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115th & 116th Issue
September, 2023 & March, 2024

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SARVEKSHANA

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सत्यमेव जयते

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Ministry of Statistics and Programme Implementation
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Foreword

Bringing out *Sarvekshana* has always been an enlightening endeavor. The first issue of *Sarvekshana* was released during July, 1977 and the latest released issue is 114th issue. The present combined 115th & 116th issue comes with three papers on the subjects of (i) Interstate Variations in Consumption Gap and Income Gap, (ii) Quantifying and Comparing Underemployment: A Multidimensional Approach using Fuzzy Logic and (iii) Decoding Assam's Crime Landscape: A Longitudinal Statistical Study. In addition, the highlights of the recent survey report of Periodic Labour Force Survey namely, 'Annual Report of Periodic Labour Force Survey (PLFS), July 2022 – June 2023' have been included in the combined 115th & 116th issue.

Referees have been very kind in examining the papers in detail and offering their suggestions in a short span of time. So have been the Members of the Editorial Advisory Board of *Sarvekshana*. I offer my sincere gratitude to them and solicit continued support for the Journal. Authors of the papers have also been cooperative in accepting the suggestions for repetitive revisions of the respective papers. I congratulate them for their work which we hope would be useful. Officers of Survey Coordination Division of National Sample Survey Office have been meticulous at various stages of publication of this issue and their hard work deserves appreciation.

The *Sarvekshana* is a known Journal among researchers, academicians and policy makers. I welcome students, researchers, Government officials and all those working on data based on sample surveys and censuses to contribute papers for this Journal.



Chairman

New Delhi

May, 2024

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Contents

	Page No.
PART-I: TECHNICAL PAPERS	
1. Interstate Variation in Consumption Gap and Income Gap by P. D. Joshi & Jena P Joshi	01-19
2. Quantifying and Comparing Under Employment: A Multidimensional approach using Fuzzy Logic by Sonakhyka Samaddar	20-41
3. Decoding Assam's Crime Landscape: A Longitudinal Statistical Study by Puspita Saha & Dibjojyoti Bhattacharjee	42-53
PART-II: HIGHLIGHTS OF THE REPORT RELEASED BY NSSO	
4. Highlights: Annual Report of Periodic Labour Force Survey (PLFS) (2022-2023)	56-66
PART-III: HINDI SECTION	
5. Highlights: Hindi	70-80

PART-I

TECHNICAL PAPERS

Interstate Variations in Consumption Gap and Income Gap¹

P. D. Joshi² and Jena P Joshi³

Abstract

In the context of strategy for removal of poverty, the knowledge of statistical dimension of gap in consumption expenditure as well as income gap in population of poor persons are useful. These measures provide dimensional idea on the quantification of aggregate monitoring requirement for up lift of poor persons. Thus, the measures are helpful to planners, policy makers, and administrators in focussing attention on welfare of the poor people for forming strategies, policy and programme formulation with the purpose of distribution in entire population of poor persons to attain the minimum level of expenditure.

This paper, therefore, presents sector and state specific consumption gap and income gap based on two sets of poverty line one advocated by expert group headed by Rangarajan (2014) and the other expert group headed by Tendulkar (2009). Its association with important indicators viz., poverty ratio, per capita consumption expenditure, inequality in size distribution of consumption expenditure and inequality in distribution of per capita consumption expenditure of poor persons employing Regression Analysis on double log model has been presented.

The analyses based on regression parameters indicate that an increase in per capita consumption expenditure of entire population reduces the consumption gap and thus increase in per capita consumption expenditure closes the consumption gap. Further, increase in poverty ratio and inequality in the distribution of consumption expenditure (LR) inflates the consumption gap. Replacing inequality in consumption expenditure among the entire population (LR) with inequality in consumption expenditure among the poor group of population (LR_p) in the regression equation, the analysis shows that inequality in the distribution of per capita consumption expenditure of the poor persons is also positively and significantly associated with consumption gap. However, the association between consumption gap and inequality in population of poor persons is less in the year 2011-12 compared to year 2009-10. The poverty ratio regressed on per capita consumption and inequality in the distribution of consumption of poor group of population indicates lowering of the partial elasticity. Statistically, the regression parameters are significant in all the cases.

Key Words: Poverty line, Poverty Ratio, Consumption Gap, Income Gap, Regression

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¹ The author has expressed his inability to further revise this paper citing health reasons. Hence, the paper may lack the final minor revision.

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1. Introduction

Poverty in general refers to a state of deprivation wherein a household (or a person) fails to meet its material needs. For practical purposes, it is measured with the help of poverty line, which incorporates a norm of minimum living standard and serves as a cut-off line for separating the poor from the non-poor.

The most commonly used measure for assessment of poverty and policy intervention in India has been headcount ratio i.e. ratio of number of poor persons below poverty line to total number of persons in percentage terms. The other measures of poverty include Foster, Greer, and Thornback (1984), $P_\alpha(\alpha=0, 1, 2)$ class of poverty measure, which for $\alpha=1$ provides depth measure of poverty and for $\alpha=2$ provides severity measure of poverty (Joshi, 2006, 2014a). Added to this is the Joint poverty measure $J^\beta_\alpha(\beta=.5 \text{ and } \alpha=0, 1, 2,)$ (Joshi, 2014b). For uplift of poor persons, these measures do not provide dimensional idea on the quantification of aggregate monitoring requirement in attaining minimum level of expenditure in formulating strategies, policy, and programme for distribution in entire population of poor persons. Thus, in the context of strategy for removal of poverty, the knowledge of statistical dimension of gap in consumption expenditure and income gap in population of poor persons are useful to planners, policy makers, and administrators in giving focussed attention on the poor people in the rural and urban sector of different states and all India. The paper therefore, brings out consumption gap and income gap based on Rangarajan's poverty line (RPL) and Tendulkar's poverty line (TPL) in the rural and urban sectors of different states and all India. The analysis shows sectoral, spatial and inter temporal dimensions across 21 states and all India (including all states and union territories). Their association with important indicators, viz. poverty ratio, per capita consumption expenditure, inequality in size distribution of consumption expenditure, inequality in distribution of per capita consumption expenditure of poor persons, as independent variables, and consumption gap, as dependent variable, employing regression analysis has been investigated using a double log model.

Consumption Gap is the ratio of aggregate consumption expenditure necessary to allow the poor for attaining the minimum level of expenditure to total consumption expenditure expressed in percent. Mathematically,

$$\text{Consumption Gap (CG)} = ((Z-m) * q / (n * M)) * 100$$

Where,

Z: denotes the poverty line,

m: mean per capita consumption expenditure of the poor,

M: mean per capita consumption expenditure of the entire population,

q: number of poor persons and

n: population size.

This can be rewritten as:

$$CG = ((Z-m) * P_{0/M}) * 100 = (Z/M) * P_1 * 100$$

Where, P_0 is the head-count ratio ($= q/n$) and $P_1 = P_0 * (1 - m/Z)$

In the literature the term $1 - m/Z$ is called *Income Gap* (I), under the assumption that the poor have zero savings.

In this article, however, both the indicators, *consumption gap* (CG) and *income gap* (I), are computed from the data of household consumer expenditure surveys.

2. Data and Methodology

The previously mentioned measures are based on size distribution of consumption expenditure and choice of poverty line. The datasets for the study, therefore, consist of (i) the size distribution of consumption expenditure based on the results of nationwide consumer expenditure survey conducted by National Sample Survey Office (NSSO), Government of India in its 66th round (July2009-June 2010), 68th round (July 2011-June 2012) and (ii) the poverty lines for these two years. The survey results are based on scientific sampling technique – two-stage stratified sampling and interview method for collection of data. The first stage units were villages in the rural sector and urban blocks in the urban sector. Households were the second stage units.

Different reference period systems were used for collection of consumption data in these rounds viz., uniform reference period (URP), mixed reference period (MRP) and modified mixed reference period (MMRP). URP means reference period of 30 days for all items of consumer expenditure. MRP means mixed reference period of 30 days for all items of consumer expenditure other than clothing, footwear, education, medical (institutional) and durables, which has a reference period of 365 days. MMRP means 30 days for all the items of consumer expenditure except (a) clothing, footwear, education, medical (institutional) and durables which has a reference period of 365 days and (b) edible oil; egg, fish and meat; vegetables; fruits; spices; beverages and processed foods; pan, tobacco and intoxicants which has reference period of 7 days.

The poverty line figures (Z) i.e. the RPL and TPL are based on alternative recall period data. The former is based on the MMRP approach but the latter is as per the MRP approach. Further, the average MPCE figures and LR calculations are based on the data as per MMRP approach.

The sample sizes of the two surveys are shown in Table 1.

Table 1. Sample Size (1st stage and 2nd Stage units) in the Rural and Urban Sector in Selected Rounds of NSS Consumer Expenditure Survey

NSS Round (Period)	Rural		Urban		Total	
	Number of villages	Number of households	Number of blocks	Number of households	Sample Size	Households
66 th	7428	59119+59097*	5263	41936+41697*	12691	201849
68 th	7469	59695+59683*	5268	41967+4196*	12737	165541

*Households for Schedule-1 & 2

Consumption included consumption out of purchases in cash or credit, out of home-grown produce, out of receipts in exchange of goods and services and out of gifts, loans and free collection. Non-monetized consumption was imputed at producers/local retail prices. The imputed rental of owner occupied houses or of free subsidized quarters provided by employers was excluded from the data on consumption expenditure.

There had been many studies on the definition of poverty line in India with varied approaches. The academic studies on poverty by social scientists, economists, statisticians, nutritionists, researchers in their individual capacities; national and international organisations, in favour or against of their conceptualisation; and measurement and dimension by critics have generated a rich and extensive literature related to poverty line. However, the differences on the ways of setting the poverty line by experts have created a dust of confusion

because of the enormous problems in assessing the incidences of poverty. No single symptom of poverty has been relied upon for getting a realistic idea of the true incidence of poverty.

Poverty is multidimensional and there is no consensus on the definition of poverty line in terms of minimum per capita per month income/expenditure. For the purpose of this paper, we have selected poverty line recommended by expert groups headed by Rangarajan (2014) and that headed by Tendulkar (2009) without getting involved in the debate advocating or favouring either of the two poverty lines. The choice of selecting the poverty line rests with users and critics.

We have taken 21 states. Smaller states and UTs have not been taken because of small sample size but the estimates at all India level include all states and union territories. The abbreviations used for state names in different tables are as under:

AP	Andhra Pradesh	J&K	Jammu and Kashmir	PUN	Punjab
ASM	Assam	JHK	Jharkhand	RAJ	Rajasthan
BHR	Bihar	KTK	Karnataka	TN	Tamil Nadu
CTG	Chhattisgarh	KRL	Kerala	TRI	Tripura
GUJ	Gujarat	MP	Madhya Pradesh	UP	Uttar Pradesh
HAR	Haryana	MAH	Maharashtra	UTK	Uttarakhand
HP	Himachal Pradesh	ODI	Odisha	WB	West Bengal

3. Results and Discussion

Average monthly per capita expenditure (M), Lorenz Ratio (LR), Poverty Ratio (p_0), Mean income of the poor (m), Inequality among the poor (LR_p) in the rural and urban sector based on Rangarajan's poverty line (RPL) and Tendulkar's poverty line (TPL) are presented in tables given in Annex-A.

3.1 Consumption Gap

Table 2, presents Consumption Gap (CG) in the rural and urban sector at the state and national level for the years 2009-10 and 2011-12. It shows that, for rural India, the RPL based CG was 6.93% in 2009-10. This can be interpreted as: "Rural poverty would have been eliminated, had the consumption expenditure of the poor increased, in proportion to their needs, by 6.93 percent of the total rural consumption expenditure". The table shows that, for rural India, the CG, based on RPL, declined from 6.93 percentage points in 2009-10 to 4.4 percentage points in 2011-12.

The CG based on TPL, declined from 5.12 percentage points in 2009-10 to 3.21 percentage points in 2011-12.

Table 2. State Specific *Consumption Gap* in the Rural and Urban Sector

State	Rural				Urban			
	Based on RPL		Based on TPL		Based on RPL		Based on TPL	
	2009-10	2011-12	2009-10	2011-12	2009-10	2011-12	2009-10	2011-12
AP	3.62	1.13	2.99	0.89	4.12	1.59	1.75	0.34
ASM	7.65	6.66	5.81	4.54	8.79	6.13	3.22	1.80
B HR	17.97	6.95	12.80	5.02	13.88	10.68	7.38	4.53
CTG	15.16	10.06	11.16	7.32	7.80	7.91	3.64	2.48
GUJ	5.76	4.01	3.14	2.11	5.58	2.58	1.79	0.77

HAR	2.06	0.91	2.11	1.09	3.78	1.34	2.12	0.63
HP	0.75	0.92	0.77	0.54	2.08	0.79	0.92	0.24
J&K	1.45	1.40	0.87	1.05	4.65	2.68	0.97	0.42
JHK	10.74	9.11	7.71	5.59	8.94	5.23	4.57	2.57
KTK	2.52	1.78	3.41	2.13	3.94	2.48	1.93	1.15
KRL	0.54	0.23	0.99	0.71	2.73	1.09	0.79	0.27
MP	11.77	9.10	8.36	6.24	9.81	7.23	2.80	1.88
MAH	4.00	2.74	4.02	3.10	4.30	1.73	1.52	0.59
ODI	11.03	9.53	7.14	5.32	7.61	6.16	2.68	1.48
PNB	1.24	0.43	1.04	0.57	3.95	1.96	1.71	0.66
RAJ	3.92	2.52	3.16	2.02	7.59	2.87	2.03	0.72
TN	3.53	3.49	2.33	1.38	4.18	2.21	0.95	0.41
TRI	1.38	2.71	1.58	1.47	4.65	4.32	0.74	0.79
UP	8.58	5.73	6.08	1.55	10.91	8.01	3.81	2.48
UTK	1.63	0.98	0.88	1.83	6.34	4.03	2.71	0.67
WB	6.20	3.78	3.97	2.48	5.88	3.81	2.09	1.08
All India	6.93	4.44	5.12	3.21	5.93	3.59	2.15	1.10

In rural sector of seven states viz., Assam, Uttar Pradesh, Jharkhand, Odisha, Madhya Pradesh, Chhattisgarh, and Bihar, the CG based on RPL was above the national level in the year 2009-10 and in the year 2011-12 but at different positions. The same scenario emerges from the CG based on TPL excluding UP in the year 2011-12. Further, in these seven states, CG based on both RPL and TPL has come down in the year 2011-12 compared to 2009-10.

The CG, based on both RPL and TPL, in the rural sector of Bihar was the highest in the year 2009-10 and came down to 5th position in the year 2011-12. Chhattisgarh was in the second position in the year 2009-10 and rose to top position based on both RPL and TPL in the year 2011-12. Improvement in terms of reduction in rank with respect to RPL based CG was seen in 10 states namely, Andhra Pradesh, Bihar, Haryana, MP, Maharashtra, Punjab, Rajasthan, UP, Uttarakhand and West Bengal based on RPL, deterioration was observed in 10 states viz., Assam, Chhattisgarh, Gujarat, HP, J&K, Jharkhand, Kerala, Odisha, Tamil Nadu, and Tripura. However, CG in rural Karnataka, based on RPL was stagnant at 14th position and changed from 10th to 9th position according to CG based on TPL.

CG in the urban sector at the state and national level for 2009-10 and 2011-12 shows that at the all India level CG declined from 5.93 percentage points in the year 2009-10 to 3.59 percentage points in the year 2011-12 based on RPL. Based on TPL, CG declined from 2.15 percent in the year 2009-10 to 1.10 percent in the year 2011-12.

In the urban sector of 9 states viz., Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh, and Uttarakhand, the CG based on RPL was above the national level in 2009-10 and except Rajasthan in the year 2011-12. However, their positions (rankings) were different. Based on TPL, similar scene was seen in the year 2009-10 except Rajasthan in the year 2009-10 and 2011-12 and Karnataka in the year 2009-10 but on different positions.

CG based on both RPL and TPL in the urban sector depicts that Bihar was on the top in the year 2009-10 and in the year 2011-12. Uttar Pradesh was on the second position in the year 2009-10 and 2011-12. Based on TPL, Uttar Pradesh was on position 3 in the year 2009-10 and in the year 2011-12. Improvement about CG based on RPL was seen in eight states namely, Andhra Pradesh, Assam, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu. However, the urban sector CG based on RPL in Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Uttar Pradesh, Uttarakhand, and West Bengal were stagnant at 14th position. Deterioration in CG was in five states viz., Chhattisgarh, Karnataka, Odisha, Punjab, and Tripura.

As poverty ratio derived from different poverty lines plays an important role in obtaining CG, we have derived its elasticity with respect to per capita expenditure using log-log equation,

$$\text{Log } P_0 = a + b \text{ Log PCE}$$

Where, 'a' is Constant and 'b' stands for elasticity of poverty ratio.

For the purpose of this paper, poverty ratio (P_0) based on RPL and TPL has been used. The results are presented in Table 3.

Table 3. Estimated Elasticity of Poverty Ratio (P_0) with Respect to per Capita Expenditure

Rural					Urban			
Based on RPL					Based on RPL			
Year	Elasticity	t-value	R Sq	Adj. R Sq	Elasticity	t-value	R Sq	Adj. R Sq
2009-10	-1.908	-9.029	0.811	0.801	-1.177	-9.746	0.833	0.825
2011-12	-1.177	-9.746	0.913	0.908	-1.722	-7.914	0.767	0.755
Based on TPL					Based on TPL			
2009-10	-1.627	-7.718	0.758	0.745	-1.216	-3.738	0.424	0.393
2011-12	-1.605	-6.212	0.67	0.653	-1.926	-4.839	0.552	0.528

It reveals that poverty ratio based on both RPL and TPL declines with increase in per capita expenditure in rural as well as in urban sector of India as the sign of elasticity is negative. The elasticity has declined in the rural sector under both RPL and TPL but in the urban sector, elasticity has increased.

Binary correlations between poverty ratio (PR), per capita expenditure (PCE), Lorenz ratio in entire population (LR), and Lorenz ratio in population of poor persons (LR_p) and CG based on RPL and TPL in the year 2009-10 and 2011-12 are presented in Table 4.

Table 4. Binary Correlations for CG, PR, PCE, LR, and LR_p in the Rural and Urban Sector in the Year 2009-10 and 2011-12 under RPL and TPL

Variables		Rural				Urban			
		2009-10 based on		2011-12 based on		2009-10 based on		2011-12 based on	
		RPL	TPL	RPL	TPL	RPL	TPL	RPL	TPL
PR	PCE	-0.86	-0.829	-0.9	-0.779	-0.884	-0.694	-0.863	-0.751
	LR	-0.365	-0.432	-0.566	-0.484	-0.068	0.09	0.072	0.055
	LR _p	0.884	0.748	0.202	-0.407	0.323	0.893	0.781	0.454
	CG	0.971	0.972	0.979	0.942	0.979	0.948	0.982	0.957

PCE	LR	0.69	0.756	0.792	0.732	0.417	0.423	0.357	0.339
	LR _p	-0.844	-0.618	-0.373	0.705	-0.135	-0.57	-0.527	-0.202
	CG	0.81	-0.781	0.849	-0.787	-0.87	-0.754	-0.868	-0.77
LR	LR _p	-0.335	-0.305	-0.357	0.543	0.187	0.16	0.441	0.056
	CG	-0.37	-0.395	-0.516	-0.433	-0.066	-0.094	-0.011	-0.114
LR _p	CG	0.826	0.649	0.165	-0.337	0.261	0.821	0.756	0.513

The negative sign of the correlation coefficient between poverty ratio and the per capita consumption and its value (>0.5) under both RPL and TPL in the rural and urban sector shows that as the per capita consumption increases, poverty ratio decreases.

We, now, assess the association of the CG with (a) per capita consumption expenditure (AMPCE in Annex-B), (b) inequality in distribution of per capita consumption of entire population (G in Annex-B) and (c) proportion of poor persons (HCR in Annex-B), employing regression analysis. The results are based on the values of different parameters for 21 states under both RPL and TPL. Annex-B presents the results of the analysis. These indicate that the CG is positively associated with poverty. A rise in per capita consumption of entire population or inequality reduces the CG. On the other hand, as the analysis shows, increase in HCR brings about an increase in the CG. There exists inverse relationship between per capita consumption expenditure and the CG, which implies that an increase in per capita consumption closes the consumption gap. The increase in poverty ratio and inequality in the distribution of consumption inflates the CG. The regression parameters of poverty ratio and inequality in the distribution of consumption are positive whereas that of per capita consumption is negative. The regression parameters are statistically significant in all cases and coefficient of determination exceeds, 95 under both RPL and TPL.

As different values of inequality may provide identical poverty ratios, we have presented similar regression results but replacing inequality among the entire population with inequality among the poor group of population (G_p in Annex-C). The results are presented in Annex-C for the rural and urban sector.

Table 4, shows that poverty ratio is positively associated with inequality in the distribution of per capita consumption of poor group of population but per capita expenditure is negatively associated with inequality in the distribution of per capita consumption of poor group of population. The inequality in the distribution of per capita consumption of the poor is also positively and significantly associated with CG. However, CG is highly correlated ($>.95$) with poverty ratio under both RPL and TPL in the rural and urban sector. The strong correlation coefficient shows that the poverty ratios in the states are more sensitive to per capita consumption and inequality in consumption distribution of the poor. The association between CG and Lorenz ratio of entire population compared to association between CG and Lorenz ratio of poor population is less.

The regression analysis presented in Annex-C indicate the partial elasticity i.e. response of these variables to the changes in the CG. The results are same except that the partial elasticity is reduced significantly. However, the association between CG and Lorenz ratio of poor population is less in the year 2011-12 compared to year 2009-10. Statistically, the regression parameters are significant and the coefficient of determination adjusted for degrees of freedom always exceeds 0.5.

The relationship between poverty ratio and per capita consumption expenditure (AMPCE in Annex-D) and inequality in the distribution of consumption expenditure (G in Annex-D) based on log-log function has also been assessed utilising the data for 21 states. The results are given in Annex-D for the rural and urban sector. The regression coefficients indicate partial elasticity of poverty ratios with respect to per capita consumption

and inequality. The coefficients of per capita consumption are negative and exceed unity. The coefficient of inequality (G or G_p), which is in fact the Gini's coefficient, is positive and less than unity in a few cases. Further, Table 4 shows that per capita consumption is inversely and inequality in the distribution of per capita consumption is positively associated with poverty ratio. The poverty ratio regressed on per capita consumption and inequality in the distribution of consumption of poor group of population indicates a lowering of the partial elasticity. All the regression parameters are statistically significant and their coefficient of determination adjusted for degrees of freedom generally exceeds 0.8.

As different values of inequality may provide identical poverty ratios, we have presented similar regression results but replacing inequality among the entire population with inequality among the poor group of population. The results are presented in Annex-E for the rural and urban sector.

3.2 Income Gap

In the rural sector of different states, wide disparity in regard to income gap based on both RPL and TPL in the year 2009-10 as well as in the year 2011-12 has been observed as may be seen in Table 5. Among 21 states, Chhattisgarh and Madhya Pradesh are the top two states about income gap ratio (I) under RPL and TPL in the year 2011-12 whereas in the year 2009-10, Bihar and Chhattisgarh were on the top two positions under RPL and Bihar and Madhya Pradesh under TPL.

Table 5. Income Gap Ratio (I) based on Rangarajan's Poverty line (2014) and Tendulkar's Poverty line (2009) for the Years 2009-10 and 2011-12 and Drop in Income Gap Ratio (I) between 2009-10 and 2011-12 in the Rural Sector

State	Rangarajan's			Tendulkar's		
	Rural			Rural		
	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)
AP	0.1986	0.1511	-0.0474	0.2061	0.1469	-0.0592
ASM	0.2127	0.1920	-0.0207	0.1823	0.1711	-0.0112
BHR	0.2630	0.2012	-0.0619	0.2433	0.1838	-0.0596
CTG	0.2644	0.2303	-0.0341	0.2210	0.2011	-0.0199
GUJ	0.2010	0.1780	-0.0230	0.1728	0.1502	-0.0227
HAR	0.1841	0.1601	-0.0240	0.2037	0.1774	-0.0264
HP	0.1236	0.1575	0.0339	0.1692	0.1255	-0.0437
J&K	0.1597	0.1849	0.0251	0.1840	0.1643	-0.0197
JHK	0.2153	0.2208	0.0056	0.2178	0.1683	-0.0494
KTK	0.1551	0.1442	-0.0110	0.1845	0.1342	-0.0503
KRL	0.1282	0.0861	-0.0421	0.1875	0.1792	-0.0083
MP	0.2682	0.2463	-0.0219	0.2530	0.2319	-0.0211
MAH	0.2015	0.1826	-0.0189	0.1920	0.1911	-0.0009
ODI	0.2523	0.2281	-0.0242	0.2298	0.1941	-0.0357
PUN	0.1558	0.1205	-0.0353	0.1337	0.1517	0.0180
RAJ	0.1676	0.1813	0.0137	0.1643	0.2013	0.0370
TN	0.2009	0.2250	0.0241	0.1747	0.1558	-0.0189
TRI	0.1289	0.1716	0.0427	0.1181	0.1327	0.0146

State	Rangarajan's			Tendulkar's		
	Rural			Rural		
	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)
UP	0.2167	0.1955	-0.0212	0.2561	0.2898	0.0338
UTK	0.1526	0.1325	-0.0202	0.0661	-0.0240	-0.0902
WB	0.2035	0.1733	-0.0301	0.1840	0.1645	-0.0195
IND	0.2302	0.2114	-0.0188	0.2145	0.1970	-0.0175

Drop in income gap based on both RPL and TPL shows dramatic decline between 2009-10 and 2011-12. For poverty line based on RPL, drop in income gap was of 6.19 percentage points in rural Bihar, 4.74 percentage points in rural Andhra Pradesh. Based on TPL, drop in income gap was of 5.96 percentage points in rural Bihar, of 5.92 percentage points in rural Andhra Pradesh. Rise in income gap ratio based on RPL has been seen in seven states namely, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Kerala, Rajasthan, Tamil Nadu, and Tripura. Based on TPL, drop in income gap was in three states - Punjab, Rajasthan, and Tripura.

In the urban sector also, income gap ratio for the years 2009-10 and 2011-12 and drop in income gap ratio between the previously mentioned years present an interesting picture as given in Table 6.

Table 6. Income Gap Ratio (I) based on Rangarajan's Poverty Line (2014) and Tendulkar's Poverty Line (2009) for the Years 2009-10 and 2011-12 and Drop in Income Gap Ratio (I) between 2009-10 and 2011-12 in the Urban Sector

State	Based on Rangarajan's Poverty Line			Based on Tendulkar's Poverty Line		
	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)
AP	0.2400	0.1998	-0.0402	0.2151	0.1481	-0.0671
ASM	0.3112	0.2763	-0.0349	0.2276	0.1826	-0.0449
BHR	0.3025	0.2577	-0.0448	0.2648	0.2193	-0.0455
CTG	0.3013	0.2750	-0.0263	0.2597	0.2100	-0.0497
GUJ	0.2405	0.1988	-0.0417	0.2007	0.1630	-0.0377
HAR	0.2774	0.2189	-0.0585	0.1900	0.1752	-0.0148
HP	0.2079	0.2076	-0.0002	0.1912	0.1620	-0.0291
J&K	0.2104	0.2200	0.0097	0.1488	0.1361	-0.0127
JHK	0.3095	0.2651	-0.0444	0.2547	0.2014	-0.0533
KTK	0.2643	0.2179	-0.0465	0.2232	0.2007	-0.0225
KRL	0.2439	0.1801	-0.0638	0.1771	0.1698	-0.0073
MP	0.3148	0.2637	-0.0511	0.2422	0.1843	-0.0579
MAH	0.2597	0.2085	-0.0511	0.1939	0.1678	-0.0262
ODI	0.2777	0.2733	-0.0044	0.2065	0.1824	-0.0241
PUN	0.2365	0.2099	-0.0265	0.2039	0.1692	-0.0347
RAJ	0.2761	0.2216	-0.0545	0.1901	0.1474	-0.0427
TN	0.2322	0.2066	-0.0256	0.1671	0.1696	0.0025
TRI	0.2344	0.2148	-0.0195	0.1591	0.2308	0.0718
UP	0.3063	0.2704	-0.0359	0.2272	0.2024	-0.0249

State	Based on Rangarajan's Poverty Line			Based on Tendulkar's Poverty Line		
	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)	2009-10 (I)	2011-12 (I)	Drop in Income Gap Ratio (I)
UTK	0.2596	0.2271	-0.0326	0.1966	0.1594	-0.0372
WB	0.2717	0.2480	-0.0237	0.2056	0.1865	-0.0191
IND	0.2798	0.2544	-0.0254	0.2223	0.1988	-0.0235

In the urban sector of different states, distinct disparity about income gap based on both RPL and TPL in the year 2009-10 as well as in the year 2011-12 has been observed. Among the states, Madhya Pradesh and Assam are the top two states in respect of income gap ratio under RPL in the year 2009-10; and Assam and Chhattisgarh in the year 2011-12. Based on TPL, the states with top two positions were Tamil Nadu and Bihar in the year 2009-10; and Tripura and Bihar in the year 2011-12.

The Table, shows significant decline between 2009-10 and 2011-12 in income gap for poverty line based on RPL (of 6.38 percentage points in urban Kerala, of 5.85 percentage points in urban Haryana). For poverty line based on TPL, it also shows significant decline between 2009-10 and 2011-12 (of 6.71 percentage points in urban Andhra Pradesh, of 7.18 percentage points in urban Tripura).

Classification of States for income gap (I) at the all India level between 2009-10 and 2011-12 in the rural and urban sector has been presented in Table 7. It reveals that out of 21 states under study, the income gap based on RPL in the rural sector was above the all India level in four states, viz. ODI, BHR, CTG and MP in the year 2009-10 and in five states namely JHK, TN, ODI, CTG, and MP in the year 2011-12. Based on TPL, the income gap ratio was above the all India level in 6 states, viz. JHK, CTG, ODI, BHR, MP and UP in the year 2009-10 and 4 states, viz. CTG, RAJ, MP and UP in the year 2011-12.

Table 7. States Above all-India Average Income Gap (I) based on Rangarajan's Poverty Line and Tendulkar's Poverty Line in the Rural and Urban Sector, 2009-10 and 2011-12

Rural			
Based on Rangarajan's Poverty Line(RPL)		Based on Tendulkar's Poverty Line(TPL)	
2009-10	2011-12	2009-10	2011-12
4	5	6	4
ODI	JHK	JHK	CTG
BHR	TN	CTG	RAJ
CTG	ODI	ODI	MP
MP	CTG	BHR	UP
	MP	MP	
		UP	
Urban			
Based on Rangarajan's Poverty Line		Based on Tendulkar's Poverty Line	
2009-10	2011-12	2009-10	2011-12
6	7	7	6
CTG	BHR	KTK	KTK
BHR	MP	UP	JHK
UP	JHK	ASM	UP
JHK	UP	MP	CTG

ASM	ODI	JHK	BHR
MP	CTG	CTG	TRI
	ASM	BHR	

In the urban sector, the income gap ratio was above the all India level in six states viz., CTG, BHR, UP, JHK, ASM and MP in the year 2009-10. In the year 2011-12, 7 states, viz. BHR, MP, JHK, UP, ODI, CTG, ASM under RPL were above the all India level. Based on TPL, seven states viz., KTK, UP, ASM, MP, JHK, CTG, BHR in the year 2009-10, and six states, viz. KTK, JHK, UP, CTG, BHR, TRI in the year 2011-12 were above the corresponding all India levels.

Classification of states by the level of income gap ratio and the rate of reduction presented in Table 8 reveals that the states with income gap ratio above the national average during 2009-10 and could not achieve the average rate of reduction during the two year period need considerable attention and focus on poverty front. The states, which achieved above the average reduction in spite of having below average income gap, are well in the path of welfare state.

Table 8. Classification of States by Level of Income Gap Ratio (I) in 2010-11 and Rate of Reduction in Income Gap Ratio based on RPL and TPL in the Rural Sector

States Below / Above all India Level I in 2009-10	States Below / Above all India Level Reduction in I between 2009-10 and 2011-12							
	Rural				Urban			
	Based on RPL		Based on TPL		Based on RPL		Based on TPL	
	Below	Above	Below	Above	Below	Above	Below	Above
Number below	10	7	9	6	10	5	8	6
States below	KRL	HP	UTK	TRI	TN	HP	RAJ	J&K
	UTK	TRI	HP	PUN	PUN	J&K	HP	TRI
	PUN	KTK	GUJ	RAJ	AP	TRI	MAH	TN
	HAR	J&K	TN	ASM	GUJ	WB	UTK	KRL
	AP	RAJ	J&K	KRL	KRL	ODI	GUJ	HAR
	GUJ	TN	WB	MAH	UTK		PUN	WB
	MAH	JHK	KTK		MAH		ODI	
	WB		HAR		KTK		AP	
	ASM		AP		RAJ			
	UP				HAR			
Number above	4	None	5	1	6	None	6	1
States above	ODI		JHK	UP	CTG		UP	KTK
	BHR		CTG		BHR		ASM	
	CTG		ODI		UP		MP	
	MP		BHR		JHK		JHK	
			MP		ASM		CTG	
					MP		BHR	

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A Table 1R. State Specific Average Monthly per Capita Expenditure (M) in Rs., Lorenz Ratio (LR), Poverty Line (Z) in Rs, Poverty Ratio (p₀), Mean Income of the Poor (m) in Rs, Inequality among the Poor (LR_p) in the Rural Sector based on RPL.

State	Based on RPL (2009-10)						Based on RPL (2011-12)					
	M	LR	Z	p ₀	m	LR _p	M	LR	Z	p ₀	m	LR _p
AP	1233.76	0.261	832.27	27	667.0	0.085	1753.96	0.245	1031.74	12.7	875.8	0.180
ASM	1003.28	0.219	840.87	42.9	662.0	0.091	1218.57	0.221	1006.66	42	813.4	0.153
BHR	780.15	0.206	818.77	65.1	603.4	0.115	1126.75	0.198	971.28	40.1	775.9	0.136
CTG	783.57	0.234	762.55	58.9	560.9	0.119	1026.73	0.234	911.8	49.2	701.8	0.108
GUJ	1109.76	0.236	859.35	37	686.6	0.092	1535.66	0.248	1102.83	31.4	906.5	0.093
HAR	1509.91	0.272	879.65	19.2	717.7	0.064	2176.04	0.261	1127.82	11	947.2	0.072
HP	1535.75	0.262	827.03	11.2	724.8	0.016	2034.15	0.282	1066.6	11.1	898.6	0.074
J&K	1343.88	0.216	847.57	14.4	712.2	0.046	1742.64	0.235	1044.48	12.6	851.4	0.091
JHK	825.15	0.224	744.7	55.3	584.4	0.087	1005.55	0.206	904.02	45.9	704.4	0.099
KTK	1020.4	0.241	680.81	24.3	575.2	0.068	1561.28	0.259	975.43	19.8	834.8	0.136
KRL	1835.22	0.318	803.06	9.7	700.1	0	2668.73	0.363	975.43	7.3	891.4	0.073
MP	902.82	0.277	772.29	51.3	565.2	0.123	1152.39	0.267	941.7	45.2	709.8	0.127
MAH	1152.79	0.232	829.29	27.6	662.2	0.087	1619.22	0.253	1078.34	22.5	881.4	0.094
ODI	818.47	0.249	715.56	50	535.0	0.115	1002.61	0.232	876.42	47.8	676.5	0.102
PUN	1648.92	0.284	888.08	14.8	749.7	0.044	2344.66	0.277	1127.48	7.4	991.6	0.050
RAJ	1179.4	0.242	864.49	31.9	719.6	0.072	1597.5	0.248	1035.97	21.4	848.1	0.094
TN	1159.69	0.255	785.66	25.9	627.8	0.084	1692.93	0.277	1081.94	24.3	838.5	0.107
TRI	1176.17	0.206	777.48	16.2	677.3	0.038	1334.39	0.219	935.52	22.5	775.0	0.09
UP	899.1	0.229	768.65	46.3	602.1	0.095	1156.03	0.247	889.82	38.1	715.9	0.091
UTK	1747.41	0.421	830.09	22.5	703.4	0.058	1725.77	0.249	1014.95	12.6	880.5	0.179
WB	952.32	0.221	767.2	37.8	611.1	0.09	1290.68	0.239	934.1	30.1	772.2	0.104
AI	1053.64	0.27	801	39.6	616.6	0.102	1429.96	0.283	972	30.9	766.5	0.142

A Table 2R. State Specific Average Monthly per Capita Expenditure (M) in Rs., Lorenz Ratio (LR), Poverty Line (Z) in Rs, Poverty Ratio (p₀), Mean Income of the Poor (m) in Rs, Inequality among the Poor (LR_p) in the Rural Sector based on TPL.

State	Based on TPL (2009-10)						Based on TPL (2011-12)					
	M	LR	Z	p ₀	m	LR _p	M	LR	Z	p ₀	m	LR _p
AP	1090.28	0.269	693.8	22.8	550.8	0.084	1563.21	0.246	860	10.96	733.7	0.069
ASM	866.57	0.219	691.7	39.9	565.6	0.211	1056.98	0.213	828	33.89	686.3	0.070
BHR	689.37	0.215	655.6	55.3	496.1	0.110	970.41	0.205	778	34.06	635.0	0.074
CTG	685.89	0.234	617.3	56.1	480.9	0.098	904.04	0.244	738	44.61	589.6	0.090
GUJ	1065.4	0.252	725.9	26.7	600.4	0.068	1430.12	0.25	932	21.54	792.0	0.384
HAR	1423.27	0.277	791.6	18.6	630.3	0.069	1925.96	0.251	1,015	11.64	835.0	0.682
HP	1412.7	0.282	708	9.1	588.2	0	1800.62	0.275	913	8.48	798.5	0.044
J&K	1243.63	0.218	722.9	8.1	589.9	0	1601.51	0.248	891	11.54	744.6	0.078
JHK	724.22	0.212	616.3	41.6	482.1	0.093	919.59	0.214	748	40.84	622.1	0.068
KTK	887.86	0.232	629.4	26.1	513.3	0.072	1395.10	0.264	902	24.53	780.9	0.055
KRL	1763.14	0.35	775.3	12	629.9	0.034	2355.53	0.357	1,018	9.14	835.6	0.734
MP	802.79	0.276	631.9	42	472.0	0.111	1024.14	0.264	771	35.74	592.2	0.105
MAH	1048.41	0.244	743.7	29.5	600.9	0.075	1445.89	0.255	967	24.22	782.2	0.542
ODI	715.59	0.248	567.1	39.2	436.8	0.105	904.78	0.236	695	35.69	560.1	0.082
PUN	1565.53	0.285	830	14.6	719.0	0.036	2136.39	0.273	1,054	7.66	894.1	0.767
RAJ	1035.15	0.213	755	26.4	631.0	0.063	1445.74	0.23	905	16.05	722.8	0.101
TN	1017.07	0.256	639	21.2	527.4	0.064	1570.61	0.278	880	15.83	742.9	0.068
TRI	980.21	0.197	663.4	19.8	585.1	0.041	1194.14	0.209	798	16.53	692.1	0.053
UP	832.18	0.231	663.7	39.4	535.3	0.084	1072.93	0.258	880	11.62	624.9	0.082
UTK	1694.67	0.438	719.5	14.9	619.8	0.043	1551.42	0.25	768	30.4	786.5	0.044
WB	857.77	0.22	643.2	28.8	524.9	0.074	1170.11	0.238	783	22.52	654.2	0.074
AI	953.05	0.276	672.8	33.8	528.5	0.094	1287.17	0.284	816	25.7	655.3	0.089

A Table 1U. State Specific Average Monthly per Capita Expenditure (M) in Rs., Lorenz Ratio (LR), Poverty Line (Z) in Rs, Poverty Ratio (p₀), Mean Income of the Poor (m) in Rs, Inequality among the Poor (LR_p) in the Urban Sector based on RPL.

State	Based on RPL (2009-10)						Based on RPL (2011-12)					
	M	LR	Z	p ₀	m	LR _p	M	LR	Z	p ₀	m	LR _p
AP	2237.6	0.360	1258.1	30.5	956.1	0.126	2685.1	0.301	1370.84	15.6	1096.9	0.080
ASM	1754.7	0.333	1232.2	40.2	848.7	0.103	2189.2	0.326	1420.12	3.2	1027.8	0.140
BHR	1237.5	0.325	1032.8	55	720.4	0.141	1506.6	0.291	1229.3	0.8	912.5	0.116
CTG	1647.3	0.312	1167.8	36.5	816.0	0.102	1867.9	0.364	1229.72	437	891.6	0.127
GUJ	1909.1	0.305	1244.8	35.6	945.4	0.116	2581.3	0.284	1507.06	2.2	1207.4	0.030
HAR	2321.5	0.344	1275.5	24.8	921.7	0.116	3817.3	0.41	1528.31	5.3	1193.8	0.090
HP	2653.9	0.373	1178.5	22.5	933.5	0.118	3258.5	0.29	1411.59	8.8	1118.5	0.071
J&K	1759.5	0.284	1200.4	32.4	947.9	0.113	2485.3	0.301	1403.25	216	1094.5	0.088
JHK	1583.8	0.356	1086.1	42.1	749.9	0.117	2018.3	0.312	1272.06	3.3	934.8	0.140

KTK	2053.2	0.338	1145.5	26.7	842.7	0.084	3025.5	0.403	1373.28	5.1	1074.1	0.030
KRL	2412.6	0.388	1139.8	23.7	861.8	0.094	3408.5	0.414	1353.68	153	1109.9	0.090
MP	1665.8	0.366	1153.6	45	790.4	0.145	2058.0	0.362	1340.28	4.1	986.8	0.119
MAH	2436.8	0.378	1331.3	30.3	985.6	0.133	3189.0	0.35	1560.38	7	1235.0	0.101
ODI	1548.4	0.354	1030.7	41.2	744.5	0.137	1940.6	0.359	1205.37	6.3	876.0	0.140
PUN	2108.8	0.328	1230.7	28.6	939.7	0.101	2794.0	0.31	1479.27	176	1168.7	0.940
RAJ	1663.1	0.309	1186.7	38.5	859.1	0.101	2442.4	0.32	1406.15	2.5	1094.5	0.101
TN	1947.6	0.323	1179.8	29.7	905.9	0.104	2622.2	0.326	1380.36	0.3	1095.2	0.089
TRI	1871.1	0.313	1171.6	31.7	897.0	0.112	2144.5	0.297	1376.55	313	1080.8	0.050
UP	1573.9	0.377	1130.8	49.6	784.5	0.087	2051.2	0.391	1329.55	4.7	970.1	0.190
UTK	1744.9	0.309	1169.8	36.4	866.1	0.116	2339.0	0.312	1408.12	9.5	1088.4	0.011
WB	1964.8	0.376	1162.1	36.6	846.3	0.137	2591.0	0.372	1372.68	29	1032.2	0.107
AI	1984.5	0.362	1198.0	35.1	862.8	0.111	2629.7	0.363	1407	26.4	1049.0	0.115

A Table 2U. State Specific Average Monthly Per capita Expenditure (M) in Rs., Lorenz Ratio (LR), Poverty Line (Z) in Rs, Poverty Ratio (p₀), Mean Income of the Poor (m) in Rs, Inequality Among the Poor (LR_p) in the Urban Sector based on TPL.

State	Based on TPL (2009-10)						Based on TPL (2011-12)					
	M	LR	Z	p ₀	m	LR _p	M	LR	Z	p ₀	m	LR _p
AP	2015.4	0.353	926.4	17.7	727.1	0.075	2559.30	0.313	1,009	5.81	860	0.062
ASM	1604.1	0.327	871	26.1	672.8	0.098	2090.18	0.35	1,008	20.49	824	0.073
BHR	1096.6	0.316	775.3	39.4	570.0	0.113	1396.65	0.284	923	31.23	721	0.084
CTG	1370.3	0.305	806.7	23.8	597.2	0.104	1776.21	0.391	849	24.75	671	0.077
GUJ	1914.2	0.308	951.4	17.9	760.5	0.069	2472.49	0.287	1,152	10.14	964	0.062
HAR	2008.2	0.357	975.4	23	790.1	0.063	3346.32	0.386	1,169	10.28	964	0.069
HP	2301.1	0.352	888.3	12.6	718.5	0.038	3173.30	0.333	1,064	4.33	892	0.063
J&K	1666.8	0.307	845.4	12.8	719.6	0.029	2320.28	0.304	988	7.2	854	0.051
JHK	1442.1	0.342	831.2	31.1	619.5	0.111	1894.41	0.34	974	24.83	778	0.080
KTK	2060.3	0.374	908	19.6	705.3	0.077	2898.94	0.411	1,089	15.25	870	0.075
KRL	2267.2	0.399	830.7	12.1	683.6	0.032	3044.22	0.393	987	4.97	819	0.078
MP	1529.8	0.365	771.7	22.9	584.8	0.092	1842.35	0.366	897	21	732	0.067
MAH	2251.4	0.38	961.1	18.3	774.7	0.058	2937.06	0.363	1,126	9.12	937	0.065
ODI	1468.8	0.376	736	25.9	584.0	0.088	1830.33	0.348	861	17.29	704	0.061
PUN	2072.1	0.357	960.8	18.1	764.9	0.069	2743.07	0.318	1,155	9.24	960	0.068
RAJ	1576.6	0.316	846	19.9	685.2	0.069	2206.93	0.311	1,002	10.69	854	0.060
TN	1795.5	0.328	800.8	12.8	667.0	0.038	2534.32	0.333	937	6.54	778	0.085
TRI	1675.0	0.286	782.7	10	658.2	0	1996.66	0.293	920	7.42	708	0.074
UP	1512.2	0.395	799.9	31.7	618.1	0.097	1942.25	0.346	941	26.06	756	0.078
UTK	1643.2	0.322	898.6	25.2	721.9	0.082	2452.02	0.411	1,082	10.4	926	0.052
WB	1801.0	0.384	830.6	22	659.8	0.083	2489.89	0.387	981	14.6	798	0.070
AI	1856.0	0.371	860	20.9	669.0	0	2477.02	0.372	1,000	13.7	801	0.083

A Table B. Coefficients of Log Linear Model and their Standard Errors for Consumption Gap based on RPL and TPL in the Rural and Urban Sector, 2009-10 and 2011-12.

Rural								
RPL (2009-10)					RPL (2011-12)			
	Constant	AMPCE	G	HCR	Constant	AMPCE	G	HCR
Coefficient	-1.533	-0.175	-0.414	1.648	-2.617	0.091	1.598	-0.971
Robust S.E. (est.b)	1.467	0.372	0.286	0.143	2.179	0.544	0.211	0.471
Statistic-t	-1.045	-0.472	-1.451	1.497	-1.201	0.167	7.579	-2.059
Sig.	0.311	0.643	0.165	0.000	0.246	0.869	0.000	0.055
R Square	0.988				0.991 ^a			
Adj. R Square	0.985				0.981			
TPL (2009-10)					TPL (2011-12)			
	Constant	AMPCE	G	HCR	Constant	AMPCE	G	HCR
Coefficient	1.758	-0.927	1.146	0.130	2.605	-1.040	0.997	0.540
Robust S.E. (est.b)	1.523	0.388	0.163	0.338	1.243	0.303	0.133	0.487
Statistic-t	1.154	-2.388	7.023	0.386	2.096	-3.430	7.493	1.110
Sig.	0.264	0.029	0.000	0.705	0.051	0.003	0.000	0.282
R Square	0.968				0.951			
Adj. R Square	0.963				0.943			
Urban								
RPL (2009-10)					RPL (2011-12)			
	Constant	AMPCE	G	HCR	Constant	AMPCE	G	HCR
Coefficient	-0.152	-0.475	1.620	0.053	1.040	-0.705	1.272	-0.165
Robust S.E. (est.b)	1.896	0.411	0.298	0.356	1.361	0.309	0.151	0.278
Statistic-t	-0.080	-1.157	5.436	0.148	0.764	-2.282	8.448	-0.591
Sig.	0.937	0.263	0.000	0.884	0.455	0.036	0.000	0.562
R Square	0.959				0.987			
Adj. R Square	0.952				0.985			
TPL (2009-10)					TPL (2011-12)			
	Constant	AMPCE	G	HCR	Constant	AMPCE	G	HCR
Coefficient	-1.348	-0.233	1.618	-0.649	-0.009	-0.462	1.240	-0.406
Robust S.E. (est.b)	0.828	0.193	0.096	0.295	0.915	0.222	0.081	0.290
Statistic-t	-1.627	-1.206	16.93	-2.200	-1.627	-1.206	16.93	-2.200
Sig.	0.122	0.244	0.000	0.042	0.122	0.244	0.000	0.042
R Square	0.981				0.983			
Adj. R Square	0.978				0.980			

A Table C. Coefficients of Log Linear Model and their Standard Errors for Consumption Gap based on RPL and TPL in the Rural and Urban Sector, 2009-10, and 2011-12.

Rural								
RPL (2009-10)					RPL (2011-12)			
	Constant	AMPCE	Gp	HCR	Constant	AMPCE	Gp	HCR
Coefficient	1.109	-0.697	1.279	0.226	0.494	-0.640	1.416	-0.043
Robust S.E. (est.b)	1.003	0.241	0.171	0.127	1.804	0.488	0.216	0.143
Statistic-t	1.106	-2.890	7.474	1.790	0.274	-1.312	6.559	-0.298
Sig.	0.285	0.011	0.000	0.092	0.788	0.207	0.000	0.769
R Square	0.986				0.977			
Adj. R Square	0.983				0.972			
TPL (2009-10)					TPL (2011-12)			
	Constant	AMPCE	Gp	HCR	Constant	AMPCE	Gp	HCR
Coefficient	-0.459	-0.319	1.465	0.131	3.323	-1.297	0.932	0.169
Robust S.E. (est.b)	1.041	0.288	0.159	0.048	0.748	0.202	0.093	0.037
Statistic-t	-0.441	-1.108	9.229	2.704	4.446	-6.405	10.013	4.613
Sig.	0.665	0.283	0.000	0.015	0.000	0.000	0.000	0.000
R Square	0.978				0.977			
Adj. R Square	0.977				0.973			
Urban								
RPL (2009-10)					RPL (2011-12)			
	Constant	AMPCE	Gp	HCR	Constant	AMPCE	Gp	HCR
Coefficient	-1.055	-0.326	1.758	-0.187	3.100	-1.044	0.991	
Robust S.E.(est.b)	1.444	0.313	0.251	0.162	0.884	0.179	0.123	0.440
Statistic-t	-0.731	-1.043	7.003	-1.159	3.507	-5.826	8.029	0.196
Sig.	0.475	0.311	0.000	0.262	0.003	0.000	0.000	2.244
R Square	0.959				0.987			0.038
Adj. R Square	0.952				0.985			
TM (2009-10)					TM (2011-12)			
	Constant	AMPCE	Gp	HCR	Constant	AMPCE	Gp	HCR
Coefficient	-0.129	-0.460	1.505	0.030	1.642	-0.687	1.123	HCR
Robust S.E.(est.b)	0.625	0.173	0.086	0.036	0.580	0.144	0.058	0.499
Statistic-t	-0.207	-2.657	17.560	0.843	2.832	-4.771	19.422	0.165
Sig.	0.839	0.017	0.000	0.411	0.012	0.000	0.000	3.031
R Square	0.976				0.988			0.008
Adj. R Square	0.972				0.986			

A Table D. Coefficients of Log Linear Model and their Standard Errors for Poverty Ratio based on RPL and TPL in the Rural and Urban Sector, 2009-10, and 2011-12.

Rural						
RPL (2009-2010)				RPL (2011-12)		
	Constant	AMPCE	G	Constant	AMPCE	G
Coefficient	9.601	-2.417	1.267	9.567	-2.416	0.903
Robust S.E. (est..b)	0.838	0.222	0.362	0.924	0.215	0.482
Statistic-t	11.458	-10.890	3.495	10.350	-11.227	1.871
Sig.	0.000	0.000	0.003	0.000	0.000	0.078
R Square	0.887			0.927		
Adj.R Square	0.875			0.919		
TPL (2009-10)				TPL (2011-12)		
	Constant	AMPCE	G	Constant	AMPCE	G
Coefficient	8.331	-2.096	1.050	6.620	-1.665	0.204
Robust S.E. (est..b)	0.992	0.265	0.421	1.552	0.366	0.861
Statistic-t	8.399	-7.919	2.497	4.265	-4.546	0.237
Sig.	0.000	0.000	0.022	0.000	0.000	0.815
R Square	0.820			0.671		
Adj.R Square	0.800			0.635		
Urban						
RPL (2009-10)				RPL (2011-12)		
	Constant	AMPCE	G	Constant	AMPCE	G
Coefficient	6.128	-1.302	0.707	8.754	-1.962	1.478
Robust S.E. (est..b)	0.405	0.108	0.227	0.529	0.141	0.262
Statistic-t	15.122	-12.073	3.111	16.541	-13.918	5.640
Sig.	0.000	0.000	0.006	0.000	0.000	0.000
R Square	0.892			0.916		
Adj.R Square	0.880			0.907		
TPL (2009-10)				TPL (2011-12)		
	Constant	AMPCE	G	Constant	AMPCE	G
Coefficient	7.384	-1.606	1.905	9.794	-2.297	2.133
Robust S.E. (est..b)	1.069	0.288	0.573	1.313	0.349	0.676
Statistic-t T	6.908	-5.577	3.326	7.458	-6.588	3.153
Sig.	0.000	0.000	0.004	0.000	0.000	0.005
R Square	0.643			0.711		
Adj.R Square	0.603			0.679		

A Table E. Coefficients of Log Linear Model and their Standard Errors for Poverty Ratio in the Rural and Urban Sector, 2009-10, and 2011-12 based on RPL and TPL Employing G_p in Place G.

Rural						
RPL (2009-10)				RPL (2011-12)		
	Constant	AMPCE	Gp	Constant	AMPCE	Gp
Coefficient	7.296	-1.891	0.062	8.086	-2.141	-0.062
Robust S.E. (est.b)	0.652	0.214	0.077	0.493	0.170	0.156
Statistic-t	11.187	-8.816	0.801	16.397	-12.577	-0.398
Sig.	0.000	0.000	0.433	0.000	0.000	0.695
R Square	0.818			0.914		
Adj.R Square	0.797			0.904		
TPL (2009-10)				TPL (2011-12)		
	Constant	AMPCE	Gp	Constant	AMPCE	Gp
Coefficient	4.953	-1.051	0.319	6.759	-1.729	0.067
Robust S.E. (est.b)	0.403	0.163	0.109	1.022	0.311	0.091
Statistic-t	12.279	-6.465	2.935	6.615	-5.562	0.737
Sig.	0.000	0.000	0.010	0.000	0.000	0.470
R Square	0.919			0.680		
Adj.R Square	0.909			0.644		
Urban						
RPL (2009-10)				RPL (2011-12)		
	Constant	AMPCE	Gp	Constant	AMPCE	Gp
Coefficient	5.519	-1.145	0.249	6.841	-1.250	1.207
Robust S.E. (est.b)	0.382	0.116	0.140	0.500	0.174	0.244
Statistic-t	14.453	-9.900	1.783	13.675	-7.184	4.948
Sig.	0.000	0.000	0.091	0.000	0.000	0.000
R Square	0.858	0.901		0.901		
Adj.R Square	0.843	0.890		0.890		
TPL (2009-10)				TPL (2011-12)		
	Constant	AMPCE	Gp	Constant	AMPCE	Gp
Coefficient	5.572	-1.350	-0.092	8.106	-1.812	0.802
Robust S.E. (est.b)	1.111	0.354	0.095	1.393	0.403	0.644
Statistic-t	5.016	-3.812	-0.968	5.820	-4.498	1.245
Sig.	0.000	0.001	0.346	0.000	0.000	0.229
R Square	0.452			0.588		
Adj. R Square	0.391			0.542		

Quantifying and Comparing Underemployment: A Multidimensional Approach using Fuzzy Logic

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Abstract

The labour dynamics of a nation are frequently assessed by the volume of job seekers and the number of individuals who have successfully secured employment. However, we often overlook those who are employed but endure profound hardships due to various deficiencies in their working conditions. In the case of a developing nation like India, where the prevalence of working poverty is significant, it becomes imperative to transcend the conventional definition of unemployment and labour supply when formulating critical policy decisions. The objective of this paper was to devise a measure of inadequate employment that captures the numerous inadequacies experienced by individuals in the workforce, encompassing low wages, insufficient full-time employment, and occupations that do not utilize their full skill set. Instead of the traditional approach of measuring underemployment by classifying a person as underemployed based on the hours they work, this paper uses a multidimensional approach based on which a score of underemployment is assigned to each individual. Notably, despite India's unemployment rate standing at a mere 6.8% according to the Periodic Labour Force Survey (PLFS) data of first quarter of 2023, the underemployment metric was unsurprisingly high. To foster a forward-looking perspective on growth, it is crucial for every developing nation to consider underemployment as a vital metric due to its importance in socio-economic and human resource development planning and policy formulation.

Keywords: Unemployment, Underemployment, PLFS. Adequate Employment, Sustainable Development Goals, Fuzzy Logic, Fuzzy System

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1. Introduction

Viksit Bharat Abhiyan aims to establish India as a developed nation by 2047, the main criterion for which is that per capita income should be at least \$13,000, which presently is \$2,300 for India. The eighth goal of the Sustainable Development Goals (SDGs) focuses on promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. The score of India in this goal is a moderate 61 out of 100 as per data available on the official site of Niti Aayog [1] during the middle of 2023. The indicators which are monitored to achieve performance against this goal include unemployment rate (UR), labour force participation rate (LFPR) and percentage of regular wage/salaried employees employed in non-agricultural sectors who do not receive any social security benefits. These indicators may be mapped to targets 8.5 through 8.8 set by the United Nations ([2]) which are designed specifically for promoting productive employment and decent work conditions for all. It has been predicted by many Indian policy makers that at a GDP growth rate of 6.5%-7%, India can achieve not just the SDG goals by 2030, but also the status of developed nation by 2047. For some of the indicators of goal 8 the targets do not seem to be farfetched, as unemployment rate has been dipping for years and is not very far from achieving the target of 3% while overall LFPR sat at 55.2% in 2021-22 with a target of 68.3%. But, when we speak about decent work conditions, UR and LFPR may not be sufficient to measure the impact. When India achieves the targeted values for UR and LFPR, we will certainly be able to celebrate its full employment status, but will we also be able to celebrate the productivity and inclusiveness of the Indian labour market?

Even though National Family Health Survey (NFHS)-5 data shows that India has significantly improved in terms of sex ratio (sex ratio at birth has improved from 919 as reported by NFHS-4 (2014-15) to 929 as reported by NFHS-5 (2019-20)), the story of female empowerment remains incomplete if we do not speak about the low female LFPR which decreased from 39.2% in 2020-21 to 38.7% in 2021-22 (by Current Weekly Status, (CWS)). Another interesting fact about India's labour dynamics is that as per the PLFS 2021-22 report, only 21.5% of India's work force is employed as regular wage/salaried workers while the rest are either self-employed or are working as casual labourers. Also about one-fourth (23.3%) of the work force are engaged as elementary workers which consist of simple and routine tasks which mainly require the use of hand-held tools and often some physical effort.

A recently published article [3] tells the tale of a female cab driver named Sheetal Kashyap who works for 18 hours daily to earn Rs. 35,000 to Rs. 40,000 per month, while her monthly expense exceeds Rs. 45,000, of which her medical bills alone amount to Rs. 20,000. Another narration from a book by Rukmini S. ([4]) explores the life of Ramkumar Gupta, who is more than 60 years old and sells seasonal fruits from 9am to 9pm in the streets of Delhi. The site of Ministry of Labour and Employment (<https://labour.gov.in/unorganized-workers>) of India states that about 93% of the total workforce in the country works in the unorganized sector and the majority of them are like Sheetal and Ramkumar, who are not covered by any social security benefit. To capture the plight of people like Sheetal and Ramkumar, it is necessary to go beyond the concept of unemployment to understand deficiencies in the labour market.

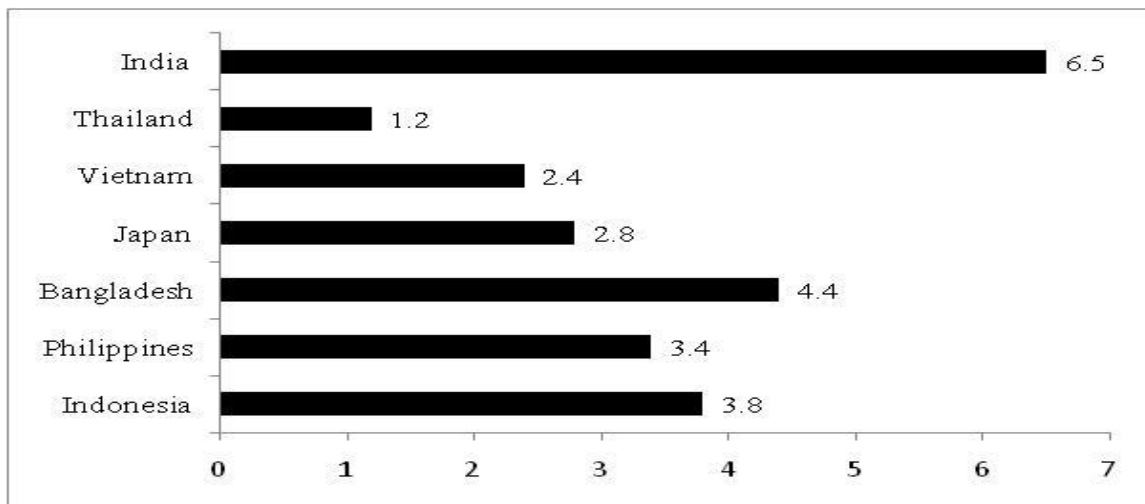


Figure 1. Unemployment Rate, Selected Asian Countries, 2022;

Source: ILO, <https://ilostat ilo.org/topics/unemployment-and-labour-underutilization/>

A group of employed people who are often underutilized in terms of their desire or capacity to do work are counted as ‘underemployed’ according to ICLS standards. *They tend to work less hours, earn less income or use their occupational skills incompletely; in other words, they tend to carry out an activity which is less productive than they could and would like to carry out* [5]. In developing countries like India, the unemployment rate tends to be generally low (6.5% as per PLFS 2021-22 report by CWS method) which is not significantly higher than the unemployment rate of other Asian countries as illustrated in figure 1. This is because people cannot ‘afford’ to stay unemployed and need to be involved in a job even if they cannot utilize their full potential in it. Many people from poor households are often involved in non-standard form of employment which involve part time and contractual works. They are alternatively often engaged in precarious works, where they are paid a low hourly wage, lack control over their work, are not entitled to social security benefits, and have low or no job security and unsafe and unhealthy work environments. In India, around 93% of workers are involved in informal sectors of the economy where non-standard form of employment and precarious work are very common. Also, a large number of employed people classify themselves as either self-employed or casual wage labourers. Owing to the wide definition of self-employed which ranges from running a tea stall to working in a farm to being a practicing doctor, it is very likely that many self-employed people are also susceptible to the risk of involvement in precarious works.

While conceptually underemployment may encompass all the important characteristics of a job which deviate from the characteristics of full time work with justified pay and a healthy work environment, measuring it with equal inclusivity is complicated and is often hindered by data gaps. The labour utilization framework of Hauser (1974 [6] and 1977 [7]) explores the topic of underemployment and has identified 6 strata of the labour force. The first two strata are individuals who are either out of the labour force or unemployed. The next three concern underemployment

- i. **Low-hour workers (H).** This includes workers who are involuntary working part-time or who work less than the normal working hours.

- ii. **Low-income workers (I).** This includes workers whose work-related income is less than the minimum social requirement, i.e., less than 1.25 times the poverty line for an individual.
- iii. **Mismatched workers (M).** Mismatched workers can be a result of being overeducated compared to what is typically required in relevant occupations, i.e., years of schooling is more than one standard deviation above the mean schooling years required for relevant occupations.

The last category, which is defined as ‘adequately employed’, includes those who do not fall in any of the previously described five categories. However, as per recommendations of the 16th International Conference of labour Statisticians in October 1998 [8], measurements related to underemployment and inadequate employment are restricted to time-related underemployment only. A time-related underemployed person is defined as a person satisfying the following three criteria: (i) working less than a threshold relating to working time, (ii) willing to work additional hours, and (iii) available to work additional hours. The ILO research reveals that 40 hours per week is now the most prevalent weekly hour standard. Almost half of 103 countries reviewed in the ILO report have adopted 40 hours per week or less ([9]). ADB [10] proposed a new normal working time of 44 hours based on cluster analysis applied to the Indonesian labour force survey. Developed countries like the UK and US use the time-based measurement to obtain the percentage of part-time workers as a metric for underemployment. However, normal working hours should be determined considering the national circumstances, usual practices or a uniform conventional norm.

Practically, there is no such concept as ‘normal working hours’ for India, though the maximum working hours for a day are capped at 8 hours by the Factories Act, 1948. Developing countries like India tend to have longer working hours and hence, applying a cut-off of 40 hours or even 44 hours coupled with the other two conditions that a person should be willing to work additional hours and must be available to do so will yield only a very insignificant figure. However, working for longer hours does not necessarily indicate adequate employment. It is high time that we explore new dimensions of measuring underemployment which involve at least two more criteria for identifying inadequate employment, namely, wage, and skill-mismatch.

In light of recent developments in the labour market, the 19th ICLS (2013) has recognised that there is need to move away from the old definition of underemployment related to time and focus on other dynamics including wages earned per hour, skill utilization of a worker, social security benefits received at work, decent work condition etc. [11]. However, the inclusion of multiple characteristics renders the measure more intricate and requires extensive research to develop a standardized international measure of inadequate employment.

So far we have explored the inadequacies of measuring underemployment using only time measures. In the rest of the paper, we examine and propose a new measure based on multiple dimensions of inadequate employment as proposed by the 19th ICLS. Section 2, discusses in detail the data we used, while section 3, and explains the dimensions of employment we considered in our analysis. Finally, section 4, proposes a new measure with a detailed account of our methodology and section 5, concludes our analysis and discusses further scope for improvement and possible data gaps.

2. A brief description of the PLFS Data (2021-22)

The National Sample Survey Office (NSSO) has been conducting the Periodic Labour Force Survey (PLFS) since 2017 in recognition of the significance of having more frequent labour force data. The PLFS serves as the primary data source concerning employment and unemployment conditions in India. The data obtained from the PLFS is utilized for planning, formulating policies, providing decision support, and serving as input for statistical analysis by different government departments, ministries, organizations, scholars, researchers, and academicians.

Some important definitions regarding labour force parameters in India are:

- **Labour Force:** Persons who are either 'working' (or employed) or 'seeking or available for work' (or unemployed) constitute the labour force.
- **Self-employed:** Persons who operate their own farm or non-farm enterprises or are engaged independently in a profession or trade on own-account or with one or a few partners are deemed to be self-employed in household enterprises.
- **Regular wage/salaried employee:** These are persons who work in others' farm or nonfarm enterprises (both household and non-household) and, in return, receive salary or wages on a regular basis (i.e. not on the basis of daily or periodic renewal of work contract).
- **Casual Labour:** A person who is casually engaged in others' farm or non-farm enterprises (both household and non-household) and, in return, receive wages according to the terms of the daily or periodic work contract, is considered as a casual labour.
- **Different approaches for determining activity status:** In the labour force surveys, the activity status of a person is determined on the basis of the activities pursued by the person during certain specified reference period. The activity status determined on the basis of the reference period of last 365 days preceding the date of survey is known as the usual activity status of the person, that determined on the basis of a reference period of last 7 days preceding the date of survey is known as the current weekly status (CWS) of the person and the activity status determined for each day of the reference week which is known as the current daily status (CDS) of the person. For the PLFS, activity status is collected for all the three reference periods mentioned above, viz., last 365 days for usual status, using a reference period of 7 days preceding the date of the survey for current weekly status and each day of the reference week for current daily status. However, all the analysis and result presented here are based on activity status of CWS.
- **Current Weekly Activity Status (CWS):** A person is considered working (or employed) according to CWS status if he/ she worked for at least one hour on at least one day during the 7 days preceding the date of survey or if he/she had work for at least 1 hour on at least one day during the 7 days preceding the date of the survey but did not do the work. The short reference period helps to capture short term fluctuations caused due to seasonality in the labour market. Also, it characteristically gives more importance to "working" than to "not working".

The information on wage, hours worked and the industry the person worked in (National Industrial Classification (NIC) Code) is also available for the last 7 days. Moreover, we also have

information about the additional hours an individual was willing to work. All NSS survey data (households/establishments) comes with an inflating factor (survey weights/multipliers) indicating the number of similar households/establishments the entity represents. For more details on the survey’s theory and concept the annual report of PLFS 2021-22 ([12]) may be referred to. We shall now explore in detail the various aspects of labour dynamics like time, wage, occupational skill etc. based on PLFS data from 2021-22. Also, we shall show why the current estimate of underemployment based on time alone may not be a sufficiently explicable measure of employment adequacy.

3.1 How many hours do Indians work?

An average Indian works fairly longer hours as compared to other Asian countries, as illustrated in figure 2. By CWS status, according to PLFS 2021-22 findings an average Indian works for 47.6 hours per week. An average Indian male works for 50.8 hours and an average Indian female works for 38.8 hours weekly. The corresponding figure for females does not include unpaid family work such as childcare and household chores.

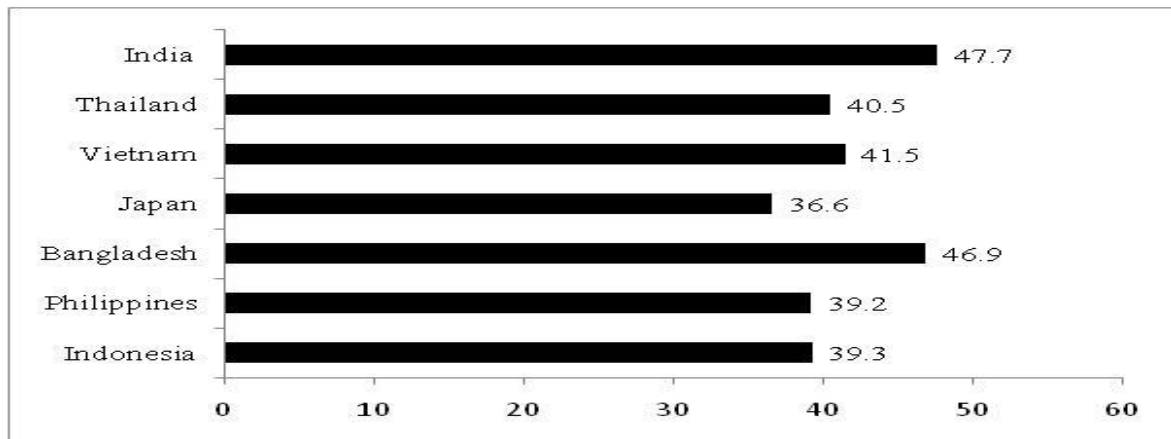


Figure 2. Average Weekly Working hours per Person, Selected Asian Countries, 2022;

Source: ILO <https://ilostat.ilo.org/topics/working-time/>

Using a definition of underemployment stating that anyone working less than 40 hours per week and who is available to do additional work is considered so, only 1.2% of Indians can be categorized as underemployed. The figure for males is 0.09%, while for females it is 1.8%. Moving the cutoff from 40 to 44 hours as suggested by ADB results in only a small change to the figures, to 1.6% for the total population.

Considering the long hours Indians work, it would be beneficial to know what proportion of people actually work more than the prescribed 48 hours’ maximum defined by international labour standards (8 hours per day for 6 days according to Article 13, Hours of Work Convention, 1930, ILO). A hefty 55% of the employed population works for more than 48 hours every week (63.8% for men and 30.2% for women). For people aged over sixty years, 35% work more than 48 hours weekly. The respective figures for males and females are 40% and 16.2%, respectively. This shows that not only do Indians work long hours on average, the trend is also prevalent among the senior citizens of the country who are mostly engaged in agriculture (57%), service works (8.5%) and elementary occupation (18%).

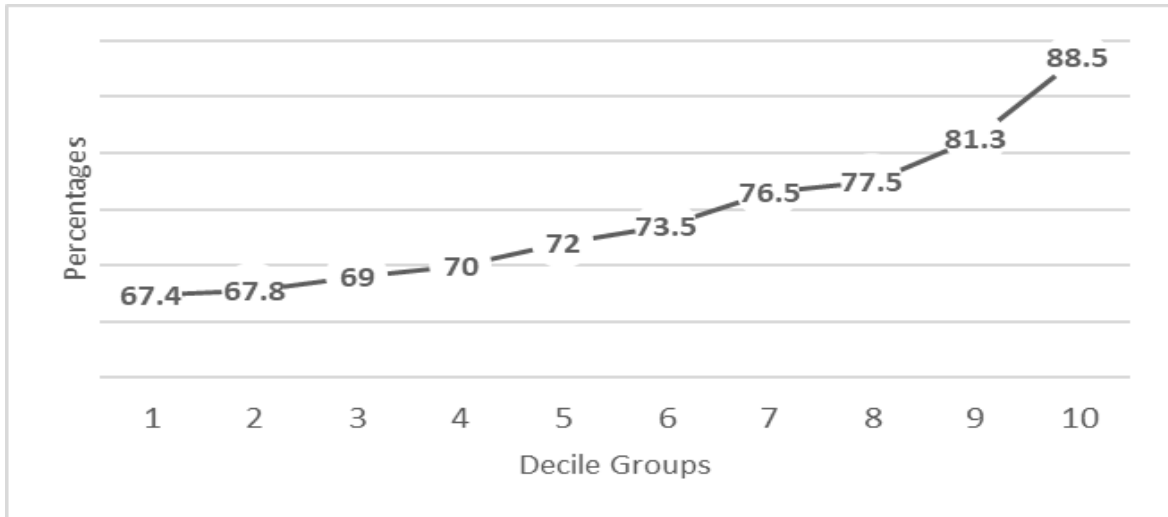


Figure 3. Percentage of Indians Adequately Employed using the Time-Related Underemployment Concept, by Groups of MPCE

In the context of the Indian economy, it is thus very unlikely that an employed person will be underemployed by the time definition. However, as we look at figure 3, it becomes clearer whom we might be missing when we define an employed person as adequately employed. We can observe that for the first three poorest deciles, we are classifying a majority of people as adequately employed considering only time criteria without looking at other aspect of their employment status like the wage they receive and the condition of their work environment. This is important to note because a significant number of Indians are classified as working poor; people who are employed but are still not earning enough to escape poverty. Some of them may actually be classified as extremely poor (earning less than \$1.90 per day, the international poverty line defined by World Bank).

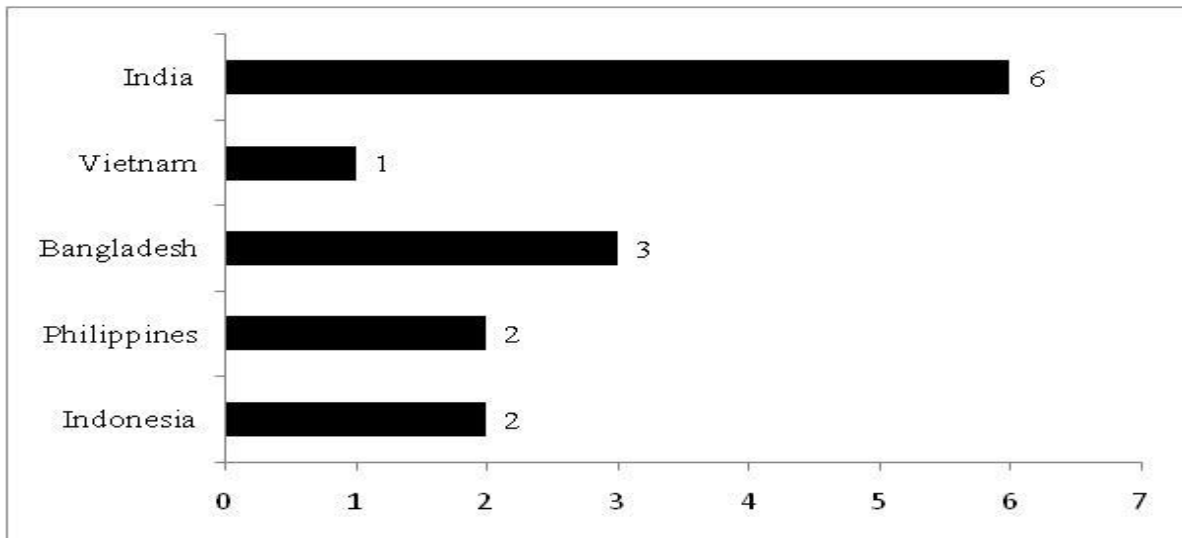


Figure 4. Working Poverty Rate, Selected Asian Countries, 2022;

Source: ILO, <https://ilostat.ilo.org/topics/working-poverty/>

Figure 4 shows us the percentage of people who are working and are extremely poor for India and other Asian countries and we can observe that 6% of Indians are working population are extremely poor. Another 28% are classified as moderately poor and another 39% are near poor.

Thus wage, too plays an important role in labour dynamics and we shall now look at some of it's characteristics in the Indian context.

3.2. How much do Indians earn?

Indians earn comparatively less than other Asian developing countries of the world as illustrated in figure 5, which could be a possible explanation of the high working hours. Further in figure 6 where we plotted average working hours (x-axis) against average wage (y-axis) received by National Industrial Classification (NIC, 2008) it is observed that the relationship is highly heretoscedastic where variability in wage increases with increase in working hours. An average Indian earns around Rs. 2,500 monthly (including earnings from regular salary, casual labour wage and earnings from self engagement) with an hourly wage rate of Rs. 50 according to PLFS data of 2021-22 by CWS status. The disparity in labour dynamics among gender is reflected not only through the difference in LFPR but also through weekly wages, where an average Indian male earns around Rs. 3,000 (hourly wage rate of Rs. 58) while an average Indian female earns only around Rs. 1,300 (hourly wage rate of Rs. 30).

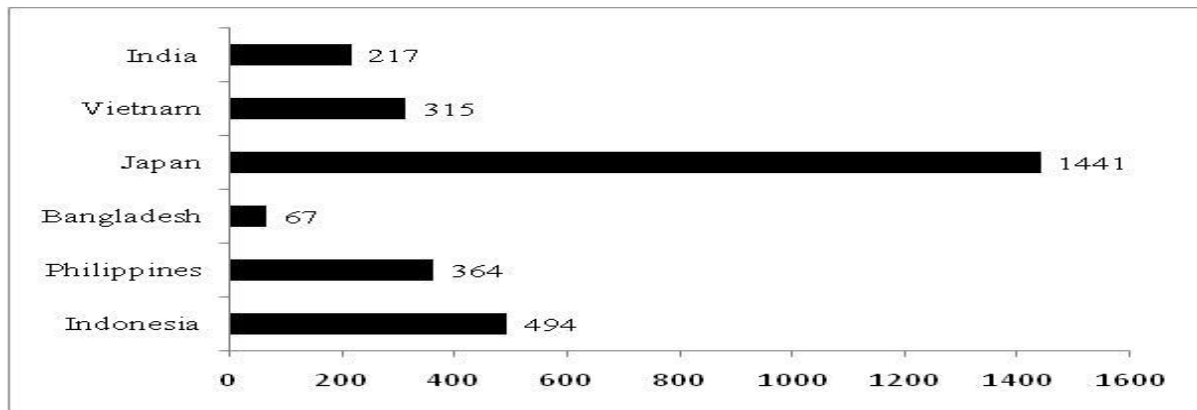


Figure 5: Statutory gross monthly minimum wage in 2017 PPP USD, selected Asian countries, 2022; source: ILO, <https://ilostat ilo.org/topics/wages/>

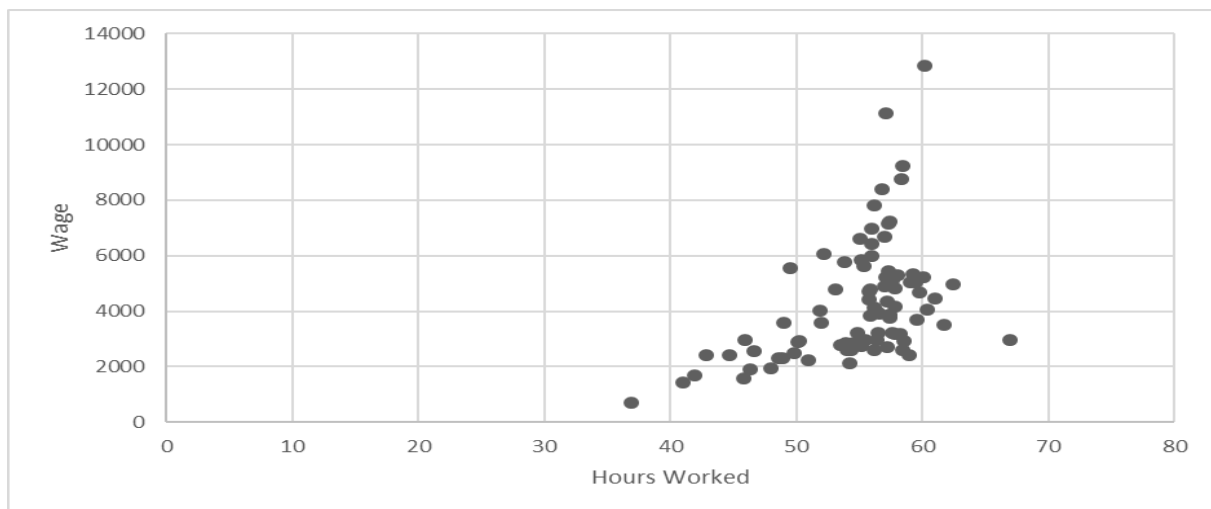


Figure 6. Hours Worked Versus Wage Received According to NIC

The minimum wage rate differs across regions and professions in India. However, to define a cut-off to meet social requirements, ILO, in reference to labour legislation of different nations,

has published the monthly minimum wage rate (2022) as Rs. 4,629 for India. Considering the Wage Rate Index (WRI) of 2021 (with base year 2016) as 125.3 and that of 2022 as 130.8 and dividing by 4.33 to convert the monthly wage into weekly wage rate and adjust for inflation, we obtain the weekly minimum wage rate as Rs. 1,024. Around 27% of Indians earn less than that amount weekly while the corresponding figures for male and females are 15% and 60%, respectively. Thus, considering the low wage criterion, many Indians can be classified as inadequately employed.

Another interesting thing about wages is the variation of wage across income groups and type of work they are engaged in (self-employed, regular salaried and casual labourers). Those in the lowest income group are mostly engaged as either self-employed (55%) or as casual labourers (36%) while the least are engaged as regular salaried (9%). The situation is completely opposite for the upper income decile where most of them are engaged as regular salaried (55%). We compared the total wages received weekly by each income group and observed that for the poor, the most important source of income is from casual labour work and thus it is essential to have a strict regulation on minimum wage or lowest income they receive through government intervention to help them escape the poverty trap.

3.3. Are Indians Pursuing Jobs suitable for their Qualifications?

The occupations in PLFS are recorded as per National Classification Code (NCO) formulated by the Ministry of Labour and Employment. NCO also provides different skill levels against each occupation code considering the level of expertise required to pursue the profession (Table 2). The same skill levels are also assigned against educational attainment indicating the educational qualification suitable to execute the professional requirements. The skill levels against educational attainment and professional codes are tabulated in Table 1.

Table 1. Matching Educational Requirements with Skill Levels

Skill Level	Educational Requirement	Years of Education
I	Primary Education	Up to 10 or informal skills
II	Secondary Education	11-13
III	First University Degree	14-15
IV	Post-Graduate University Degree	More than 15

Table 2. Matching NCO Code with Skill Levels

Skill Level	NCO Code	Title
Undefined	1	Legislators, Senior Officials, and Managers
IV	2	Professionals
III	3	Associate Professionals
II	4	Clerks
II	5	Service Workers and Shop & Market Sales Workers
II	6	Skilled Agricultural and Fishery Workers
II	7	Craft and Related Trades Workers
II	8	Plant and Machine Operators and Assemblers
I	9	Elementary Occupations

In a utopian scenario, Table 1 and Table 2 will match exactly for a given country, i.e., people with education skill at x level will pursue a profession that needs skill x or higher. However, often, in India, it is witnessed how graduates line up outside recruitment centres for posts of group D staff that are categorised as elementary occupations (NCO Code 9). Such is another example of underemployment and underutilization of human resources. Table 3 gives us the estimated percentages of employed Indians segregated according to educational and occupational skill. The region of the table on the upper right side (above diagonal) gives us the estimate of people who are more qualified than the job they pursue while the region below diagonal of the table gives us estimated people who are less qualified than the job they pursue. Most of the people in the below diagonal region possess informal educational skill which has helped them to acquire the job where their educational skill was lower than that required. The region to focus on is the upper diagonal region which implies underutilization of labour force.

Table 3. Distribution (Percentages) of Employed People According to Educational Skill (Rows) and Occupational Skill (Columns)

Educational Skill	1	2	3	4
Occupational Skill				
1	29.67	14.28	5.51	1.61
2	68.79	75.51	63.38	29.39
3	0.87	4.68	9.56	10.51
4	0.66	5.53	21.55	58.49
Total	100.00	100.00	100.00	100.00

It was also observed that for a given educational level, the Monthly Per Capita Consumption Expenditure (MPCE) used in lieu of household income, decreases with lower value of occupational skill. For example, average MPCE for people with educational skill 4 and occupational skill 4 is Rs. 5,596 while that for occupational skill 3 does not vary much with Rs. 5,720. But MPCE decreases drastically when occupational skill is 2 (Rs. 3,700) and 1 (Rs. 2,686). The same was true for educational level 3 as well. However, it is not clear whether lower occupational skill at higher educational level is the cause of lower MPCE or vice-versa.

4.1 What is fuzzy logic?

To develop a system which segregates a group of objects as good or bad based on one or more conditions is relatively easy to build. However, when we are faced with challenges when instead of marking an object as good or bad, we want to quantify its tendency to be bad, a much more complex system is required. For example, a person earning Rs. 20 a day is considered as poor and so is another person earning Rs. 25 a day. But the former person is poorer than the later.

In such cases, fuzzy logic comes in handy when it is required to mimic human decision whenever we are provided with a set of conditions and logic. Fuzzy logic is particularly helpful in this context because the main focus of the paper was to involve multiple characteristics of employment into the measurement of underemployment and in doing so, we needed a composite measure based on several criteria. Fuzzy logic works in a similar way by introducing a probabilistic component into the measure which makes it robust by accounting for the noise in the data. It is particularly helpful when we are trying to measure a “vague” predicate as has been

illustrated for measuring multidimensional poverty in Mozaffar Qizilbash, 2006 [13]. In addition, unlike composite indices, fuzzy system does not assume linear dependencies between the aggregated components (Cardenas, 2019, [14]). Due its robust characteristics, fuzzy logic has recently gained popularity in the field of economics as well.

Let us now explain how fuzzy logic works. First, we will talk about fuzzy sets whose members have different factors of belonging to each set. For example, consider temperature as the variable of interest. Let's say that a temperature below 25 degrees Celsius is considered cold, above 25 degrees is considered hot, and from 15 to 35 degrees is considered medium. With this information and a certain value of dispersion, we create a distribution for temperature which roughly looks like that in figure 7. We observe that a temperature of 20 has factor point (the amount of membership) of 0.35 belonging to the set cold and 0.5 to the set medium. Such is the case with other temperature points as well. In a similar fashion we define sets for humidity and fan speed as well.

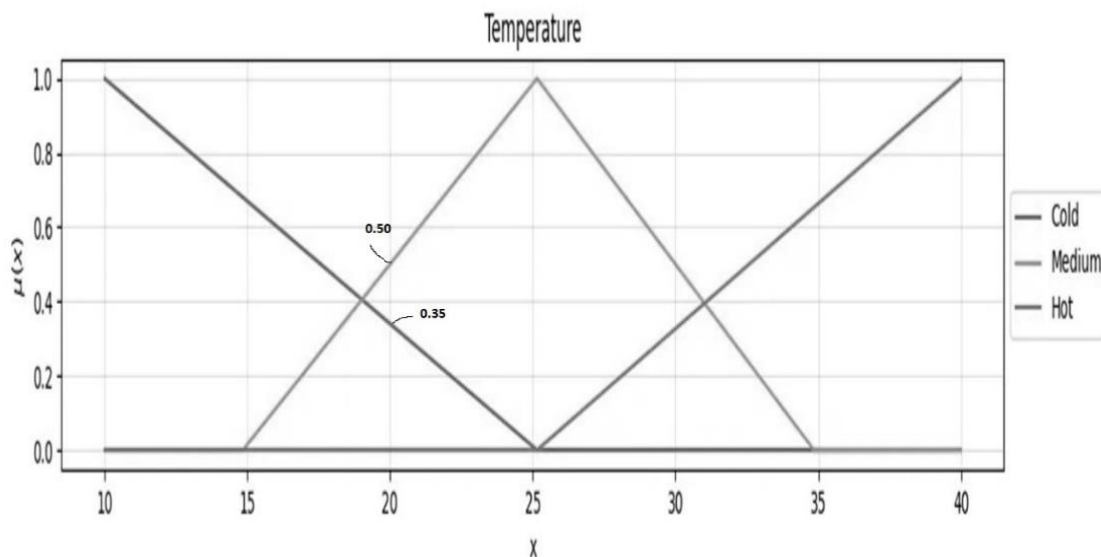


Figure 7. Defining Fuzzy Set for the Variable Temperature, where x is the Temperature and $\mu(x)$ is the Factor Point (Degree of Belonging) of that Temperature to that Set.

After a proper fuzzy set is defined it is required to define a set of rules and logic. Continuing with the previous example, on the basis of temperature and humidity we are to determine the speed of a fan. So we define a set of rules as given by Table 4.

Table 4. Logical Rules for Fan Speed

Temperature	Humidity	Fan Speed
Cold	Dry	Slow
Medium	Dry	Slow
Cold	Normal	Slow
Hot	Dry	Moderate
Medium	Normal	Moderate
Cold	Wet	Moderate
Hot	Normal	Fast
Hot	Wet	Fast
Medium	Wet	Fast

Now that our fuzzy system is built, we may try to test it with a couple of values of temperature and humidity. A temperature value of 18 and humidity of 60 results in factor point of 0.48 for cold and 0.29 for medium temperature and similarly factor point of 1.0 for normal and factor point of 0.0 for wet and dry humidity [15]. In such a scenario, we obtain a factor point of 0.48 for slow and 0.29 for moderate fan speed.

Next is the step for de-fuzzification where these factor points are combined to produce a single number which will correspond to the fan speed. De-fuzzification is done in various ways, one of them being the simple calculation of mean and another popular method being centre-of-gravity de-fuzzification. Using the latter technique, the value of fan speed was obtained as 36.8. Following all the steps that we discussed in this section we shall build our own fuzzy system for determining the score of underemployment for each of the employed person.

4.2 Developing a Fuzzy System for Measuring Underemployment and Discussion of Results

To set up our own fuzzy logic system we first chose our variables which are total hours worked in a week, total wage received in a week (including casual wage, earnings from self-employment and regular salary) and difference in educational skill and occupational skill. The different cut-offs we chose for the system and the logic behind such choice is as tabulated in Table 5.

Table 5. Cut off Values for Chosen Variables

Variable	Cut-off	Cut-off Value	Reason
Hours Worked	Low	40	The mandated low hours of working by ILO and many other nations
	Good	45	This was average working hours for most of the NICs observed for India
	High	60	About 90% of the NICs have average working hours less than 60 hours
Total Wage	Low	400	Mandated minimum wage prescribed by many researchers including NBER working papers. This is 1.5 times the poverty line for a week. It was obtained by multiplying 1.9\$ with 1.5*6 and then adjusting by PPP of 2021 which is Rs. 23.22.

	Low2	1024	This was the inflation adjusted lowest wage for India mentioned in the site of ILO.
	Okay	4000	This was the average wage across all the NICs of India.
Difference in Skill (Occupation-Education)	Low	-2	A skill difference of -1 maybe due to some valid reason but -2 maybe an indication of underuse of human resource.
	Good	0	This indicates no difference.

With these values and a standard deviation of 10 for each, the distributions for each of the variables were defined. For the resultant variable, which is underemployment, we defined three values (out of 100), 40 for ‘sure’ event of underemployment, 65 which is the medium state between sure underemployment and adequate employment and we call it ‘maybe’ and finally, we assign the value 80 which we call the ‘adequate’ state of employment. The distribution of the variables is shown in Figure 8.

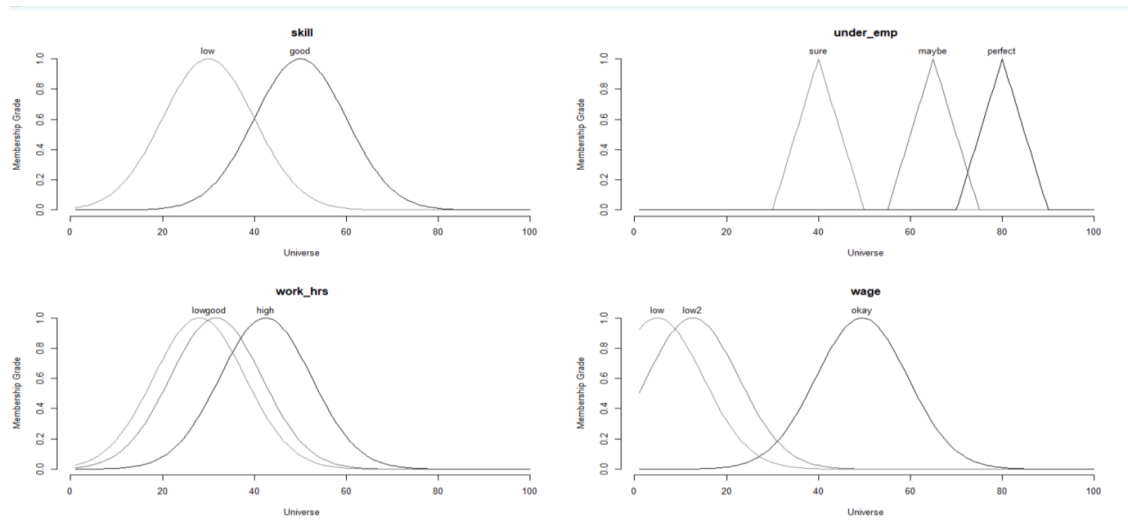


Figure 8. Distribution of the Variables used in Fuzzy System

The rules set up for the working of the fuzzy system are given in Table 6.

Table 6. Rules for the Fuzzy System

Hours Worked	Wage	Skill Difference	Underemployment
Good	Okay	Good	Perfect
High	Low2	Low	Sure
Low	Low	-	Sure
Good	(OR) Low2	-	Maybe
High	Okay	-	Maybe
-	Okay	Low	Maybe

The resultant fuzzy system generated a score within the range 40 and 80 against each employed individuals and a brief summary of the scores along with histogram to illustrate the distribution

of the scores are presented in figure 9 and Table 7. In figure 9 we observe that the density is greater around 65 and 69 which may be considered as the area of ‘medium’ level of inadequate employment. The high density of score in this region suggests that an average India is likely to be moderately underemployed or suspected to be underemployed (satisfying at least one criterion for underemployment but not all). This could also be explained from the criteria of moderate underemployment tabulated in Table 6. A large proportion of the employed Indians satisfies the conditions necessary to classify them as moderately underemployed (good working hours but low wage, or good wage but very high working hours etc.).

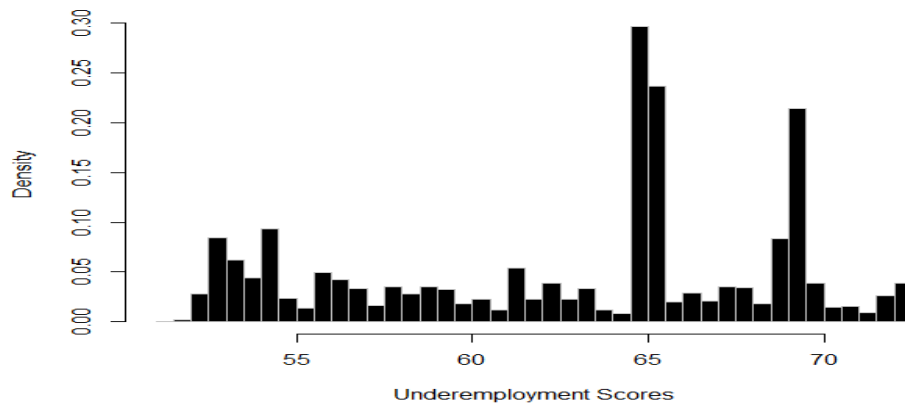


Figure 9. Distribution of Underemployment Scores

Table 7. Descriptive Analysis for Underemployment Score

Min	51.27
Q1	57.65
Q2	65.00
Mean	62.78
Q3	67.37
Max	72.50

Evaluating the correctness of the values generated by the fuzzy system would have been more convenient if we already had some reference values to compare with. But in its absence and also in the absence of a linear relationship between the variables, we shall first look at five random results obtained as summarized in Table 8.

Table 8. Five Random Examples from the Model

Score	Total Weekly Wage (Rs.)	Hours Worked in a Week	Educational Skill	Occupational Skill
62.1	2078	56	1	2
55.6	1270	60	1	2
51.3	462	29	1	1
72.5	5427	19	1	2
67.7	2800	56	1	1

The lowest score among these five values (51.3) was observed for an individual with very low income as well as low working hours. In this case, in reference to Table 5, working hours of 29 hours may be perceived as low and similarly, a wage of Rs. 462 is also perceived as low and there was no skill mismatch. Then, while referring to table 6, we observe that low value of hours worked and wage, irrespective of skill mismatch will indicate that the adequate employment score will tend to be low and so was the result obtained. Similarly, the highest score was observed for an individual with very high income (more than average) and no mismatch in skill. In this case, even if the working hours was low, the score was high since only low working hours coupled with low wage was considered for inadequacy. The high wage in this case has pushed the score towards a better value. Also, it is observed that for the same working hours (56), score was higher for the individual person earning more. We shall now discuss about how the average wage, working hours and skill mismatch change across different ranges of score in Table 9.

Table 9. Comparison of Underemployment Scores with Other Features of Labour Adequacy

Score	<55	55-60	60-65	65-70	70-75
Total Wage received in a Week (Rs.)	986	1551	2102	4623	3892
Hours Worked in a Week	40	42.21	49.61	55.67	54.1
Skill Mismatch (percentage of workers with occupational skill two or less than that of Educational Skill)	1.8	1.96	3.35	1.83	0

We observe that except for the last two sets of scores, the average wage increases as scores of adequate employment increases. A similar observation was obtained for working hours as well. However, for the last set of scores, even for an average income near 4,000 and working hours near 54, the score is higher than those with average income more than 4,500 and working hours near 55. This was explained by the phenomenon of skill mismatch which is nil for those with highest score. The above two tables empirically indicate that the scores which we obtained to quantify underemployment were justifiable enough to reflect the labour market situation and can be used as an important tool of official statistics.

The overall underemployment score for India was observed to be 62.28 which suggests the presence of low to moderate underemployment in the economy. The score can be used by policymakers to monitor improvement in India's labour market, with for instance a target of 70 or higher which will be closer to 80 that was conceived as the adequate state of employment without any underutilization. The underemployment scores are presented in Table 10 according to sector and gender.

From Table 10, we observe that women are more underemployed than men and underemployment is more prevalent in rural regions than in urban regions.

Table 10. Underemployment Scores at Disaggregated Level by Sex and Sector

	Male	Female	Total
Rural	62.50	59.81	61.73
Urban	64.89	60.80	63.95
Total	63.13	60.02	62.28

Table 11. Underemployment Scores at Disaggregated Level by Sex and Workers' Type

	Male	Female	Total
Casual Labourers	61.26	56.53	60.14
Self Employed	63.39	61.07	62.68
Regular Salaried	64.45	60.53	63.55

In Table 11, we have presented the underemployment scores of employed individuals based on their employment type, namely self-employed, regular salaried, and casual labourers. As discussed in Section 3.2, we previously examined how the distribution of employment types varies across MPCE classes and how their wages differ. Furthermore, we found that among employed workers with education skill 2 or above, the percentage of workers employed in work requiring less occupational skill is the least among regular salaried employees (32%), followed by self-employed workers (38%) and casual labourers (77%). This hints about the disparity of skill mismatch among the different groups of workers.

Examining Table 11, we note that due to better wage conditions and lower skill disparity, the underemployment score for regular salaried employees is 63.6, which is the highest among the different types of workers. This score is followed by self-employed workers (62.7) and, lastly, casual labourers (60.1). However, for women engaged as casual labourers, the situation appears to be the most challenging, with an underemployment score of only 56.5.

Aggregated values of underemployment scores against different socio economic and demographic factors are presented in Appendix.

5. Conclusion and Scope for Future Analysis

The existing measures of labour dynamics are not sufficient enough to move the economy towards a holistic development by presenting a clear picture of the labour market. The classic definition of unemployment-employment needs to be supplemented by a new and better measure which may be based on the concepts of underemployment and adequate employment. But the present standard definition of underemployment is solely reliant on the time a person devotes for his work which is again, insufficient to capture many other important aspects of labour dynamics including low wages and underutilization of skill.

To incorporate as much information as possible to arrive at a suitable estimate of underemployment, a score based method could be used which will not just identify a person as underemployed but will rather provide a score of underemployment out of 100. Aggregating these scores, we arrived at a national metric that suggested the presence of moderate underemployment in the Indian economy. It is also pointed out that underemployment is more prevalent in rural areas and among women.

The newly developed measure is a better way to quantify underemployment that could help in making important policy decisions as has also been suggested in the 19th ICLS. To move towards a score based system of measuring underemployment that could be used globally and could enable international comparison, a uniform rule needs to be specified. While score-based analysis presented in this paper overcomes some of the fallacies of criteria based classification (accounting for robustness and noise), it is important to make such measures more transparent starting from the first step of defining fuzzy sets to make it suitable for usage in official statistics.

In addition, separate rules could be applied for rural and urban sectors and across different industries. The paper has assumed equal weights for different categories of workers and the question of different weights to the categories is to be further investigated. Also, other metrics of employment could also be incorporated while computing these scores such as social benefits received by an employee and how satisfied the employed person is with respect to his/her current job. Japan and a few other nations enquire about the job satisfaction of a person in their employment surveys. A similar approach may be taken up by other nations in future for better analysis of the job market and better policy making.

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Appendix

Appendix Table 1. Underemployment Scores of different Age Groups

Age Group	Male	Female	Overall
0-15	61.25	62.32	61.56
15-25	62.32	61.15	62.08
25-35	63.57	60.20	62.72
35-40	63.88	59.61	62.48
40-50	63.71	59.82	62.50
50-60	62.76	59.90	61.94
>60	60.90	59.39	60.58

Appendix Table 2. Underemployment Score Aggregated by NIC

NIC Code	NIC Description	Underemployment Score
1	Crop and animal production, hunting and related service Activities	61.26
2	Forestry and logging	62.35
3	Fishing and aquaculture	62.88
5	Mining of coal and lignite	63.08
6	Extraction of crude petroleum and natural gas	66.71
7	Mining of metal ores	64.24
8	Other mining and quarrying	62.94
9	Mining support service activities	64.16
10	Manufacture of food products	63.08
11	Manufacture of beverages	61.99
12	Manufacture of tobacco products	54.71
13	Manufacture of textiles	62.43
14	Manufacture of wearing apparel	60.55
15	Manufacture of leather and related products	62.37
16	Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	63.40
17	Manufacture of paper and paper products	62.67
18	Printing and reproduction of recorded media	64.09
19	Manufacture of coke and refined petroleum products	66.72
20	Manufacture of chemicals and chemical products	63.97
21	Manufacture of pharmaceuticals, medicinal chemical and botanical products	65.65
22	Manufacture of rubber and plastics products	63.97
23	Manufacture of other non-metallic mineral products	63.68
24	Manufacture of basic metals	64.09
25	Manufacture of fabricated metal products, except machinery and equipment	65.12
26	Manufacture of computer, electronic and optical products	65.45

27	Manufacture of electrical equipment	65.53
28	Manufacture of machinery and equipment n.e.c.	66.25
29	Manufacture of motor vehicles, trailers and semi-trailers	65.71
30	Manufacture of other transport equipment	65.64
31	Manufacture of furniture	64.94
32	Other manufacturing	64.27
33	Repair and installation of machinery and equipment	64.55
35	Electricity, gas, steam and air conditioning supply	64.01
36	Water collection, treatment and supply	63.98
37	Sewerage	58.38
38	Waste collection, treatment and disposal activities; materials Recovery	61.79
39	Remediation activities and other waste management services	62.92
41	Construction of buildings	62.50
42	Civil engineering	57.42
43	Specialized construction activities	65.21
44	Wholesale and retail trade and repair of motor vehicles and	64.09
46	Wholesale trade, except of motor vehicles and motorcycles	63.99
47	Retail trade, except of motor vehicles and motorcycles	63.67
49	Land transport and transport via pipelines	64.86
50	Water transport	65.10
51	Air transport	63.15
52	Warehousing and support activities for transportation	64.85
53	Postal and courier activities	65.55
55	Accommodation	63.72
56	Food and beverage service activities	63.40
58	Publishing activities	65.50
59	Motion picture, video and television programme production, sound recording and music publishing activities	65.49
60	Broadcasting and programming activities	66.88
61	Telecommunications	65.12
62	Computer programming, consultancy and related activities	66.03
63	Information service activities	65.49
64	Financial service activities, except insurance and pension Funding	65.31
65	Insurance, reinsurance and pension funding, except compulsory social security	65.21
66	Other financial activities	65.43
68	Real estate activities	64.85
69	Legal and accounting activities	65.91
70	Activities of head offices; management consultancy activities	65.62
71	Architecture and engineering activities; technical testing and Analysis	65.57
72	Scientific research and development	65.11
73	Advertising and market research	67.85
74	Other professional, scientific and technical activities	64.98
75	Veterinary activities	65.49

77	Rental and leasing activities	64.04
78	Employment activities	64.87
79	Travel agency, tour operator and other reservation service Activities	65.39
80	Security and investigation activities	64.35
81	Services to buildings and landscape activities	61.37
82	Office administrative, office support and other business support Activities	64.57
84	Public administration and defence; compulsory social security	64.07
85	Education	62.70
86	Human health activities	63.48
87	Residential care activities	63.74
88	Social work activities without accommodation	58.33
90	Creative, arts and entertainment activities	63.87
91	Libraries, archives, museums and other cultural activities	65.16
92	Gambling and betting activities	59.83
93	Sports activities and amusement and recreation activities	62.74
94	Activities of membership organizations	61.68
95	Repair of computers and personal and household goods	62.57
96	Other personal service activities	61.65
97	Activities of households as employers of domestic personnel	58.35
99	Activities of extraterritorial organizations and bodies	61.70

Appendix Table 3. Underemployment Score Aggregated by MPCE Classes

Decile Group of MPCE	Underemployment Score
1	60.59
2	60.84
3	61.37
4	61.85
5	62.03
6	62.47
7	62.74
8	63.38
9	63.94
10	65.13

Appendix Table 4. Underemployment Score by Level of General Education

Level of Education	Underemployment Score
Not Literate	60.52
Literate Without Formal Schooling: EGS/ NFEC/ AEC	60.33
Literate Without Formal Schooling: TLC	60.32
Literate Without Formal Schooling: Others	60.74
Literate: below primary	61.26
Literate: primary	61.80
Literate: middle	62.64
Literate: secondary	63.35
Literate: higher secondary	63.21
Literate: diploma/certificate course	64.42
Literate: graduate	63.98
Literate: post graduate and above	64.64

Decoding Assam's Crime Landscape: A Longitudinal Statistical Study

Puspita Saha¹ and Dibyojyoti Bhattacharjee²

Abstract

Given the crucial geographical positioning of Assam in the North-East region of India and its strategic importance in the successful execution of India's Act East policy, it becomes imperative to ensure effective maintenance of law and order in the region. The analysis of crime trends and patterns in the state holds utmost significance for the strategic deployment of law enforcement agencies. This examination, which relies on comprehensive data pertaining to diverse criminal activities spanning all districts of Assam from 2010 to 2021, aims to quantitatively decipher the crime landscape of the region. The cluster analysis performed in this study utilizes growth rates of various crime types across different districts of Assam as inputs. These growth rates are employed to categorize the districts into distinct, non-overlapping subgroups that share similar characteristics based on their respective crime growth rates.

Keywords: Cluster analysis, Time Series analysis, North East India, Law and Order

JEL Code: C38, K14

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1. Introduction

Assam's locational advantage is its central position in north-east India. It is connected to all the north-eastern states and also enjoys international border with Bangladesh and Bhutan. Geographically, Assam is located between 24°3'N latitude and 27°58'N latitude and 89°5' E longitude and 96°1' E longitude. The importance of Assam not only in northeast India but also for the entire country is rising with the increasing importance of India's Look East Policy since Assam holds a very strategic position and a gateway to the Far East. Thus, it is essential that Assam develops its infrastructure in terms of transport and communication and creates an ambiance of safety and security both for its citizens and non-citizens. Increasing criminal activity shall usher an atmosphere of negative attitude of institutions and investors towards the state, leading to a retarded economic growth and investment even in the backdrop of the Act East Policy. Increasing crime leads to social unrest and a lack of faith in the stakeholders in the legal system and governance. Increasing crime is a proportionate threat to the life and property of citizens and their allies and thus, calls for proper analysis to identify the hotpot of crime in the state.

In this setting, the paper is framed so that a district-wise analysis can be done to understand the pattern of the growth rate of crime in Assam. Such research endeavour shall enable in identification of the districts that need immediate attention of the policymakers towards neutralizing the accelerating crime rate.

2. Literature Review

Marzbali *et al.* (2012) refer to crime prevention as a combination of all actions and efforts to reduce crime and the fear of crime. The main hindrance that law-enforcement agencies face in crime prevention is the need for appropriate methodologies to analyse the growing volumes of crime data precisely and professionally. The very statistic of the number of crimes in a particular region is not a good indicator to understand the crime scenario. Rather, it is the growth rate of crime in a region that shall disclose how dynamic the crime scenario is. The diversity in crime also portrays a different narrative of the difficulties posed before the authorities leading to different approaches to crime prevention decisions. This traditional method of tracking crime based on the expertise of specialists has instances of criminal experts' fatigue, slip up, and slow response (Noor *et al.*, 2015). Moreover, the traditional methods need to provide an opportunity for accurate data verification. This makes it difficult to apply the findings to the actual policymakers. With the advances in computer technology- data collection, storage, retrieving, and analysis have become more accessible than before. This has paved the way for the application of data analytics in almost every field of knowledge, and analysis of crime data cannot be an exception. Therefore, researchers have continued to apply improved data analytics methods in this area.

The applications of data science and artificial intelligence for the analysing crime data are crucial to understanding crime patterns and identifying the hotspots of illegal activities in a large geographical area. This helps in developing effective strategies for crime prevention and law enforcement. Some of the works that analysed crime data using data science tools and artificial intelligence includes Al-Janabi (2011), Noor *et al.* (2015), Malathi and Baboo (2011) etc. Li, Kuo, and Tsai (2010) applied a Fuzzy Self-Organizing Map (FSOM) and developed an extraction algorithm to analyse crime statistical data for 20 county police bureaus in Taiwan from 2003-2004. Their results had ways and means that can be utilized for criminal incident prevention. Al-Janabi (2011), based on crime-related data collected from a secondary source, discovered patterns and trends, made forecasts, found relationships, and provided possible explanations, mapped criminal networks, and identified possible suspects using tools like classification, clustering, association, prediction, and link analysis. Applying sentimental analysis and lexicon-based method, Malathi and Baboo (2011), based on a Twitter data

set, and tried to predict the crime and location in which specific types of crime will occur. Phillips and Lee (2012) presented a methodology, an exploratory approach using knowledge discovery in a massive dataset related to crime. They used techniques of data visualization to extract and visualize crime patterns. Ku, Nguyen, and Leroy (2012) developed a crime report visualization of Textual Analysis of Similar Crimes (TASC) using a combination of visualization and clustering techniques to support crime analysis, compare and contrast crime reports in a timely manner. Based on data from Malaysian crime records, Noor *et al.* (2015) proposed an architecture of a decision support system using visualization techniques for more comprehensibly representing crime data.

In addition to the works involving artificial intelligence and data mining, several other qualitative works also enriched our search. Maity and Roy (2021) thoroughly examined the growth of crime against women, comprehensively analysing the various forms and underlying causes therein. Piquero *et al.* (2007) studied the growth of crime over time using time series data. Comparison of diversification in criminal careers across different offender populations is discussed in the work of DeLisi and Piquero (2011) using some diversity measures.

One of the pioneering empirical works related to crime in Assam is that of Doley (1978). In the work, it is observed that irrespective of the rural-urban divide, most of the economic crimes in Assam are committed by people aged 21 to 30. Land disputes in Assam are generally connected to most murders committed in the state. The community having the maximum involvement in economic crime is the tea garden working community. The study of Doley (1978) is based on primary data collected from convicted persons of two District Jails of the state, viz. Jorhat and Dibrugarh. Goswami (2018) discussed the crime situation of Assam based on the absolute number of crimes committed in the state, with particular reference to crimes against women, taking data from the period 2006 to 2016. In Saikia (2016), the author tried to draw a picture of the nature and magnitude of different types of crime in the districts of Assam, bringing a comparison with the national and state averages. The study records that Assam is one of the leading states in terms of incidents of different types of crime in the entire country and that there is a significant variation in the incidence of recorded crimes in the different districts of the state. The study detects a changing pattern in the type of crime. Also relates aggregate criminal behaviour to the different socio-economic and deterrence variables of the people of the state by the application of panel regression and time series analysis.

From the above discussion, some facts can be inferred. The application of artificial intelligence and data mining tools is becoming commonplace in the analysis of crime data. Different researchers are tracing exciting insights from the crime incidence data, and the application of such models is providing valuable inputs to decision-makers in combatting crime. The north-eastern state of Assam holds a vital geographic position owing to the changing scenario of the country's foreign policy. The state is also continually registering itself as one of the highest-ranked states in the country, with remarkable internal variation in crime incidence scenarios. This triggers the requirement of analytical work on a frequent basis to decode the changing crime scenario of Assam. However, such studies hardly appear in the literature explored by the authors, which sets the motivation behind the current work.

3. Objective of the Study

Based on the literature review that preceded, the need was felt to analyse crime-related data of Assam to understand the changing scenario of crime in the state. This, in turn, may indicate a path towards better governance in regulating the criminal activities in Assam. Accordingly, the paper is out to attend the following primary objectives:

- a) To identify the growth of different types of crime across the different districts of Assam.

- b) To classify the different districts of Assam into similar groups based on their growth rate in different types of crime.

4. Methodology

This section discusses the origin of the data, the temporal scope of the investigation, the variables from which information is synthesized, and so forth. It also portrays a concise description of the statistical tools and their respective purposes that are applied in the study to attain the objectives laid down in the section above.

5. Data Source

For the study, district-wise crime data of Assam is collected from the Statistical Handbook of Assam, a publication by the Directorate of Economics and Statistics of the Government of Assam, India, for several years. The dataset includes crime data from the years 2010 to 2021. This compilation offers valuable insight into the crime landscape of the region and serves as a significant resource for researchers, policymakers, and law enforcement agencies. The information from the handbooks of several years enables the analysis of trends and patterns in crime across different districts of Assam. The Statistical Handbook of Assam is a thorough compilation of numerous socio-economic indicators and statistical data concerning the state. The handbooks also provide thorough information on crime, including district-specific categories for crime rates, types of crimes, and other relevant information. The cleaned data collected from the handbook contains thorough details on various criminal acts reported in each district over the given time frame. The data pertains to the total number of offences reported in each of the 27 districts annually for the period 2010 to 2021 on Murder, Rape, Kidnapping, DRB (Dacoity, Robbery, and Burglary), Riot, Cheating, and Theft. The entire dataset is collected from the source mentioned above.

6. Statistical Methods

The following statistical methods are utilized for the analysis of the crime scenario in Assam.

6.1 β - value

For any statistical analysis, choosing the appropriate metric that can explain the situation under study is important. The actual count of registered crimes, as provided in the data source mentioned above, does not pose a sufficient justification for comprehending a place's crime situation- as the districts are all different in terms of their geographical and demographic characteristics. Consequently, the growth rate of individual crimes, studied either separately or in unison, is regarded to present an appropriate mosaic of comparable crime situations in a place.

Though there are several formulas for measuring growth rate here the β -value is used to measure of growth of a particular type of crime in a given district. Formally, it can be defined as follows.

If β_{ij} denotes the β -value of the i^{th} crime in the j^{th} district then,

$$\beta_{ij} = \frac{\sum_{t=t_0}^{t_n} (C_{ijt} - \bar{C}_{ij\bullet}) (t - \bar{t})}{\sum_{t=t_0}^{t_n} (t - \bar{t})^2} \quad (1)$$

Where, $\bar{C}_{ij\bullet}$ is the average number of i^{th} crime committed in the j^{th} district over the entire period of study? The starting year of the study i.e. 2010 is denoted as t_0 and the final year of study is denoted as t_n i.e. 2021. The value of β_{ij} indicates the aggregate growth in the i^{th} crime committed in the j^{th} district for a unit increase in the

time i.e. a year. A positive value of β_{ij} indicates that the i^{th} crime in the j^{th} district is increasing over the years on an average and vice-versa for a negative value of β_{ij} .

For the β -values of all crimes in the j^{th} district, the formula is similar to that of (1) with withdrawal of the index i from the formula i.e.

$$\beta_j = \frac{\sum_{t=t_0}^{t_n} (C_{jt} - \bar{C}_{j\bullet})(t - \bar{t})}{\sum_{t=t_0}^{t_n} (t - \bar{t})^2} \quad (2)$$

Where, β_j indicates the aggregate growth of all crimes committed in the j^{th} district for a unit increase in the time i.e. a year and C_{jt} denotes the total number of crimes committed in the j^{th} district in the year t and $\bar{C}_{j\bullet}$ denotes the average number of crimes committed in the j^{th} district over the entire period of study.

6.2 k- Mean Clustering

The process of arranging a set of subjects, each of which has information about multiple variables, into non-overlapping groups, often known as clusters, is termed cluster analysis or clustering (Frades & Matthiesen, 2010). Clusters are created so that objects inside a cluster are more similar to one another than to objects in the other clusters. It is a crucial task of exploratory data analysis, so cluster analysis is a statistical data analysis technique used in various domains, such as pattern recognition, image analysis, information retrieval, bioinformatics, data compression, computer graphics, and machine learning (Vladimir, 2002).

There are various algorithms and methods for clustering, each with its strengths and weaknesses. Among the various clustering methods, however, in this study, the variables under consideration are continuous so k -mean clustering is implemented.

The purpose of the algorithm is to minimise the objective function provided in (3).

$$J = \sum_{j=1}^k \sum_{i=1}^n \|x_{ij} - c_j\|^2 \quad (3)$$

Here $\|x_{ij} - c_j\|$ is a chosen distance measure between a data point x_{ij} and the cluster centre c_j indicates the distance of n data points from the respective cluster centres.

The following steps make up the algorithm:

Step 1: Select k points as the initial centroids of k groups or clusters.

Step 2: Assign each item to the group whose centroid is closest to it.

Step 3: Recalculate the k centroids' positions once all the items are assigned.

Step 4: Continue performing Steps 2 and 3 until the items stop moving. As a result, the items are divided into k groups, i.e. in k -clusters.

Among various existing methods of choosing the distance function or the similarity function, selecting the initial centroid, and computation of the centroid, we have taken up the commonly used practice to perform the k -means clustering. We have considered the Euclidean distance. The initial centroid for k clusters are chosen randomly i.e. a random set of (distinct) rows in the data matrix is chosen as the initial centres. The computation of the centroid is done by taking the mean of the data points falling in every cluster. For partitioning the data points by K -means algorithm, here the algorithm of Hartigan and Wong (1979) is considered and the `kmeans()`

function of R software uses this algorithm by default. The Hartigan and Wong (1979)’s method is described as searching for a K-partition with locally optimal within cluster sum of squares by moving points from one cluster to another. The procedure stops when no movement of a point from one cluster to another reduces the within-cluster sum of squares.

For further details on the process, one can look into Hartigan (1975), Hartigan and Wong (1979), Gupta et al., (2011) and others.

7. Computation and Results

Based on the discussion in the previous section, necessary computation is done, and the results are accordingly placed below. Table 1 shows the beta values of different types of crime along with their ranks for the districts (in brackets) under consideration. The last column of Table 1 shows the β -values i.e. β_j of the ‘All Crimes’ in the different districts of Assam. The ‘All Crime’ data is the aggregate of all the other individual crimes (8 in number) viz. Murder, Rape, Kidnapping, DRB (Dacoity, Robbery, and Burglary), Riot, Cheat, Theft and Other crimes. The ‘Other crimes’ comprises of crimes like Criminal breach of Trust, Counterfeiting and any other type of crime that cannot be classified to any of the above mentioned categories. It is interesting to note that, sum of β -values of individual crimes of a particular district equals to the β -value of total crime of that district, algebraically speaking-

$$\sum_{i=1}^8 \beta_{ij} = \beta_j \quad \forall j \tag{4}$$

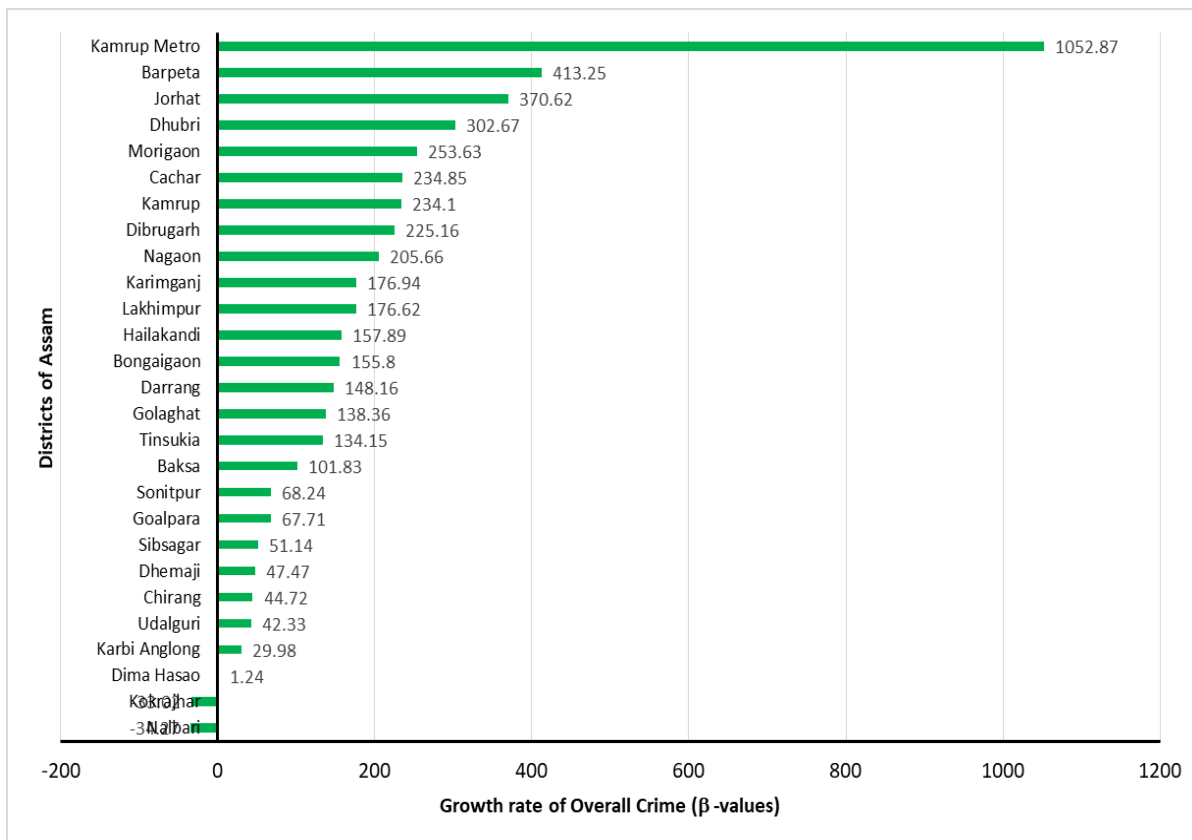


Figure 1. Growth Rate (β - values) of All Crimes in districts of Assam (2010-2021)

If one investigates the growth (β - values) of the overall crime scenario of Assam (*c.f.* Figure 1), districts with alarming growth are noticed in Kamrup Metro, Barpeta, Jorhat, and Dhubri. Comparatively, negligible growth is registered in Dima Hasao, Karbi Anglong, Udalguri, Chirang, and Dhemaji districts. Interesting to note the

negative growth rate in overall crime in the districts of Kokrajhar and Nalbari. This indicates that a varied situation prevails in the districts of Assam so far as the growth of crime is concerned.

Table 1. β - values of different types of crime across in the districts of Assam

Districts	Murder	Rape	Kidnap	DRB	Riot	Cheat	Theft	Other	All Crimes
Baksa	-1.531 (12)	1.024 (20)	12.895 (13)	3.633 (14)	8.21 (7)	2.08 (11)	2.385 (15)	73.13 (11)	101.83 (17)
Barpeta	1.315 (26)	10.64 (27)	38.748 (27)	8.479 (19)	30.469 (21)	13.252 (24)	24.014 (25)	286.33 (26)	413.25 (2)
Bongaigaon	-0.07 (19)	-0.923 (13)	14.066 (17)	6.892 (18)	14.626 (12)	3.85 (15)	11.885 (23)	105.48 (14)	155.8 (13)
Cachar	-0.531 (16)	-2.329 (8)	19.759 (22)	10.42 (22)	43.671 (23)	2.161 (12)	-21.224 (2)	182.93 (22)	234.85 (6)
Chirang	-1.42 (13)	-1.287 (9)	5.206 (5)	0.451 (12)	6.58 (5)	1.374 (7)	2.605 (16)	31.21 (6)	44.72 (22)
Darrang	-0.245 (18)	-0.563 (14)	13.65 (16)	0.444 (11)	10.864 (11)	4.57 (16)	4.962 (17)	114.48 (16)	148.16 (14)
Dhemaji	0.052 (21)	-4.353 (6)	4.766 (3)	4.608 (16)	10.455 (10)	1.892 (9)	0.752 (13)	29.3 (5)	47.47 (21)
Dhubri	-1.969 (8)	-4.801 (4)	13.255 (14)	6.535 (17)	21.794 (17)	7.14 (20)	33.171 (26)	227.55 (23)	302.67 (4)
Dibrugarh	-2.594 (5)	-2.521 (7)	16.899 (18)	9.395 (21)	48.227 (25)	12.661 (23)	-17.86 (4)	160.96 (20)	225.16 (8)
DimaHasao	-2.836 (4)	-0.185 (17)	0.731 (1)	0.143 (10)	2.28 (3)	0.168 (3)	-0.241 (9)	1.19 (2)	1.24 (25)
Goalpara	-1.542 (11)	-4.769 (5)	9.427 (10)	-1.217 (5)	5.57 (4)	0.801 (5)	0.759 (14)	58.68 (10)	67.71 (19)
Golaghat	-0.486 (17)	-1.115 (12)	19.227 (21)	-0.203 (7)	19.969 (15)	1.094 (6)	9.161 (21)	90.72 (13)	138.36 (15)
Hailakandi	0.136 (22)	6.056 (26)	6.636 (6)	2.073 (13)	1.329 (2)	1.664 (8)	0.35 (11)	139.65 (18)	157.89 (12)
Jorhat	0.531 (24)	-1.175 (11)	23.916 (25)	11.57 (24)	51.65 (26)	31.374 (26)	11.164 (22)	241.59 (24)	370.62 (3)
Kamrup	-1.175 (14)	4.675 (24)	20.164 (23)	-13.748 (1)	35.49 (22)	3.437 (13)	-56.759 (1)	242.02 (25)	234.1 (7)
Kamrup Metro	1.311 (25)	-1.238 (10)	36.829 (26)	100.752 (27)	268.899 (27)	75.909 (27)	127.101 (27)	443.31 (27)	1052.87 (1)
KarbiAnglong	-1.913 (9)	0.517 (19)	7.601 (7)	-0.895 (6)	10.056 (8)	3.668 (14)	-4.15 (8)	15.09 (3)	29.98 (24)
Karimganj	0.035 (20)	5.294 (25)	9.357 (9)	10.787 (23)	21.287 (16)	7.413 (21)	5.969 (18)	116.8 (17)	176.94 (10)
Kokrajhar	-3.86 (3)	-0.406 (15)	4.986 (4)	-0.126 (8)	-39.923 (1)	5.206 (17)	-0.178 (10)	41.87 (7)	-33.02 (26)
Lakhimpur	0.388	1.503	19.199	9.367	16.021	9.941	6.077	114.13	176.62

Districts	Murder	Rape	Kidnap	DRB	Riot	Cheat	Theft	Other	All Crimes
	(23)	(22)	(20)	(20)	(13)	(22)	(19)	(15)	(11)
Morigaon	1.542 (27)	3.08 (23)	22.437 (24)	19.192 (26)	17.507 (14)	7.031 (19)	17.825 (24)	165.02 (21)	253.63 (5)
Nagaon	-1.64 (10)	-8.944 (1)	18.759 (19)	-1.392 (4)	28.427 (20)	22.241 (25)	7.965 (20)	140.24 (19)	205.66 (9)
Nalbari	-2.017 (7)	0.409 (18)	3.367 (2)	-8.192 (2)	7.189 (6)	0.038 (1)	-17.21 (5)	-17.85 (1)	-34.27 (27)
Sibsagar	-3.892 (2)	-6.367 (2)	13.367 (15)	-6.745 (3)	26.864 (19)	0.381 (4)	-21.108 (3)	48.64 (9)	51.14 (20)
Sonitpur	-5.748 (1)	-5.689 (3)	10.79 (11)	4.465 (15)	23.031 (18)	0.084 (2)	-5.822 (7)	47.13 (8)	68.24 (18)
Tinsukia	-2.021 (6)	1.189 (21)	12.888 (12)	11.927 (25)	44.066 (24)	6.252 (18)	-14.427 (6)	74.28 (12)	134.15 (16)
Udalguri	-1.161 (15)	-0.322 (16)	8.164 (8)	-0.126 (8)	10.294 (9)	1.976 (10)	0.441 (12)	23.06 (4)	42.33 (23)

From Table 1, it can be seen that the prime concern is the type of crime, Kidnapping and Cheating, which has shown enormous positive growth in all the districts and varying degrees. Except in Kokrajhar, riots have registered a positive growth with time in all other districts. The growth of crimes related to Murder, Rape, DRB, and Theft has registered a mixed effect. When some districts have shown a positive growth, several others have grown negatively. Barpeta, Morigaon, Lakhimpur, Jorhat, and Kamrup Metro are the districts that have registered high growth rates in all the different types of crime.

Next, *k*-mean clustering is performed based on the β -values of the different types of crime (as in Table 1) for clustering the districts based on some similarity. The R-code for performing the clustering is provided in the papers Appendix. Here, an objective method is applied to determine the number of clusters. The exercise identifies only two clusters, with Kamrup Metro in one cluster and all other districts in another. This happens as the growth rate of Kamrup Metro is notably high in all types of crime, reflecting its status as a fully developed city. Thus the district has little resemblance to the growth rates observed in the other 26 districts. Thus, removing Kamrup Metro from the data set, *k*-mean clustering is rerun. This time, the algorithm identified six clusters, and the position of the districts in the different clusters can be identified in Figure 2.

For further analysis and presentation of the result of the cluster analysis Table 2 is produced.

The crime growth rates in the different districts can be better visualized through Figure 3, which depicts the type of crime that has grown higher in which cluster. In each box, the value inside is the cluster number and is similar to the values in column 1 of Table 2. A higher growth rate of crime in a particular cluster is characterized by the increasing intensity of color in the box. Figure 3 indicates that the growth rate of murder is very high in Cluster 2 while Theft has proliferated in Cluster 1. Kidnapping has grown very highly in Cluster 1 and 2, while Riot has increased enormously in Cluster 1, 2, and 5. Cases of Cheating has grown very high in Cluster 1 and Cluster 4.

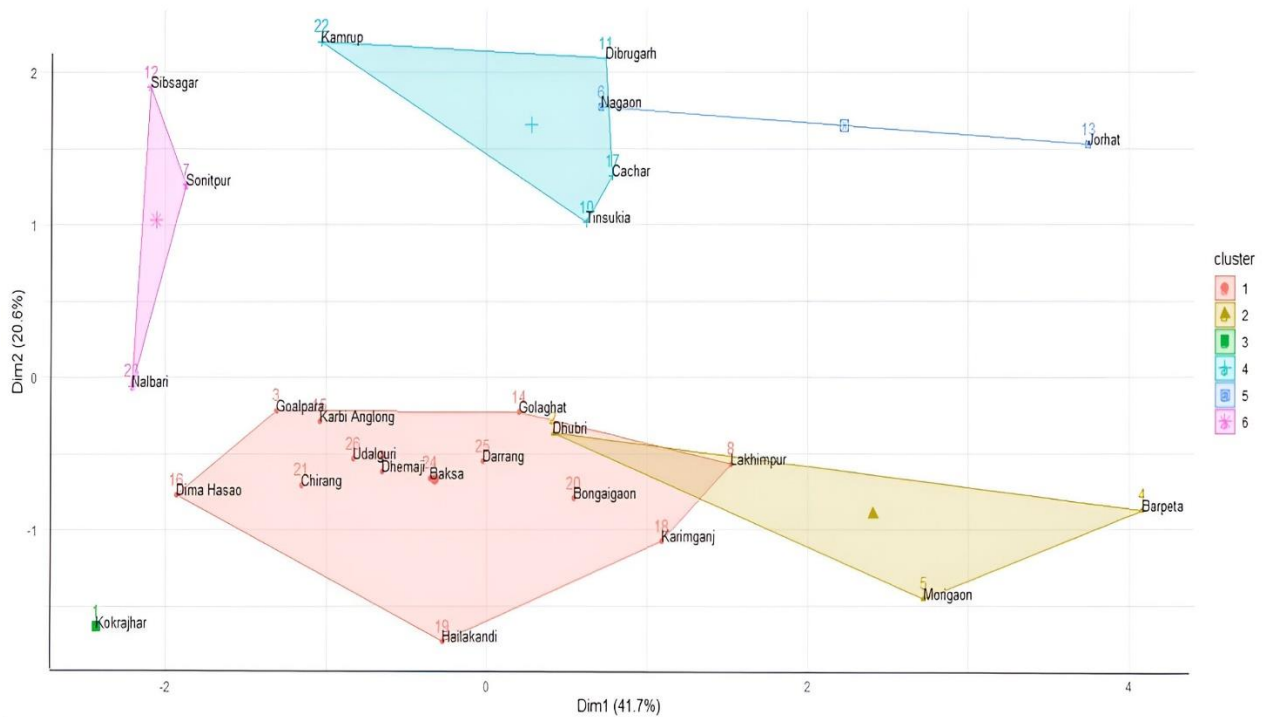


Figure 2. Outcome of Cluster Analysis on Districts based on β - values of the Different types of Crime in Assam (Excluding Kamrup Metro)

Note: This graph is produced using R Package with the R-code provided in the Appendix of the paper

Table 2. Position of the District in the Different Clusters and their Observed Similarity

Cluster No.	Districts	Observation or Comments on Similarity
1	Dhubri, Barpeta, Morigaon, Nagaon, and Jorhat	The growth rate of incidents involving Kidnapping, Riot, Cheating, and Theft is rising within this cluster.
2	Kamrup	It exhibits unique characteristics or trends that sets it apart from the rest of the districts.
3	Sonitpur, Sibsagar, and Nalbari	Share a notable similarity in the decreasing growth rates of Murder and Theft incidents.
4	Kokrajhar	Accept Kidnapping and Cheating, all other crimes are decreasing.
5	Dibrugarh, Tinsukia, and Cachar	The growth rate of Murder and Theft are decreasing at a low rate, but kidnapping and Riot are increasing at a very high rate.
6	Goalpara, Lakhimpur, Dhemaji, Golaghat, KarbiAnglong, DimaHasao, Karimganj, Hailakandi, Bongaigaon, Chirang, Baksa, and Darrang	Unlike the other clusters, these districts do not showcase distinct trends or patterns in their crime statistics.

Note: Computed by the authors based on data collected from the source mentioned earlier

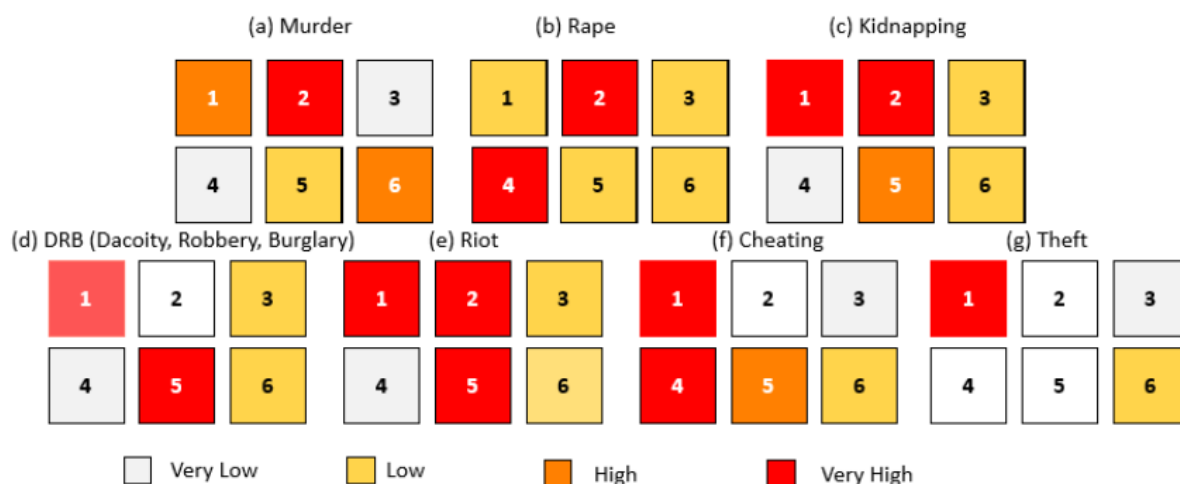


Figure 3. Box Showing the Level of Growth Rate of Different Types of Crime in the Different Clusters.

8. Conclusion

In this study, a comprehensive analysis is conducted on the district-wise growth rates of crimes in Assam for the period 2010-2021 using the β -values. The study involved the examination of the total, as well as individual types of crime growth rates across different districts in Assam. The take away from the study can be summarized as:

- Kamrup Metro has registered an enormous growth rate in all types of crime across the period of study. The district does not even have any comparable values with any other district.
- Besides Kamrup Metro, the overall crime rate increased rapidly during the study period in the districts of Barpeta, Jorhat, Dhubri, Morigaon, Cachar, Kamrup, Dibrugarh and Nagoan.
- Overall, crime has registered less or negative growth rates in Dima Hasao, Karbi Anglong, Udalguri, Kokrajhar and Nalbari.
- When growth rates in different types of crime are computed for the districts of Assam and applied for clustering Kamrup and Kokrajhar formed two individual and different clusters indicating that the crime scenerio in these two districts are different from all others. These two districts also differ from each other.
- Of the different crimes, Riots, Kidnapping, Rape, and Cheating are the crimes that are increasing at an alarming rate in different clusters of districts.

The analysis performed in this exercise portrays the crime landscape of Assam in a much more vivid manner. It pinpoints the districts that need immediate attention and the type of crime that needs to be controlled at the earliest. It also identifies the similar districts in terms of the growth of crime specific to the type of crime. The study can be further pursued with more regorious statistical analysis leding to exploration of facts that can be utilized by the law enforcing agencies for immediate attention. In order to develop such studies to a level that can be of use to society, the personnel from the policymakers and their executive bodies (law enforcing agencies) and the data scientists need to work in unison. Only then that the benefit of such exercise can be utilized to its full potential.

Acknowledgment

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Code I: R-code for computing the beta values for “All Crimes”

Here, for an example, the case of “Baksa” is taken. The R-Code and the corresponding result is as follows:

```
All_crime = c(413, 615, 776, 664, 768, 1018, 1293, 1282, 1334, 1432, 1537, 1419)
```

```
Time = c(2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021)
```

```
lm(All_crime ~ Time)
```

RESULT:

```
lm(formula = All_crime ~ Time)
```

Coefficients:

(Intercept)	Time
-204189.8	101.83

Code II: R-code for Cluster Analysis of the districts based on growth rate of different types of crime

```
data = read.csv("BETA value.csv", header=T)
```

```
attach(data)
```

```
install.packages("cluster")
```

```
install.packages("factoextra")
```

```
install.packages("ggfortify")
```

```
library(cluster)
```

```
library(factoextra)
```

```
library(ggfortify)
```

```
z = data[,-1] # to use only those variables with numerical values i.e. excluding district names
```

```
fviz_nbclust(z, kmeans, method = "wss") # determine the number of clusters (elbow break)
```

```
kc=kmeans(z,6) # The WSS method indicated 6 clusters only
```

```
# getting clusterwise arrangement of names
```

```
Cluster = kc$cluster
```

```
dd=cbind(Districts, Cluster)
```

```
dd1=dd[order(Cluster),] # ordering the clusters
```

```
write.csv(dd1, "cluster.csv", row.names=FALSE) # creates a file in Documents named "cluster.csv" which shows the results
```

```
fviz_cluster(kc, z)+ geom_text(aes(label=Districts),hjust=0, vjust=0) + theme_minimal()
```

```
# to get the graph of clustering
```

Highlights of Reports Released by National Sample Survey Office (NSSO)

(The 'Highlights' are reproduced from related report prepared by Survey Design and Research Division (SDRD) of NSSO. For details, the reader may refer to the related main report.)

SARVEKSHANA

Highlights of Recent Survey Report(s) Released by National Sample Survey Office (NSSO)

1. Periodic Labour Force Survey (PLFS) (2022-23)

HIGHLIGHTS

Periodic Labour Force Survey (PLFS) 2022-2023

Survey
Period



July 2022 to June 2023

Survey
Coverage

Surveyed

12,714 First Stage Units (FSUs)

Rural: 6,982 villages
Urban: 5,732 urban blocks



1,01,655 Households

55,844 in rural areas
45,811 in urban areas



4,19,512 Persons

2,43,971 in rural areas
1,75,541 in urban areas

The survey covered the whole of the Indian Union *except* the villages in Andaman and Nicobar Islands which remained extremely difficult to access throughout the year.

Approaches
for
presenting
Labour
Force
Indicators

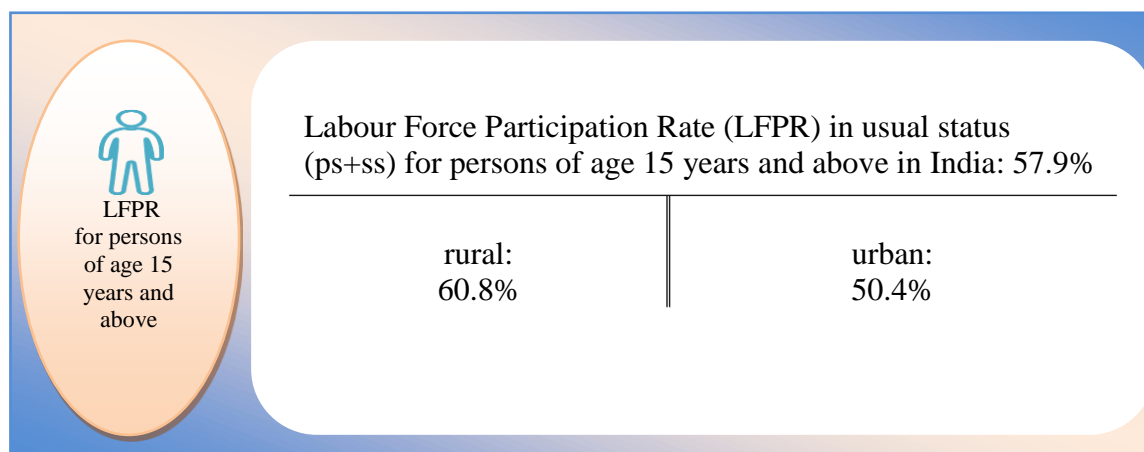
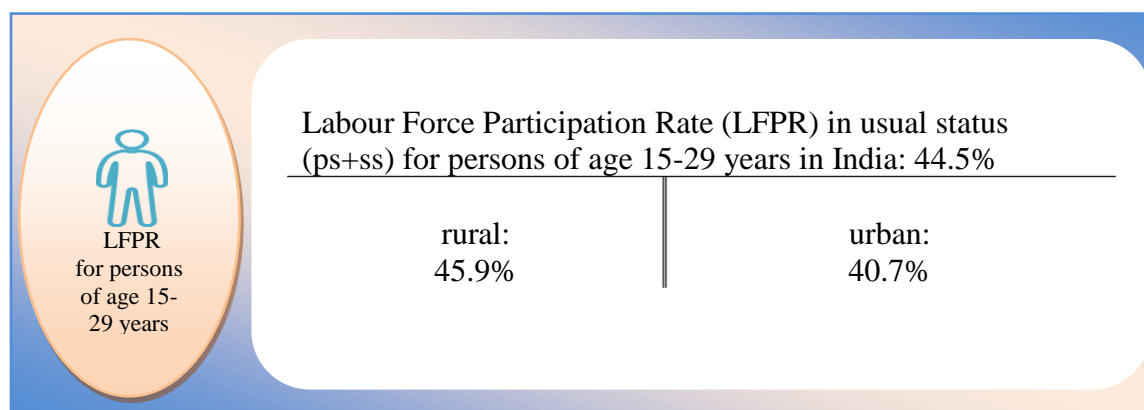
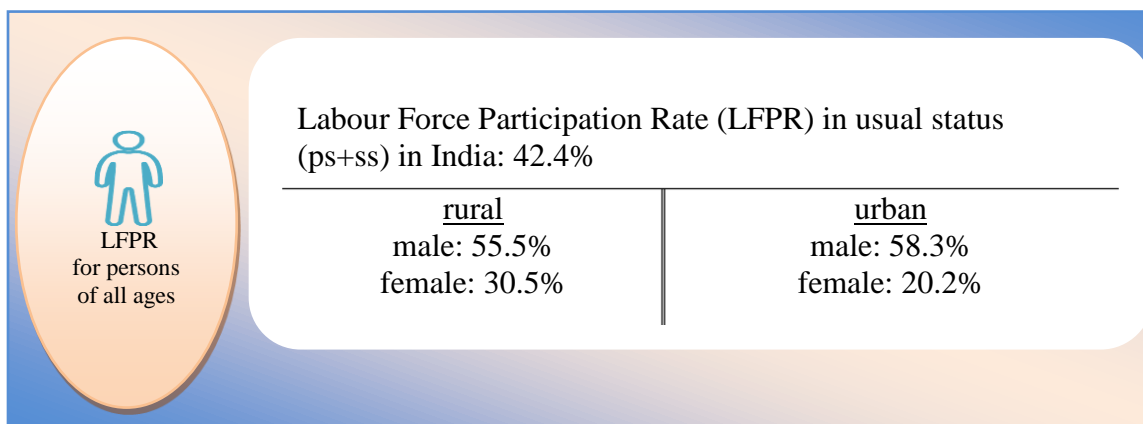
Approaches followed for presenting Labour Force Indicators

usual status (ps+ss)
Reference period : 1 year

current weekly status(CWS)
Reference period : 1 week

Some of the key results at the all-India level for the period July 2022 - June 2023 emerging from PLFS are highlighted below.

A. Labour Force in usual status (ps+ss)



B. Workforce



WPR
in usual
status for
persons of
all ages

Worker Population Ratio (WPR) in usual status (ps+ss) in India: 41.1%

rural
male: 54.0%
female: 30.0%

urban
male: 55.6%
female: 18.7%



WPR
in usual
status for
persons of
age 15-29
years

Worker Population Ratio (WPR) in usual status (ps+ss) for persons of age 15-29 years in India: 40.1%

rural:
42.3%

urban:
34.3%



WPR
in usual
status for
persons of
age 15 years
and above

Worker Population Ratio (WPR) in usual status (ps+ss) for persons of age 15 years and above in India: 56.0%

rural:
59.4%

urban:
47.7%



Status in employment among workers in usual status (ps+ss)

Share (%) of self-employed among workers in usual status (ps+ss)

rural male: 58.8	rural female: 71.0	urban male: 39.4	urban female: 40.4
---------------------	-----------------------	---------------------	-----------------------

Share (%) of regular wage/ salaried employees among workers in usual status (ps+ss)

rural male: 14.3	rural female: 8.0	urban male: 47.1	urban female: 50.8
---------------------	----------------------	---------------------	-----------------------

Share (%) of casual labour among workers in usual status (ps+ss)

rural male: 26.8	rural female: 21.0	urban male: 13.6	urban female: 8.9
---------------------	-----------------------	---------------------	----------------------

C. Unemployment Rate in usual status (ps+ss)



Unemployment Rate (UR) in usual status for persons of all ages

Unemployment Rate in usual status (ps+ss) for persons of all age in India: 3.2%

rural male: 2.8% female: 1.8%	urban male: 4.7% female: 7.5%
-------------------------------------	-------------------------------------



Unemployment Rate (UR) in usual status for persons of age 15 years and above

Unemployment Rate in usual status (ps+ss) for persons of age 15 years and above in India: 3.2%

rural male: 2.7% female: 1.8%	urban male: 4.7% female: 7.5%
-------------------------------------	-------------------------------------



Unemployment Rate (UR) in usual status for educated persons of all age 15 years and above

Unemployment Rate in usual status (ps+ss) for educated (*highest level of education secondary and above*) persons of age 15 years and above in India: 7.3%

rural	urban
6.6%	8.4%



Unemployment Rate (UR) in usual status for persons of age 15 -29 years

Unemployment Rate in usual status (ps+ss) for youth persons of age 15 -29 years in India: 10.0%

rural	urban
male: 8.3%	male: 13.8%
female: 7.4%	female: 21.7%

**D.Time Series of Key Labour Force indicators in usual status (ps+ss)
obtained from PLFS**

Table 1: Labour force participation rates (in per cent) in usual status (ps+ss) estimated from PLFS (2017-18), PLFS(2018-19), PLFS (2019-20), PLFS (2020-21), PLFS (2021-22) and PLFS (2022-23)									
all-India									
age group	Rural			urban			rural+urban		
	male	female	person	male	female	person	male	female	person
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLFS (2022-23)									
15 years and above	80.2	41.5	60.8	74.5	25.4	50.4	78.5	37.0	57.9
all ages	55.5	30.5	43.4	58.3	20.2	39.8	56.2	27.8	42.4
PLFS (2021-22)									
15 years and above	78.2	36.6	57.5	74.7	23.8	49.7	77.2	32.8	55.2
all ages	56.9	27.2	42.2	58.3	18.8	39.0	57.3	24.8	41.3
PLFS (2020-21)									
15 years and above	78.1	36.5	57.4	74.6	23.2	49.1	77.0	32.5	54.9
all ages	57.1	27.7	42.7	58.4	18.6	38.9	57.5	25.1	41.6
PLFS (2019-20)									
15 years and above	77.9	33.0	55.5	74.6	23.3	49.3	76.8	30.0	53.5
all ages	56.3	24.7	40.8	57.8	18.5	38.6	56.8	22.8	40.1
PLFS (2018-19)									
15 years and above	76.4	26.4	51.5	73.7	20.4	47.5	75.5	24.5	50.2
all ages	55.1	19.7	37.7	56.7	16.1	36.9	55.6	18.6	37.5
PLFS (2017-18)									
15 years and above	76.4	24.6	50.7	74.5	20.4	47.6	75.8	23.3	49.8
all ages	54.9	18.2	37.0	57.0	15.9	36.8	55.5	17.5	36.9
<i>2022-23 refers to the period July 2022 – June 2023 and likewise for 2021-22, 2020-21, 2019-20, 2018-19 and 2017-18</i>									

Table2: WPR (in per cent) in usual status (ps+ss) estimated from PLFS (2017-18), PLFS(2018-19), PLFS (2019-20), PLFS (2020-21), PLFS (2021-22) and PLFS (2022-23) for persons of age 15 years and above and persons of all ages

all-India

age group	rural			urban			rural+urban		
	male	female	person	male	female	person	male	female	person
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLFS (2022-23)									
15 years and above	78.0	40.7	59.4	71.0	23.5	47.7	76.0	35.9	56.0
all ages	54.0	30.0	42.3	55.6	18.7	37.7	54.4	27.0	41.1
PLFS (2021-22)									
15 years and above	75.3	35.8	55.6	70.4	21.9	46.6	73.8	31.7	52.9
all ages	54.7	26.6	40.8	55.0	17.3	36.6	54.8	24.0	39.6
PLFS (2020-21)									
15 years and above	75.1	35.8	55.5	70.0	21.2	45.8	73.5	31.4	52.6
all ages	54.9	27.1	41.3	54.9	17.0	36.3	54.9	24.2	39.8
PLFS (2019-20)									
15 years and above	74.4	32.2	53.3	69.9	21.3	45.8	73.0	28.7	50.9
all ages	53.8	24.0	39.2	54.1	16.8	35.9	53.9	21.8	38.2
PLFS (2018-19)									
15 years and above	72.2	25.5	48.9	68.6	18.4	43.9	71.0	23.3	47.3
all ages	52.1	19.0	35.8	52.7	14.5	34.1	52.3	17.6	35.3
PLFS (2017-18)									
15 years and above	72.0	23.7	48.1	69.3	18.2	43.9	71.2	22.0	46.8
all ages	51.7	17.5	35.0	53.0	14.2	33.9	52.1	16.5	34.7

2022-23 refers to the period July 2022 – June 2023 and likewise for 2021-22, 2020-21, 2019-20, 2018-19 and 2017-18

Table3: Unemployment Rate (in per cent) in usual status (ps+ss) estimated from PLFS (2017-18), PLFS(2018-19), PLFS (2019-20), PLFS (2020-21), PLFS (2021-22) and PLFS (2022-23)
all-India

age group	rural			urban			rural+urban		
	male	female	person	male	female	person	male	female	person
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLFS (2022-23)									
15 years and above	2.7	1.8	2.4	4.7	7.5	5.4	3.3	2.9	3.2
all ages	2.8	1.8	2.4	4.7	7.5	5.4	3.3	2.9	3.2
PLFS (2021-22)									
15 years and above	3.8	2.1	3.2	5.8	7.9	6.3	4.4	3.3	4.1
all ages	3.8	2.1	3.3	5.8	7.9	6.3	4.4	3.3	4.1
PLFS (2020-21)									
15 years and above	3.8	2.1	3.3	6.1	8.6	6.7	4.5	3.5	4.2
all ages	3.9	2.1	3.3	6.1	8.6	6.7	4.5	3.5	4.2
PLFS (2019-20)									
15 years and above	4.5	2.6	3.9	6.4	8.9	6.9	5.0	4.2	4.8
all ages	4.5	2.6	4.0	6.4	8.9	7.0	5.1	4.2	4.8
PLFS (2018-19)									
15 years and above	5.5	3.5	5.0	7.0	9.8	7.6	6.0	5.1	5.8
all ages	5.6	3.5	5.0	7.1	9.9	7.7	6.0	5.2	5.8
PLFS (2017-18)									
15 years and above	5.7	3.8	5.3	6.9	10.8	7.7	6.1	5.6	6.0
all ages	5.8	3.8	5.3	7.1	10.8	7.8	6.2	5.7	6.1

2022-23 refers to the period July 2022 – June 2023 and likewise for 2021-22, 2020-21, 2019-20, 2018-19 and 2017-18

E. Time Series of Key Labour Force indicators in Current Weekly Status (CWS) obtained from PLFS

all-India									
Age Group	Rural			Urban			Rural+Urban		
	Male	Female	Person	Male	Female	Person	Male	Female	Person
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLFS (2022-23)									
15 years and above	78.8	34.6	56.7	73.9	24.0	49.4	77.4	31.6	54.6
all ages	54.5	25.4	40.4	57.9	19.1	39.0	55.4	23.7	40.0
PLFS (2021-22)									
15 years and above	76.7	29.2	53.0	74.2	22.1	48.6	75.9	27.2	51.7
all ages	55.7	21.7	38.9	57.9	17.5	38.2	56.3	20.5	38.7
PLFS (2020-21)									
15 years and above	76.7	30.0	53.4	73.8	21.7	48.0	75.8	27.5	51.8
all ages	56.0	22.7	39.7	57.8	17.3	38.0	56.5	21.2	39.2
PLFS (2019-20)									
15 years and above	76.7	28.3	52.5	73.8	22.1	48.2	75.8	26.3	51.2
all ages	55.4	21.1	38.6	57.2	17.5	37.8	56.0	20.0	38.3
PLFS (2018-19)									
15 years and above	75.5	22.5	49.1	73.7	19.7	47.1	74.9	21.6	48.5
all ages	54.5	16.7	36.0	56.7	15.6	36.7	55.2	16.4	36.2
PLFS (2017-18)									
15 years and above	75.6	21.7	48.9	74.1	19.6	47.1	75.1	21.1	48.4
all ages	54.4	16.1	35.7	56.7	15.3	36.4	55.0	15.8	35.9
2022-23 refers to the period July 2022 – June 2023 and likewise for 2021-22, 2020-21, 2019-20, 2018-19 and 2017-18									

Table 2. Worker Population Ratio (in Percent) Current Weekly Status Estimated from PLFS (2017-18), PLFS (2018-19), PLFS (2019-20), PLFS (2020-21), PLFS (2021-22) and PLFS (2022-23)									
all-India									
Age Group	rural			Urban			Rural+Urban		
	Male	Female	Person	Male	Female	Person	Male	Female	Person
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLFS (2022-23)									
15 years and above	75.2	33.2	54.2	69.3	21.8	46.0	73.5	30.0	51.8
all ages	52.0	24.4	38.6	54.2	17.4	36.3	52.6	22.5	38.0
PLFS (2021-22)									
15 years and above	71.7	27.9	49.9	68.4	19.9	44.6	70.7	25.6	48.3
all ages	52.1	20.7	36.6	53.4	15.7	35.0	52.4	19.3	36.1
PLFS (2020-21)									
15 years and above	71.2	28.6	50.0	66.8	19.0	43.1	69.9	25.7	47.9
all ages	52.0	21.6	37.1	52.4	15.2	34.1	52.1	19.8	36.3
PLFS (2019-20)									
15 years and above	70.1	26.7	48.4	66.0	19.4	43.0	68.8	24.4	46.7
all ages	50.6	19.9	35.5	51.2	15.4	33.6	50.8	18.6	35.0
PLFS (2018-19)									
15 years and above	69.0	20.9	45.0	67.2	17.4	42.7	68.4	19.8	44.3
all ages	49.7	15.5	32.9	51.7	13.7	33.2	50.3	15.0	33.0
PLFS (2017-18)									
15 years and above	69.1	20.1	44.8	67.7	17.1	42.6	68.6	19.2	44.1
all ages	49.6	14.8	32.6	51.7	13.3	32.9	50.2	14.4	32.7
<i>2022-23 refers to the period July 2022 – June 2023 and likewise for 2021-22, 2020-21, 2019-20, 2018-19 and 2017-18</i>									

Table 3. Unemployment Rate (in Percent) Current Weekly Status Estimated from PLFS (2017-18), PLFS (2018-19), PLFS (2019-20), PLFS (2020-21), PLFS (2021-22) and PLFS (2022-23) all-India									
Age Group	Rural			Urban			Rural+Urban		
	Male	Female	Person	Male	Female	Person	Male	Female	Person
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLFS (2022-23)									
15 years and above	4.6	4.0	4.4	6.3	9.1	7.0	5.1	5.1	5.1
all ages	4.6	4.0	4.5	6.3	9.1	7.0	5.1	5.1	5.1
PLFS (2021-22)									
15 years and above	6.5	4.5	6.0	7.8	9.9	8.3	6.9	5.8	6.6
all ages	6.5	4.6	6.0	7.8	9.9	8.3	6.9	5.8	6.6
PLFS (2020-21)									
15 years and above	7.1	4.8	6.5	9.4	12.2	10.1	7.8	6.6	7.5
all ages	7.2	4.8	6.5	9.4	12.2	10.1	7.8	6.6	7.5
PLFS (2019-20)									
15 years and above	8.7	5.5	7.8	10.5	12.4	11.0	9.3	7.3	8.8
all ages	8.7	5.5	7.9	10.6	12.4	11.0	9.3	7.3	8.8
PLFS (2018-19)									
15 years and above	8.6	7.3	8.3	8.8	12.1	9.5	8.7	8.7	8.7
all ages	8.7	7.3	8.4	8.9	12.1	9.5	8.8	8.7	8.8
PLFS (2017-18)									
15 years and above	8.7	7.5	8.4	8.7	12.7	9.5	8.7	9.0	8.7
all ages	8.8	7.7	8.5	8.8	12.8	9.6	8.8	9.1	8.9
<i>2022-23 refers to the period July 2022 – June 2023 and likewise for 2021-22, 2020-21, 2019-20, 2018-19 and 2017-18</i>									

खण्ड-III हिंदी

सर्वेक्षण

राष्ट्रीय प्रतिदर्श सर्वेक्षण कार्यालय की पत्रिका

भाग सं० -PDOS-57-XXXIX सितंबर 2023 और मार्च 2024 (1-2 और 3-4)

अंक संख्या 115वां एवं 116वां

सितंबर, 2023 और मार्च, 2024



सत्यमेव जयते

राष्ट्रीय प्रतिदर्श सर्वेक्षण कार्यालय
सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय
भारत सरकार
नई दिल्ली

सम्पादकीय सलाहकार बोर्ड

1. डॉ. जी. सी. मन्ना, अध्यक्ष, पूर्व-महानिदेशक, एनएसएसओ, नई दिल्ली
2. डॉ. मनोज पांडा, पूर्व-निदेशक, आई.ई.जी., नई दिल्ली
3. श्री अलोक कर, पूर्व उप महानिदेशक, एनएसएसओ, कोलकाता
4. प्रो. टी. जे. राव., प्रोफेसर (सेवानिवृत्त), भारतीय सांख्यिकी संस्थान, कोलकाता
5. महानिदेशक, नेशनल काउंसिल ऑफ एप्लाइड इकोनॉमिक रिसर्च (एन.सी.ए.ई.आर), नई दिल्ली
6. अपर महानिदेशक, एनएसएसओ (एफ.ओ.डी.), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, नई दिल्ली
7. अपर महानिदेशक, एनएसएसओ (एस.डी.आर.डी.), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, कोलकाता
8. अपर महानिदेशक, एनएसएसओ (डी.पी.डी.), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, कोलकाता
9. अपर महानिदेशक, एनएसएसओ (एस.सी.डी.), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, प्रबंध संपादक, नई दिल्ली
10. अपर महानिदेशक, एनएसएसओ (ई.एस.डी.), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, नई दिल्ली
11. उप महानिदेशक, एनएसएसओ, (डी.पी.डी. (आई.एस.विंग)), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, कोलकाता
12. निदेशक, अंतर्राष्ट्रीय जनसंख्या विज्ञान संस्थान (आई.आई.पी.एस.), मुंबई
13. निदेशक, इंदिरा गांधी इंस्टीट्यूट ऑफ डेवलपमेंट रिसर्च (आई.जी.आई.डी.आर.), मुंबई
14. प्रो. के. नारायण, आईआईटी बॉम्बे, मुंबई
15. ओ.आर.जी.आई., नई दिल्ली से प्रतिनिधि
16. डॉ. फरजाना अफरीदी, आईएसआई दिल्ली, नई दिल्ली
17. निदेशक, एनएसएसओ (एस.सी.डी.), सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय, नई दिल्ली

सम्पादकीय सचिवालय – सर्वेक्षण समन्वय प्रभाग, राष्ट्रीय सांख्यिकी कार्यालय, सांख्यिकी एवं कार्यक्रम कार्यान्वयन मंत्रालय, सांख्यिकी भवन, महर्षि वाल्मीकि मार्ग, नई दिल्ली-110032

1. श्री किशोर कुमार, अपर महानिदेशक, एनएसएसओ (एस.सी.डी)
2. श्री एम एस सुब्रह्मण्य राव., उप महानिदेशक, एनएसएसओ (एस.सी.डी)
3. श्री आशीष सक्सेना, संयुक्त निदेशक, एनएसएसओ (एस.सी. डी)
4. श्री राहुल सिंह, सहायक निदेशक, एनएसएसओ (एस.सी.डी)
5. श्री रंजन मौआर, कनिष्ठ सांख्यिकी अधिकारी, एनएसएसओ (एस.सी.डी)

सर्वेक्षण

भाग सं०-PDOS-57-XXXIX सितंबर 2023 और मार्च 2024 (1-2 और 3-4)

एनएसएसओ द्वारा जारी की गई रिपोर्ट की मुख्य बातें
(मुख्य बातें एनएसएसओ के एस.डी.आर.डी.प्रभाग द्वारा तैयार की गई सम्बंधित रिपोर्ट
से उद्धृत की गई हैं। विवरण के लिए पाठक सम्बंधित मुख्य रिपोर्ट देख सकते हैं)

आवधिक श्रमबल सर्वेक्षण (पीएलएफएस) 2022-2023

सर्वेक्षण
भतधि



जुलाई 2022 से जून 2023

सर्वेक्षण
कवरेज

सर्वेक्षण किया गया

12,714 फर्स्ट स्टेज उनिट्स
(एफएसयु)

ग्रामीण: 6,982 गांवों
नगरीय: 5,732 नगरीय खंडों

1,01,655 परिवारों

55,844 ग्रामीण क्षेत्रों में
45,811 नगरीय क्षेत्रों में

4,19,512 वयक्तियों

2,43,971 ग्रामीण क्षेत्रों में
1,75,541 नगरीय क्षेत्रों में

इस सर्वेक्षण में पूरे भारतीय संघ को शामिल किया गया अंडमान और निकोबार द्वीप समूह के उन गांवों को छोड़कर जिन तक पहुँच पाना पूरे वर्ष तक बेहद कठिन था।

श्रम बल
संकेतक पेश
करने के
आधार

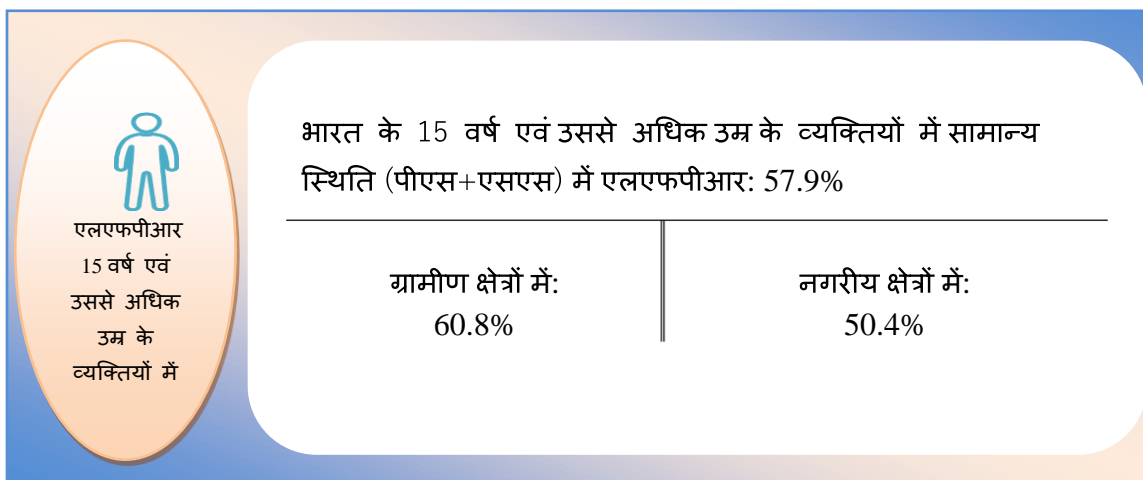
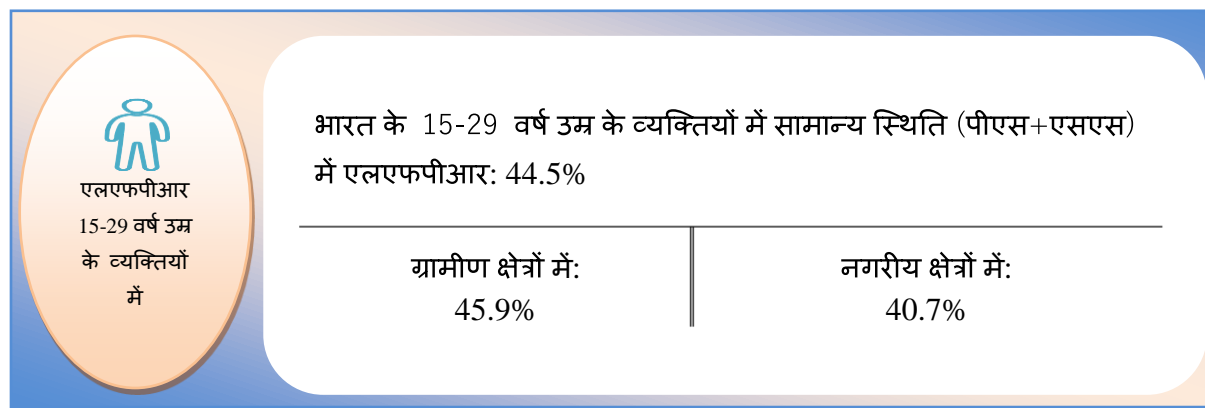
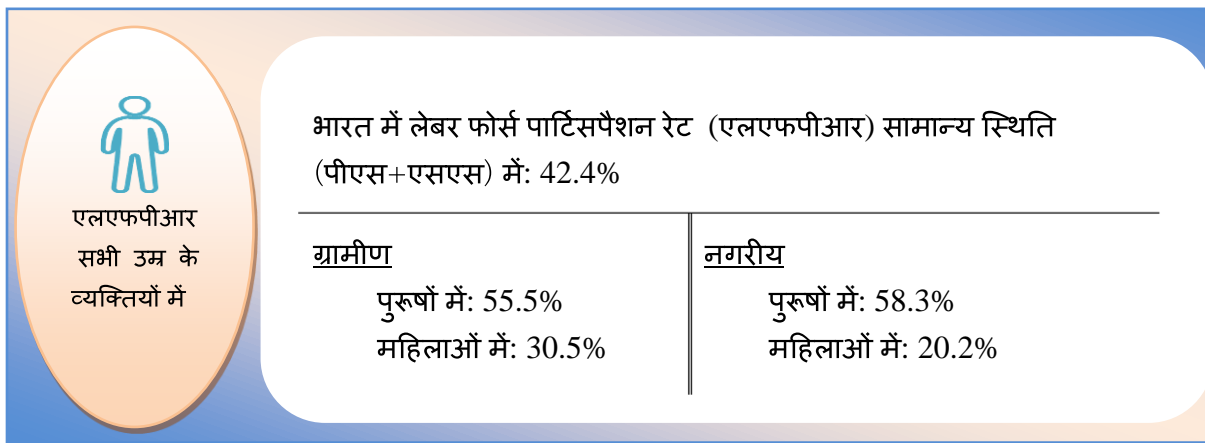
श्रम बल संकेतक पेश करने के लिए अपनाया गया आधार

सामान्य स्थिति
(पीएस+एसएस)
सन्दर्भ अबधि: 1 वर्ष

वर्तमान साप्ताहिक
स्थिति(सीडब्ल्यूएस)
सन्दर्भ अबधि: 1 सप्ताह

अखिल भारतीय स्तर पर जुलाई 2022 - जून 2023 की अबधि के लिए पीएलएफएस से प्राप्त कुछ मुख्य परिणाम निम्नलिखित हैं। (क)

(क) श्रमबल सामान्य स्थिति (पीएस+एसएस) में



(ख) कार्यबल



डब्ल्यूपीआर
सभी उम्र के
व्यक्तियों में

कामगार जनसंख्या अनुपात (डब्ल्यूपीआर) सामान्य स्थिति में
(पीएस+एसएस) में: 41.1%

ग्रामीण

पुरुषों में: 54.0%
महिलाओं में: 30.0%

नगरीय

पुरुषों में: 55.6%
महिलाओं में: 18.7%



डब्ल्यूपीआर
15-29 वर्ष उम्र
के व्यक्तियों में

15-29 वर्ष उम्र के व्यक्तियों में भारत में डब्ल्यूपीआर सामान्य स्थिति
(पीएस+एसएस) में: 40.1%

ग्रामीण क्षेत्रों में:
42.3%

नगरीय क्षेत्रों में:
34.3%



डब्ल्यूपीआर 15
वर्ष एवं उससे
अधिक उम्र के
व्यक्तियों में

15 वर्ष एवं उससे अधिक उम्र के व्यक्तियों में भारत में डब्ल्यूपीआर सामान्य
स्थिति (पीएस+एसएस) में: 56.0%

ग्रामीण क्षेत्रों में:
59.4%

नगरीय क्षेत्रों में:
47.7%



सामान्य
स्थिति
(पीएस+एस
एस) में
कामगारों के
बीच रोजगार
स्थिति

सामान्य स्थिति (पीएस+एसएस) में कामगारों के बीच स्व-रोजगार का शेयर(%)

ग्रामीण	ग्रामीण	नगरीय	नगरीय
पुरुषों में: 58.8	महिलाओं में: 71.0	पुरुषों में: 39.4	महिलाओं में: 40.4

सामान्य स्थिति (पीएस+एसएस) में कामगारों के बीच नियमित मजदूर/वेतनभोगी कर्मचारियों का शेयर(%)

ग्रामीण	ग्रामीण	नगरीय	नगरीय
पुरुषों में: 14.3	महिलाओं में: 8.0	पुरुषों में: 47.1	महिलाओं में: 50.8

सामान्य स्थिति (पीएस+एसएस) में कामगारों के बीच आकस्मिक मजदूरों का शेयर(%)

ग्रामीण	ग्रामीण	नगरीय	नगरीय
पुरुषों में: 26.8	महिलाओं में: 21.0	पुरुषों में: 13.6	महिलाओं में: 8.9

(ग) बेरोजगार दर सामान्य स्थिति (पीएस+एसएस) में



बेरोजगार दर
सभी उम्र के
व्यक्तियों पर

भारत में सामान्य स्थिति (पीएस+एसएस) में बेरोजगार दर: 3.2%

ग्रामीण	नगरीय
पुरुषों में: 2.8%	पुरुषों में: 4.7%
महिलाओं में: 1.8%	महिलाओं में: 7.5%



बरोजगार दर
15 वर्ष एवं
उससे अधिक
उम्र के

भारत में सामान्य स्थिति (पीएस+एसएस) में बरोजगार दर 15 वर्ष एवं उससे अधिक उम्र के व्यक्तियों में: 3.2%

ग्रामीण	नगरीय
पुरुषों में: 2.7%	पुरुषों में: 4.7%
महिलाओं में: 1.8%	महिलाओं में: 7.5%



बरोजगार दर
15 वर्षों और
उससे उपर के
उम्र के
शिक्षित

भारत में 15 वर्षों और उससे उपर के उम्र के शिक्षित (माध्यमिक एवं उसके उच्चतर का अधिकतम शिक्षा का स्तर) व्यक्तियों में सामान्य स्थिति (पीएस+एसएस) में बरोजगार दर: 7.3%

ग्रामीण क्षेत्रों में	नगरीय क्षेत्रों में
6.6%	8.4%



बरोजगार दर
युवा (15-29
वर्ष उम्र के)
व्यक्तियों में

भारत में बरोजगार दर युवा (15-29 वर्ष उम्र के) व्यक्तियों में: 10.0%

ग्रामीण	नगरीय
पुरुषों में: 8.3%	पुरुषों में: 13.8%
महिलाओं में: 7.4%	महिलाओं में: 21.7%

(घ). प्रमुख श्रम बल संकेतक की टाइम-सीरीज सामान्य स्थिति (पीएस+एसएस) में पीएलएफएस में

प्राक्कलित

टेबल 1: लेबर फोर्स पार्टिसिपेशन रेट (एलएफपीआर) (प्रतिशत में) सामान्य स्थिति (पीएस+एसएस) में पीएलएफएस (2017-18), पीएलएफएस (2018-19), पीएलएफएस (2019-20), पीएलएफएस (2020-21), पीएलएफएस (2021-22) एवं पीएलएफएस (2022-23) से प्राक्कलित
अल-इंडिया

आयु वर्ग	ग्रामीण			नगरीय			ग्रामीण + नगरीय		
	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
पीएलएफएस (2022-23)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	80.2	41.5	60.8	74.5	25.4	50.4	78.5	37.0	57.9
सभी उम्र के व्यक्तियों के लिए	55.5	30.5	43.4	58.3	20.2	39.8	56.2	27.8	42.4
पीएलएफएस (2021-22)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	78.2	36.6	57.5	74.7	23.8	49.7	77.2	32.8	55.2
सभी उम्र के व्यक्तियों के लिए	56.9	27.2	42.2	58.3	18.8	39.0	57.3	24.8	41.3
पीएलएफएस (2020-21)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	78.1	36.5	57.4	74.6	23.2	49.1	77.0	32.5	54.9
सभी उम्र के व्यक्तियों के लिए	57.1	27.7	42.7	58.4	18.6	38.9	57.5	25.1	41.6
पीएलएफएस (2019-20)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	77.9	33.0	55.5	74.6	23.3	49.3	76.8	30.0	53.5
सभी उम्र के व्यक्तियों के लिए	56.3	24.7	40.8	57.8	18.5	38.6	56.8	22.8	40.1
पीएलएफएस (2018-19)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	76.4	26.4	51.5	73.7	20.4	47.5	75.5	24.5	50.2
सभी उम्र के व्यक्तियों के लिए	55.1	19.7	37.7	56.7	16.1	36.9	55.6	18.6	37.5
पीएलएफएस (2017-18)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	76.4	24.6	50.7	74.5	20.4	47.6	75.8	23.3	49.8
सभी उम्र के व्यक्तियों के लिए	54.9	18.2	37.0	57.0	15.9	36.8	55.5	17.5	36.9

2022-23 जुलाई 2022-जून 2023 की अवधि को संदर्भित करता है और इसी तरह 2021-22, 2020-21, 2019-20, 2018-19 और 2017-18 के लिए

टेबल 2: कामगार जनसंख्या अनुपात (डब्ल्यूपीआर) (प्रतिशत में) सामान्य स्थिति (पीएस+एसएस) में पीएलएफएस (2017-18), पीएलएफएस (2018-19), पीएलएफएस (2019-20), पीएलएफएस (2020-21), पीएलएफएस (2021-22) एवं पीएलएफएस (2022-23) से प्राक्कलित अल-इंडिया									
आयु वर्ग	ग्रामीण			नगरीय			ग्रामीण + नगरीय		
	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
पीएलएफएस (2022-23)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	78.0	40.7	59.4	71.0	23.5	47.7	76.0	35.9	56.0
सभी उम्र के व्यक्तियों के लिए	54.0	30.0	42.3	55.6	18.7	37.7	54.4	27.0	41.1
पीएलएफएस (2021-22)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	75.3	35.8	55.6	70.4	21.9	46.6	73.8	31.7	52.9
सभी उम्र के व्यक्तियों के लिए	54.7	26.6	40.8	55.0	17.3	36.6	54.8	24.0	39.6
पीएलएफएस (2020-21)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	75.1	35.8	55.5	70.0	21.2	45.8	73.5	31.4	52.6
सभी उम्र के व्यक्तियों के लिए	54.9	27.1	41.3	54.9	17.0	36.3	54.9	24.2	39.8
पीएलएफएस (2019-20)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	74.4	32.2	53.3	69.9	21.3	45.8	73.0	28.7	50.9
सभी उम्र के व्यक्तियों के लिए	53.8	24.0	39.2	54.1	16.8	35.9	53.9	21.8	38.2
पीएलएफएस (2018-19)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	72.2	25.5	48.9	68.6	18.4	43.9	71.0	23.3	47.3
सभी उम्र के व्यक्तियों के लिए	52.1	19.0	35.8	52.7	14.5	34.1	52.3	17.6	35.3
पीएलएफएस (2017-18)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	72.0	23.7	48.1	69.3	18.2	43.9	71.2	22.0	46.8
सभी उम्र के व्यक्तियों के लिए	51.7	17.5	35.0	53.0	14.2	33.9	52.1	16.5	34.7
2022-23 जुलाई 2022- जून 2023 की अवधि को संदर्भित करता है और इसी तरह 2021-22, 2020-21, 2019-20, 2018-19 और 2017-18 के लिए									

टेबल 3: बरोजगार दर (प्रतिशत में) सामान्य स्थिति (पीएस+एसएस) में पीएलएफएस (2017-18), पीएलएफएस (2018-19), पीएलएफएस (2019-20), पीएलएफएस (2020-21), पीएलएफएस (2021-22) एवं पीएलएफएस (2022-23) से प्राक्कलित

अल-इंडिया

आयु वर्ग	ग्रामीण			नगरीय			ग्रामीण + नगरीय		
	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
पीएलएफएस (2022-23)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	2.7	1.8	2.4	4.7	7.5	5.4	3.3	2.9	3.2
सभी उम्र के व्यक्तियों के लिए	2.8	1.8	2.4	4.7	7.5	5.4	3.3	2.9	3.2
पीएलएफएस (2021-22)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	3.8	2.1	3.2	5.8	7.9	6.3	4.4	3.3	4.1
सभी उम्र के व्यक्तियों के लिए	3.8	2.1	3.3	5.8	7.9	6.3	4.4	3.3	4.1
पीएलएफएस (2020-21)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	3.8	2.1	3.3	6.1	8.6	6.7	4.5	3.5	4.2
सभी उम्र के व्यक्तियों के लिए	3.9	2.1	3.3	6.1	8.6	6.7	4.5	3.5	4.2
पीएलएफएस (2019-20)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	4.5	2.6	3.9	6.4	8.9	6.9	5.0	4.2	4.8
सभी उम्र के व्यक्तियों के लिए	4.5	2.6	4.0	6.4	8.9	7.0	5.1	4.2	4.8
पीएलएफएस (2018-19)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	5.5	3.5	5.0	7.0	9.8	7.6	6.0	5.1	5.8
सभी उम्र के व्यक्तियों के लिए	5.6	3.5	5.0	7.1	9.9	7.7	6.0	5.2	5.8
पीएलएफएस (2017-18)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	5.7	3.8	5.3	6.9	10.8	7.7	6.1	5.6	6.0
सभी उम्र के व्यक्तियों के लिए	5.8	3.8	5.3	7.1	10.8	7.8	6.2	5.7	6.1
2022-23 जुलाई 2022-जून 2023 की अवधि को संदर्भित करता है और इसी तरह 2021-22, 2020-21, 2019-20, 2018-19 और 2017-18 के लिए									

(ड) प्रमुख श्रम बल संकेतक की टाइम-सीरीज साप्ताहिक स्थिति (सीडब्ल्यूएस) में
पीएलएफएस में प्राक्कलित

टेबल 1: लेबर फोर्स पार्टिसिपेशन रेट (एलएफपीआर) (प्रतिशत में) वर्तमान साप्ताहिक स्थिति (सीडब्ल्यूएस) में पीएलएफएस (2017-18), पीएलएफएस (2018-19), पीएलएफएस (2019-20), पीएलएफएस (2020-21), पीएलएफएस (2021-22) एवं पीएलएफएस (2022-23) में प्राक्कलित
अल-इंडिया

आयु वर्ग	ग्रामीण			नगरीय			ग्रामीण + नगरीय		
	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
पीएलएफएस (2022-23)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	78.8	34.6	56.7	73.9	24.0	49.4	77.4	31.6	54.6
सभी उम्र के व्यक्तियों के लिए	54.5	25.4	40.4	57.9	19.1	39.0	55.4	23.7	40.0
पीएलएफएस (2021-22)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	76.7	29.2	53.0	74.2	22.1	48.6	75.9	27.2	51.7
सभी उम्र के व्यक्तियों के लिए	55.7	21.7	38.9	57.9	17.5	38.2	56.3	20.5	38.7
पीएलएफएस (2020-21)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	76.7	30.0	53.4	73.8	21.7	48.0	75.8	27.5	51.8
सभी उम्र के व्यक्तियों के लिए	56.0	22.7	39.7	57.8	17.3	38.0	56.5	21.2	39.2
पीएलएफएस (2019-20)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	76.7	28.3	52.5	73.8	22.1	48.2	75.8	26.3	51.2
सभी उम्र के व्यक्तियों के लिए	55.4	21.1	38.6	57.2	17.5	37.8	56.0	20.0	38.3
पीएलएफएस (2018-19)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	75.5	22.5	49.1	73.7	19.7	47.1	74.9	21.6	48.5
सभी उम्र के व्यक्तियों के लिए	54.5	16.7	36.0	56.7	15.6	36.7	55.2	16.4	36.2
पीएलएफएस (2017-18)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	75.6	21.7	48.9	74.1	19.6	47.1	75.1	21.1	48.4
सभी उम्र के व्यक्तियों के लिए	54.4	16.1	35.7	56.7	15.3	36.4	55.0	15.8	35.9

2022-23 जुलाई 2022-जून 2023 की अवधि को संदर्भित करता है और इसी तरह 2021-22, 2020-21, 2019-20, 2018-19 और 2017-18 के लिए

टेबल 2: कामगार जनसंख्या अनुपात (डब्ल्यूपीआर) (प्रतिशत में) सामाहिक स्थिति (सीडब्ल्यूएस) में पीएलएफएस (2017-18), पीएलएफएस (2018-19), पीएलएफएस (2019-20), पीएलएफएस (2020-21), पीएलएफएस (2021-22) एवं पीएलएफएस (2022-23) से प्राक्कलित अल-इंडिया									
आयु वर्ग	ग्रामीण			नगरीय			ग्रामीण + नगरीय		
	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
पीएलएफएस (2022-23)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	75.2	33.2	54.2	69.3	21.8	46.0	73.5	30.0	51.8
सभी उम्र के व्यक्तियों के लिए	52.0	24.4	38.6	54.2	17.4	36.3	52.6	22.5	38.0
पीएलएफएस (2021-22)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	71.7	27.9	49.9	68.4	19.9	44.6	70.7	25.6	48.3
सभी उम्र के व्यक्तियों के लिए	52.1	20.7	36.6	53.4	15.7	35.0	52.4	19.3	36.1
पीएलएफएस (2020-21)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	71.2	28.6	50.0	66.8	19.0	43.1	69.9	25.7	47.9
सभी उम्र के व्यक्तियों के लिए	52.0	21.6	37.1	52.4	15.2	34.1	52.1	19.8	36.3
पीएलएफएस (2019-20)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	70.1	26.7	48.4	66.0	19.4	43.0	68.8	24.4	46.7
सभी उम्र के व्यक्तियों के लिए	50.6	19.9	35.5	51.2	15.4	33.6	50.8	18.6	35.0
पीएलएफएस (2018-19)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	69.0	20.9	45.0	67.2	17.4	42.7	68.4	19.8	44.3
सभी उम्र के व्यक्तियों के लिए	49.7	15.5	32.9	51.7	13.7	33.2	50.3	15.0	33.0
पीएलएफएस (2017-18)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	69.1	20.1	44.8	67.7	17.1	42.6	68.6	19.2	44.1
सभी उम्र के व्यक्तियों के लिए	49.6	14.8	32.6	51.7	13.3	32.9	50.2	14.4	32.7
2022-23 जुलाई 2022-जून 2023 की अवधि को संदर्भित करता है और इसी तरह 2021-22, 2020-21, 2019-20, 2018-19 और 2017-18 के लिए									

टेबल 3: बरोजगार दर (प्रतिशत में) साप्ताहिक स्थिति (सीडब्ल्यूएस) में पीएलएफएस (2017-18), पीएलएफएस (2018-19), पीएलएफएस (2019-20), पीएलएफएस (2020-21), पीएलएफएस (2021-22) एवं पीएलएफएस (2022-23) से प्राक्कलित									
अल-इंडिया									
आयु वर्ग	ग्रामीण			नगरीय			ग्रामीण + नगरीय		
	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में	पुरुषों में	महिलाओं में	व्यक्तियों में
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
पीएलएफएस (2022-23)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	4.6	4.0	4.4	6.3	9.1	7.0	5.1	5.1	5.1
सभी उम्र के व्यक्तियों के लिए	4.6	4.0	4.5	6.3	9.1	7.0	5.1	5.1	5.1
पीएलएफएस (2021-22)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	6.5	4.5	6.0	7.8	9.9	8.3	6.9	5.8	6.6
सभी उम्र के व्यक्तियों के लिए	6.5	4.6	6.0	7.8	9.9	8.3	6.9	5.8	6.6
पीएलएफएस (2020-21)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	7.1	4.8	6.5	9.4	12.2	10.1	7.8	6.6	7.5
सभी उम्र के व्यक्तियों के लिए	7.2	4.8	6.5	9.4	12.2	10.1	7.8	6.6	7.5
पीएलएफएस (2019-20)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	8.7	5.5	7.8	10.5	12.4	11.0	9.3	7.3	8.8
सभी उम्र के व्यक्तियों के लिए	8.7	5.5	7.9	10.6	12.4	11.0	9.3	7.3	8.8
पीएलएफएस (2018-19)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	8.6	7.3	8.3	8.8	12.1	9.5	8.7	8.7	8.7
सभी उम्र के व्यक्तियों के लिए	8.7	7.3	8.4	8.9	12.1	9.5	8.8	8.7	8.8
पीएलएफएस (2017-18)									
15 वर्ष और उससे अधिक उम्र के व्यक्तियों के लिए	8.7	7.5	8.4	8.7	12.7	9.5	8.7	9.0	8.7
सभी उम्र के व्यक्तियों के लिए	8.8	7.7	8.5	8.8	12.8	9.6	8.8	9.1	8.9
2022-23 जुलाई 2022-जून 2023 की अवधि को संदर्भित करता है और इसी तरह 2021-22, 2020-21, 2019-20, 2018-19 और 2017-18 के लिए									

BROAD CONTENTS OF THE LAST THREE ISSUES OF ‘SARVEKSHANA’

(A) 112th ISSUE

PART –I: TECHNICAL PAPERS

1. Measurement of Completion Rate of Education in India
Akhilesh Kumar, Vibeesh E. M and Priyanka Sethi
2. Under Listing of Establishments in Sixth EC: A Comparison between Sixth EC and NSS Conducted on Non-agricultural Enterprises
Dipankar Mitra
3. Role of the Indian System of Medicine and Homeopathy in Treating Communicable and Non-communicable Diseases in India
Chander Shekhar and Rajaram Yadav

PART-II: HIGHLIGHTS OF THE REPORT RELEASED BY NSO:

4. Highlights I: Situation Assessment of Agricultural Households and Land and Livestock Holdings of Households in Rural India, 2019: NSS 77th Round (January to December, 2019)
5. Highlights II: All India Debt & Investment (AIDIS) Survey: NSS 77th Round (January to December, 2019)

(B) 113th ISSUE

PART –I: TECHNICAL PAPERS

1. Estimating Annual Change in Inventory for the Unorganised Sector – an alternative approach
Dipankar Mitra
2. Status of Morbidity and Prevalence of Disease Specific Morbidity in Assam NSS 75th Round
Nayanakhee Sarma and Rajshree Bedamatta
3. Disaggregate Level Estimation and Mapping of Time Spent by Women on Unpaid Activities via Small Area Modeling by Integrating Survey and Census Data
Sonakhya Samaddar, Hukum Chandra

PART-II: HIGHLIGHTS OF THE REPORT RELEASED BY NSSO:

4. Highlights I: Annual Report of Periodic Labour Force Survey (PLFS), July 2020-June 2021
5. Highlights II: Migration in India, 2020-2021

(C) 114th ISSUE

PART –I: TECHNICAL PAPERS

- 1 Making India Open Defecation Free: A Machine Learning Approach
Piyush Kumar Sing
2. Estimation of Quality Adjusted Life Year (QALY) based on Discrete Axiom of Revealed Preferences (DARP) and Splines for Different States of India
Gurprit Grover & Radhika Magan Bedamatta
3. Recent Estimates of Dynamic Mobility of Persons in Current Weekly Activity Status Based on Markov Chain
P. D. Joshi & Jena P Joshi

PART-II: HIGHLIGHTS OF THE REPORT RELEASED BY NSSO:

4. Highlights: Annual Report of Periodic Labour Force Survey (PLFS) (2021-2022)

PDOS-57-XXXIX Sept. 2023 and March 2024 (1-2 and 3-4)
305

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