Appendix C

Sample Design & Estimation Procedure

51st Round

51.0.1 Introduction. The fifty-first round of NSS (1994-95) was mainly devoted to collection of data on economic and operational characteristics of small manufacturing and repairing enterprises (i.e. those in the unorganised sector). In addition, data on consumer expenditure were also collected from a thin sample of households according to the programme of providing estimates of consumer expenditure on an annual basis to generate a time series data starting with the 42nd round of NSS (1986-87).

51.0.2 Period of survey. The fifty-first round was of one year's duration starting from 1st July 1994 and ending on 30th June 1995.

51.0.3 Programme of work. The sample was divided equally into sample 1 and sample 2 in both the rural and the urban sector. The villages and blocks of sample 1 were distributed over the four sub-rounds in equal numbers, whereas for sample 2, there was no sub-round restriction.

51.0.4 Sub-round periods. The survey periods of the four sub-rounds are given below:

sub-round	period
1	July - September 1994
2	October - December 1994
3	January - March 1995
4	April - June 1995

51.1 Sample Design

51.1.0 General. As usual, a stratified two-stage sampling design was adopted. The first stage units were villages (panchayat wards in case of Kerala) in rural areas and urban blocks in urban areas. More specifically, for the urban sector, the first stage units (fsu's) were the enumeration blocks (EB's) where the sampling frame was EC-90, and UFS blocks otherwise. The second stage units were households in both rural and urban areas.

51.2.0 Sample size. The total sample size (i.e., total number of villages and blocks to be surveyed) at all-India level was fixed at 14,072, made up of 8536 villages and 5536 urban blocks. The numbers of sample villages and blocks allotted to the different states and u.t.s, as well as the number of villages, blocks, and rural and urban households surveyed, are shown in Table 51S.

51.3.0 Allocation of sample fsu's between rural and urban sectors. State/u.t. level total sample size (i.e. total number of villages and blocks to be surveyed) was allocated between the rural and urban sectors in proportion to population as per 1991 population census with double weightage to the urban sector. The total sample was equally divided into sample 1 and sample 2 for both rural and urban sectors.

51.3.1 Rural sector

51.3.1.0 Sampling frame. Lists of villages showing number of OAME's, NDME's, and DME's as per 1990 Economic Census were used as the sampling frame for the selection of fsu's in the states/u.t.s where such lists were available. In other areas, namely, J & K, Arunachal Pradesh and Nicobar district, population census frame was used. In the case of Arunachal Pradesh, the list of villages as per 1991 population census was used as the sampling frame for selection of sample 'nucleus' villages around which clusters were to be formed. For the state of Kerala, however, lists of panchayat wards, giving count of OAME's/NDME's/DME's at panchayat ward level as per 1990 Economic Census, were used as the sampling frame for selection of panchayat wards. For Jammu & Kashmir (where 1991 census was not conducted), the sampling frame was the list of 1981 census villages, while for Nicobar Islands, it was the 1991 list of census villages that was used.

51.3.1.2 Stratification. For sample 1, each district generally formed a separate stratum. However, for the state of Gujarat, where NSS regions cut across some district boundaries, parts (viz. groups of taluks) of each such district belonging to different NSS regions formed separate strata. If any district (or part thereof lying in an NSS region in case of Gujarat) had a very small number of manufacturing enterprises, it was clubbed with the neighbouring district(s) within the same NSS region to form a stratum to ensure a minimum allocation of 8 villages at the stratum level as far possible. For sample 2, each district as a whole was always taken as a separate stratum.

51.3.1.3 Sub-stratification. For sample 1, the fsu's in a stratum were grouped into 3 sub-strata where 1990 EC frames were used for sampling. The three sub-strata were as follows :

a) sub-stratum 1 consisting of fsu's having at least one DME;

b) sub-stratum 2 consisting of those of the remaining fsu's which had at least one NDME;

c) sub-stratum 3 consisting of all the residual fsu's in the stratum having no DME or NDME or no information about the numbers of DME/NDME/OAME due to incompleteness of the available EC frame.

For states/u.t's where population census frame was used for selection of fsu's, though there was no sub-stratification at the stratum level, all fsu's in a stratum were identified with sub-stratum 3.

For sample 2, there was no sub-stratification at the stratum level.

51.3.1.4 Allocation of sample fsu's among strata and sub-strata. For sample 1, rural sample size for a state/sub-strata in proportion to weighted sum of the number of manufacturing enterprises of different types as per 1990 EC '90 with weights as 16, 4 &1 respectively for DME, NDME & OAME. A minimum allocation of one sample was ensured at sub-stratum level and efforts were made to make the stratum level allocations as multiples of 4 to the extent possible to allocate equal number of samples in each of the four sub-rounds. However, for sample 2, rural sample size for a state/u.t. was allocated to the constituent strata in proportion to their total number of manufacturing enterprises (weights being equal for DME, NDME, OAME) available from 1990 EC. A minimum allocation of 2 fsu's was given to each district/stratum (including those having very insignificant number of manufacturing enterprises).

51.3.1.5 Selection of fsu's for sample 1. State sample fsu's for each state/u.t. were selected in the form of two independent sub-samples from each stratum x sub-stratum using circular systematic sampling with probability proportional to size. The sample fsu's for sample 1 (

central sample were also selected with probability proportional to size from each stratum x sub-stratum. The size was as follows:

Case I : State/u.t's where 1990 EC frame was used

Size = number of DMEs/NDMEs/OAMEs in the fsu in case of sub-stratum; 1/2/3 (after assigning '1' to the fsu's of sub-stratum 3 having no OAME or no information about number of enterprises due to incompleteness of the frame).

Case II :   Other states/u.t's

(a) Arunachal Pradesh ; size = 1 for each fsu.
(b) Jammu & Kashmir ; size = population in the fsu as per 1981 census.
(c) Nicobar district of Andaman & Nicobar ; size = population in the fsu as per 1991 census.

51.3.1.6 Selection of fsu's for sample 2. Sample fsu's from each stratum (district) were selected with probability proportional to size with replacement. The size was as follows:

Case I : States/u.t's where 1990 EC frame was used

Size = total number of manufacturing enterprises (i.e. total of OAMEs, NDMEs & DMEs) in the fsu (after assigning '1' to the fsu's having no manufacturing enterprises or no information about them)

Case II : Other states/u.t's

The size for different states were the same as described in para 51.3.1.5, Case II.

51.3.2 Urban sector

51.3.2.1 Sampling frame for state samples & sample 1. The list of EBs as per 1990 EC frame constituted the sampling frame for Class I towns (except for Class I towns of J & K sample). The latest available list of Urban Frame Survey (UFS) blocks were used as the sampling frame for all other towns (including class I towns of J & K).

51.3.2.2 Sampling frame for sample 2. The list of EBs as per 1990 EC frame was used as the sampling frame for all towns (except for J & K, for which UFS blocks were used as the sampling frame).

51.3.2.3 Stratification adopted for sample 1. Strata were formed within each NSS region by grouping cities/towns according to the fixed population size classes viz. p<0.5, 0.5<p<1, 1<p<5, 5<p<10 and p<10 (where p stands for population of the town in lakhs as per 1991 census). Each city with population 10 lakhs or more formed a separate stratum.

51.3.2.4 Stratification adopted for sample 2. Strata were formed within each district by grouping cities/towns according to the population size classes viz. p<1, 1<p<5, 5<p<10 and each city with p>10. However, no grouping of towns was done for the states of Assam, Haryana and Pondicherry.

51.3.2.5 Sub-strata for sample 1. For Class I towns (except for J & K), three sub-strata were formed within a stratum as follows:

sub-stratum 1 consisting of EBs having at least one DME

(ii) sub-stratum 2 consisting of those of the remaining EBs in the stratum those having at least one NDME

(iii) sub-stratum 3 consisting of all the residual EBs in the stratum having no DME OR NDME or no information about number of DME/NDME/OAME due to incompleteness of the available EC frame.

51.3.2.6 For other towns (including all towns of J & K), two sub-strata were formed within each stratum as follows :

(i) sub-stratum 1 consisting of all UFS blocks identified as Industrial Area (IA) blocks
(ii) sub-stratum 2 consisting of the remaining UFS blocks (identified as non-industrial blocks)

However, no sub-stratification was done for sample 2.

51.3.2.7 **Allocation of sample blocks among strata/sub-strata for sample 1.** Sample size state samples & sample 1 of central sample) for a state/u.t. was allocated to the constituent st in proportion to 16DME + 4NDME + OAME (i.e. weighted sum of the number of manufactu enterprises in the ratio of 16 : 4 : 1) as per 1990 EC and in proportion to population for J & For Class I towns (except for class I towns of J & K), the sample size at the stratum level allocated to three sub-strata again in proportion to 16DME + 4NDME + OAME (i.e. weigh sum of the numbers of manufacturing enterprises in the ratio 16 : 4 : 1) as per 1990 EC in respective sub-strata. The allocation at the sub-stratum level was kept at a minimum sample fsu's (multiple of 4 at stratum level) for each of sample 1 of central sample and sub-samples 2 of state samples. For other towns (including all towns of J & K), the UFS blocks of stratum 1 were completely enumerated (sample 1 central sample and sub-samples 1 & 2 for samples put together) subject to the condition that for each of the three types of samples sample 1 of central sample and sub-samples 1 & 2 of state sample, a maximum of 50% o stratum allocation of the particular sample type was allocated to sub-stratum 1 and the re sub-stratum 2 (a minimum of one sample was ensured for sub-stratum 1 at the tim allocation). For strata of Class I towns and other towns, the size of allocation at stratum was kept at multiple of 4. Efforts were made to allocate equal number of sample blocks to of the four sub-rounds at least at the stratum level.

51.3.2.8 **Allocation of sample blocks among strata for sample 2.** Sample size for sam for a state/u.t. except for J & K was allocated to the constituent strata in proportion to their number of manufacturing enterprises. For the state of J & K, sample size was allocated t constituent strata in proportion to their population figures as per 1981 census. Mini allocation at stratum level was kept at 2 sample fsu's. There was no sub-roundwise allocatio sample 2.

51.3.2.9 The allotted numbers of sample first stage units (fsu's) are shown in Table 51S by and sector.

51.3.2.10 **Selection of sample blocks for sample 1.** Sample blocks were selected from ea the sub-strata of Class I towns (except for Class I towns of J & K) with probability propor to size with replacement (where size was the number of DME/NDME/OAME for sub-st 1/2/3. after assigning '1' to those EBs of sub-stratum 3 having no manufacturing enterprises information about them). For other towns (including all towns of J & K) the sample blocks each sub-stratum were selected circular systematically with equal probability.

51.3.2.11 **Selection of sample blocks for sample 2.** Sample blocks were selected probability proportional to size with replacement (size being the total number of OAME, N

& DME, after assigning '1' to those fsu's having no manufacturing enterprises) for all the states/u.t's except J & K, where sample blocks were selected by simple random sampling without replacement.

51.3.3 **Hamlet-group/sub-block selection.** Large villages/blocks having (i) approximate present population 1200 or more (600 or more for rural areas of Himachal Pradesh, Sikkim and Punch, Rajouri, Udhampur & Doda districts of J & K) and/or (ii) approximate present number of non-agricultural enterprises more than 200, were divided into a suitable number (say, D) of hamlet-groups (h.g)/sub-blocks (s.b.) and then the survey was conducted in two h.g.s/s.b.s to be selected in the following manner. The h.g./s.b. having maximum number of manufacturing/repairing enterprises (OAMEs, NDMEs and DMEs combined) was always selected and allotted a serial no. '0'. From the remaining h.g.s/s.b.s, one more h.g./s.b. was selected at random for survey and allotted a serial no. '1'. If the same maximum number of manufacturing/ repairing enterprises appears in more than one h.g./s.b., the one among these which contains maximum population was allotted serial no. '0'. In case there was not even a single manufacturing/repairing enterprise in a large village/block, the h.g./s.b. having maximum population was selected and allotted serial no. '0' and from the remaining h.g.s/s.b.s, another was selected at random and allotted serial no. '1'. When there was no h.g./s.b. formation, the whole

Table 51S: Number of villages/blocks allotted and surveyed and number of sample households and persons surveyed

state/u.t.	number of				number of surveyed			
	villages		blocks		households		persons	
	allotted	surveyed	allotted	surveyed	rural	urban	rural	urban
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	568	567	424	421	2225	1675	9683	7473
Assam	392	383	96	89	1520	356	8115	1604
Bihar	824	811	256	250	3140	999	15493	5009
Gujarat	272	271	280	278	1076	1076	5287	5137
Haryana	128	128	80	80	510	316	2839	1472
Karnataka	304	304	272	272	1196	1086	6055	5043
Kerala	*320	320	224	224	1280	896	5788	4167
M.P.	592	590	360	354	2308	1428	11468	7201
Maharashtra	488	487	608	527	1940	2104	9165	9780
Orissa	384	384	120	119	1510	476	7230	2113
Punjab	248	248	216	244	971	864	5060	3837
Rajasthan	360	360	216	216	1417	858	7315	4253
Tamil Nadu	488	488	512	522	1939	2035	7588	8095
J.P.	1048	1047	520	515	4089	2055	22423	11131
West Bengal	520	518	400	387	2048	1548	9854	6711
North-eastern	904	821	440	430	3213	1702	15214	7527
North-western	560	349	392	253	1325	994	6403	4322
Southern	136	135	120	119	535	474	2404	1974
All-India	8536	8211	5536	5300	32242	20942	157384	96849

figures denote number of panchayat wards.

village/block was treated as bearing h.g./s.b. serial no. '0'. It may be mentioned that there was no hamlet-group formation in the rural areas of Arunachal Pradesh.

51.3.3.1 Number of hamlet-groups (h.g.s) / sub-blocks (s.b.s) to be formed was the *higher* value of D obtained from the two charts A and B.

However, for rural areas of H.P., Sikkim, and Punch, Rajouri, Udhampur and Doda districts of J&K, the criterion for forming hamlet-groups was as follows: for population less than 600, D=1; for population 600-1199, D=4, for population 1200-1499, D=5; for population 1500-1799, D=6; and so on.

51.3.4 Sampling of households (for sch.1.0). A thin sample of 4 households was selected

Chart B	
approximate present number of non-agricultural enterprises (OAEs, NDEs & DEs combined) in the sample village/block	no. of hamlet-groups/ sub-blocks to be formed (D)
< or = 200	1
201 - 400	4
401 - 500	5
501 - 600	6
and so on	

Chart A	
approximate present population of the sample village/block	no. of hamlet-groups/ sub-blocks to be formed (D)
< 1200	1
1200 - 1599	4
1600 - 1999	5
2000 - 2399	6
2400 - 2799	7
and so on	

from the village/block/s.b. as the case might be.

from among the households listed in each sample village/blocks for canvassing the household schedule 1.0. In villages/blocks with h.g./s.b. formation, two households were selected from each of the two selected hamlet-groups/sub-blocks for this purpose. If, however, there was a shortfall in the required number of households in a particular h.g./s.b., the quota for the other h.g./s.b. was increased so that a total of 4 households were selected in all. The households were first arranged by their means of livelihood and then the required number of sample households was selected circular systematically with a random start

51.4 Estimation Procedure

51.4.1 For both rural and urban areas, each of the two samples - sample 1 and sample 2 - can be used to provide a valid estimate of any population character. Since the method of formation of strata for the two samples was different, no combined estimate can be formed at the stratum level. There were two sets of estimates at the stratum level - one for sample 1 and the other for sample 2. The same holds good at the region or state or all-India level. The combined estimate at the level of region or state or all India was obtained by taking a simple average of the two sets of aggregate estimates. Estimates of the ratios of the type Y/X are always obtained at the last stage of estimation as Y/X at the region or state or all-India level.

51.4.2 Notations:

s = subscript for stratum
t = subscript for sub-stratum
i = subscript for sample village/block (i.e. fsu)
D = total number of hamlet-groups/sub-blocks formed in a sample village/block (D = 1,4,5,6 etc.)

Z = total size of a sub-stratum within a stratum (or total size of a stratum when no sub-stratification was there)

z = villages/block size used for selection

n = number of sample villages/blocks surveyed including uninhabited and zero cases (used for tabulation) for a particular sample type/sub-sample.

H = total number of households listed in the selected h.g./s.b.

h = number of households surveyed (used for tabulation) in the h.g./s.b.

$0/1$ = subscript for h.g./s.b. no.

Y = value of any character under estimation

y = estimate of population total of the character y for a state/u.t.

.4.3 Formulae for estimation

Rural

) For sample 1 for all the states/u.t.'s except for J & K, Arunachal Pradesh & Nicobar district Andaman & Nicobar Islands, the formula is as follows:

$$\hat{Y} = \sum_{s} \sum_{t} \frac{Z_s}{n_{st}} \sum_{i=1}^{n_{st}} \frac{1}{z_{sti}} [\frac{H_{sti0}}{h_{sti0}} \sum_{k=1}^{h_{sti0}} y_{sti0k} + (D_{si} - 1) \frac{H_{sti1}}{h_{sti1}} \sum_{k=1}^{h_{sti1}} y_{stilk}]$$

) For sample 2 for all the states/u.t's including sample 1 for J & K and Nicobar districts of Andaman & Nicobar Islands but excluding Arunachal Pradesh, the formula is as follows:

$$= \frac{Z_s}{n_s} \sum_{i=1}^{n_s} \frac{1}{z_{si}} [\frac{H_{si0}}{h_{si0}} \sum_{k=1}^{h_{si0}} y_{si0k} + (D_{si} - 1) \frac{H_{si1}}{h_{si1}} \sum_{k=1}^{h_{si1}} Y_{si1k}]$$

) The formula for Arunachal Pradesh is as follows:

$$\hat{Y} = \sum_{s} \frac{Z_s}{n_s} \sum_{i=1}^{n_s} \frac{H_{si0}}{h_{si0}} \sum_{k=1}^{h_{si0}} y_{si0k}$$

Urban

The formulae for strata 3 to 6 (i.e. Class I towns) of all the states/u.t's (excepting J & K) ed on sample 1 are exactly the same as given in I (A).

The formula for strata 1 & 2 (i.e. Class II to VI towns) for all states/u.t's (including J & K) also for strata 3 to 6 (i.e.Class I towns) of J & K based on sample 1 are also the same as en in I (A) with the only change that z_{sti} was taken as '1' for all i.

The formula for all the states/u.t's (excepting J & K) based on sample 2 are the same as n in I (B).

The formula for J & K based on sample 2 are also the same as given in para 51.4.3(I) (B) the only change that z_{si} was taken as '1' for all i.