



GOVERNMENT OF NATIONAL CAPITAL TERRITORY OF DELHI

**POOLING & POOLABILITY
ANALYSIS OF
HOUSEHOLD CONSUMER EXPENDITURE**

**NSS 68th Round
Schedule-1.0**

(CENTRAL & STATE SAMPLES)

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PREFACE

National Statistical Commission constituted a committee under the Chairmanship of Prof.R.Radhakrishna on Pooling of Central and State samples of National Sample Surveys (NSS) to identify the preconditions for pooling of Central and State sample NSS data and to suggest appropriate methodology for pooling the data to bridge the data gaps and in turn strengthen the database for decentralized planning and governance.

The necessity for pooling the Central and State data arose due to the growing need for improving the precision of estimates of policy parameters such as the incidence of poverty, State Domestic Product (SDP), District Domestic Product (DDP) etc and for strengthening the database at district level required for decentralized governance.

Directorate of Economics and Statistics (DES), Delhi has already released the report on pooling of state and central samples of NSS 66th Round for Sch. 1.0 (Household Consumer Expenditure) and Sch.10.0 (Employment & Unemployment). The pooling is done on the basis of *weighted average mean* methodology as suggested by Minhas-Sardana report on pooling.

This report focused on the poolability testing and analysis of pooled data extracted from Sch. 1.0 (Household Consumer Expenditure) of NSS 68th round for certain parameters eg. MPCE (Food & Non-food), number of households, population and sex-ratio.

This report has been prepared by Sh.Hemant Kumar, Statistical Assistant under the technical guidance of Sh.P.K.Srivastava, Programmer. Necessary improvements in the report have been initiated by Sh.C.K.Dutta, Deputy Director.

The field work of state samples was conducted by Socio-economic unit under the guidance of Sh. K.R Chhibber and R.K. Sharma, Statistical Officers. The role of this unit in collection of data from field against all odd is highly appreciated. An extraordinary effort made by Sh. P.K. Chaurasia, Statistical Officer and his entire DPA section under the able guidance of Sh. Sabir Ali, Assistant Director for thorough scrutiny of the raw data is also acknowledged.

The technical assistance provided by National Sample Office, Government of India is acknowledged with special gratitude. A Special thank is also given to Data Processing Division, NSSO for sharing unit level Central data of Delhi for pooling purpose.

Comments and valuable suggestions from the Researchers and Scholars on this report are most welcome.

MAY, 2015

(Dr. B.K.Sharma)
Special Secretary-cum-Director

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HIGHLIGHTS

The followings are the main highlights of the report on data pooling of **“Household Consumer Expenditure”**, based on NSS 68th round survey of Sch. 1.0.

- I. Report is containing four major parameters for poolability analysis i.e. MPCE (Food & Non-food), number of households, population and Sex-Ratio.
- II. Only Median/Chi-Square Test is applied for poolability testing for the parameters of discrete nature.
- III. Sector-wise (urban and rural) poolability testing and analysis are performed due to non availability of district wise data for Delhi state as no district code were provided by NSSO in UFS frame.
- IV. All the considered Parameters i.e. MPCE (Food & Non-food), number of households, population and sex-ratio have necessarily passed the poolability test for rural sector as well as for urban sector at 1% significance level.
- V. The Chi-Square test of pooled data of urban sector gives better result as compared to that of rural sector for type –I data. However, rural sector gives better result in the case of run test for respective test parameters for type I data.
- VI. On the other hand, Chi-Square test of pooled data of rural sector for type 2 data gives better result as compared to urban sector. Rural sector exhibits better result in the case of run test also for respective test parameter for type 2 data.
- VII. The presences of non- sampling errors are found at the time of poolability analysis in both the samples. However, quantum of such errors is very nominal.
- VIII. The non-sampling errors in pooled data of rural sector are less than that of urban sector for all the considered parameters except sex-ratio in the case of type 1 data.
- IX. On the other hand, the non-sampling errors of pooled data of type 2, Urban sector is containing less error as compared to rural sector.
- X. The deviational value in the term of RSE lies around 1% for all the considered parameter for sch.1.0 of NSS 68th round.

Salient features of the report

With the objective of getting better estimates at lower sub-state level and increased precision of the estimates at state level, pooling of state and central unit level data is being undertaken for various NSS rounds.

The pooled estimates are based on the survey result of NSS 68th round, July 2011 to June 2012. In this round detail of consumer expenditures and its pattern had been captured through schedule 1.0 with its two variants type-I and type -II.

In type -I schedule, two types of reference periods were used: one is *usual reference period* URP (reference period last 30 days for all items) and *mixed reference period*, MRP (last 365 days for clothing, bedding, footwear, education, medical-institutional, and durable goods and last 30 days for remaining items).

In type-II schedule, reference period is termed as *modified mixed reference period*, MMRP (last 365 days for clothing, bedding, footwear, education, medical-institutional, and durable goods; last 7 days for edible oil, egg, fish, meat, vegetables, fruits, spices, beverages, and processed foods; pan, tobacco and intoxicants; last 30 days for all other foods, fuel, light, miscellaneous goods and services)

Detail of numbers of sample households in respect of Central and State sample for rural and urban Delhi may be seen from the table given below:

Delhi – RURAL				
	Central sample		State sample	
Schedule	FSU surveyed	HH surveyed	FSU surveyed	HH surveyed
1.0 Type-I	8	64	16	128
1.0 Type-II	8	63	16	128
Delhi – URBAN				
	Central sample		State sample	
Schedule	FSU surveyed	HH surveyed	FSU surveyed	HH surveyed
1.0 Type-I	120	887	240	1916
1.0 Type-II	120	882	240	1914

Two types of 1.0 schedule type-I and type-II were canvassed in two independent sets of sample households.

In Delhi, district-wise sample frame is not available as UFS frame does not contain the district code of all towns. So, Poolability test and pooling are restricted to Sectors i.e. Urban and Rural only.

For Parameters of *continuous nature* like MPCE- food, MPCE-non-food and total MPCE *Run test* has been applied to test the Poolability of two different sets of data extracted from Central and State level samples; whereas, *Median test* has been applied for parameters of *discrete nature* like population, households and sex ratio.

All four parameters under consideration (MPCE, population, households and sex ratio) have been **accepted by null hypothesis** that the state samples and central Samples are realized from **identical distribution function and they are fit to be pooled** (detail of result may be seen from the table depicted in chapter-3).

Data have been pooled on the basis of *weighted average of the estimates by matching ratio of states participation*.

Details of results as received from pooling of two sets of data are stated below:

Figures based on Schedule 1.0, type-1(URP&MRP):

- a) Total number of household in rural Delhi is estimated as 2, 20,446 with average household size of 4.79.
- b) Number of household in urban Delhi is estimated as 23, 71,960 with average household size of 4.05.
- c) Sex ratio is returned as 859 for Rural Delhi as against 862 for its urban counterpart.
- d) Average monthly per capita expenditure (MPCE) – URP is returned as Rs. 2068/- for rural Delhi and that for urban Delhi is estimated as Rs. 3240/-
- e) MPCE (URP) on food items in Rural Delhi is estimated as Rs. 946 (46% of total MPCE) as against Rs. 1122 (54% of total MPCE) for non-food items. The same for Urban Delhi is estimated as Rs. 1190 (37%) for food items and Rs. 2050 (63%) for non-food items.
- f) MPCE (MRP) for urban Delhi has shown a slight difference. MPCE (MRP) is estimated as Rs. 3340; only an increase of Rs.100 from MPCE (URP). This is due to change in reference period used for consumption of some of non- food items (last 365 days for clothing, bedding, footwear, education, medical-institutional, and durable goods). MPCE (MPR) for non-food items is estimated as Rs.2150.

Figures based on Schedule 1.0, type-II (MMRP):

- g) On the other hand, as per type-II schedule of 1.0 (MMRP) total households is estimated as 2, 20,446 in rural Delhi with average

household size 4.3 as against 23, 75,654 HHs with average hh size 4.1 in urban Delhi.

- h) Sex ratio has been estimated as 776 for rural Delhi and 801 for its urban counterpart.
- i) Total MPCE is estimated as Rs. 2642 in rural Delhi with Rs. 1171 (44% of total MPCE) for food-items and Rs. 1471 (56% of total MPCE) for non-food items.
- j) For urban Delhi the total MPCE is returned as Rs.3615. MPCE for food items is estimated as Rs. 1430 (40% of total MPCE) as against Rs.2185 for non-food items (60% of total MPCE).
- k) For all the selected parameters, relative standard error has been calculated for state estimates, centre estimates and pooled estimates and it comes out to be around 1 (one) or less than one for each parameter.
- l) Detail of report may kindly be seen from chapter-2 and 3.

Chapter 1

Introduction and Background

Background

The National Sample Survey (NSS) was set up in 1950, to bridge large gaps in statistical data needed for planning, policy formulation and computation of national income aggregates, especially in respect of the unorganized and household sector of the economy. NSSO has been conducting nationwide multi-subject, integrated, large scale sample surveys in the form of successive rounds covering various aspects of social, economic, demographic, industrial and agricultural statistics. These surveys are undertaken striking a balance between the urgent and contemporary need for reliable statistical data on different topics and the constraints of limited resources, both physical and financial. The subject coverage of Socio-Economic enquiries for different rounds is decided on the basis of a 10-year cycle. Certain topics like labour force, household consumer expenditure, social consumption, housing condition of people, and unorganized non agricultural enterprise surveys, household land and live stock holding and Debt and Investment are repeated at quinquennial or decadal intervals. The remaining years are for open rounds in which subjects of current/special interest are undertaken on the demand of other central ministries, national and international organizations, etc. NSSO has become synonymous with reliable estimates on various aspects of economic and social life in India based on large scale sample surveys.

State's Participation in NSS surveys

DES, Delhi participated in the NSS surveys of Household consumer expenditure in 27th round (1972-73), 32nd (1977-78), 38th (1983), 43rd (1987-88), 50th (1993-94), 55th(1999-2000),61th (2004-05), 66th (2009-2010) and 68th (2011-2012) round by using the same concepts, definitions and procedures and by adopting the same sample design based on independently drawn sample as that of NSSO . A sample set undertaken by NSSO is referred as Central samples and set of samples undertaken by a state is referred as State samples. Sample sizes of central and state samples are equal for most of the states/UTs (equal matching sample) but there are some states including Delhi, where the number of samples surveyed by state statistical agencies is usually double to that of the size of the central samples.

Main Objectives of Pooling

One of the objectives of States' participation in the NSS surveys is to provide a mechanism by which sample size could be increased and the pooling of the two sets of data would enable better estimate at lower sub state level, particularly at district level. At the State level, this will result in increased precision of the estimates and at disaggregated level, estimates will be more stable. But the major benefit will be derived in the case of estimates are generated at sub-state level like NSS region/districts.

National Statistical Commission constituted a committee under the Chairmanship of Dr. R. Radhakrishna on Pooling of Central and State samples of National Sample Surveys (NSS) to identify the preconditions for pooling of Central and State sample NSS data and to suggest appropriate methodology for pooling the data to bridge the data gaps and in turn strengthen the database for decentralized planning and governance. The National Statistical Commission in its report has indicated the importance of pooling in the statement: "the statistical agencies of different State governments have been participating in the NSS programme and canvassing the same questionnaires in matched samples of households in their respective States following identical concepts, definitions and procedures. Results from the central samples and state sample(s) have occasionally been compared. The main purpose of the programme is to pool the two samples and obtain dependable estimates for regions within the States". The Commission recommended: "The State sample data should be processed regularly within a reasonable time after the completion of fieldwork and attempts should be made to obtain and utilize pooled estimates by combining central and state samples".

Emerging need for pooling of estimates

There has been of late major thrust for lower level data for decentralized planning and development. The 73rd and 74th constitutional amendment (1992) has brought into existence the democratically elected grassroots institutions of local self governance, with respective delegated functions, both in rural and urban areas. This has enhanced the demand for local level statistics and necessitated requirement of developing basic capabilities at grass root levels to organize such statistics in a harmonious manner. In this context, it is envisaged that the survey resources in overall NSS programme both by Central and State Agencies can be more effectively utilized to generate lower level

estimates of key indicators at district level. 13th Finance Commission, in Para 12.99 of its report, noted that "Comparable estimates of district income are extremely relevant for measuring intra-state income disparities. This will enable State Governments to effectively plan policy and programme interventions. They could also be used as a parameter for horizontal distribution of fiscal transfers". The Commission also recommended for granting finance to State Governments, which should be utilized by them for strengthening statistical infrastructure at the district level. These requirements are subsequently brought in institutional framework in the implementation of the 13th Finance Commission. The States started participating in the programme of collecting socioeconomic data on the same subjects from the 8th round (July 1954- June 1955) using the same concepts, definitions and procedures and by adopting the same sample design based on independently drawn sample as that of NSSO.

One of the objectives of States participation in the NSS programme is to provide a mechanism by which sample size will be increased and the pooling of the two sets of data would enable better estimates at lower sub state level, particularly at district level.

Data Entry and Validation Software

The State DES of Delhi developed its own software for data entry and validation and the central sample data which has been entered in central software has been converted to state format so as to pool the data of two sets. Pooling has been done for NSS 68th round on different parameters like Household Consumer Expenditure (Food and non-food) based on URP, MRP and MMRP, No of household, Population and sex-ratio etc as per the methods prescribed by NSC committee after performing some of the poolability tests like non-parametric test (Wald-Wolfowitz run test) and parametric test. The RSE for food, non-food and MPCE, divergence between the estimates of central and state sample have also been calculated. Pooling by simple weighted average of the estimates is attempted.

Poolability Test of central and state sample

Though the central sample and state sample are drawn independently following identical sampling design with same concepts, definitions and instructions to collect the state sample data but due to lack of adequate training of field and processing staff of State/UTs, the data files in some cases are not properly validated. There is also expected agency bias in the two sets of data generated by different agencies. As such they cannot be merged for generating pooled estimate. Therefore, one needs to test that the samples

are coming from identical distribution function. Since the parametric distribution of the sample mean is unknown one may adopt non-parametric tests such as K-S test, Wald-Wolfowitz run Test, Median test etc to test that the samples are coming from identical distribution function.

An attempt by DES, Delhi

Minhas and Sardana in their paper titled "A note on pooling of central and state samples data of National Sample Survey" which appeared in *Sarvekshana July- September 1990* proposed a methodology for computation of pooled multiplier and laid down certain guidelines and procedure to be followed by the State DESs in the pooling exercise.

DES, Delhi has made an attempt and followed the methodology of Minhas and Sardana in order to pool the state and central data. DES, Delhi has successfully released the pooled data of 66th NSS round in the year 2013-14. Some of the results based on pooled data of NSS 68th round (Household consumer expenditure) are presented in this report.

Limitation of Report

In Delhi the district wise sample frame is not available as UFS frame of Delhi does not contain the district code of all the towns. Therefore, poolability testing and analysis has been limited to made sectors i.e. for Urban and Rural .

Methodology and software used

Complete analysis and poolability testing is based on nonparametric and parametric test especially, Z-test/Run Test and Median Test as per nature of unit level data either of discrete or continuous in nature. For overall test, we have used the poolability software supplied by NSSO (MOSPI) in the workshop held in January and August 2013. Poolability of data and its analysis has been worked out with the help of SPSS & Micro soft office 2007. As per our own convenience, we have adopted the method of weighted mean for pooling two sets of data in respect of the accepted attributes which satisfy the poolability test. In this report we have also calculated the Errors (SE) and Relative standard Errors (RSE) for checking the percentage of standard errors and its deviation from central point. SE is usually estimated by dividing the population standard deviation by the square root of the sample size (if, population SD is unknown then sample standard deviation is used). The RSE is simply the standard error divided by the mean of the sample. After getting

the value of RSE for Urban and rural sectors of state and central level data we need also to calculate RSE of pooled estimate to check the percentage of error which is likely to occur at the time of pooling.

Parameters considered for poolability Test

In this report total four parameter of NSS 68th round (Type-I and Type-II) has been considered for poolability test and analysis. In which Median test has been applied for the data of discrete nature and Run test has been applied for the data of continuous nature.

a) Parameters of **Continuous Nature**:- MPCE of Food, Non-Food and Total MPCE derived from detail item (food and non-food wise) from URP, MRP and MMRP

b) Parameters of **Discrete Nature** :-Household size, Population, and sex-ratio

Sample size of Delhi: Total sample size of Delhi State for central and state sample is given below:

Delhi – RURAL				
	Central sample		State sample	
Schedule	FSU surveyed	HH surveyed	FSU surveyed	HH surveyed
1.0 Type-I	8	64	16	128
1.0 Type-II	8	63	16	128
Delhi – URBAN				
	Central sample		State sample	
Schedule	FSU surveyed	HH surveyed	FSU surveyed	HH surveyed
1.0 Type-I	120	887	240	1916
1.0 Type-II	120	882	240	1914

CHAPTER-2

Summary of Poolability Test Result (Sch.1.0)

Statement: 1 (Sch.1.0-Type1): Parameters for which Poolability was Accepted/ Rejected (Y/N) in run test using Z-Statistic (one sided) and Median test

PARAMETERS	Sector	
	RURAL	URBAN
Acceptance of Chi-Square Test At 0.01 significance level for single degree of freedom (6.635)		
HOUSEHOLD	Y	Y
POPULATION	Y	Y
SEX-RATIO	Y	Y
Acceptance of Wald Woolfwitz Run Test (z-value)at 0.01 significance level for single degree of freedom (-2.33)		
MPCE(MRP)	Y	Y
MPCE(URP)	Y	Y

The Z-statistic by run test at 1% critical error has been applied for rural and urban areas of Delhi for testing poolability of parameters like MPCE(URP) & MPCE(MRP) and MPCE for food & nonfood items(MRP).These parameters are accepted the null hypothesis in the case of sch-1.0 , type-1 unit level data for both sector . The Median test has been applied for parameters of discrete nature i.e. Sex-Ratio, household and population. All have been accepted by null hypothesis for both the sectors at 1% critical level having single degree of freedom.

Statement: 2 (Sch.1.0)-Type2(MMRP)): Parameters for which Poolability was Accepted/Rejected(Y/N) in run test using Z-Statistic (one sided) and Median test

Result Of Poolability test for various parameters for Consumer Expenditure (Sch.1.0,Type-2) NSS 68th Round		
PARAMETERS	Sector	
	RURAL	URBAN
Acceptance of Chi-Square Test at 0.01 significance level for single degree of freedom (6.635)		
HOUSEHOLD	Y	Y
POPULATION	Y	Y
SEX-RATIO	Y	Y
Acceptance of Wald Woolfwitz Run Test (Z-Value)At 0.01 significance level for single degree of freedom (-2.33)		
MPCE(MRP)	Y	Y

The Z-statistic by run test at 1% critical error has been applied for rural and urban areas of Delhi for parameters like MPCE as a whole and separate for food & non-food items. These parameters are accepted the null hypothesis in the case of sch-1.0 , type-2 unit level data for both sector . The Median test has been applied for discrete nature of parameters in which all the parameters have been accepted by null hypothesis in the case of both the sectors at 1% critical level having single degree of freedom. It reveals that the collected unit level data is significant having negligible non sampling errors at the time of collection of unit level data by surveyors.

Hence, the NSS 68th Round (Type-I & Type-II) data reflects the quality of data which is the great achievement of our surveyors.

Chapter 3
POOLABILITY TEST RESULT
(Type-1&Type-2)

Statement 3: Test Result of Run test and Median Test for sch.1.0 (Type-1)

Summary of POOLABILITY TESTING FOR VARIOUS Parameters for Consumer Expenditure (Sch.1.0,Type-1) NSS 68th Round		
Sector	RURAL	URBAN
Parameters		
CHI-SQUARE TEST		
HOUSEHOLD	2.17398	1.854392
POPULATION	2.17398	1.854392
SEX-RATIO	0.437637	0.007442
WALD WOOLFWITZ RUN TEST (Z-VALUE)		
MPCE(MRP)	3.387952	11.12355
MPCE(URP)	4.095059	12.09853

Statement 4: Test Result of Run test and Median Test for sch.1.0 (Type-2)

Summary of Poolability Testing For Various Parameters For Consumer Expenditure (Sch.1.0,Type-2) NSS 68th Round		
Sector	RURAL	URBAN
Parameters		
CHI-SQUARE TEST		
HOUSEHOLD	0.251587	0.454033
POPULATION	0.251587	0.454033
SEX-RATIO	0.185234	2.178894
WALD WOOLFWITZ RUN TEST (Z-VALUE)		
MPCE(MMRP)	3.387952	11.91129

Chapter 4

Summary of Pooled Results & RSE OF Type-1 of Sch. 1.0

Statement 5: Estimated Number of HHs, Population, Value for MPCE (MRP)

Summary of Estimated Values(in Numbers) of Various Parameters for Consumer Expenditure						MRP
PARAMETERS	Sector					
	RURAL			URBAN		
	STATE	CENTER	POOLED	STATE	CENTER	POOLED
HOUSEHOLD	211301	238735	220446	2083635	2948610	2371960
POPULATION	1081759	1004223	1055914	8566395	11692962	9608584
MPCE(TOTAL)	2050	2348	2068	3525	2920	3212
MPCE(FOOD)	906	1032	946	1234	1126	1190
MPCE(NONFOOD)	1032	1316	1122	2291	1794	2150
SEX-RATIO	843	895	859	859	867	862

Statement 6: Estimated Value for MPCE (URP) (Sch.1.0 Type-1)

Summary of Estimated Values(in Numbers) of Various Parameters for Consumer Expenditure						URP
	URP					
Sector	RURAL			URBAN		
PARAMETERS	STATE	CENTER	POOLED	STATE	CENTER	POOLED
HOUSEHOLD	211301	238735	220446	2083635	2948610	2371960
POPULATION	1081759	1004223	1055914	8566395	11692962	9608584
MPCE(TOTAL)	1938	2348	2068	3412	2920	3212
MPCE(FOOD)	906	1032	946	1234	1126	1190
MPCE(NONFOOD)	1032	1316	1122	2178	1794	2050
SEX-RATIO	843	895	859	859	867	862

Statement 7: Estimated RSE for MPCE (MRP) (Sch.1.0 Type-1)

RSE of Estimated Values(in Numbers) of Various Parameters for Consumer Expenditure						
RSE OF TYPE -1	MRP					
	RURAL			URBAN		
PARAMETERS	STATE	CENTER	POOLED	STATE	CENTER	POOLED
HOUSEHOLD	0.34957	1.04168	0.19207	0.03047	0.06486	0.02090
POPULATION	0.77052	0.80898	0.20977	0.02670	0.04528	0.01724
MPCE(TOTAL)	0.11821	0.29541	0.08357	0.81110	0.01946	0.00568
MPCE(FOOD)	0.07089	0.14837	0.04793	0.51117	0.01092	0.00342
MPCE(NONFOOD)	0.04732	0.14704	0.03563	0.29993	0.00854	0.00225
SEX-RATIO	0.30519	0.51623	0.18325	0.55482	0.01158	0.00261

Statement 8: Estimated RSE for MPCE (URP) (Sch.1.0 Type-1)

RSE of Estimated Values(in Numbers) of Various Parameters for Consumer Expenditure						URP
RSE OF TYPE -1	URP					
	RURAL			URBAN		
PARAMETERS	STATE	CENTER	POOLED	STATE	CENTER	POOLED
HOUSEHOLD	0.45393	0.97738	0.22030	0.03033	0.06486	0.02064
POPULATION	0.54115	0.72678	0.24117	0.02626	0.04528	0.24117
MPCE(TOTAL)	0.11821	0.29541	0.08357	0.81110	0.01946	0.56834
MPCE(FOOD)	0.07089	0.14837	0.04793	0.51117	0.01092	0.34282
MPCE(NONFOOD)	0.04732	0.14704	0.03563	0.29993	0.85417	0.22553
SEX-RATIO	0.29065	0.51398	0.14989	0.47641	0.01101	0.41904

Statement 9: Estimated Values for MPCE (MMRP) (Sch.1.0 Type-2)

Summary of Estimated Values(in Numbers) of Various Parameters for Consumer Expenditure						
	MMRP					
Sector	RURAL			URBAN		
PARAMETERS	STATE	CENTER	POOLED	STATE	CENTER	POOLED
HOUSEHOLD	211301	238735	220446	2093112	2948610	2375654
POPULATION	838984	1135075	937681	8511810	12191390	9738337
MPCE(TOTAL)	2561	2762	2642	3841	3299	3615
MPCE(FOOD)	1183	1154	1171	1489	1347	1430
MPCE(NONFOOD)	1378	1608	1471	2352	1952	2185
SEX-RATIO	806	733	776	829	764	801

Statement 10: Estimated RSE for MPCE (MMRP) (Sch.1.0 Type-2)

RSE of Estimated Values(in Numbers) of Various Parameters for Consumer Expenditure						MMRP
RSE OF TYPE -II	MMRP					
	RURAL			URBAN		
PARAMETERS	STATE	CENTER	POOLED	STATE	CENTER	POOLED
HOUSEHOLD	0.4313675	0.9971324	0.1977828	0.0323133	0.0662754	0.0217177
POPULATION	0.7333774	0.6434468	0.2151606	0.0302666	0.0497044	0.0190671
MPCE(TOTAL)	0.1076171	0.2443712	0.0742640	0.0074988	0.0170263	0.0051717
MPSC(FOOD)	0.0669676	0.1439948	0.0457954	0.0047256	0.0104244	0.0032302
MPCE(NONFOOD)	0.0406495	0.1003764	0.0284686	0.0027731	0.0066019	0.0019415
SEX-RATIO	0.2195533	0.6782816	0.1747105	0.0027819	0.0167298	0.0018497

Chapter 5

Statement of Pooled Results

Statement 11(State) :Estimated number of households and persons by sex for each MPCE class(MRP) Type-I									
RURAL									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	0	0	0	0	0	0	0	0	0
501-1000	556	556	556	1112	1112	3335	1000	1	6
1001-1500	83753	239437	108758	50471	90054	488720	686	16	99
1501-2000	35303	46857	48771	23296	56726	175649	1504	18	123
2001-2500	25832	56187	44150	11719	13684	125740	852	20	100
2501-3000	23093	48140	46881	6261	23204	124488	1288	20	99
above 3000	42764	77041	53992	25746	7049	163828	594	53	241
all classes	211301	468217	303108	118604	191829	1081759	843	128	668
sample no.		260	219	100	89	668			
URBAN									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	0	0	0	0	0	0	0	0	0
501-1000	14000	26645	22240	11902	32590	93377	1422	28	190
1001-1500	218725	409068	373751	247250	241775	1271844	938	203	1143
1501-2000	261656	471661	416685	223296	217351	1328993	912	246	1235
2001-2500	288892	502376	327157	131700	128651	1089884	719	190	777
2501-3000	224737	376217	296458	140600	96766	910041	761	171	671
above 3000	1075626	1671436	1466716	396375	337730	3872256	873	1078	3878
all classes	2083635	3457403	2903007	1151123	1054862	8566395	859	1916	7894
sample no.		3182	2706	1034	972	7894			

Statement 12(state):Estimated number of households and persons by sex for each MPCE class(URP) Type-I									
RURAL									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	0	0	0	0	0	0	0	0	0
501-1000	1053.898805	1555	3040	1618	1120	7333	1311	3	27
1001-1500	94787.6267	250485	118320	60720	96586	526111	691	17	94
1501-2000	27615.4942	45768	42277	15856	51272	155173	1518	19	129
2001-2500	39860.49095	82113	66212	10639	36336	195300	1106	26	125
2501-3000	6177.62515	12235	20623	5921	225	39005	1148	14	74
above 3000	41805.58175	76062	52635	23850	6291	158837	590	49	219
all classes	211301	468217	303108	118604	191829	1081759	843	128	668
sample no.	128	260	219	100	89	668			
URBAN									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	0.00	0	0	0	0	0	0	0	0
501-1000	23898.88	46195	45958	30814	40099	163065	1117	43	283
1001-1500	216614.15	413520	374550	207534	238193	1233797	987	207	1142
1501-2000	290224.04	516608	455371	252279	230208	1454466	892	251	1231
2001-2500	280039.11	487689	328981	143138	119295	1079104	711	189	803
2501-3000	236024.74	386685	300749	141236	107908	936578	774	174	653
above 3000	1036834.53	1606704	1397398	376123	319159	3699385	866	1052	3782
all classes	2083635	3457403	2903007	1151123	1054862	8566395	859	1916	7894
sample no.	1916	3182	2706	1034	972	7894			

Statement 13(Centre):Estimated number of households and persons by sex for each MPCE class(MRP) Type-1									
RURAL									
MPCE CLASS	Estimated number					Sex ratio	Sample households	Sample persons	
	households	adults		children					persons
		male	female	male	female				
upto 500		0	0	0	0	0			
501-1000	14416	42198	56089	1265	28307	127859	1942	3	19
1001-1500	21352	26838	36164	35933	28793	127728	1035	11	56
1501-2000	18836	25736	23959	17102	28251	95049	1219	9	40
2001-2500	29327	35260	34263	18390	20674	108586	1024	12	53
2501-3000	55336	107351	70331	10177	13969	201828	717	11	55
above 3000	99468	133983	133282	75773	135	343173	636	18	60
all classes	238735	371366	354088	158640	120129	1004223	895	64	283
sample no.		104	94	49	36	283			
URBAN									
MPCE CLASS	Estimated number					Sex ratio	Sample households	Sample persons	
	households	adults		children					persons
		male	female	male	female				
upto 500		0	0	0	0	0			
501-1000	102460	231197	191177	71710	138610	632694	1089	22	137
1001-1500	323065	607424	555645	376769	325623	1865461	895	124	721
1501-2000	444574	811063	780089	336979	320659	2248790	959	117	569
2001-2500	443276	707585	648937	285742	277577	1919840	933	107	383
2501-3000	252749	393693	298583	84582	65231	842090	761	79	264
above 3000	1382487	1993190	1616897	363488	210511	4184086	775	438	1353
all classes	2948610	4744152	4091328	1519271	1338211	11692962	867	887	3427
sample no.		1418	1206	415	388	3427			

Statement 14(Centre):Estimated number of households and persons by sex for each MPCE class(URP) Type-I

RURAL									
MPCE CLASS	Estimated number					Sex ratio	Sample households	Sample persons	
	households	adults		children					persons
		male	female	male	female				
upto 500		0	0	0	0	0			
501-1000	14416	42198	56089	1265	28307	127859	1942	3	19
1001-1500	21644	27342	36455	36304	28793	128894	1025	13	64
1501-2000	36044	45723	42738	31398	43881	163740	1123	13	60
2001-2500	52773	97529	63698	6711	10348	178286	710	13	58
2501-3000	14736	24802	22827	7182	8697	63508	986	5	23
above 3000	99123	133772	132280	75781	103	341936	632	17	59
all classes	238735	371366	354088	158640	120129	1004223	895	64	283
sample no.		104	94	49	36	283			
URBAN									
MPCE CLASS	Estimated number					Sex ratio	Sample households	Sample persons	
	households	adults		children					persons
		male	female	male	female				
upto 500		0	0	0	0	0			
501-1000	130651	326900	209848	95297	150154	782199	853	38	222
1001-1500	415217	740816	730609	405724	433312	2310461	1015	136	772
1501-2000	463928	828956	793830	368342	265684	2256812	885	126	567
2001-2500	367595	582407	546939	257799	209622	1596766	900	92	340
2501-3000	283882	440477	342611	97422	82275	962784	790	80	252
above 3000	1287336	1824597	1467491	294687	197165	3783940	785	415	1274
all classes	2948610	4744152	4091328	1519271	1338211	11692962	867	887	3427
sample no.		1418	1206	415	388	3427			

Statement 15(Pooled):Estimated number of households and persons by sex for each MPCE class(MRP) Type-I								
Rural								
MPCE CLASS	MPCE CLASS							
	upto 500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000	above 3000	all
Estimated HHS	0	5508	70406	30425	44165	9030	60911	220446
Sample HHS	0	6	30	32	39	19	66	192
Estimated persons	0	47508	393705	158028	189628	47173	219870	1055914
Sample HHS	0	46	158	189	183	97	278	951
Sex –Ratio	0	1096	909	859	816	446	785	859
Statement (Pooled):Estimated number of households and persons by sex for each MPCE class(MRP) Type-I								
URBAN								
MPCE CLASS	MPCE CLASS							
	upto 500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000	above 3000	all
Estimated HHS	0	59483	282815	348125	309225	251977	1120335	2371960
Sample HHS	0	81	343	377	281	254	1467	2803
Estimated Persons	0	369443	1592685	1721915	1251658	945313	3727570	9608584
Sex –Ratio	1135	860	944	784	789	713	857	844
Sample HHS	0	505	1914	1798	1143	905	5056	11321

Statement 16 (Pooled):Estimated number of households and persons by sex for each MPCE class(URP) Type-I								
Rural								
MPCE CLASS	MPCE CLASS							
	upto 500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000	above 3000	all
Estimated HHS	0	5508	70406	30425	44165	9030	60911	220446
Sample hhs	0	6	30	32	39	19	66	192
Estimated Persons	0	47508	393705	158028	189629	47173	219870	1055914
Sample HHS	0	46	158	189	183	97	278	951
Sex –Ratio	0	1096	909	859	816	446	785	859
Statement (Pooled):Estimated number of households and persons by sex for each MPCE class(URP) Type-I								
URBAN								
MPCE CLASS	MPCE CLASS							
	upto 500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000	above 3000	all
Estimated HHS	0	59483	282815	348125	309225	251977	1120335	2371960
Sample HHS	0	81	343	377	281	254	1467	2803
Estimated Persons	0	369443	1592685	1721915	1251658	945313	3727570	9608584
Sex –Ratio	1135	860	944	784	789	713	857	84
Sample HHS	0	505	1914	1798	1143	905	5056	11321

Statment (State):Estimated number of households and persons by sex for each mpce class(MMRP) Type-II									
RURAL									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	24650	24892	25013	1129	17760	68794	1644	7	26
501-1000	977	1412	842	361	375	2990	687	4	24
1001-1500	1348	1446	1425	2054	2462	7388	1110	6	40
1501-2000	55784	72097	72472	84961	7288	236818	508	16	91
2001-2500	69929	78612	78647	65672	52261	275192	907	23	109
2501-3000	32758	48062	58894	23691	9853	140499	958	16	71
above 3000	25855	50953	37893	9298	9159	107303	781	56	259
all classes	211301	277474	275186	187166	99158	838984	806	128	620
sample no.		233	215	99	73	620			
URBAN									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	60956	83903	54007	10407	24057	172374	828	53	134
501-1000	18358	26387	25771	24866	20824	97848	909	23	128
1001-1500	169258	329173	275988	220153	195618	1020931	859	172	1011
1501-2000	236571	373289	346712	233806	180069	1133876	868	199	945
2001-2500	248844	411283	339333	144478	98782	993875	788	174	724
2501-3000	204978	347269	251288	104649	66663	769870	704	166	694
above 3000	1154147	1871847	1670589	472365	308234	4323035	844	1127	4123
all classes	2093112	3443149	2963688	1210725	894248	8511810	829	1914	7759
sample no.		3156	2689	1047	867	7759			

Statement (Central):Estimated number of households and persons by sex for each mpce class(MMRP)									
RURAL									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	0	0	0	0	0	0	0	0	0
501-1000	0	0	0	0	0	0	0	0	0
1001-1500	20204	71150	57463	14721	6321	149654	743	5	37
1501-2000	35827	107946	64301	29961	588	202796	471	10	53
2001-2500	54947	113845	160535	43096	41667	359143	1288	14	70
2501-3000	18047	30299	36712	27941	2806	97759	679	13	66
above 3000	109710	152979	79794	63113	29837	325723	507	21	61
all classes	238735	476219	398805	178831	81220	1135075	733	63	287
sample no.		115	95	54	23	287			
URBAN									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	0	0	0	0	0	0	0	0	0
501-1000	43169	98496	76933	61456	63265	300150	876	15	103
1001-1500	244660	504993	416006	335220	220694	1476913	758	96	586
1501-2000	432933	844524	728733	456670	376466	2406393	849	108	566
2001-2500	455656	871493	715320	311336	227656	2125805	797	112	487
2501-3000	312797	590483	391485	167959	109944	1259871	661	81	300
above 3000	1451525	2219601	1594761	449375	358521	4622259	732	469	1450
all classes	2940739	5129590	3923238	1782016	1356547	12191390	764	881	3492
sample no.		1469	1157	478	392	3496			

Statement(Pooled):Estimated number of households and persons by sex for each mpce class(MMRP) TYPE-II									
RURAL									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	16434	16595	16675	753	11840	45863	1644	7	26
501-1000	651	941	562	241	250	1993	687	4	24
1001-1500	7633	24681	20104	6276	3748	54810	771	11	77
1501-2000	49132	84047	69748	66627	5055	225477	496	26	144
2001-2500	64935	90356	105943	58147	48730	303175	1042	37	179
2501-3000	27855	42141	51500	25108	7504	126253	877	29	137
above 3000	53806	84962	51860	27236	16052	180110	605	77	320
all classes	220446	343722	316393	184388	93179	937681	776	191	907
sample no.		348	310	153	96	907			
URBAN									
MPCE CLASS	Estimated number						Sex ratio	Sample households	Sample persons
	households	adults		children		persons			
		male	female	male	female				
upto 500	40637	55935	36005	6938	16038	114916	828	53	134
501-1000	26629	50423	42825	37062	34971	165282	889	38	231
1001-1500	194392	387779	322661	258509	203977	1172925	815	268	1597
1501-2000	302025	530367	474052	308094	245535	1558049	858	307	1511
2001-2500	317781	564686	464662	200097	141740	1371185	793	286	1211
2501-3000	240917	428340	298021	125753	81090	933204	684	247	994
above 3000	1253273	1987765	1645313	464702	324996	4422776	803	1596	5573
all classes	2375654	4005296	3283538	1401155	1048348	9738337	801	2795	11251
sample no.		4625	3846	1525	1259	11255			

Chapter Four: Methodology for pooling

Testing poolability of central and state sample

Though the central sample and state sample are drawn independently following identical sampling design with same concepts, definitions and instructions to collect the state sample data but due to lack of adequate training of field and processing staff of State DES, unit level data in some cases are not properly validated. There is also expected agency bias in the two sets of data generated by different agencies. As such they cannot be merged for generating pooled estimate without testing that the samples are realized from identical distribution function. Since the parametric distribution of the sample mean is unknown one may adopt non-parametric tests such Run test, Median test, chi-square test etc to test that the samples are coming from identical distribution function.

Median test

In statistics, the median test is a special case of Pearson's Chi-square test. It tests the null hypothesis that the medians of the populations from which two samples are drawn, are identical. Observations in each sample are assigned to two groups, one consisting of data whose values are higher than the median value in the two groups combined, and the other consisting of data whose values are at the median or below. A Pearson's Chi-square test is then used to determine whether the observed frequencies in each group differ from expected frequencies derived from a distribution combining the two groups.

Let m^* be the median of the pooled sample data. Construct 2 X 2 contingency table as below and use chi-square test if State sample and Central sample have identical median.

Sample-type	no of sample observation		Total
	$\leq m^*$	$> m^*$	
State Sample	N_{11}	N_{12}	$N_{1.}$
Central Sample	N_{21}	N_{22}	$N_{2.}$
Total	$N_{.1}$	$N_{.2}$	$N_{..}$

Observed frequency of each cell $O_{ij} = N_{ij}$ where $i = 1$ to 2 , $j = 1$ to 2 .

Expected frequency of each cell $E_{ij} = (N_{i.} * N_{.j})/N_{..}$ where $i = 1$ to 2 , $j = 1$ to 2 .

$$\chi^2 \text{ Value} = \sum_{i=1}^2 \sum_{j=1}^2 (O_{ij} - E_{ij})^2 / O_{ij} \text{ with degrees of freedom} = (2-1)*(2-1) = 1$$

The statistical power of this test may sometimes be improved by using a value other than the median to define the groups say quintile classes– that is, by using a value which divides the groups into more nearly equal groups than the median would.

Multinomial distribution test or χ^2 test

For discrete data such as status of activity, educational level and categorical variable such as land possessed etc, standard tests of equality of sample proportions of two sets of data based on multinomial distributions, relevant chi-square tests may be used after grouping the attributes/categorical variables in to a suitable number of classes so that each class contains adequate number of sample observations. Construct $2 \times k$ contingency table for k classes at the domain where two sets of data are to be pooled as below and use chi-square test if State sample and Central sample have identical distribution.

Sample-type	no of sample observation					Total
	Class-1	Class-2	...	Class-k-1	Class-k	
State Sample	N_{11}	N_{12}	...	N_{1k-1}	N_{1k}	$N_{1.}$
Central Sample	N_{21}	N_{22}	...	N_{2k-1}	N_{2k}	$N_{2.}$
Total	$N_{.1}$	$N_{.2}$...	$N_{.k-1}$	$N_{.k}$	$N_{..}$

Observed frequency of each cell $O_{ij} = N_{ij}$ where $i = 1$ to 2 , $j = 1$ to k .

Expected frequency of each cell $E_{ij} = (N_{i.} * N_{.j})/N_{..}$ where $i = 1$ to 2 , $j = 1$ to k .

$$\chi^2 \text{ Value} = \sum_{i=1}^2 \sum_{j=1}^k (O_{ij} - E_{ij})^2 / O_{ij} \text{ with degrees of freedom} = (2-1)*(k-1) = k-1$$

Wald-Wolfowitz run test

Suppose X and Y are independent random samples with cumulative distribution function (CDF) as $F_s(x)$ and $F_c(y)$. Null Hypothesis to be tested is $H_0: F_s(x) = F_c(x)$ for all x against alternative Hypothesis is $H_1: F_s(x) \leq F_c(x)$ for all x and $F_s(x) < F_c(x)$ for some x. Let x_1, x_2, \dots, x_m be iid observation from state sample with distributive function F_s and y_1, y_2, \dots, y_n be iid observation from central sample with distributive function F_c . Pool the data and order them with respect to comparable characteristic under consideration say monthly per capita expenditure (MPCE). In the pooled order sequence put "1" for X and "0" for Y. Let U be the total runs observed where 'run' is a sequence of adjacent equal symbols. For example, following sequence: 1111000111001111110000 is divided in six runs, three of them are made out of "1" and the others are made out of "0". The number of runs U is a random variable whose distribution for large sample can be treated as normal with:

$$\text{mean: } \frac{2mn}{m+n} + 1$$

$$\text{variance: } \frac{2mn(2mn - m - n)}{(m+n)^2(m+n-1)}$$

After normalizing the variable U one may use one sided z-test for testing the Null hypothesis. In extreme case the value of U will be 2 meaning by observed characteristic of all the observation of one sample is less than the other samples.

One of the limitations of this test is when there is a tie between two samples in the observed value. One has to resolve ties in usual manner. However if there is large number of ties which is bound to occur specially for qualitative attributes like education level, activity status etc, this test is not recommended. This test can be well applied for a continuous variable such as MPCE which are less prone to ties. For discrete variable chi-square test is recommended.

Parametric test

Aggregate estimate: Let t_{yc} and t_{ys} be the estimate of Y at domain level of pooling based on central and state sample respectively with corresponding variances $V(t_{yc})$ and

$V(t_{ys})$. For large sample, making all assumption of parametric test, one may use Z-Statistic to test the null hypothesis $H_0 E(t_{yc}) = E(t_{ys})$ where E stands for expectation.

$$Z = \frac{(t_{yc} - t_{ys})}{\sqrt{(V(t_{yc}) + V(t_{ys}))}}$$

$V(t_{yc})$ and $V(t_{ys})$ could be estimated as

$$\hat{V}(t_{yc}) = \sum_l (t_{yd} - t_{ye2})^2 / 4, \quad \hat{V}(t_{ys}) = \sum_l (t_{ysl} - t_{ys2})^2 / 4 \quad \text{based on sub-sample 1 \& 2}$$

estimates where \sum_l stands for summing over stratum x sub-stratum level variance at the domain of pooling.

Estimate of rate: Let r_c and r_s be the estimate of population rates R_c and R_s ie Y/X based on central and state sample respectively with corresponding mean square error $MSE(r_c)$ and $MSE(r_s)$. For large sample, making all assumption of parametric test, one may use Z-Statistic to test the null hypothesis $H_0 E(r_c) = E(r_s)$ where E stands for expectation.

$$Z = \frac{(r_c - r_s)}{\sqrt{(MSE(r_c) + MSE(r_s))}}$$

$MSE(r_c)$ and $MSE(r_s)$ are estimated as follows:

$$mse(r_c) = (\hat{V}(t_{yc}) - 2 * r_c \hat{Cov}(t_{yc}, t_{xc}) + r_c^2 * \hat{V}(t_{xc})) / t_{xc}^2$$

$$mse(r_s) = (\hat{V}(t_{ys}) - 2 * r_s \hat{Cov}(t_{ys}, t_{xs}) + r_s^2 * \hat{V}(t_{xs})) / t_{xs}^2$$

where

$$\hat{V}(t_{yc}) = \sum_l (t_{yd} - t_{ye2})^2 / 4, \quad \hat{V}(t_{ys}) = \sum_l (t_{ysl} - t_{ys2})^2 / 4$$

$$\hat{V}(t_{xc}) = \sum_l (t_{xd} - t_{xe2})^2 / 4, \quad \hat{V}(t_{xs}) = \sum_l (t_{xsl} - t_{xs2})^2 / 4$$

$$\hat{Cov}(t_{yc}, t_{xc}) = \sum_l (t_{yd} - t_{ye2})(t_{xd} - t_{xe2}) / 4 \quad \text{based on sub-sample 1 \& 2 estimates.}$$

where \sum_l stands for summing over stratum x sub-stratum level variance, covariance at the domain of pooling.

Methodology for pooling

Pooling by inverse weight of the variance of the estimates

Aggregate estimate: For any characteristic, consider the state sample [s] in the form of two independent sub- sample s1 and s2 and the central sample [c] in the form of two independent sub- sample c1 and c2. Based on this, the respective estimates for state and central can be computed as:

$$t_s = \sum_l (t_{s1} + t_{s2})/2 \text{ and } t_c = \sum_l (t_{c1} + t_{c2})/2$$

Pooled estimate leading to optimum combination of these two estimates is given by weighing with inverse of the variance of the estimate. Thus the pooled estimate is given by:

$$T_p = \frac{V(t_c)t_s + V(t_s)t_c}{V(t_c) + V(t_s)} \text{ with } V(T_p) = \frac{V(t_c)V(t_s)}{V(t_c) + V(t_s)}$$

In general $V(t_c)$ and $V(t_s)$ are unknown and can be estimated as

$$\hat{V}(t_c) = \sum_l (t_{c1} - t_{c2})^2 / 4, \hat{V}(t_s) = \sum_l (t_{s1} - t_{s2})^2 / 4$$

where \sum_l stands for summing over stratum x sub-stratum level variance at the domain of pooling.

Thus pooled estimate and estimate of pooled variance is given by

$$t_p = \frac{\hat{V}(t_c)t_s + \hat{V}(t_s)t_c}{\hat{V}(t_c) + \hat{V}(t_s)}, \hat{V}(t_p) = \frac{\hat{V}(t_c)\hat{V}(t_s)}{\hat{V}(t_c) + \hat{V}(t_s)}$$

By virtue of weighing the two estimates at the domain level at which two estimates are pooled, the pooled estimate will always lie between the central and state sample estimates.

Estimate of rate: Let r_c and r_s be the estimate of R_c and R_s ie Y/X based on central and state sample respectively with corresponding estimated mean square error $mse(r_c)$ and

mse(r_s). The pooled estimate and estimate of variance of pooled ratio estimate may be given by:

$$r_p = \frac{mse(r_c)r_s + mse(r_s)r_c}{mse(r_c) + mse(r_s)}, \quad mse(r_p) = \frac{mse(r_c)mse(r_s)}{mse(r_c) + mse(r_s)}$$

Where $mse(r_c)$ and $mse(r_s)$ are calculated using formula given in above. Alternatively one can generate the pooled estimate of aggregate by inverse weight of estimate of variance obtained from central and state sample using formula given in para for the characteristics x as well as y and obtain the pooled estimate of ratio as ratio of pooled estimate of aggregate. This will ensure consistency between pooled estimates of aggregate and the pooled estimate of ratio.

Let t_{xp} and t_{yp} be the pooled estimate of aggregate for the parameter X and Y. The pooled estimate of R (i.e Y/X) is given by

$$r_p = t_{yp} / t_{xp}$$

Where $t_{yp} = at_{yc} + bt_{ys}$ and $t_{xp} = ct_{xc} + dt_{xs}$ and (a, b), (c, d) are the estimated inverse variance weight pair of the characteristic x and y respectively.

The estimated mse of pooled ratio estimate r_p is given by:

$$mse(r_p) = (\hat{V}(t_{yp}) - 2 r_p \hat{Cov}(t_{yp}, t_{xp}) + r_p^2 \hat{V}(t_{xp})) / t_{xp}^2$$

$$\text{where } \hat{V}(t_{yp}) = \frac{ab}{a+b}, \quad \hat{V}(t_{xp}) = \frac{cd}{c+d} \text{ and}$$

$$\hat{Cov}(t_{yp}, t_{xp}) = ac\hat{Cov}(t_{yc}, t_{xc}) + bd\hat{Cov}(t_{ys}, t_{xs}).$$

$$\hat{Cov}(t_{yc}, t_{xc}) = \sum_l (t_{yd} - t_{y2})(t_{xd} - t_{x2}) / 4 \text{ based on sub-sample 1 \& 2 estimates.}$$

$$\text{Similarly, } \hat{Cov}(t_{ys}, t_{xs}) = \sum_l (t_{ysl} - t_{y2})(t_{xsl} - t_{x2}) / 4$$

Where \sum_l stands for summing over stratum x sub-stratum level covariance at the domain of pooling.

Method laid down in above para and requires calculation of estimate of variance of the estimates before pooling them. Reliability of estimate of variance should be ascertained

with due consideration of sample size. Besides the complex calculations of variances and covariances for each cell of the table, one needs to address the issue of non-additivity of the component estimates with the estimate of marginal total. For e.g. pooled estimate of MPCE of FOOD and NON-FOOD may not add up to MPCE of TOTAL. To obviate this problem one may generate the pooled estimates of components first and then derive the estimate of total as sum of estimates of components.

Pooling by simple average of the estimates

Many of the States are not fully equipped with complex calculation of estimate of variance especially when cells of the table contains ratio of two characteristics which is usually presented in the NSS reports. When the State's participation is equal matching of central samples, the simple average of two estimates may be a way of combining the estimates considering central and state samples as independent samples. The pooled estimate will always lie between the estimates based on central and state sample separately.

When the State's participation is of unequal matching of central samples, the weighted average of two estimates with weights being matching ratio of central and state sample may be a better way of combining the estimates considering central and state samples as independent samples. For any characteristic, consider the state sample [s] in the form of two independent sub-sample s1 and s2 and the central sample [c] in the form of two independent sub- sample c1 and c2. Let matching ratio of state and central sample be m : n. Based on this, the respective estimates for state and central can be computed as:

$$t_s = \sum_l (t_{s1} + t_{s2})/2 \text{ and } t_c = \sum_l (t_{c1} + t_{c2})/2$$

Pooled estimate of these two estimates is given by weighing with matching participation rate m:n. Thus the pooled estimate is given by:

$$t_p = \frac{mt_s + nt_c}{m + n} \text{ with } V(t_p) = \frac{m^2 V(t_s) + n^2 V(t_c)}{(m+n)^2}$$

In general $V(t_c)$ and $V(t_s)$ can be estimated as $\hat{V}(t_c) = \sum_l (t_{c1} - t_{c2})^2 / 4$,

$\hat{V}(t_s) = \sum_l (t_{s1} - t_{s2})^2 / 4$ and thus $\hat{V}(t_p) = \frac{m^2 \hat{V}(t_s) + n^2 \hat{V}(t_c)}{(m+n)^2}$. The pooled estimate will

always lie between the estimates based on central and state sample separately.

SUMMING UP

For characteristics such as MPCE (URP,MRP and MMRP) for food ,Non-food and combined , Non-parametric run test were applied for central and state sample. Population, household and sex-ratio have been tested by Run test and Median test for testing poolability. The poolability test is also indicating the acceptance of MPCE on food & non-food items individually in both the sectors in state & central samples. Pooled results are presented in this report for both the sectors and ALL types for central, state and pooled sample.

To the some extent the acceptance or rejection of poolability test is depending upon the level of significance and degree of freedom involved in the test variables especially on Median Test.

The distribution of range of RSE of MPCE of central, state and pooled sample estimates of Delhi is presented in chapter 3. RSE of estimate of MPCE on food and non food was found to be negligible per cent for both central and state sample. For the remaining parameters RSE is less than 1% for both type of data.

The RSE and Divergence result may help to conclude that ; The various parameters of Employment & Unemployment (Sch.10.0) and Household consumer expenditure (Sch.1.0) of NSS 66th round having on an average 5% errors, however Poolability report of Household consumer expenditure (Type-1 & 2) of NSS 68th round give the average errors is around 1% ``.

CONCEPTS & DEFINITIONS

The concepts and definitions adopted during the NSS 68th round are explained in this section.

HOUSE: Every structure, tent, shelter, etc., is a house irrespective of its use. It may be used for residential or non-residential purpose or both or even may be vacant.

HOUSEHOLD: A group of persons normally living together and taking food from common kitchen constitute a household.

HOUSEHOLD SIZE: The number of normally resident members of a household is its size. It will include temporary stay away but exclude temporary visitors and guests.

HOUSEHOLD CONSUMER EXPENDITURE: The expenditure incurred by a household on domestic consumption during the reference period is the household's consumer expenditure. The household consumer expenditure is the total of the monetary value of consumption of various groups of items namely:

- i) food, pan (betel leaves), tobacco, intoxicants and fuels and light.
- ii) clothing and footwear; and
- iii) miscellaneous goods and services and durable articles.

For group (i) and (ii), the total value of consumption is derived by aggregating the monetary value of goods actually consumed during the reference period. An item of clothing and footwear would be considered to have been consumed if it is brought into maiden or first use during reference period, The consumption may be out of:

- a) purchase made during the reference period or earlier.
- b) home grown stock.
- c) receipt in exchange of goods and services.
- d) any other receipt like gift, charity, borrowings; and
- e) free collection.

For evaluating the consumption of the items of group (iii) i.e. items categorised as miscellaneous goods and services and durable articles, a different approach is followed, In this case, the value of actual purchase i.e., the expenditure made during the reference period for the purchase of goods and services is considered as consumption.

It is pertinent to mention here that the consumer expenditure for a household on food items relate to the actual consumption made by the normal resident member of the household and also by the guests during the ceremonies otherwise. To avoid double counting, transfer payments like charity, loan advances, etc. made by the households are not considered as consumption for items of groups (i) and (ii), since transfer receipts of these items have been taken into account. However, the item "cooked meals" is an exception to the rule. Meals prepared in that household kitchen and provided to the employees and/or other would automatically get included in domestic consumption of employer (payer) household. There is a practical difficulty of estimating the quantities and values of individual items used for preparing the meals served to the employees or the others. Thus, to avoid double counting, cooked meals received, as perquisites from employer household or as gift or charity are not recorded in the recipient household. As a general principle, cooked meals purchased from the market for the consumption of the normal resident members and for the guest and employees will also be recorded in the purchaser household.

This procedure of recording cooked meals served to others in the expenditure of serving households only leads to bias free estimates of average per capita consumption as well as total consumer expenditure. However, as the proportions of donors and recipients of free cooked meals are likely to vary in opposite direction over the expenditure classes, the nutritional intake derived from the consumer expenditure survey data may present a somewhat distorted picture. These derived nutrition intakes may get inflated for the rich (net donors) and somewhat understated for the poor (net recipients). This point has to be kept firmly in mind while using the NSS consumer expenditure data for any nutritional studies.

TOTAL HOUSEHOLD EXPENDITURE: The total household expenditure is composed of expenditure of the household on broad group of items.

VALUE OF CONSUMPTION: Consumption out of purchase is evaluated at the purchase price. Consumption out of home produce is evaluated at ex factory prices.

Value of consumption out of gifts, loans, free collection and goods received in exchange of goods and service is imputed at the rate of average local retail prevailing during the reference period.

REFERENCE PERIOD: The consumption of any good or service by a household or person occurs in the form of a flow over time. The survey may need to record the volume of consumption over a short period such as a day, or a long period such as a year. The time period for which consumption is recorded is called the reference period. It may vary from item to item. Because the respondents are asked to recall and report the volume of consumption, the reference period is also called the recall period.

MONTHLY PER CAPITA CONSUMER EXPENDITURE (MPCE): For a household, this is its 30 days consumer expenditure divided by its size. A person's MPCE is understood as that of the household to which he or she belongs. This measure serves as the indicator of the household's level of living.

In this round, two schedule types i.e. Type 1 and Type 2 have been drawn up. Schedule Type 1 and Schedule Type 2 were canvassed in two independent sets of sample household.

From each sample household where type 1 was canvassed, two measures of MPCE emerged i.e. $MPCE_{URP}$ and $MPCE_{MRP}$. This was because for each such household, there were two sets of data category for each item (as explained in Section 1). Whereas from each sample household where schedule Type 2 was canvassed, a single measure of MPCE emerged i.e. $MPCE_{MMRP}$ as, for each item of consumption, data for only one reference period has been collected.

Uniform Reference Period MPCE (or $MPCE_{URP}$): This is the measure of MPCE obtained by the NSS consumer expenditure survey (CES) when household consumer expenditure on each item is recorded for a reference period of "last 30 days"(preceding the date of survey).

Mixed Reference Period MPCE (or $MPCE_{MRP}$): This is the measure of MPCE obtained by the CES when household consumer expenditure on items of clothing and bedding, footwear, education, institutional medical care, and durable goods is recorded for a reference period of "last 365 days", and expenditure on all other items is recorded with a reference period of "last 30 days".

Modified Mixed Reference Period MPCE (or $MPCE_{MMRP}$): This is the measure of MPCE obtained by the CES when household consumer expenditure on edible oil, egg, fish and meat, vegetables, fruits, spices, beverages, refreshments, processed food, pan, tobacco and intoxicants is recorded for a reference period of "last 7 days", and for all other items, the reference periods used are same as in case of Mixed Reference Period MPCE ($MPCE_{MRP}$).

Standard Errors (SE):-SE is usually estimated by dividing the population standard deviation by the square root of the sample size.

Relative Standard Errors (RSE):-The RSE is simply the standard error divided by the mean of the sample.

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