent of rural and urban population respectively was vulnerable[9] to poverty in 2019, while the national estimate of vulnerability was 52 percent. As expected, vulnerability to poverty is low amongst the urban households as compared to the rural counterpart. 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 exhibit also depicts the distribution of vulnerable population among poor and non-poor categories. It is disturbing that even 41 percent of rural non-poor population was vulnerable to poverty which 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 83 and 74 percent of rural and urban poor households respectively would be moved up.

Exhibit – 6
Estimates of Vulnerability to Poverty – 2019
[*Percentage of Population*]

	Estimated Poor Population	Estimated Population Vulnerable to Poverty		
		Overall	Poor	Non-Poor
National:				
Overall	36.6	51.7	79.8	35.4
Urban	32.1	41.3	73.8	26.0
Rural	39.3	57.6	82.6	41.4

Source: Estimated from HIES data, 2018-19.

Exhibit-7 furnishes inter-temporal changes in the profile of vulnerability to poverty of Pakistan and its provinces[10]. Few interesting observations are noteworthy. Overall, percentage of population vulnerable to poverty has increased, especially in urban areas. Close to 7 percent rise is observed in the urban vulnerable population during 2016 and 2019. The provincial estimates indicate that close to 24, 12 and 6 percent increase in the vulnerability is noted respectively in the urban areas

[8] A brief methodology of measuring vulnerability to poverty as proposed by Chaudhuri et al. (2003) is reproduced from Jamal (2009 and 2017) in the Appendix-C. The author adopted this approach for deriving vulnerability estimates in the context of Pakistan for the year 2000-2001, 2004-2005 and 2015-16.

[9] 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 current 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/consumption 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.

[10] Estimates for the year 2015-16 are taken from Jamal (2017).

of Sindh, KPK and Balochistan provinces. Barring Punjab province and rural areas of Sindh and Balochistan provinces, vulnerability to poverty is showing an upward trend during 2016-19 period. KPK is the only province where rise in vulnerability is observed both in urban and rural part; whereas decline in the vulnerability of rural population is evident in other provinces.

Exhibit – 7
Comparative Percentage of Population Vulnerable to Poverty
[2019 v/s 2016]

	2015-16	2018-19	Change	% Change
Pakistan	51.0	51.7	0.7	1.4
Urban	38.8	41.3	2.6	6.6
Rural	57.5	57.6	0.1	0.2
Punjab	44.6	41.6	-3.0	-6.8
Urban	36.3	33.1	-3.1	-8.7
Rural	48.6	46.6	-2.1	-4.2
Sindh	59.7	63.2	3.5	5.9
Urban	38.6	48.0	9.4	24.4
Rural	80.9	79.7	-1.3	-1.6
KPK	53.7	59.1	5.4	10.1
Urban	48.7	54.7	6.0	12.3
Rural	54.8	60.0	5.2	9.5
Balochistan	77.5	77.1	-0.5	-0.6
Urban	66.1	70.0	3.9	5.9
Rural	81.8	79.8	-2.1	-2.5

Source: Estimated from HIES data, 2015-16 and 2018-19.

4. Concluding Remarks

This research furnishes poverty and vulnerability to poverty estimates for Pakistan using the latest available household survey data of eleventh round of PSLM 2018-19.

According to the updated estimates of poverty, about 37 percent population of Pakistan was poor during 2018-19. Slight decline of close to 3 percent (1.3 percentage points) is noted since the year 2015-16. Nonetheless, in terms of absolute numbers, five million persons has been added in the population below the poverty line during 2016-19 period. Close to 78 million persons were designated poor during the year 2018-19; in contrast, the estimated poor population for the year 2015-16 was 73 million.

The provincial headcounts indicate that close to 32, 44, 36 and 57 percent of population was poor during the year 2018-19 in Punjab, Sindh, KPK and Balochistan provinces respectively. The high magnitude of poverty incidence for Sindh as compared with the KPK province is not much surprising as the comparative economic and social indicators for KPK and Sindh support this finding. Moreover, same phenomenon was observed while estimating poverty using previous HIES data for the year 2015-16. The latest estimates for the year 2018-19 also endorse the trend of regional poverty. As expected, the rural poverty incidence is higher (39 percent) as compared with the urban estimates (32 percent).

An attempt is also made in this paper to update the estimates for vulnerability to poverty using the latest available household data. The updated estimates show that about half (51.7 percent) population of Pakistan was vulnerable to poverty during 2019; the comparative figure for the year 2015-16 was 51. Unsurprisingly, probability of being vulnerable to poverty in the rural areas was relatively higher than the probability in urban populations. Provincial vulnerability estimates present the worst situation prevailing in the province of Balochistan in terms of the vulnerability. Close to 77 percent of the population of the province is estimated as being vulnerable to poverty. No significant changes in the provincial and regional vulnerability profile are observed during 2016-19 period.

It is however worthy to reiterate that the vulnerability to poverty in the risk-response-outcome framework is best assessed with a rich panel or longitudinal data of households. However, the non-availability of a nationally representative panel in Pakistan compelled to adopt the methodology to compute vulnerability from cross-sectional data and thus the vulnerability estimates are a ballpark figure and should be interpreted accordingly.

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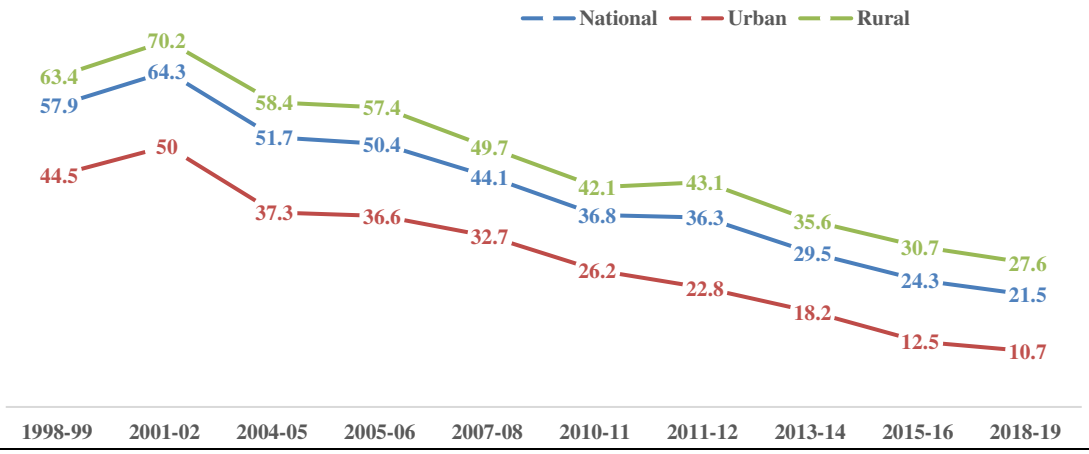
APPENDICES

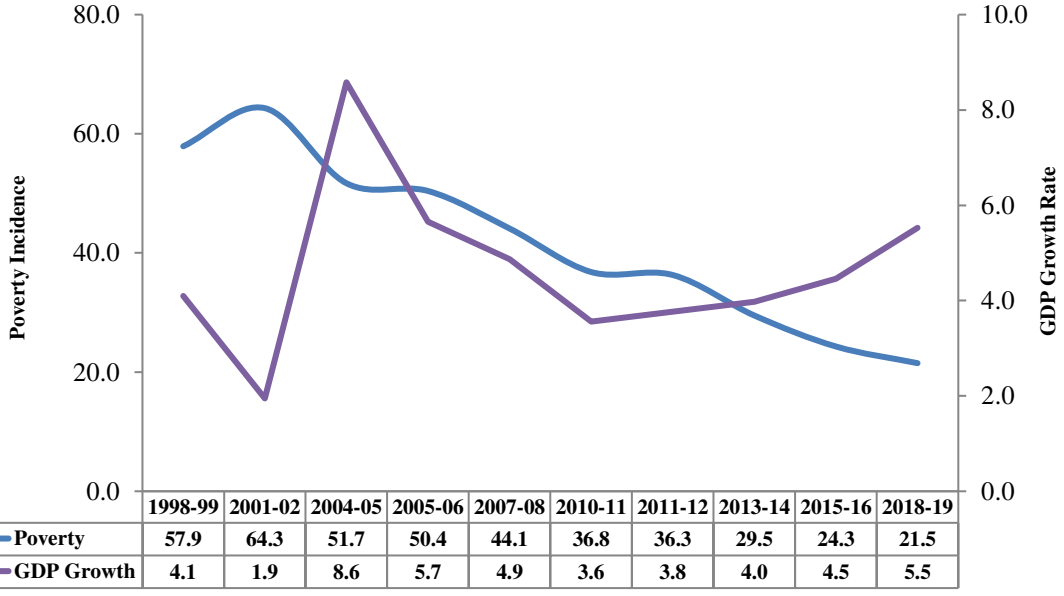
Appendix – A
Pakistan's Official Estimates of Poverty Incidence

Exhibit – A1
Percentage of Population Living Below the Official Poverty Line



Sources: 1. Pakistan Economic Survey (2015-16) - Annexure III.
2. National Poverty Report, 2016, Planning Commission of Pakistan.
3. Iqbal (2020), PIDE Knowledge Brief

Exhibit – A2
Official Poverty Incidence and GDP Growth

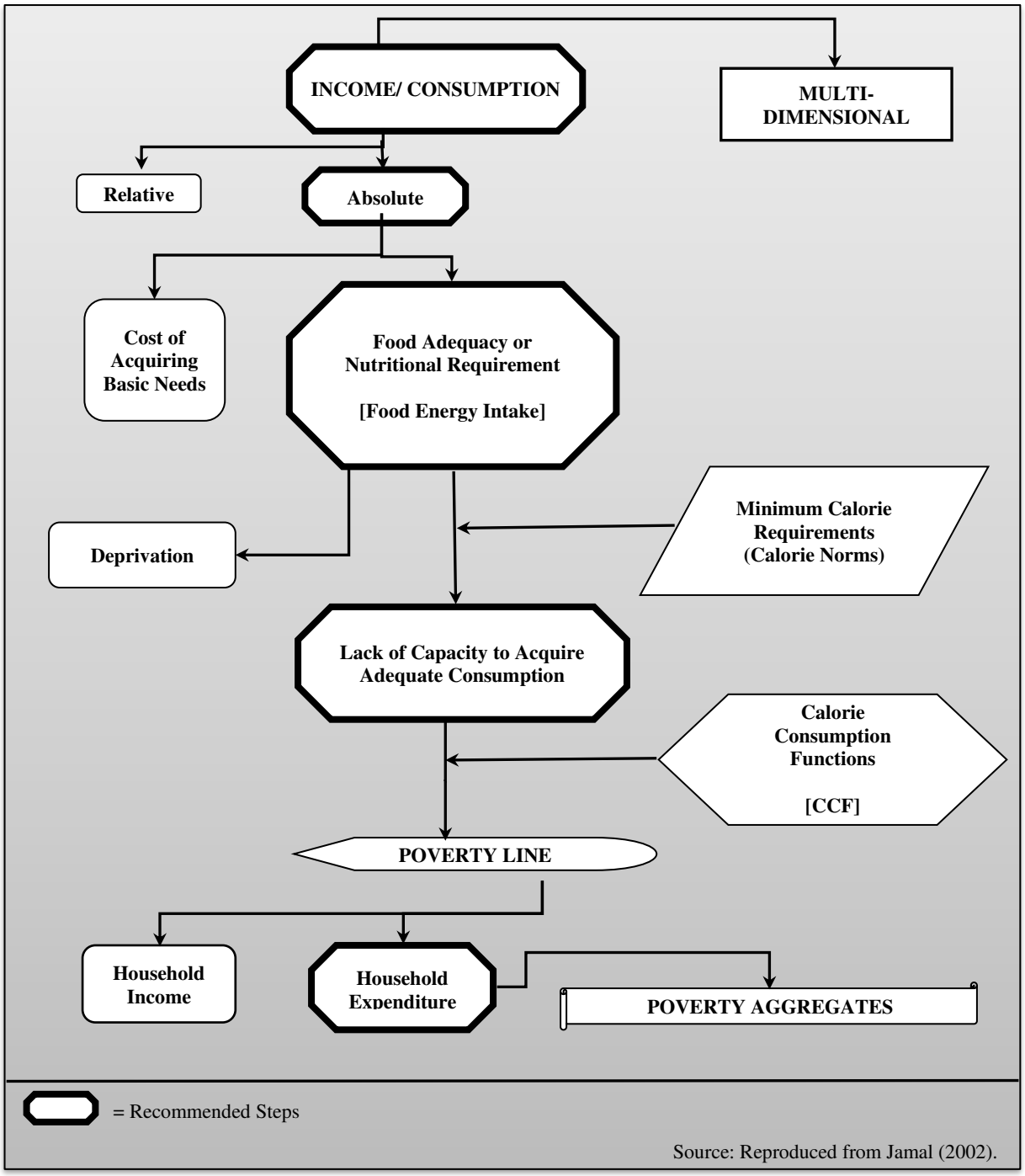


	1998-99	2001-02	2004-05	2005-06	2007-08	2010-11	2011-12	2013-14	2015-16	2018-19
Poverty	57.9	64.3	51.7	50.4	44.1	36.8	36.3	29.5	24.3	21.5
GDP Growth	4.1	1.9	8.6	5.7	4.9	3.6	3.8	4.0	4.5	5.5

Appendix – B
Methodology for Estimating Poverty Line and Poverty Aggregates:

Exhibit–B1 presents a schematic view of various options, described in the literature for estimating poverty line. Recommended steps adopted by this author for poverty line estimation are also highlighted in the Exhibit.

Exhibit – B1
Approaches to Estimate Poverty Line



Source: Reproduced from Jamal (2002).

Accordingly, to compute the poverty line by applying Food Energy Intake (FEI) approach, calorie norms (minimum required calories or cut-off point) and estimated coefficients of the Calorie-Consumption Function (CCF) are required. Both information together facilitate estimation of amount of household expenditure necessary to obtain the minimum required calories (poverty line).

Estimation of CCF: First, household food consumption is translated into calories using Food Consumption Tables for Pakistan (GoP, 2001). The CCF are then estimated by regressing household per adult[11] daily calorie consumption on household expenditure. Separate CCFs are estimated for urban and rural areas[12] as the 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. The estimated coefficients of calorie-consumption functions are then applied to derive the urban and rural poverty lines. Consistent with the earlier poverty estimates, this paper follows 2,550 and 2,230 calories per day per adult as calorie norms (minimum requirement) respectively for rural and urban areas.

Poverty Indices: After determining the household poverty status through relating poverty threshold and household expenditure, the next task is to aggregate this information into a single index to proxy the status of a group of individuals. 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 weights (power) of the proportional gap between the observed and the required expenditure. The power or weight indicates the level of intensity of poverty. Thus, the FGT 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 observed total expenditure (food plus non-food)
Z	=	Poverty line
$\sum$	=	Summation for all individuals who are below the poverty line

[11] Adult equivalent unit is estimated with the help of minimum calorie requirements with respect to age and sex of members in household.

[12] It is worth to remind here 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.

Putting $\alpha=0$, the formula shows the HCI, i.e., proportion of households whose consumption fall below the poverty line. However, this simple measure ignores the depth of poverty. By putting $\alpha=1$, 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. The severity of poverty which is also termed as FGT index is estimated using the value of α equal 2. This FGT index considers inequality amongst the poor and shows the severity of poverty by assigning greater weights to those households who are far from the poverty line.

Intertemporal Updating of Poverty Line: 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. In the context of Pakistan, Consumer Price Index (CPI) is used to update the poverty line. However, there are many criticisms on using CPI for updating previous poverty line due to its 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 in the empirical literature on poverty. 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 400 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[13]. 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. 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.

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

Appendix – C
Methodology for Estimating Vulnerability to Poverty[14]

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[15] 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:

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

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 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:

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

[14] The appendix is reproduced from Jamal (2017).

[15] Chaudhuri (2002) 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.

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. 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.

$$\sigma_{e,h}^2 = X_h\theta \tag{3}$$

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:

$$e_{OLS,h}^2 = X_h\theta + n_h \tag{4}$$

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

$$\frac{e_{OLS,h}^2}{X_h\hat{\theta}} = \left\{\frac{X_h}{X_h\hat{\theta}}\right\}\theta + \frac{n_h}{X_h\hat{\theta}} \tag{5}$$

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 $\sigma_{e,h}^2$ which is the variance of the idiosyncratic component of household consumption. Equation (2) is also transformed with the standard error of (θ_{FGLS}).

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

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

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.

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

$$\hat{V}[(\ln c_h|X_h] = e_h^2 = X_h\theta \tag{9}$$

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

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

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[16]. 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[17].

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

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

Appendix – D
Estimated Consumption Functions for Vulnerability Estimates

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

	Standardized Coefficients	t-Statistics
Household Demography:		
Family Size	-0.442	-61.002
Dependency Ratio	-0.177	-27.316
Household Education:		
Out of School Children – Primary	-0.051	-8.103
Out of School Children - Secondary	-0.055	-9.044
Highest Education Level in Family – Female	0.13	19.689
Highest Education Level in Family – Male	0.109	14.713
Head of Household:		
Age of Head	0.044	6.612
Female Headed Household (Widow)	-0.009	-1.514
Education Level – Higher Secondary	0.055	8.987
Education Level – Tertiary	0.145	22.186
Occupation – Wage Employment	-0.086	-9.429
Occupation – Non-farm Household	-0.005	-0.434
Occupation – Owner Cultivator	0.043	6.001
Occupation – Share Cropper (HARI)	0.012	1.861
Occupation – Livestock	-0.014	-2.343
Household Assets:		
Value of Agricultural Land	0.067	11.603
Ownership of Non-Agricultural Land	0.03	5.236
Ownership of Non-Residential Buildings/House	0.027	4.628
Other Household Characteristics:		
Number of Rooms	0.247	34.711
Household Receiving Remittances	0.101	16.496
Locational Variables:		
Residence of Sindh Province	-0.068	-10.44
Residence of Balochistan Province	-0.027	-4.374
Intercept (Constant)	--	587.308
Summary Statistics:		
Adjusted R-Square 0.485	Condition Index	17.895
F-Value 680.651	Durbin-Watson	1.61

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 microdata for the year 2018-19.

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

	Standardized Coefficients	t-Statistics
Household Demography:		
Family Size	-0.449	-51.823
Dependency Ratio	-0.129	-16.755
Household Education:		
Out of School Children – Primary	-0.034	-4.489
Out of School Children - Secondary	-0.038	-5.119
Highest Education Level in Family – Female	0.136	16.205
Highest Education Level in Family – Male	0.101	10.964
Head of Household:		
Age of Head	0.021	2.727
Education Level – Tertiary	0.19	22.254
Occupation – Wage Employment	-0.041	-5.332
Occupation – Employer (including self-employment)	0.091	12.67
Household Assets:		
Ownership of Non-Agricultural Land	0.016	2.254
Value of Non-Residential Buildings/House	0.063	8.81
Value of Residential Buildings/House	0.138	18.412
Other Household Characteristics:		
Number of Rooms	0.271	29.992
Household Receiving Remittances	0.081	10.942
Locational Variables:		
Residence of Balochistan Province	-0.023	-3.113
Residence of Punjab Province	0.033	4.379
Intercept (Constant)	--	408.207
Summary Statistics:		
Adjusted R-Square 0.567	Condition Index	17.136
F-Value 681.03	Durbin-Watson	1.594

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 microdata for the year 2018-19