Developing an Appropriate Methodology for Estimating Proportion of Villages with Specific Infrastructural Facility

March 2021

Sampling and Official Statistics Unit
Indian Statistical Institute, Kolkata

Project Report -

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DISCLAIMER

This research study has been carried out with the financial support provided by Ministry of Statistics & Programme Implementation. The Ministry of Statistics & Programme Implementation does not own the findings and opinions expressed in the report.

Contents

Executive Summary

This report is based on the research project "Developing an Appropriate Methodology for Estimating Proportion of Villages with Specific Infrastructural Facility", granted by the Ministry of Statistics and Programme Implementation (MoSPI) in late February 2018.

Introduction: The study consists of developing a standard method of estimating proportions of villages with specific infrastructural facilities from the village-level data collected by the NSS in its socio-economic surveys. The present project is an investigation aimed at finding a suitable alternative procedure of estimation for improving the estimates relating to village facilities.

Background: Till recently, in the rounds devoted to household surveys, NSS has mostly been employing a PPS sampling scheme[1] – with village population as size variable – for selection of villages in rural areas. The conventional PPS estimator does not provide an estimate of proportion/total of villages having a facility with high precision. Often, alongside household- and person-level data, village-level information on availability of infrastructural facilities is collected in these surveys. The problem in this context is obtaining a reliable estimate of proportion of villages with a specific infrastructural facility. Such estimates, based on data of the recent rounds on village facilities, are found to vary too widely from round to round.

Method: The present study consists of comparing efficiencies of different design-based (direct) and model-based estimators for proportion-of-villages parameters. Since it is not possible to generate reliable design-based estimates (even under SRS) for very small States and UTs with small allocations of sample villages, the present study is restricted to exploration of methods that can be applied for generating estimates for the 'large' States.

To compare efficiencies of alternative estimators, it is necessary to calculate magnitudes of relative bias and relative standard error of each of the candidate-estimators right from the population. In view of these, the project team created a realistic prototype of population of villages in India – an 'experimental population'.

Two distinct datasets are used for the study. First, for creating the 'experimental' population, we used the data of the Village Directory of 2001. Data on only a limited number of amenities are included for the present study. The amenities finally included in the experimental population are as follows:

1. Bus stop,
2. Navigable waterway;
3. School having primary classes,
4. School with Secondary classes,
5. School with higher secondary classes,
6. Primary health centre
7. Registered medical practitioner
8. Commercial bank
9. Post office
10. Power supply

[1] The problem addressed in this study is also relevant, albeit less severely, for the kind of sampling scheme adopted since the 76th round of the NSS, which involves selecting parts of 'large' villages, instead of the whole, at the first stage. Estimating proportion of 'large' villages under such schemes should be equally problematic.

Second, the alternative estimators examined in the study are used on the data of four rounds of the NSS. The unit-level data on village facilities collected in the 69th to 72nd rounds of the NSS are used for the present study, using the data on 10 selected facilities closely resembling the 10 variables included in the experimental population.

Alternative estimators are compared based on the *relative bias* (RBs) and *mean square errors* (MSEs) estimated from 1000 independent samples drawn from the 'experimental' population. The samples were drawn exactly according to the sample design of the 68th round of the NSS, following the same allocations of samples to different strata and sub-strata. Samples were all drawn by PPSWR as was done in the 68th round.

Estimators examined: The methods examined in the present study fall under two broad heads:

A. Design-based methods

B. Model-based methods

Under design-based methods we examine:

A1. Using (design-based) estimates of aggregate number of villages, and aggregate number of villages having a specific characteristic, generated at the State level (current practice)

A2. Estimating State-region (a sub-division of a State consisting of a group of districts) level aggregates by the ratio method, using (a) the proportion estimated by the design-based method at State-region level and (b) the State-region-wise known total number of villages.

A3. Estimating district level aggregates by the ratio method, using design-based estimates of proportions at the district level and the known number of inhabited villages of the district. (This method was used in NSS 44th round).

A4. Estimating the proportions by applying SRS weights in sub-strata 1 and the PPS weights for the other sub-strata.

Under the model-based approach for estimating the domain-level ratio means, R_d, we examine the estimates of number of villages with a specific characteristic obtained from the following:

B1. Logistic model-based estimates at the stratum-level (district).

B2. Logistic-model-based estimates at state-region level (a group of contiguous districts).

B3. Logistic-model-based estimates at the domain levels (20 'large' States).

Main Findings: Based on the MSEs and RBs of the seven estimators for each of the 10 selected facilities and 20 'large' States, the main findings of the assessment are as follows:

(i) The model-based estimators are subject to very high bias for all the estimators. The bias of these estimators appears to have a negative relation with the population parameter, i.e. the lower the proportion of villages the higher is the relative bias.

(ii) MSEs vary appreciably over the estimators for each of the 10 facility and 20 'large' states.

(iii) The SR-wise reweighted is found to be within the limit specified for RB and MSE for maximum number of states for most of the facilities.

(iv) Since, A2 is found to be most suitable in the context of estimating village characteristics, only this and the currently applied A1 are applied on the NSS datasets.

(v) The findings from application of estimators A1 and A2 on the NSS datasets show little difference between the estimates in most cases. The findings emerging from the results of from the 1000 samples clearly suggest superiority of A2 to A1 in respect of RSEs. This is, however, not clearly demonstrated by their application on the NSS datasets.

Conclusion: All things considered, A2, the estimator using ratio-method reweighting at region level, appears to be most suitable.

Chapter 1 Introduction

The proposal for this research project, submitted by the Sampling and Official Statistics Unit (SOSU), ISI, was approved by the Standing Research Advisory Committee (SRAC) and the project granted by the MoSPI in late February 2018.

The study consists of developing a standard method of estimating proportions of villages with specific infrastructural facilities from the village-level data collected by the NSS in its socio-economic surveys. In the rounds devoted to household surveys, NSS usually employs a PPS sampling scheme – with village population as size variable – for selection of villages in rural areas. The conventional PPS estimator does not provide an estimate of proportion/total of villages having a facility with high precision. This estimation problem has long been known to exist in NSS surveys. The present project is an investigation aimed at finding a suitable alternative procedure of estimation for improving the estimates relating to village facilities.

1.1. Content of the Report

Section 1.2 gives a brief account of conduct of the project. It mentions the departures made during the progress of the study from the methods originally proposed and provides the reasons for the modifications. Chapter 2 begins by explaining in simple terms the basic difference between NSS data on village facilities from NSS household data in respect of its relation to village size and the implications of this for the efficiency of the design-based estimator under PPS sampling. Some complications of using the design-based estimator encountered in recent rounds are mentioned later in the section. This section also defines the scope of the study in terms of the States/UTs for which the investigation into the relative merits of alternative estimators might be usefully done. Chapter 3 explores and identifies suitable alternative estimation procedures. It lists the variants of the first-stage (rural) sample design explored by NSS through its history and notes the common features of the designs used in recent times. It reviews the alternative solutions proposed in the literature for the problems similar to the one at hand. It finally proposes the exact estimation procedures – seven in all, including both design-based and model-based estimators – that the present study might fruitfully evaluate. Chapter 4 describes in detail the data used for the study and the analytical tools used for evaluation of the estimators. Chapter 5 discusses the findings. Chapter 6 states the conclusions that may be drawn from the study.

1.2. Study proposal and conduct of the project

As initially proposed, a number of design-based ratio estimation procedures were explored in the project. The results were encouraging but not altogether satisfactory. This led to further exploration of (logistic) model based estimation procedures. Application of the model-based methods and comparing them with the design-based ratio-estimation methods forms an important part of the present report.

However, as the project progressed, examining some of the initially-proposed methods of weight-adjustment was not found necessary in view of an alternative that was simpler and therefore potentially more acceptable. Instead of weight-trimming, the study examines the alternative of applying SRS estimator for the sub-stratum-1 samples (discussed in detail later). Further, among the initially proposed methods of statistical adjustments, examination of the estimator suggested by Amahia *et. al.* (1989) was not taken up as its expression involves unknown parameter values and thus would be unsuitable for adoption by an official survey agency like the NSS. Examination of the initially-proposed *post-stratification* (by size-class of villages) estimators, too, was not found necessary as the sample designs adopted by the NSS in the recent past themselves employ sub-stratification of the basic strata by the population size of the villages.

Revision of the original time frame

The study took a much longer time to complete than was planned at the inception stage. A total of nine months' extension was granted by the Screening Committee, in view of certain unforeseen circumstances. Other reasons for delay in completion of the study and departures made from the initial proposal are placed in the Annex.

Chapter 2 Purpose of the Study

The study arises from an estimation problem that has long been known to exist in NSS surveys. NSS household surveys are primarily aimed at estimating household totals and per household averages, and population totals and per capita values, of variables that are *observable at the level of households or persons*, such as employment status, morbidity status, educational status, asset values, land and livestock holding sizes, consumption levels of foods and non-food items, and expenditures on various heads including education and medical care and their different components. To observe these variables on a sample basis at a permissible cost, the NSS has found it convenient to adopt a two-stage sampling strategy where areal clusters of households (villages and urban blocks) provide a first-stage sampling frame from which a sample of clusters is randomly selected. Each of these sampled clusters then provides a second-stage sampling frame for selection of the households to be ultimately surveyed to observe (by the interview method) the variables of interest. Since the rural clusters – the villages – differ widely in size, efficiency of estimation is gained by using Probability Proportional to Size (PPS) as the scheme for sampling of villages, with village population as the size variable, and the corresponding design-based unbiased estimator for various household totals and population totals.

The problem arises when the NSS attempts to obtain what may be termed a by-product of its household survey programmes – an estimate of the proportion of villages in each State/UT of India having, within the village, or within a specified distance from the village, a specific facility, such as a bus stop, a primary school, or a registered medical practitioner, to take three examples. Such data are in fact usually collected by an NSS household survey programme (an "NSS round") for each sampled village, with the specific aim of estimating such proportions. The problem is in choosing the estimation procedure to be adopted. The PPS design-based estimator gives good estimates compared to what could have been obtained by Simple Random Sampling (SRS) for population totals of every *variable which is observed at household or person level* – employment, unemployment, literate population, illiterate population, consumption, land holding – because these totals, at village level, are always positively correlated with village population, which is the size variable used for PPS sampling. But the number of villages in the State having, say, a primary school, is the total, across the State's villages, of a variable which takes the value 1 if the village has such a school and 0 if it does not. This variable has a much weaker correlation with village population and therefore estimating its total by the design-based PPS estimator is a method that, though unbiased, is no longer efficient but subject to high sampling error.

In fact, a far superior method of estimating the proportion of villages with a specific facility would be to simply survey an SRS sample of villages and use the SRS design-based estimator of the population proportion, which is just the sample proportion of villages having the facility. Unfortunately, this option is not available to the NSS because estimating the proportion-of-villages parameters is not important enough for it to give up the benefits of using PPS sampling and the PPS design-based estimator for the main parameters of interest in its household surveys, which are the totals and averages of household and person characteristics. And having a separate survey for estimating the proportion-of-villages parameters would be considered wasteful.

Although the study attempts to devise solutions in the form of improved estimators of proportions of villages in India's States assuming a first-stage sample design exactly like the one generally followed till recently in NSS rounds, the fact that PPS sampling is widely applied in selection of villages for household sample surveys conducted officially in various countries suggests that the results of the study should be of interest for these countries as well.

As for the sampling scheme adopted since the 76th round (henceforth called "current scheme"), the results of the present project would continue to be relevant in estimating proportion of villages with specific infrastructural facilities from normal household surveys of the NSS. In the current scheme, the first stage selection in rural areas is made from a constructed population consisting of 'small villages' (i.e. those with population less than 1200 in general cases) and notional sub-units of 'large villages', instead of the whole. A sample of sub-units is drawn from the 'constructed' population for each of the strata defined for the survey with equal probability. The problem addressed in this study is also relevant, albeit less severely, for the current scheme. Estimating proportion of 'large' villages under such schemes should be equally problematic.

2.1. Background

In NSS surveys, the first stage units (FSUs) in rural areas, i.e. villages, are drawn by a PPS sampling scheme. Often, alongside household- and person-level data, village-level information on availability of infrastructural facilities is collected in these surveys. The problem in this context is obtaining a reliable estimate of proportion of villages with a specific infrastructural facility. Such estimates, based on data of the recent rounds on village facilities, are found to vary too widely from round to round.

The data on village amenities collected in decennial Population Census conducted by the Office of Registrar General of India (ORGI) do provide a comprehensive picture of the infrastructural facilities available at the village level. But, owing to its once-in-ten-years frequency, these do not serve as indicators of current situation nor do they help in assessing development during an inter-censal period. The village facilities data collected in the annual rounds of NSS, on the other hand, can be used to generate reliable estimates for tracking changes in infrastructural facilities of the villages in different States. But, the estimation procedure used by the NSS at present is not appropriate for this purpose. The estimates of proportion of villages with specific infrastructural facilities obtained from the NSS surveys are subject to very high sampling error.

2.2. Defining the scope

The objective of the proposed study is to develop a standard method of generating robust estimates of proportion-of-villages parameters from the village-level data collected in NSS household and enterprise surveys. Any attempt at developing robust estimators for all the

States and UTs of India is immediately confronted with the problem of inadequate sample size. Even under a SRSWR sampling scheme, the minimum sample size required for estimating a proportion-of-villages parameter, which is of the order of 0.4, with 10% relative standard error is 150. Most of the smaller states and the UTs are not allotted as many villages in a regular round of the NSS. The requirement under a PPS sampling scheme is likely to be much higher.

Of the four NSS rounds covered under the present study, the 72nd round had the largest sample size. The States and UTs allotted less than 160 sample villages in this round is shown in Table 2.1. For examination of methods undertaken in the present study most of these are excluded. The state Uttarakhand is however included, as it has a large number of villages – over 2.5 % of the total villages in the country.

***Table 2.2.1*: States / UTs with less than 160 villages allotted in the 72nd round NSS**

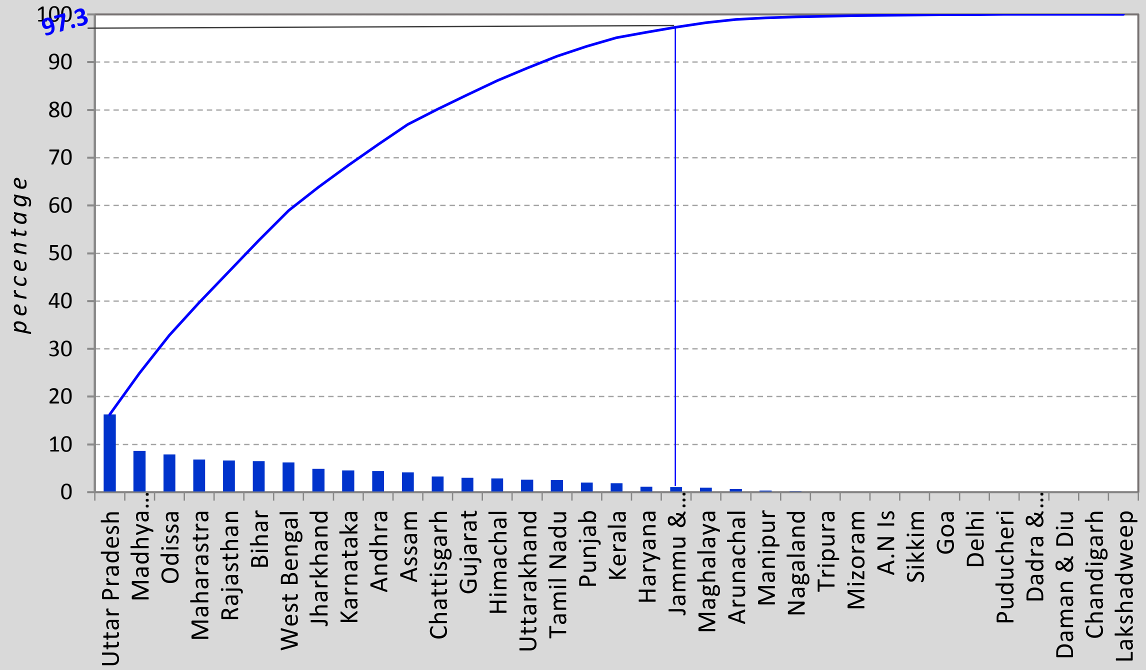
	State / UT	State code	Sample size
1.	Chandigarh	04	8
2.	Uttarakhand	05	125
3.	Delhi	07	8
4.	Sikkim	11	80
5.	Arunachal Pradesh	12	153
6.	Nagaland	13	104
7.	Mizoram	15	88
8.	Meghalaya	17	112
9.	Daman & Diu	25	8
10.	Dadra & Nagar Haveli	26	12
11.	Goa	30	24
12.	Lakshadweep	31	7
13.	Puducherry	34	16
14.	A & N Is	35	32

The present study consists of comparing efficiencies of different design-based (direct) and model-based estimators for proportion-of-villages parameters. Since it is not possible to generate reliable design-based estimates (even under SRS) for very small States and UTs with small allocations of sample villages, the present study is restricted to exploration of methods that can be applied for generating estimates for the 'large' States. In this report, 'large States' refers to those having percentage shares of greater than 1 in the number of inhabited villages in India. There are 20 such States, as shown in Table 2.2 below. As seen from Figure 2.1, the 20 large states account for 97.3 per cent of the inhabited villages of the country.

***Table 2.2.2*: Large States and their percentage shares of States in the number of inhabited villages in India – PC 2011**

Serial no.	State/ UT	percentage share	Serial no.	State/ UT	percentage share
1.	Uttar Pradesh	16.26	11.	Assam	4.17
2.	Madhya Pradesh	8.66	12.	Chhattisgarh	3.27
3.	Odisha	7.90	13.	Gujarat	2.99
4.	Maharashtra	6.81	14.	Himachal Pradesh	2.91
5.	Rajasthan	6.61	15.	Uttarakhand	2.61
6.	Bihar	6.49	16.	Tamil Nadu	2.52
7.	West Bengal	6.25	17.	Punjab	2.04
8.	Jharkhand	4.86	18.	Kerala	1.84
9.	Karnataka	4.54	19.	Haryana	1.11
10.	Andhra Pradesh	4.40	20.	Jammu & Kashmir	1.06

***Figure 2.1:* Percentage share of States and UTs in number of inhabited villages in India**



Source: Sampling frame for the 69th Round of NSSO

2.3. Statement of the problem – elaborated further

The socio-economic surveys (household and unorganized enterprise surveys) conducted by the NSSO mainly involve estimation of parameters relating to population and households. Estimates of village characteristics (distribution of villages by distance from the nearest facility) are also obtained from some rounds, as a by-product of the main enquiry. As the individual- and household-level variables are expected to be closely related to population size of villages, the sampling at the first stage (of villages) is generally done with probability proportional to population.

NSSO employs a stratified two-stage sample design. For rural areas, villages are selected at the first stage. Compact geographical areas are considered as "basic" strata (typically an administrative district). In the past (before 61st round), the sample of villages were usually selected by circular systematic PPS. In the recent rounds (including 64th, 65th, 66th, 68th and 69th for which data on village facilities were collected but not tabulated), NSSO has been using deeper stratification at the first stage.

A PPS design is indeed most ill-suited for estimating parameters relating to number of units. Des Raj (1954) has shown that if $Y_i = a + bX_i$, then the estimator of $Y = \sum_{i=1}^{N} Y_i$ based on PPSWR sampling scheme is less efficient than the estimator based on SRSWR scheme when the intercept term is quite large. Clearly, the regression of (binary) Y_i on size variable (population of village) X_i invariably has a high intercept term. Moreover it is easy to see that the PPSWR estimator of total number of villages is hardly ever equal to the total number of villages in the frame. The PPSWR estimator of number of villages with a particular characteristic is also likely to exceed the number of villages in the frame in many cases. This compels the sampler to adopt ratio estimator for estimating the number of villages with a particular characteristic.

But, ratio estimators being highly biased for small-sized samples, use of "separate-ratio" estimators, built from sub-stratum-level (with sample size = 4), is not advisable. Only the "combined-ratio" estimators, based on estimates pooled at the domain (State) level, are used to restrict the bias within acceptable limits. But, this does not provide satisfactory estimates for proportion of villages with a specified characteristic.

In most cases, the distribution of the size-variable (village population) is such that the PPSWR estimate for number of villages at the stratum level, as well as sub-stratum level, is likely to exceed twice the actual value of villages in the frame for a considerable number of samples. *Table 2.3.1* shows the number of strata in which the PPS estimate of number of inhabited villages in the 69th to 72nd rounds of NSS exceeds twice the number of inhabited villages in the sampling frame. This is more likely in the sub-strata with smaller villages that are now carved out of each basic stratum. Thus, even the second order approximation cannot be applied for obtaining expressions for the bias and variance of the ratio. The values that an estimated ratio may take thus remain highly unpredictable.

***Table 2.3.1*: Number of regions and strata in NSS 69th, 70th, 71st and 72nd Rounds**

Round	Number of regions	Number of strata	No. of strata with $\widehat{N}_s > N_s$
69th	88	626	23
70th	88	626	0
71st	88	626	27
72nd	88	651	5

Chapter 3 Exploring suitable alternative estimation procedures

Generally speaking, the NSS sampling design is a stratified multistage sampling design. The entire geographical area of the country is stratified into basic strata which mostly are districts. First Stage Units (FSU) are the Census list of villages in the rural sector.

The sampling schemes for selection of villages adopted for household surveys in various rounds of NSS are as follows:

1. Stratified SRSWOR – with districts as strata
2. Stratified PPSWR – with districts as strata
3. Stratified PPSWR – with districts sub-stratified by population size of the villages (since the 61st round)
4. PPS Systematic (FSUs arranged by population)
5. PPS Systematic (FSUs arranged in geographical order)

Village selection in different rounds of NSS

The NSS has been using different sampling schemes for selecting rural samples for its socio-economic surveys since 2000. The general practice of stratifying the villages followed in all these rounds consists of first grouping the villages of the districts into what is called 'basic strata' in the NSS parlance. This is followed by further subdividing the villages of a district by their population size. The sub-divisions of villages of a district is called 'sub-strata', which in fact are the strata for selection of the first stage sampling units, i.e. villages, for rural sampling.

A departure from the general procedure of stratification of villages was made in the 72nd round, in which a special stratum was carved out in the States/ UTs having at least 50 villages with population less than 150 as per Census 2011. The special strata were formed with such villages in these States/ UTs. The rest of the villages 0f a State/ UT were then sub-divided by population size of the villages into 'sub-strata'.

In the 69th, 70th and 71st rounds, the sub-strata were defined as follows:

> The villages within a district (stratum) as per frame were first arranged in ascending order by their population. Denoting the number of villages to be sampled from the district by **r**, the number of sub-strata to be formed was determined to be **r**/2. Then, sub-strata **1** to **'r/2'** were demarcated in such a way that each sub-stratum comprised a group of villages appearing together in the arranged frame and had more or less the same population.

In the 72nd round, the method of sub-stratification remained essentially unchanged. Only, instead of forming r/2 sub-strata, r/4 sub-strata were demarcated in the 72nd round.

For all these rounds, except the 70th round, the villages within a sub-stratum were selected by *PPSWR*, with Census 2001 or Census 2011 population as the size variable. For the 70th round, *SRSWOR* was adopted for selection of villages.

3.1. Estimators used by the NSS

For estimating the number of villages in a stratum × sub-stratum having a facility, the NSS uses the following (Hansen-Horwitz) estimator:

$$\hat{\boldsymbol{Y}} = \frac{\boldsymbol{Z}}{\boldsymbol{n}} \sum_{\boldsymbol{i}=1}^{\boldsymbol{n}} \frac{\mathbf{1}}{\boldsymbol{z_i}} \boldsymbol{y_i}$$

where y_i is taken as 1 for i^{th} sample village if it has the facility and 0 otherwise

z_i the population size of the i^{th} sample village

Z the population of all the villages in the sub-stratum and

n the sample size.

For estimating proportion of villages with a specific facility, NSS employs the *combined* estimate of ratio $(\hat{\boldsymbol{R}})$ of the ratio $\left(\boldsymbol{R} = \frac{\boldsymbol{Y}}{\boldsymbol{N}}\right)$ at the domain-levels (state- and national-levels), which is obtained as the ratio of $\hat{Y}$ at the domain-level to estimated number of villages $\hat{N}$ in the domain. With the use of *pps* sampling scheme for selection of villages, the estimate $\hat{N}$ is hardly ever equal to the known value of N.

NSS has also used the *separate* estimate of ratio in the past, perhaps only once in its 44th round. The *separate* estimate of ratio at the domain-levels, in this round, was obtained as the ratio of sum of ratio estimators of $\hat{Y}$ at the stratum-levels to the number of villages N in the domain. The ratio estimators of $\hat{Y}$ for the s^{th} stratum of the domain was obtained as

$$\hat{Y}_s = N_s \left(\sum_{i=1}^{n_s} \frac{y_i}{z_i} \Big/ \sum_{i=1}^{n_s} \frac{1}{z_i} \right)$$

Both the estimators – the *combined* and *separate* – are included for examination in the study.

3.2. A Review of the methods proposed for similar problems in the literature

Consider a finite population U of size N identifiable, distinct units $u_1, u_2, \dots u_i, \dots, u_N$.

The study variables Y's in this case are typically binary.

$$Y_i = \begin{cases} 1 & \text{if } u_i \in \text{C the subset of the population having the characteristics} \\ 0 & \text{otherwise} \end{cases}$$

The problem is to estimate the population proportion/total of the villages in C and thus the proportion of units in C.

In such cases the conventional *pps* estimator $\hat{Y}_{NHT}$ (Narain-Horwitz-Thompson estimator)

$$\hat{Y}_{NHT} = \sum_1^n \frac{y_i}{\pi_i} = \sum_1^n w_i y_i \quad \text{where } w_i = {}^1/_{\pi_i} \text{ (design-based weights)}$$

does not provide an estimate of proportion/total of Y's with high precision. In fact, the *pps* estimators are most often (especially when Y_i is not related to π_i) poorer than the conventional estimates under equal probability sampling. As Rao (1966) has demonstrated that if Y_i is not related to the size measure π_i,

$$V(\hat{Y}_{NHT}) > V(\hat{Y}_U) \quad \text{where} \quad \hat{Y}_U = \frac{N}{n}\sum_1^n y_i$$

Therefore, there is a need to use an additional auxiliary variable to estimate proportion /total of these Y's with higher precision. For example,

$$\hat{Y}_{л} = \hat{Y}_{NHT}\,\frac{N}{\hat{N}_{NHT}} \quad \text{where} \quad \hat{N}_{NHT} = \sum_1^n 1/\pi_i$$

This is a ratio estimator. Using a 'combined' ratio estimator at the domain level, does not help improve the estimates of proportions at the domain level. On the other hand, using 'separate' ratio estimator at the smaller sub-domain levels to arrive at domain level aggregate estimates, makes the domain level estimates of proportions subject to high bias.

Estimating proportion of villages with a specified characteristic is a typical case of the study variable being weakly or not at all correlated with the size variable in a PPS selection scheme. A number of estimators have been proposed for estimating totals under PPS that are more efficient than the NHT estimators, especially when the characteristic under study is poorly correlated with the size variable. Rao (1966) provides a review of some alternative estimators that are more efficient than the NHT estimators. Assuming zero correlation between the study variable and the size measure, he showed that, though biased, these are more efficient than NHT estimator.

Later, Rao (1993) reviewed the alternative linear-weighted estimators under PPSWR using more than one auxiliary variables suggested by Aggarwal and Singh (1980), Bansal and Singh (1985), Amahia, Chaubey and Rao (1989) and Tripthy and Chaubey (1990). Bansal and Singh (I985), Amahia et. al. (1989), Grewal (1999) and others have proposed estimators for characteristics that are poorly correlated with selection probabilities. The estimators proposed by Amahia et. al. take into consideration the correlation coefficient between the variable of interest and selection probabilities even though this correlation may be very small.

More recently, Aggarwal and Al Mannai (2009) has reviewed the linear-weighted estimators developed in the preceding four decades. The following remark made in the paper is most relevant in the context of the present study:

> ". . . sample survey practitioners have not shown much interest in these developments. This is a sort of paradox and there appears to be a gap in the theory developed on linear weighted estimators and its applications in actual surveys. One of the reasons appears to be that the weighted estimator involves unknown parameter values in the estimator …".

The authors studied the relative efficiency and the relative bias of linear-weighted estimators over conventional estimators, for a wide variety of populations. They found the performances of the linear-weighted estimators quite satisfactory even if the guess value of the weights in the weighted linear estimator departs by 50% from the optimum value.

The studies cited above are relevant for the present study as they deal with poorly associated study variable and size measure. But, the study variables in the present study being of categorical type, application of the estimators proposed in the cited references as such are not quite appropriate.

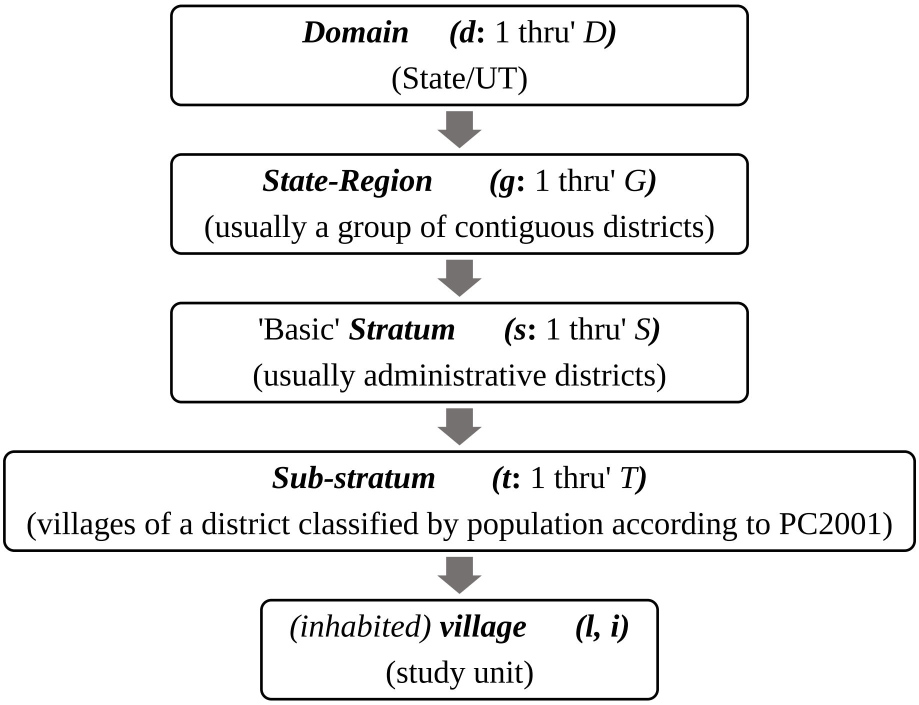
3.3. Selecting methods for exploration

The methods examined in the present study fall under two broad heads:

- **A.** Design-based methods
- **B.** Model-based methods

The NSS uses a stratified multi-stage sampling design for its household surveys. So far as selection of villages is concerned, however, one can treat it as a stratified single-stage design. Stratification of villages is done at different levels. Further, the uninhabited villages, as per the last population census, are also included in the frame. But, collection of data on village facilities is restricted to only the villages found to be inhabited during conduct of the survey.

The following discussion on alternative estimators examined in the study uses a common notation. Describing the estimation procedures examined in the study requires a cross-classification into domains and strata of the entire population (of inhabited villages). The hierarchical arrangement underlying the classification and the subscripts used for levels of grouping are indicated below:



Rest of the notation:

Z	size variable (population as per PC) of a village in the frame
z	PC-population of a sample village
P	selection probability of a village within a sub-strata

p	selection probability of a sample village
N	number of villages in the frame
n	number of villages in the sample
M	number of villages with a specific characteristic

Design-based estimators (Direct approach)

Under design-based methods we examine:

A1. Using (design-based) estimates of aggregate number of villages, and aggregate number of villages having a specific characteristic, generated at the State level (current practice)

A2. Estimating State-region (a sub-division of a State consisting of a group of districts) level aggregates by the ratio method, using (a) the proportion estimated by the design-based method at State-region level and (b) the State-region-wise known total number of villages.

A3. Estimating district level aggregates by the ratio method, using design-based estimates of proportions at the district level and the known number of inhabited villages of the district. (This method was used in NSS 44^{th} round).

A4. Estimating the proportions by applying SRS weights in sub-strata 1 and the PPS weights for the other sub-strata.

The number of villages in a State possessing a specific characteristic is a sum of 1-0 variables defined for each village in the State as an indicator variable for the presence of the characteristic. Even though the proportion of villages with population greater than a number (say Z_0) having the characteristic will, given that the presence of the characteristic is associated with economic development, be positively correlated with Z_0, the variation of the indicator variable of the characteristic defined on the set of villages with village population is not of the kind that ensures a low variance of the Hansen-Hurwitz estimator for aggregate number of villages.

On the other hand, use of the auxiliary information on the number of villages in sub-strata, strata and state-regions is likely to improve the efficiency of estimators. The most common use of auxiliary variables is made in the ratio method of estimation. The methods A2 and A3 in fact uses ‘separate’ ratio estimators, while A1 is equivalent to using ‘combined’ ratio estimator. The method A4 involves a kind of weight trimming that eliminates very high weights.

The methods A2 and A3, which uses ‘separate’ ratio estimators respectively at state-region and district levels ought to be more efficient (having less variance) than the A1 estimator, as the latter is equivalent to applying ‘combined’ ratio estimator for the state-level estimates. But both A2 and A3 have larger bias than the A1. The sample sizes of the underlying ratio estimators have a determining role in relative bias of these estimators.

Moreover, the A3 estimator are likely to be subject to large bias as the sample sizes of involved ratio estimators ranges from 8 to 24 in a normal NSS annual round. At the same time, A3 estimators should have smaller variances than the A2 estimators. What is investigated in the present study is the net effect of the reverse order of variance and bias between the two estimators on the mean square error (MSE).

A precise description of the methods A1, A2 and A3 is as follows:

Let the selection probability of the i^{th} village in the t^{th} sub-stratum of the s^{th} stratum of the g^{th} state-region of the d^{th} domain be $P_{dgsti} = \frac{z_{dgsti}}{z_{dgst}}$

The objective is to estimate the ratio, $R_d = \frac{M_d}{N_d}$

Define $$Y_{dgsti} = \begin{cases} 1 & \text{if the village has the specified characteristics} \\ 0 & \text{otherwise} \end{cases}$$

Without loss of generality, the first M villages out of N is assumed to have the specific characteristics.

Thus, $$Y_{dgsti} = \begin{cases} 1 & \text{for } 1 \leq \text{i} \leq M_{dgst} \\ 0 & \text{otherwise} \end{cases}$$

Note that $\sum_{1}^{N_{dgst}} Y_{dgsti} = M_{dgst}$ and $\sum_{i=1}^{N_{dgst}} Y^2{}_{dgsti} = M_{dgst}$

Now, the design-based Hansen-Hurwitz estimators of M_{dgst} at the sub-stratum level is

$$\widehat{M}_{dgst} = \frac{1}{n_{dgst}} \sum_{i-1}^{n_{dgst}} \frac{y_{dgsti}}{p_{dgsti}}$$

The domain-level estimate of M_d is obtained as

$$\widehat{M}_d = \sum_{g=1}^{G_d} \sum_{s=1}^{S_{dg}} \sum_{t=1}^{T_{dgs}} \widehat{M}_{dgst}$$

Similarly, the estimates of M_{dg} and M_{dgs} are obtained as

$$\widehat{M}_{dg} = \sum_{s=1}^{S_{dg}} \sum_{t=1}^{T_{dgs}} \widehat{M}_{dgst} \quad \text{and} \quad \widehat{M}_{dgs} = \sum_{t=1}^{T_{dgs}} \widehat{M}_{dgst}$$

The estimate of the proportion of villages with a specified characteristic, a ratio mean R_d, can be obtained in different ways. Most commonly a 'combined' estimator of ratio mean is used by the NSS for this purpose. The estimate of M_d is divided by an estimate of number of villages at the domain level, even though N_d is actually known.

The design-based Hansen-Hurwitz estimators of N_{dgst} at the sub-stratum level is given by

$$\widehat{N}_{dgst} = \frac{1}{n_{dgst}} \sum_{i-1}^{n_{dgst}} \frac{1}{p_{dgsti}}$$

and the domain-level estimate of N_d is obtained as

$$\hat{N}_d = \sum_{g=1}^{G_d}\sum_{s=1}^{S_{dg}}\sum_{t=1}^{T_{dgs}} \hat{N}_{dgst}$$

The combined estimator of ratio mean (at the domain level) is given by

$$\hat{R}_d = \hat{M}_d / \hat{N}_d$$

The estimate of the ratio mean R_d can be obtained from *separate* ratio estimators at different levels – sub-stratum, stratum, state-region. Denoting the estimator of ratio mean defined on *separate* ratio estimators of *M* at *sub-stratum*, *stratum* and *state-region* levels respectively by ${}^{sep}_{ss}\hat{R}_d$, ${}^{sep}_{str}\hat{R}_d$ and ${}^{sep}_{reg}\hat{R}_d$, we define

$${}^{sep}_{ss}\hat{R}_d = \sum_{g=1}^{G_d}\sum_{s=1}^{S_{dg}}\sum_{t=1}^{T_{dgs}} \hat{R}_{dgst} \,.\, \omega_{dgst}$$

where $\omega_{dgst} = \frac{N_{dgst}}{N_d}$ and $\hat{R}_{dgst} = \frac{\hat{M}_{dgst}}{\hat{N}_{dgst}}$

$${}^{sep}_{str}\hat{R}_d = \sum_{g=1}^{G_d}\sum_{s=1}^{S_{dg}} \hat{R}_{dgs} \,.\, \omega_{dgs}$$

where $\omega_{dgs} = \frac{N_{dgs}}{N_d}$ and $\hat{R}_{dgs} = \frac{\hat{M}_{dgs}}{\hat{N}_{dgs}}$

and $${}^{sep}_{reg}\hat{R}_d = \sum_{g=1}^{G_d} \hat{R}_{dg} \,.\, \omega_{dg}$$

where $\omega_{dg} = \frac{N_{dg}}{N_d}$ and $\hat{R}_{dgs} = \frac{\hat{M}_{dg}}{\hat{N}_{dg}}$

The latter two are respectively called ‘stratum-reweighted’ and ‘state-region’ reweighted estimators in the rest of the report.

Model-based estimators (Prediction Approach)

Under the model-based approach for estimating the domain-level ratio means, R_d, we examine the estimates of number of villages with a specific characteristic obtained from the following:

B1. Logistic model-based estimates at the stratum-level (district).

B2. Logistic-model-based estimates at state-region level (a group of contiguous districts).

B3. Logistic-model-based estimates at the domain levels (20 ‘large’ States).

A model-based approach to estimate population parameters uses a stochastic model describing the relation between study variable and one or more auxiliary variable. If the model truly holds good for the population under study, the sample design should have no role in estimating model-parameters from the sample observations. In other words, the design-based sampling weights are not required to be used in estimation of the population parameter under study, once the value(s) taken by the auxiliary variable(s) are known for all the units of the population (Lohr 2010).

The readers may recall that the sampling scheme generally used for selection of villages in NSS household surveys is PPS with replacement, with the village population in the preceding population census as the size variable. (This variable has been used as the auxiliary variable in the logistic regression model.) Thus, the selection probability of the i^{th} unit in the t^{th} substratum of the s^{th} stratum of the g^{th} region of the d^{th} domain is given by

$$P_{dgsti} = {z_{dgsti}}/{Z_{dgst}}$$

where z_{dgsti} is the population of the village as per PC 2001 and

Z_{dgst} is the population of the sub-stratum as per PC 2001

The logistic regression model used for the study can generally be described as follows:

Let, π_{dgsti} represent $Prob\ (Y_{dgsti} = 1)$ i.e. the probability of the $(d, g, s, t, i)^{th}$ unit of the population having the specific characteristic.

Then $$\pi_{dgsti} = e^{\propto + \beta . z_{dgsti}} \Big/ \left(1 + e^{\propto + \beta . z_{dgsti}}\right)$$

The rationale for examining model-based estimators in the present context is mainly the weak association of the study variable, taking only values 0 and 1, is known to have in most cases with the size variable used at the selection stage. The simple logistic model with just one auxiliary variable chosen for the study is among the simplest for 1-0 type study variables. As the selection of sample of villages are done with a single-stage sampling, and thus free from clustering effect, inclusion of dummy variable in the model is not required. The same model can be used at different levels of stratification.

Applying model B1 consists of estimating the population parameterM_{dgs}, followed by summing these over all the strata of the domain to arrive at an estimate of M_d and finally dividing the sum by N_d to obtain an estimate of R_d. First, the $\hat{\alpha}_{dgs}$ and $\hat{\beta}_{dgs}$ are obtained by fitting the logistic regression on sample values of all the units in the $(d, g, s)^{th}$ stratum. Next, the estimate of M_{dgs} , M_d and R_d are obtained as

$$\widehat{M}_{dgs} = \sum_{t=1}^{T_{dgs}} \sum_{i=1}^{n_i} y_{dgsti} + \sum_{t=1}^{T_{dgs}} \sum_{i \notin s}^{N_{dgst}} e^{\hat{\propto} + \hat{\beta} . z_{dgsti}} \Big/ \left(1 + e^{\hat{\propto} + \hat{\beta} . z_{dgsti}}\right)$$

$$\widehat{M}_d = \sum_{g=1}^{G_d} \sum_{s=1}^{S_{dg}} \widehat{M}_{dgs}$$

and $$\hat{R}_d = {\widehat{M}_d}/{N_d}$$

A similar procedure is adopted for model B2. The difference is just that instead of running the logistic on the sample values at the stratum levels, it is run on the observations on all the units of the state-regions in the sample. Using the estimates of α and β thus obtained, $\widehat{M}_{dg}$ is estimated, which in turn are summed up over all the state-regions of the domain to arrive at $\widehat{M}_d$. Finally, as for method B1, the estimate of the required ratio is obtained as

$$\hat{R}_d = {\widehat{M}_d}/{N_d}.$$

The model B3 too is similar to B1 and B2. In this case, the logistic regression model is fitted on all the sample observations of the domain as a whole.

Chapter 4 Evaluation of selected methods

Estimating bias and sampling error of alternative estimators from a sample is not enough for establishing their relative advantages. The estimates of relative bias (RB) and relative standard error (RSE) worked out from a small number of samples, such as a few NSS rounds, can at the best serve as empirical evidence, but not prove one method to be better or worse than another. To compare efficiencies of alternative estimators, it is necessary to calculate magnitudes of relative bias and relative standard error of each of the candidate-estimators right from the population.

In view of these, the project team created a realistic prototype of population of villages in India. This is henceforth called 'experimental population'. The population of villages consisted of all inhabited census villages of 2001. For each village in this list, additional data was created on a number of categorical variables relating to village-level characteristics that are closely comparable to the facilities and amenities on which village-level data are collected by the NSS.

The rest of the discussion on comparative advantages of the estimators is based on observations made on 1000 samples drawn from this 'experimental' population. Besides, the results of applying these on NSS unit-level data (of villages) collected in the four consecutive rounds of NSS are also examined. First the data used for the study are discussed in the next sub-section, followed by a sub-section on the analytical tools used for evaluating the estimators.

4.1. Description of data used

Two distinct datasets are used for the study. First, for creating the 'experimental' population, we used the data of the Village Directory of 2001. Second, the alternative estimators examined in the study are used on the data of four rounds of the NSS. The contents of the datasets are briefly discussed below.

Village Directory of Population Census

The Village Directories published as a part of the District Census Handbook by the ORGI provides rich data on the various amenities available or accessible to the villagers for each inhabited villages of India. Data on over a hundred village amenities are provided in these publications.

For each of these amenities, data on availability are recorded in distance code in the village directories. For the purpose of the present study, only the data on whether available within the village is considered for comparing the alternative estimators of proportions.

The 'experimental' population created for the study is culled out of the Village Directory of 2001. A significant proportion (over 7%) of villages in India is uninhabited. Since, existence of the facilities is not of much consequence in these villages, data on their availability are not collected in the NSS for these villages. These are, therefore, excluded from the experimental population used for the study. It is important to note, however, that these are not excluded from the sampling frame for selection of villages in the NSS, as the villages uninhabited in the preceding census could be inhabited at the time of the survey. But, if any such village gets included in the sample and is still found to be uninhabited, data on village facilities are not collected for it. The estimates of proportion of villages generated from the NSS datasets, thus, relates only to the inhabited villages. The value of the population parameter N, which is supposed to be known, is in fact unknown. In the NSS, the uninhabited villages are included in the sampling frame but not accounted for while estimating the proportion of villages. The experimental population, on the other hand, excludes such villages altogether from the frame. The differences in biases and MSEs of proportion of inhabited villages under the two situations are not likely to be of any significance.

Data on only a limited number of amenities are included for the present study. The selection of amenities selected were determined keeping in mind the data items collected in the NSS surveys as well as the varying nature of the variables in respect of the proportion of villages having it and geographical heterogeneity of their availability. The code structure of the responses in the village directory differed from that usually used by the NSS. Thus, the former were changed to match with the latter. The amenities finally included in the experimental population are as follows:

2. Bus stop,
2. Navigable waterway;
3. School having primary classes,
4. School with Secondary classes,
5. School with higher secondary classes,
6. Primary health centre
7. Registered medical practitioner
8. Commercial bank
9. Post office
10. Power supply

NSS Data of 69th to 72nd Rounds

Typically, the NSS collects data on the distance of the nearest facility in the listing schedule, which is mainly meant for preparing a frame for selection of the households. In some of its rounds, a block was kept for recording availability of certain facilities to the villagers of the sample villages. The information regarding the facilities were collected from knowledgeable persons of the village, such as *sarpanch*, other *panchayat* member, *Patwari* / *gram sevak*, teacher, health personnel etc. Their responses were recorded in distance codes, with one of them meant for ‘within village’.

The village facilities on which data were usually collected by NSS at the village level are as follows:

1. gram panchayat headquarters
2. medicine shop
3. bus stop
4. post office
5. boat jetty
6. fair price shop
7. metaled road
8. cooperative credit society
9. school having primary level classes
10. commercial bank

11.	school having secondary level classes	12.	veterinary hospital / dispensary
13.	higher secondary school/junior college	14.	fertilizer / pesticide shop
15.	health sub-centre / dispensary	16.	agricultural produce market / rural primary market
17.	primary health centre	18.	health sub-centre / dispensary
19.	community health centre	20.	drinking water
21.	government hospital	22.	type of drainage arrangement
23.	private clinic / doctor	24.	electricity connection

The unit-level data on village facilities collected in the 69^{th} to 72^{nd} rounds of the NSS are used for the present study, using the data on 10 selected facilities closely resembling the 10 variables included in the experimental population.

4.2. Analytical tools

Computing the relative bias (RB) and mean square errors (MSE) directly from the population is not attempted in the present study. The algebraic expressions of errors involved in the model-based estimation are too complicated to be handled easily. Moreover, as discussed in Section 2.3, the condition under which standard Taylor's linearization is permitted is not satisfied for the design-based estimators considered in the present study. The estimates of number of villages in some strata exceed twice the corresponding actual number of villages in the frame for a number of samples. As an alternative, the RBs and MSEs could be computed numerically from the estimates from all possible samples. This too was not attempted as it involves stupendous amount of computational efforts.

Instead, the estimators are compared based on the RBs and MSEs estimated from 1000 independent samples drawn from the 'experimental' population. In recent times, the NSS has, by and large, been following the sample design of the 68^{th} round for all its annual rounds not involving multiple visits to the households. Thus, the samples were drawn exactly according to the sample design of the 68^{th} round of the NSS, following the same allocations of samples to different strata and sub-strata. Samples were all drawn by PPSWR as was done in the 68^{th} round. The number of inhabited villages (N) in the experimental population and the sample size (n) for all the States and UTs are shown in Table 4.1. Note that Delhi and Daman & Diu are not included in the table.

Table 4.1: Number of inhabited villages in the experimental population and sample for the States and Union Territories

States/Uts	Number of villages in the frame (N)	Number of villages in the sample (n)
Jammu and Kashmir (01)	6411	260
Himachal Pradesh (02)	17493	208
Punjab (03)	12277	180
Chandigarh (04)	23	8
Uttaranchal (05)	15759	124
Haryana (06)	6755	172
Rajasthan (08)	39749	324
Uttar Pradesh (09)	97935	736
Bihar (10)	39005	408
Sikkim (11)	450	76
Arunachal Pradesh (12)	3863	120
Nagaland (13)	1278	68
Manipur (14)	2198	172
Mizoram (15)	706	80
Tripura (16)	856	164
Meghalaya (17)	5780	108
Assam (18)	25120	292
West Bengal (19)	37939	416
Jharkhand (20)	29351	188
Orissa (21)	47526	372
Chhattisgarh (22)	19744	180
Madhya Pradesh (23)	52115	324
Gujrat (24)	18063	216
Dadra & Nagar Haveli (26)	70	12
Maharashtra (27)	41086	504
Andhra Pradesh (28)	26608	492
Karnataka (29)	27480	240
Goa (30)	347	20
Lakshadweep (31)	8	8
Kerala (32)	1362	328
Tamil Nadu (33)	15392	400
Puducherry (34)	92	16
Andaman & Nicobar Is.(35)	501	20
All-India	**593342**	**7236**

The RB and RSE of an estimator for a domain *d* are estimated as follows for all the variables under study: [subscript υ indicates one out of 1000 samples]

$$RB_d = \left[\frac{1}{1000} \sum_{\vartheta=1}^{1000} \left(\frac{\hat{M}_{d\vartheta}}{\hat{N}_{d\vartheta}} - \frac{M_d}{N_d} \right) \right] \Big/ \left(\frac{M_d}{N_d} \right)$$

$$\widehat{MSE}_d = \frac{1}{1000} \sum_{\vartheta=1}^{1000} \left(\frac{\hat{M}_{d\vartheta}}{\hat{N}_{d\vartheta}} - \frac{M_d}{N_d} \right)^2$$

and $$\widehat{RSE}_d = \widehat{MSE}_d \Big/ \left(\frac{M_d}{N_d} \right)$$

Beside, comparing the estimated RB and RSE of the estimators, the trends followed by the estimators when applied to NSSO data of the four different rounds are also examined.

Chapter 5 Findings

The investigation is carried out in two parts. The examination of the alternative methods mainly consists of applying them on the 1000 samples drawn independently from the experimental population. In the process, the estimated sampling distributions of the estimators are also compared to understand their behaviour and relative robustness. In addition, the estimation methods are also applied on the data collected by the NSSO in recent rounds – 68th to 72nd – rounds and examining the results. These data are not available in the public domain; the MoSPI provided the unit-level data of these rounds along with the sample list and sampling frame.

5.1. Results derived from 1000 samples

The estimated RSEs discussed here are, in fact, relative root mean square errors of estimators of ratio mean. Though, bias is a contributing factor towards RSE thus defined, the RBs are also tabulated separately since, in some cases, even when an estimator's RSE is found to be low, its RB is of very high order – either positive or negative.

The comparison of the estimators is, thus, based on both the RSEs and RBs estimated from the variations of estimates obtained from the same 1000 samples drawn from the experimental population. The following short forms are used to denote the seven estimators in the tables and figures presenting the results:

	estimator of proportion of villages using	Short form
A1	Design-based (PPS) estimators at the domain level	Ratio_est_state or PPSWR
A2	Design-based (PPS) estimators at the region level	SR-wise reweighted or rwt-SR
A3	Design-based (PPS) estimators at the stratum level	District-wise reweighted or rwt-dist
A4	SRS estimator for sub-stratum 1 and PPS for the rest	SRS in SS1 or SRS-SS1
B1	Logistic model-based estimates at district (stratum) level	District Logistic or log-dist
B2	Logistic model-based estimates at region level	SR Logistic or log-SR
B3	Logistic model-based estimates at domain (state) level	State Logistic or log-state

Also, in some of the charts and tables, only the State codes are used instead of using the names of the states, due to space constraint. Table 4.1 provides the codes of the states.

The comparison made in the study is, moreover, restricted to examination of RSEs and RBs of just 10 population parameters (proportion of villages with specific facilities) of 20 domains – the 'large' States. The 'small' States and Uts are left out for their small sample size. The parameters are chosen to cover widely different levels of availability of facilities in villages – ranging from just about 3% to 80% at the national level. Needless to say, the variation in availability of village facilities over the 20 large States is much wider. The spatial distribution of the selected facilities too is quite varied. For example, the primary schools are mostly spread uniformly within a district, while navigable waterways are not only rare but also more likely to be available only in villages on rivers and large canals. In view of these, the results of the analysis of just 200 parameters (10 facilities for 20 'large' villages) based on 1000 samples drawn from the experimental population are expected to be adequate for drawing valid conclusions about the estimators.

The detailed results on RSEs and RBs of the seven estimators for each of the 10 selected facilities and 20 'large' States are given in Tables 5.1.1 & 5.1.2. These are placed in Appendix – I. The box-plots of the value of estimates obtained from the 1000 samples for the seven estimators, 10 facilities and 20 'large' States are given in Appendix – III. The box-plots of values of the estimators from 1000 samples are presented in *Figure 5.1.11*.

***Figure 5.1.11*: Box-plot of values taken by the estimators at the national level**

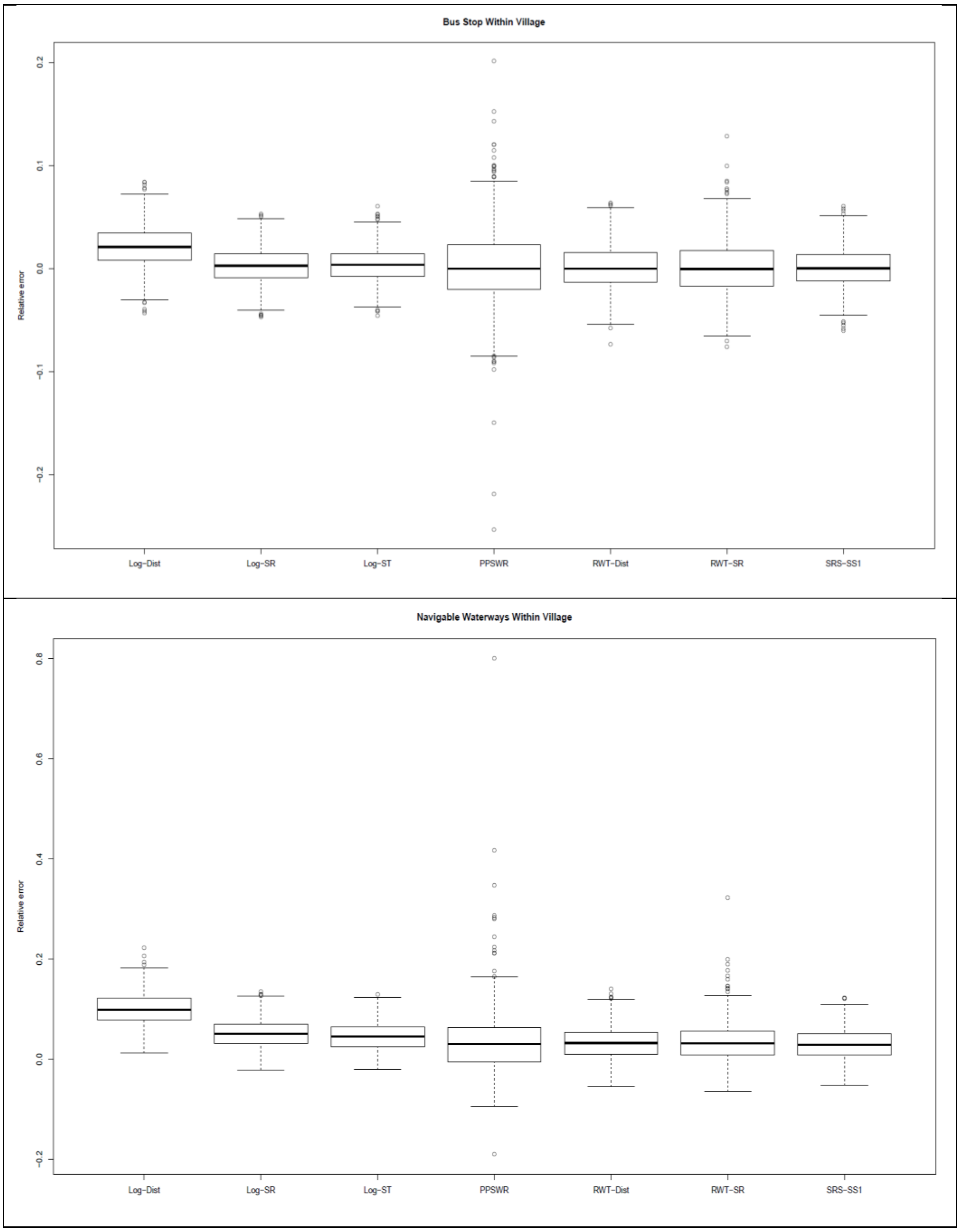


***Figure 5.1.11*: Box-plot of values taken by the estimators at the national level**

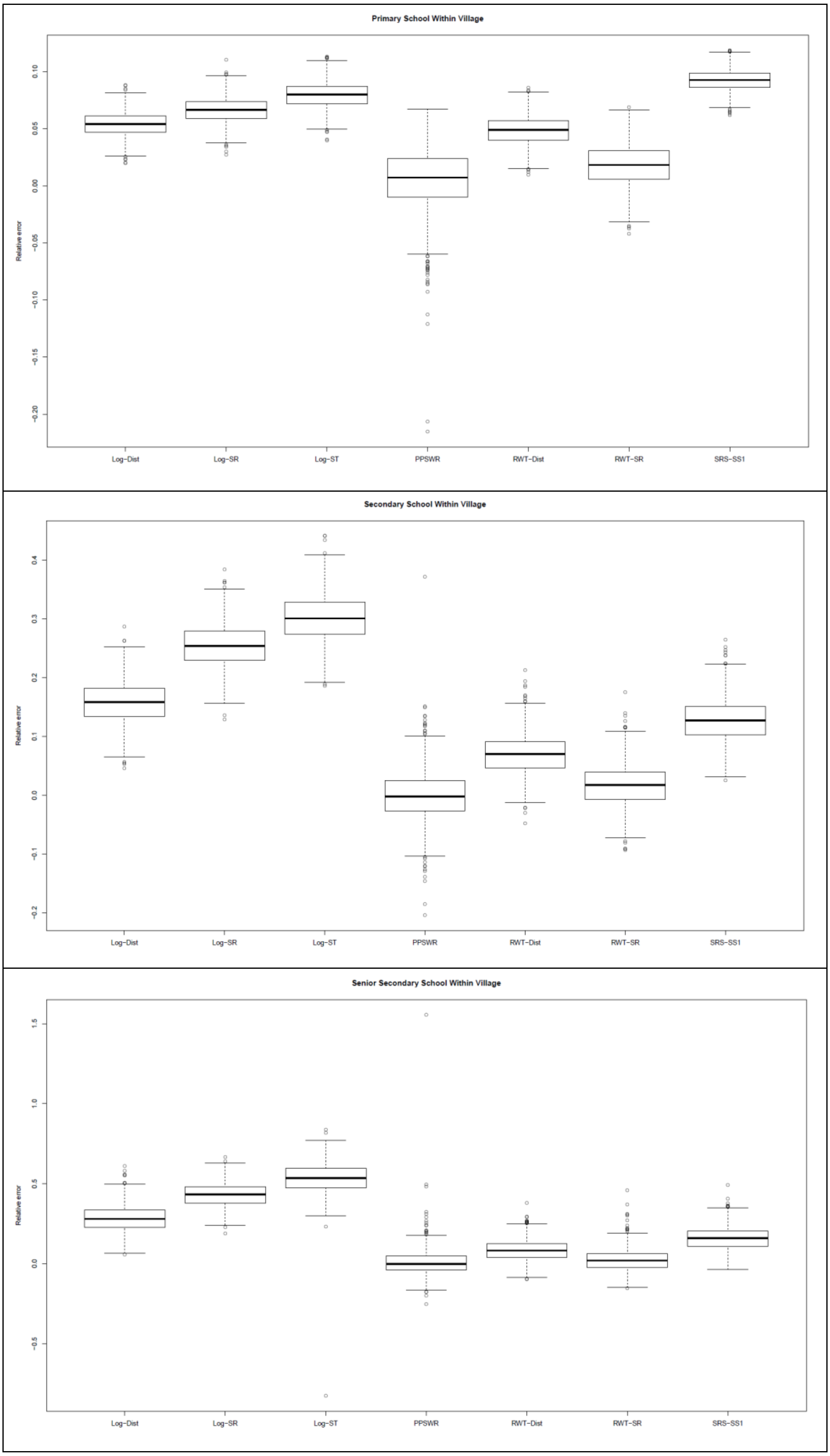


Figure 5.1.11: **Box-plot of values taken by the estimators at the national level**

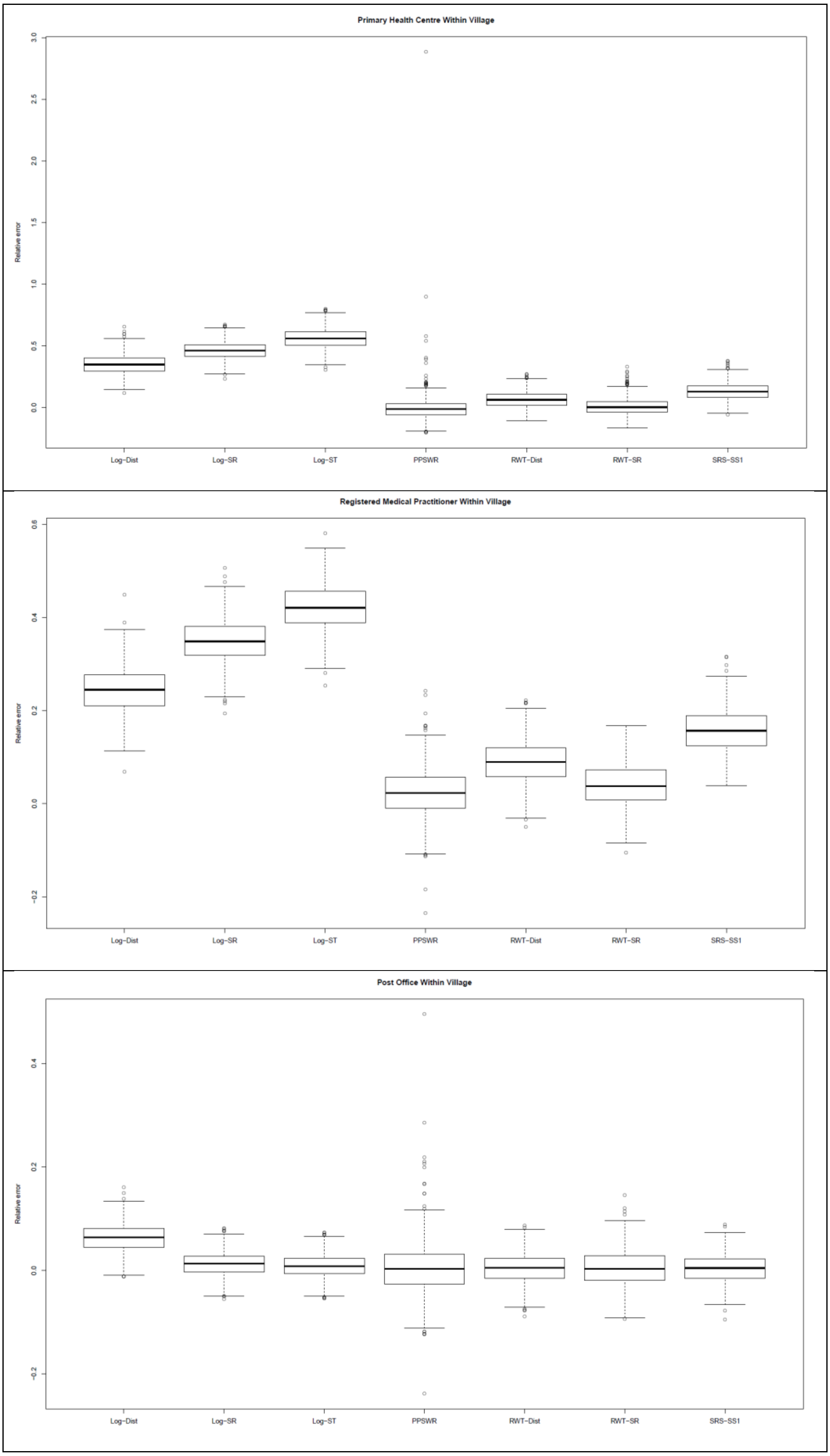
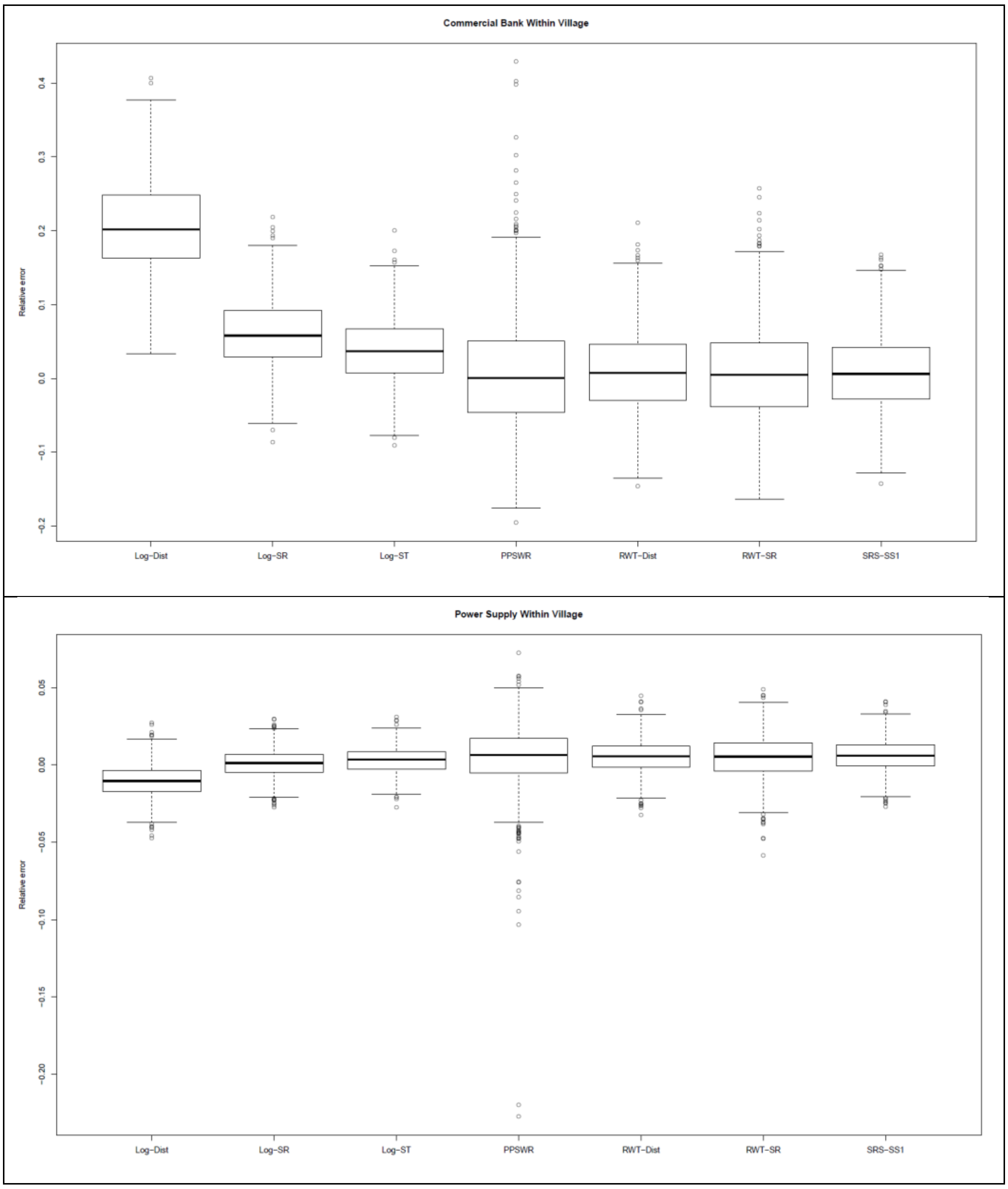


Figure 5.1.11: **Box-plot of values taken by the estimators at the national level**



Being a ratio of aggregate estimates at the domain level, which are based on large enough sample size, the 'combined' design-based PPSWR estimator of ratios hardly shows any bias. The other design-based estimator RWT-SR, for which the ratios are calculated at the region-level, too is subjected to little bias. This is because, on an average, 82 sample villages are allocated to a region. But, the bias of RWT-Dist is quite pronounced for most of the facilities. On an average, just about 12 villages are selected in a stratum (district), thus the estimates of number of villages are subject to very high relative bias. The SRS-SS1 estimates too are subject to high relative bias. These are obtained using equal weights for the sample units of sub-stratum 1, though the units are selected with PPSWR.

***Table 5.1.3*: Number of estimated State-proportions with RSE ≤ 5%, RSE ≤ 7.5% and RSE ≤ 10% using the 7 estimators by village facility**

Village Facility	All-India Population Ratio (R_d) (%)	Number of States by estimator						
		Ratio_est_state	SRS in SS1	District-wise reweighted	SR-wise reweighted	District Logistic	SR Logistic	State Logistic
State-level proportions with RSE 5% or less								
Bus Stop	40.70	2	6	5	5	5	6	6
Navigable Waterways	6.14	3	4	4	4	4	3	3
Primary School	78.50	2	6	7	7	8	10	7
Secondary School	10.97	1	1	1	9	1	1	1
Senior Secondary School	3.00	0	0	0	9	0	0	0
Primary Health Centre	3.67	0	1	1	7	1	0	0
Regd. Medical Practitioner	8.18	0	1	1	8	1	1	1
Post Office	28.46	1	1	1	2	1	1	2
Commercial Bank	11.89	0	0	0	0	0	0	0
Power Supply	70.45	9	14	13	13	13	16	17
Sum	--	**18**	**34**	**33**	**64**	**34**	**38**	**37**
State-level proportions with RSE 7.5% or less								
Bus Stop	40.70	6	7	6	12	8	9	9
Navigable Waterways	6.14	4	4	4	6	4	4	4
Primary School	78.50	8	9	15	16	13	13	11
Secondary School	10.97	1	1	1	18	1	1	1
Senior Secondary School	3.00	0	0	0	18	0	0	0
Primary Health Centre	3.67	1	1	1	18	1	1	1
Regd. Medical Practitioner	8.18	1	1	1	17	1	1	1
Post Office	28.46	1	3	2	7	3	5	5
Commercial Bank	11.89	0	0	0	4	0	0	0
Power Supply	70.45	15	17	17	18	18	18	18
Sum	--	**37**	**43**	**47**	**134**	**49**	**52**	**50**

Table 5.1.3: **Number of estimated State-proportions with RSE ≤ 5%, RSE ≤ 7.5% and RSE ≤ 10% using the 7 estimators by village facility**

Village Facility	All-India Population Ratio (R_d) (%)	Number of States by estimator						
		Ratio_est_state	SRS in SS1	District-wise reweighted	SR-wise reweighted	District Logistic	SR Logistic	State Logistic
State-level proportions with RSE 10% or less								
Bus Stop	40.70	8	13	12	18	11	12	14
Navigable Waterways	6.14	4	4	4	14	4	4	4
Primary School	78.50	17	12	17	19	17	15	13
Secondary School	10.97	2	3	3	20	1	1	1
Senior Secondary School	3.00	1	1	1	20	1	1	1
Primary Health Centre	3.67	1	1	1	20	1	1	1
Regd. Medical Practitioner	8.18	1	1	2	20	1	1	1
Post Office	28.46	2	7	7	14	6	8	10
Commercial Bank	11.89	0	0	0	13	0	0	0
Power Supply	70.45	17	19	19	19	19	19	19
Sum	--	**53**	**61**	**66**	**177**	**61**	**62**	**64**

As for the model-based estimators, *Figure 5.1.1* reveals very high bias for all the estimators. The bias of these estimators appears to have a negative relation with the population parameter, i.e. the lower the proportion of villages the higher is the relative bias.

Tables 5.1.1 and 5.1.2 given in the Appendix provide the estimates of RSE and RB in details. *Figures 5.1.1* to *5.1.10* in Appendix II show how RSEs vary over the estimators for each of the 10 facility and 20 ‘large’ states. Note that the states are indicated by their state codes in these figures.

Here, we discuss the salient points relating to comparison of the estimators based on a summary of what emerges from the tables and figures placed in the Appendix I and II.

Table 5.1.3 shows the number of states for which the RSE of an estimator is less than or equal to specified values – 5%, 7.5% and 10% – for the 10 village facilities. For all the three specified limits of the RSE, the SR-wise reweighted is found to be within the limit for maximum number of states for most of the facilities. In fact, the currently used estimator (Ratio_est_state), the ratio of PPSWR estimates at the domain level, seems to perform the worse.

But, as can be seen from *Table 5.1.4,* the Ratio_est_state is the one least affected by bias. Of the 200 parameters considered for the study, in only two cases its relative bias exceeds

5%. This is but expected, as the sample size of a state, at which the ratio is calculated, is too large to produce any significant bias. What is important to note is that the SR-wise-reweighted estimator too is equally unaffected by bias as the Ratio_est_state. This suggests that the sample size allocated to a region (82 on an average) is sufficient to derive almost unbiased estimates of ratio means under the given design of the NSS.

The other two design-based estimators, viz. District-wise reweighted and SRS in SS1, are affected more severely by bias. The latter is expected to have high bias for using SRS estimator for the PPSWR-drawn sampled units of sub-stratum1. The District-wise reweighted estimator performs better that that currently-used Ratio_est_state in terms of RSEs, but tend to be badly affected by bias owing to the sample size of about 12, on the average, usually allocated to a stratum.

As for the model-based estimators, most of them are affected by very high order of bias and sampling error. A close look at the Box-plots of the Figure 5.1.1 clearly reveals that for about 50% of the parameters examined the RSE exceeds 10%. It also reveals that the level of bias all these estimators are subject to are also similarly high. While the design-based estimators, Ratio_est_state and SR-wise reweighted, are effected by little or no significant bias, the bias in model-based estimators are of very high order in a number of cases.

Table 5.1.4**: Number of estimated State-proportions with RB ≤ 5%, RB ≤ 7.5% and RB ≤ 10% using the 7 estimators by village facility**

Village Facility	All-India proportion parameter (R_d) (%)	Number of States by estimator						
		Ratio_est_state	SRS in SS1	District-wise reweighted	SR-wise reweighted	District Logistic	SR Logistic	State Logistic
State-level proportions with RB 5% or less								
Bus Stop	40.70	20	20	20	20	13	18	18
Navigable Waterways	6.14	19	19	19	19	5	8	12
Primary School	78.50	20	8	13	20	10	13	9
Secondary School	10.97	20	3	6	20	1	1	1
Senior Secondary School	3.00	20	6	3	19	1	0	0
Primary Health Centre	3.67	20	5	6	20	1	1	1
Regd. Medical Practitioner	8.18	19	4	7	19	1	1	1
Post Office	28.46	20	20	20	20	8	18	17
Commercial Bank	11.89	20	20	20	20	1	7	11
Power Supply	70.45	20	20	20	20	19	19	19
Sum	--	**198**	**125**	**134**	**197**	**60**	**86**	**89**

***Table 5.1.4*: Number of estimated State-proportions with RB ≤ 5%, RB ≤ 7.5% and RB ≤ 10% using the 7 estimators by village facility**

Village Facility	All-India proportion parameter (R_d) (%)	Number of States by estimator						
		Ratio_est_state	SRS in SS1	District-wise reweighted	SR-wise reweighted	District Logistic	SR Logistic	State Logistic
		State-level proportions with RB 7.5% or less						
Bus Stop	40.70	20	20	20	20	16	19	19
Navigable Waterways	6.14	19	19	19	19	5	10	14
Primary School	78.50	20	11	18	20	16	14	12
Secondary School	10.97	20	6	14	20	2	1	1
Senior Secondary School	3.00	20	9	11	20	1	1	1
Primary Health Centre	3.67	20	7	11	20	2	1	1
Regd. Medical Practitioner	8.18	19	7	13	19	2	1	1
Post Office	28.46	20	20	20	20	11	20	20
Commercial Bank	11.89	20	20	20	20	1	11	15
Power Supply	70.45	20	20	20	20	20	20	20
Sum	--	**198**	**139**	**166**	**198**	**82**	**98**	**104**
		State-level proportions with RB 10% or less						
Bus Stop	40.70	20	20	20	20	18	20	20
Navigable Waterways	6.14	19	19	19	19	5	12	15
Primary School	78.50	20	14	20	20	20	16	13
Secondary School	10.97	20	9	16	20	5	1	1
Senior Secondary School	3.00	20	9	15	20	3	1	1
Primary Health Centre	3.67	20	10	17	20	2	1	1
Regd. Medical Practitioner	8.18	19	9	16	19	3	1	1
Post Office	28.46	20	20	20	20	16	20	20
Commercial Bank	11.89	20	20	20	20	2	16	17
Power Supply	70.45	20	20	20	20	20	20	20
Sum	--	**198**	**150**	**183**	**198**	**94**	**108**	**109**

5.2. Results of application on NSS data

The estimates obtained by applying the design-based estimators A1 (using PPS estimators of number of villages at the domain level) and A2 (using PPS estimators of number of villages at the region level) on the NSS datasets of 69th, 71st and 72nd rounds and SRSWOR weights on the dataset of 70th round are presented in *Table 5.2.1* in Appendix-IV. Since, A2 is found to be most suitable in the context of estimating village characteristics, only this and the currently applied A1 are applied on the NSS datasets.

The findings from application of estimators A1 and A2 on the NSS datasets show little difference between the estimates in most cases. *Table 5.2.1* reveals that only in some cases, such as for within-village proportions for a number of facilities for Punjab, the difference between the values taken by the two estimators is as wide 20 percentage points. In fact, mostly the between-rounds differences of an estimator is much larger than the difference between the values taken by the two estimators. The findings emerging from the results of from the 1000 samples clearly suggest superiority of A2 to A1 in respect of RSEs. This is, however, not clearly demonstrated by their application on the NSS datasets.

Chapter 6 Conclusion

The results of applying the estimators on the experimental population are summarized in *Table 6.1*. It shows for each estimator, the number of states (out of 20) with the least RSE among the 7 estimators separately for the 10 selected village facilities. The sum of each row is 20 (the number of 'large' States), when the minimum RSE is unique for the facility. In some cases, where the minimum is not unique, the sum exceeds 20. The final conclusions emerging from the study are summarized below.

***Table 6.1*: Number of States (out of 20) with least RSEs of the 7 estimators by 10 village facilities**

Village Facility	All-India proportion (R_d) (%)	Number of States by estimator						
		Ratio_est_state	SRS in SS1	District-wise reweighted	SR-wise reweighted	District Logistic	SR Logistic	State Logistic
Bus Stop	40.70	0	1	0	11	0	3	7
Navigable Waterways	6.14	0	3	0	16	0	0	1
Primary School	78.50	0	2	0	6	4	7	2
Secondary School	10.97	0	0	0	19	1	0	0
Senior Secondary School	3.00	0	0	0	20	0	0	0
Primary Health Centre	3.67	0	0	0	20	0	0	0
Regd. Med. Practitioner	8.18	0	0	0	20	0	0	0
Post Office	28.46	0	0	0	17	0	1	3
Commercial Bank	11.89	0	0	0	20	0	0	0
Power Supply	70.45	0	5	0	1	1	1	13
Sum	**--**	**0**	**11**	**0**	**150**	**6**	**12**	**26**

A. *Evaluation based on estimation of bias and sampling error from a sample drawn from a model population*

<u>Bias</u>

- The estimators A1 and A2 are the least biased ones among the seven. A1 has RB between minus 4% and 3% in the vast majority of cases. A2 has RB under 5% in practically all cases.
- The model-based estimators are all subject to high order of bias, rising as parameter value falls. B1, for instance, has RB rising above 15% and going higher up as the parameter falls below 0.2.

- A4 (which uses SRS estimator for sub-stratum 1) has RB exceeding 10% in about 20% of the cases, the inverse association between the parameter and the RB being weaker for A4 than for the model-based estimators.

<u>Sampling error</u>

- The model-based estimators B1, B2 and B3 are found to have the least RSE in a good proportion of cases, but not when the parameter value is low. Their RSE tends to stay below 15% when the parameter exceeds 0.3, but is very high for lower values of the parameter.
- The RSEs of A1 and A3 fall with rise in the parameter and are brought down below 15% only when the parameter exceeds 0.35. But the RSE of A2 tends to stay under 15% even when the parameter value is low.
- The RSE of A2 was under 5% for 64 out of 200 parameters estimated (followed by 38 for B2), under 7.5% for 134 parameters (followed by 52 for B2), and under 10% for 177 (followed by 66 for A3).
- Out of 200 parameters estimated, A2 has the least RSE among all seven estimators in case of 150 parameters, followed by B3 (26 parameters) and then B2(12 parameters).
- All things considered, A2, the estimator using ratio-method reweighting at region level, appears to be most suitable.

B. *Evaluation based on time pattern followed by the estimators when applied to NSS data of different rounds*

The pattern of round-to-round changes displayed by the estimators A1 (estimator used at present) and A2 (the estimator found most suitable on the basis of the criteria of estimated RSE and estimated RB) do not provide evidence of greater stability of the A2 over A1. This cannot, in fact, be expected, given the level of sampling error they are subject to. Our findings relating to RSE of A2 quite certainly illustrate that it is not feasible to reliably assess the magnitude of very small year-to-year changes in the spread of facilities across a State's villages from the village-level data collected along with the normal household surveys of the NSS. Measuring small changes in a State's progress in this respect inevitably requires a larger sample size.

C. *Developing suitable model-based estimators*

Among the estimators examined in the study, the model-based estimators are found to have the least RSE in a good proportion of cases. But, needless to say, the model-based estimators explored in the study are not suitable for estimating village characteristics under the sample design generally used by the NSS. But, the common pattern followed by the RBs and RSEs of all the three estimator indicate a determining role of bias in the mean square error. Most importantly, the strong association between the RSE and population parameter point at the possibility of building appropriate models for estimation of village characteristics that could possibly be better than the design-based estimators.

Sum Up

Among the estimators examined in the project, A2, the estimator using ratio-method reweighting at region level, appears to be most suitable. But, even this estimator is not suitable for providing reliable estimates for the small states/ U.T.s. Further, with the currently-used sample size, it is not feasible to assess the magnitude of very small year-to-year changes even for the 'large' states.

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APPENDIX I: Relative Standard Errors (%) and Relative Bias (%)

***Table 5.1.1*: RSE (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Bus Stop								
Jammu & Kashmir (01)	58.18	9.79	7.73	8.30	6.79	6.63	6.43	5.99
Himachal Pradesh (02)	64.56	9.66	6.99	7.73	7.18	6.49	6.03	5.69
Punjab (03)	47.88	13.28	8.67	9.52	8.50	8.69	11.30	11.44
Uttaranchal (05)	45.17	17.80	11.71	12.54	11.96	12.25	10.45	10.45
Haryana (06)	37.85	16.63	12.39	13.40	9.80	12.32	13.15	13.33
Rajasthan (08)	41.23	12.96	8.09	9.08	7.06	8.12	7.32	7.14
Uttar Pradesh (09)	22.30	14.74	8.75	9.67	6.35	12.87	7.85	7.65
Bihar (10)	23.87	17.79	11.69	12.70	8.21	17.34	10.17	9.90
Assam (18)	39.55	12.72	9.48	10.34	7.29	9.72	8.97	8.79
West Bengal (19)	30.53	16.04	13.12	14.27	8.38	12.58	10.51	8.68
Jharkhand (20)	18.70	27.50	19.47	21.81	11.34	27.25	17.56	17.36
Orissa (21)	27.21	17.55	11.77	13.04	8.39	13.63	10.42	10.34
Chhattisgarh (22)	17.92	23.52	18.99	20.74	9.56	22.94	18.47	17.75
Madhya Pradesh (23)	33.44	13.70	7.87	8.83	6.41	10.69	8.48	9.26
Gujrat (24)	81.26	5.16	4.07	4.49	4.43	4.97	3.81	3.63
Maharashtra (27)	74.18	4.88	3.54	3.83	3.75	4.04	3.24	2.94
Andhra Pradesh (28)	74.46	5.47	3.82	4.25	4.24	4.92	3.04	3.08
Karnataka (29)	78.28	6.76	4.87	5.33	5.43	6.20	4.52	4.05
Kerala (32)	94.57	1.79	1.53	1.55	1.72	1.68	1.36	1.36
Tamil Nadu (33)	54.38	6.01	3.09	3.36	3.44	3.76	3.50	4.04
Navigable Waterways								
Jammu & Kashmir (01)	13.07	28.06	21.45	23.88	9.45	25.26	22.03	17.99
Himachal Pradesh (02)	10.82	36.42	26.43	28.77	11.11	31.04	27.70	27.61
Punjab (03)	4.94	51.18	39.48	43.65	11.16	57.78	42.49	36.65
Uttaranchal (05)	5.20	77.03	51.41	58.58	17.56	84.91	48.38	48.38
Haryana (06)	3.27	74.71	44.61	52.34	12.76	63.26	54.99	55.08
Rajasthan (08)	4.99	44.33	33.26	37.47	9.20	55.05	37.17	28.70
Uttar Pradesh (09)	12.41	24.63	12.57	13.88	7.22	23.43	11.27	10.82
Bihar (10)	17.58	24.38	14.09	15.45	9.24	23.22	12.18	11.87
Assam (18)	6.39	40.41	29.42	32.47	9.38	49.05	33.94	26.86
West Bengal (19)	10.88	25.88	22.33	23.52	8.17	28.22	22.13	22.47
Jharkhand (20)	9.57	40.91	28.60	31.66	11.89	44.88	26.40	25.34
Orissa (21)	17.43	20.33	12.02	13.41	7.79	18.92	11.19	10.55
Chhattisgarh (22)	91.29	3.50	2.21	2.37	2.92	2.90	2.46	2.20
Madhya Pradesh (23)	98.43	1.12	0.82	0.91	1.05	1.34	1.55	0.90
Gujrat (24)	66.76	5.16	2.22	2.43	3.56	2.81	5.03	5.11
Maharashtra (27)	6.40	37.41	21.93	23.45	7.46	33.90	22.67	18.57
Andhra Pradesh (28)	6.25	39.77	31.64	34.55	9.31	49.77	22.99	23.34
Karnataka (29)	30.10	19.77	12.62	14.11	9.57	14.33	12.24	11.00
Kerala (32)	37.37	4.94	2.41	2.58	2.81	2.59	3.13	3.54

Table 5.1.1: **RSE (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Tamil Nadu (33)	16.79	137.01	136.13	136.17	55.87	138.41	127.21	128.37
Primary School								
Jammu & Kashmir (01)	87.68	7.56	5.85	5.40	5.76	4.57	4.86	8.59
Himachal Pradesh (02)	52.75	12.62	12.54	11.17	8.59	11.90	15.64	17.65
Punjab (03)	91.45	9.72	7.61	6.19	7.94	7.35	5.68	5.38
Uttaranchal (05)	60.21	15.95	20.06	14.45	12.38	14.13	34.39	34.39
Haryana (06)	92.63	7.93	5.22	4.70	6.70	4.60	4.44	4.54
Rajasthan (08)	85.70	8.42	10.12	6.80	6.19	7.66	6.00	8.00
Uttar Pradesh (09)	68.51	7.07	12.35	7.06	4.88	6.59	10.45	12.12
Bihar (10)	72.57	9.25	14.26	8.60	7.17	7.73	13.41	14.66
Assam (18)	84.71	6.12	4.95	4.60	4.97	4.03	4.96	6.93
West Bengal (19)	74.54	8.45	8.38	7.33	6.60	6.33	8.91	12.15
Jharkhand (20)	55.42	12.89	19.97	13.03	9.04	12.42	21.83	22.91
Orissa (21)	71.21	8.85	15.80	9.14	6.88	7.92	9.89	11.55
Chhattisgarh (22)	91.54	7.11	6.25	5.03	5.94	5.63	4.47	4.46
Madhya Pradesh (23)	85.82	7.75	10.68	7.04	5.64	8.26	4.65	5.28
Gujrat (24)	97.79	3.82	1.89	2.06	2.91	1.89	1.92	2.25
Maharashtra (27)	95.26	5.62	3.58	3.00	3.78	3.26	2.72	2.93
Andhra Pradesh (28)	93.86	6.52	4.43	4.13	4.95	3.96	3.89	4.20
Karnataka (29)	84.57	9.45	9.14	6.96	7.09	6.70	5.77	6.71
Kerala (32)	98.46	2.13	1.04	1.34	2.01	1.07	1.23	1.21
Tamil Nadu (33)	90.11	5.54	4.95	3.91	4.34	3.67	3.35	4.09
Secondary School								
Jammu & Kashmir (01))	14.55	15.95	18.46	16.46	6.02	27.19	35.03	39.58
Himachal Pradesh (02)	8.95	23.79	22.84	22.04	6.90	36.62	53.28	56.58
Punjab (03)	18.82	16.78	20.08	16.76	6.91	17.45	24.74	28.57
Uttaranchal (05)	5.58	41.12	44.25	40.92	9.71	66.27	126.06	126.06
Haryana (06)	34.37	14.19	20.51	13.67	7.86	11.77	16.89	17.26
Rajasthan (08)	8.98	16.24	24.18	18.19	4.57	19.61	28.26	31.80
Uttar Pradesh (09)	3.97	16.96	24.73	19.31	3.32	45.05	52.20	71.55
Bihar (10)	5.31	25.07	27.32	23.60	5.64	45.76	66.51	63.64
Assam (18)	14.41	17.70	19.52	17.60	6.54	27.69	30.85	31.89
West Bengal (19)	9.57	16.59	16.90	16.33	4.98	31.76	37.49	61.97
Jharkhand (20)	2.06	44.44	45.57	45.13	6.43	68.35	105.06	108.63
Orissa (21)	13.45	13.38	14.58	14.16	4.72	17.59	25.54	28.06
Chhattisgarh (22)	7.28	21.74	30.23	23.09	5.83	26.56	33.83	34.55
Madhya Pradesh (23)	6.35	25.33	52.36	24.85	4.77	20.57	25.19	27.53
Gujrat (24)	20.82	14.29	21.23	15.10	6.29	13.97	17.82	19.04
Maharashtra (27)	21.83	9.16	9.46	8.75	3.77	12.02	18.85	21.53
Andhra Pradesh (28)	21.13	10.86	9.49	9.71	4.28	14.09	17.99	22.05
Karnataka (29)	16.10	17.41	30.74	20.28	6.70	19.72	26.44	28.46
Kerala (32)	78.85	4.75	3.88	3.77	4.03	3.19	3.63	3.61

Table 5.1.1: **RSE (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Tamil Nadu (33)	18.67	11.81	13.81	12.12	4.95	17.95	19.69	23.07
Senior Secondary	**School**							
Jammu & Kashmir (01)	1.72	39.25	43.63	41.09	5.23	78.29	85.33	95.19
Himachal Pradesh (02)	3.03	38.38	38.05	37.63	6.62	64.67	77.48	82.53
Punjab (03)	6.30	25.38	29.18	27.04	6.26	36.15	40.98	43.38
Uttaranchal (05)	3.38	54.00	61.42	56.32	9.92	97.98	144.66	144.64
Haryana (06)	13.97	21.54	21.38	19.15	7.66	20.81	25.85	25.88
Rajasthan (08)	2.44	24.42	35.90	27.58	3.83	32.97	42.20	48.75
Uttar Pradesh (09)	2.48	24.48	27.92	23.18	3.76	51.40	53.67	80.72
Bihar (10)	0.68	66.64	69.78	66.17	5.60	136.94	119.56	111.44
Assam (18)	1.45	44.68	48.34	46.77	5.45	90.68	90.15	91.63
West Bengal (19)	2.50	25.79	26.45	25.93	4.03	62.07	70.96	123.63
Jharkhand (20)	0.37	120.06	125.99	126.35	7.36	214.16	225.99	197.11
Orissa (21)	1.66	30.15	32.70	32.18	3.90	58.98	78.27	88.93
Chhattisgarh (22)	4.05	26.67	38.29	28.49	5.38	34.07	39.47	40.32
Madhya Pradesh (23)	3.21	44.54	68.37	31.46	4.96	29.85	36.20	40.87
Gujrat (24)	4.92	29.50	30.47	27.12	6.22	33.40	37.86	39.97
Maharashtra (27)	4.69	14.45	14.77	15.10	3.05	28.60	46.74	58.15
Andhra Pradesh (28)	2.63	24.95	17.40	20.42	3.63	35.25	45.52	48.76
Karnataka (29)	3.68	28.67	47.28	33.37	5.51	43.05	50.56	55.51
Kerala (32)	32.53	8.22	8.30	7.84	4.63	7.72	9.01	9.50
Tamil Nadu (33)	7.86	17.57	19.45	18.27	4.93	28.60	30.69	38.88
Primary Health Centre								
Jammu & Kashmir (01)	5.12	29.06	27.16	27.43	6.37	47.06	49.85	50.75
Himachal Pradesh (02)	1.71	52.24	49.11	51.43	6.88	93.23	115.89	117.59
Punjab (03)	5.13	29.91	35.96	31.23	6.75	46.51	53.78	59.22
Uttaranchal (05)	1.16	84.17	92.31	84.71	9.07	151.48	252.52	252.52
Haryana (06)	6.11	28.13	30.27	28.30	6.81	35.79	35.91	39.04
Rajasthan (08)	3.81	25.14	32.60	26.49	4.80	41.70	58.19	67.28
Uttar Pradesh (09)	1.94	24.25	29.86	24.82	3.30	54.90	59.76	92.75
Bihar (10)	3.06	28.88	32.15	30.08	5.01	59.82	60.47	64.08
Assam (18)	2.56	42.67	43.04	42.29	6.80	80.93	61.74	61.09
West Bengal (19)	2.97	28.09	28.35	28.21	4.83	65.61	71.63	116.22
Jharkhand (20)	1.59	55.27	62.82	58.25	7.02	106.77	100.28	109.36
Orissa (21)	2.67	26.42	29.12	28.29	4.30	67.47	84.66	87.64
Chhattisgarh (22)	2.55	34.97	59.35	39.64	5.69	48.08	54.70	54.27
Madhya Pradesh (23)	2.33	26.54	77.02	35.57	4.15	39.26	43.14	55.46
Gujrat (24)	6.15	46.24	29.84	25.74	6.83	38.93	47.02	50.13
Maharashtra (27)	4.25	17.01	16.88	17.20	3.42	45.06	70.85	81.17
Andhra Pradesh (28)	7.13	21.13	25.78	23.58	5.61	75.56	67.75	72.36
Karnataka (29)	8.11	40.29	32.17	28.60	9.92	28.87	25.28	27.42
Kerala (32)	60.43	5.44	4.88	4.69	4.10	4.45	5.42	5.39

***Table 5.1.1*: RSE (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Tamil Nadu (33)	10.56	16.50	17.54	16.28	5.25	26.33	30.48	36.58
Regd. Med. Practitioner								
Jammu & Kashmir (01)	3.60	37.91	35.12	35.62	7.05	54.19	60.64	61.92
Himachal Pradesh (02)	4.78	32.30	33.08	32.36	7.03	51.82	76.49	80.94
Punjab (03)	35.88	13.96	16.41	13.26	7.86	12.48	15.96	21.73
Uttaranchal (05)	3.00	44.18	55.46	45.86	7.65	86.18	207.50	207.50
Haryana (06)	29.02	15.67	18.81	14.68	8.07	16.04	26.94	28.74
Rajasthan (08)	5.22	32.39	43.78	33.00	6.85	43.58	36.64	36.31
Uttar Pradesh (09)	6.58	14.84	21.62	16.57	3.73	34.16	36.59	41.23
Bihar (10)	4.96	26.67	27.00	24.84	5.88	50.27	52.83	57.09
Assam (18)	0.06	198.84	246.75	216.77	4.83	396.57	392.82	411.07
West Bengal (19)	12.19	16.21	16.78	16.01	5.56	31.77	33.36	46.97
Jharkhand (20)	1.71	53.43	58.90	55.29	7.06	97.44	109.72	112.48
Orissa (21)	0.61	52.87	57.37	57.42	4.20	101.06	113.30	112.89
Chhattisgarh (22)	6.16	25.90	29.88	26.35	6.35	33.79	42.95	46.63
Madhya Pradesh (23)	5.88	20.10	47.44	25.48	4.84	33.32	44.63	48.59
Gujrat (24)	17.78	16.23	20.08	16.55	6.61	18.28	25.35	26.98
Maharashtra (27)	12.27	13.27	13.52	13.02	4.40	24.47	43.62	50.67
Andhra Pradesh (28)	28.21	10.41	11.02	9.31	4.66	20.52	28.40	38.22
Karnataka (29)	11.11	18.46	24.54	17.61	5.84	19.83	27.98	42.50
Kerala (32)	61.97	5.51	4.93	4.87	4.21	4.59	4.81	4.82
Tamil Nadu (33)	3.39	23.69	24.32	23.54	4.40	40.73	52.08	65.25
Post Office								
Jammu & Kashmir (01)	29.67	17.13	13.22	14.32	8.50	12.09	11.49	10.35
Himachal Pradesh (02)	28.25	21.44	15.65	17.35	10.62	14.55	13.09	13.15
Punjab (03)	24.31	23.23	15.99	17.20	10.57	18.05	16.24	16.16
Uttaranchal (05)	27.62	27.85	18.68	20.83	14.64	21.74	16.79	16.79
Haryana (06)	24.15	23.82	17.05	18.55	11.06	20.68	15.59	15.48
Rajasthan (08)	26.09	18.07	11.67	12.93	7.82	14.05	10.14	9.99
Uttar Pradesh (09)	23.92	14.39	8.32	9.13	6.12	12.08	7.44	7.16
Bihar (10)	28.76	16.64	10.51	11.54	8.33	13.02	9.35	9.41
Assam (18)	21.30	19.89	14.80	16.04	8.47	17.30	13.74	12.85
West Bengal (19)	23.92	19.39	15.82	17.51	9.02	14.64	12.09	9.84
Jharkhand (20)	18.83	28.92	20.24	22.29	11.58	26.61	17.36	16.96
Orissa (21)	22.30	18.72	13.02	14.29	8.05	17.24	11.70	11.28
Chhattisgarh (22)	15.94	27.64	20.91	23.56	10.51	27.69	21.02	19.55
Madhya Pradesh (23)	25.71	16.37	10.53	11.82	7.14	15.21	10.44	11.00
Gujrat (24)	46.93	11.49	8.51	9.43	7.13	8.47	8.50	8.22
Maharashtra (27)	36.58	11.37	7.59	8.34	5.85	7.60	6.43	6.17
Andhra Pradesh (28)	50.32	10.68	7.29	8.40	6.76	7.01	6.09	5.72
Karnataka (29)	46.98	13.56	8.88	9.83	8.01	9.43	7.87	7.51
Kerala (32)	72.91	4.13	3.61	3.71	3.46	3.50	3.43	3.43
Tamil Nadu (33)	42.09	8.66	5.68	6.18	4.89	5.72	5.15	4.98

***Table 5.1.1*: RSE (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Commercial Bank								
Jammu & Kashmir (01)	14.23	26.05	20.11	22.26	9.14	24.14	20.60	17.87
Himachal Pradesh (02)	15.13	34.16	23.26	26.24	12.03	24.76	22.15	22.09
Punjab (03)	9.95	42.73	26.97	29.80	12.12	39.36	27.57	26.93
Uttaranchal (05)	10.08	51.40	35.56	40.61	16.32	54.08	31.74	31.74
Haryana (06)	8.02	45.08	31.34	35.33	12.31	43.18	30.14	30.28
Rajasthan (08)	8.58	35.99	24.44	27.64	9.10	43.65	23.77	20.73
Uttar Pradesh (09)	13.79	18.73	11.85	13.24	6.40	22.46	10.48	10.09
Bihar (10)	16.17	23.46	15.48	17.05	8.92	24.95	13.14	12.97
Assam (18)	8.31	33.25	24.88	27.05	8.83	40.36	27.48	23.71
West Bengal (19)	12.82	25.27	21.41	22.86	8.64	25.32	19.85	20.03
Jharkhand (20)	11.87	36.03	26.45	28.83	11.79	40.92	24.33	23.16
Orissa (21)	9.47	29.08	21.11	23.43	8.55	37.02	19.48	18.33
Chhattisgarh (22)	4.62	49.07	39.76	44.12	10.16	61.05	54.34	41.46
Madhya Pradesh (23)	9.33	29.75	20.04	23.14	8.22	38.00	22.24	18.72
Gujrat (24)	12.10	28.52	22.08	24.17	9.30	31.89	22.24	20.66
Maharashtra (27)	11.93	24.01	16.33	17.27	6.93	23.28	14.47	13.52
Andhra Pradesh (28)	17.05	21.80	15.12	17.43	8.17	17.21	11.77	10.79
Karnataka (29)	18.97	26.11	18.60	20.18	10.28	27.21	18.44	16.74
Kerala (32)	14.02	17.58	14.40	14.76	6.23	14.78	13.53	13.50
Tamil Nadu (33)	8.99	25.38	20.33	22.06	7.23	25.95	18.64	17.52
Power Supply								
Jammu & Kashmir (01)	87.86	3.99	3.01	3.37	3.47	3.68	3.14	2.64
Himachal Pradesh (02)	89.26	4.39	3.16	3.46	3.85	3.70	3.41	3.37
Punjab (03)	84.64	5.17	3.75	4.16	4.56	4.16	3.38	3.25
Uttaranchal (05)	82.50	8.03	5.54	6.08	7.30	6.88	4.12	4.12
Haryana (06)	76.55	6.95	4.65	5.08	5.72	5.43	5.06	4.63
Rajasthan (08)	78.19	5.50	3.72	4.16	4.28	4.91	3.35	3.20
Uttar Pradesh (09)	62.25	6.32	3.44	3.78	4.33	3.66	3.12	3.03
Bihar (10)	36.04	13.56	8.84	9.65	7.62	9.72	7.55	7.48
Assam (18)	65.71	7.23	5.36	5.80	5.32	5.87	4.71	4.62
West Bengal (19)	50.75	10.35	8.16	8.93	6.86	6.74	6.92	8.26
Jharkhand (20)	26.19	21.45	13.77	15.35	10.38	16.93	13.30	12.78
Orissa (21)	62.09	8.25	5.49	6.14	5.91	5.57	4.53	4.45
Chhattisgarh (22)	88.09	4.37	3.36	3.69	3.82	4.54	3.28	3.19
Madhya Pradesh (23)	89.66	3.14	2.11	2.36	2.68	3.66	2.55	2.15
Gujrat (24)	93.91	2.63	2.01	2.21	2.43	2.91	2.25	2.02
Maharashtra (27)	93.07	2.58	1.54	1.65	1.99	2.21	1.49	1.28
Andhra Pradesh (28)	94.73	2.30	1.74	1.96	2.08	2.95	1.38	1.24
Karnataka (29)	91.45	4.23	2.70	3.08	3.53	4.64	2.86	2.31
Kerala (32)	96.18	1.18	1.05	1.10	1.15	1.16	1.12	1.09
Tamil Nadu (33)	57.69	5.66	2.52	2.82	3.24	3.39	3.50	3.66

APPENDIX I: Relative Standard Errors (%) and Relative Bias (%)

***Table 5.1.2*: RB (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
			Bus Stop					
Jammu & Kashmir (01)	58.18	0.35	0.88	0.46	0.31	0.11	0.61	0.44
Himachal Pradesh (02)	64.56	0.05	-0.04	0.14	0.06	-1.72	-1.72	-0.83
Punjab (03)	47.88	0.45	-0.03	-0.03	0.23	0.04	8.03	8.52
Uttaranchal (05)	45.17	0.75	-1.35	-0.37	0.75	1.88	5.41	5.41
Haryana (06)	37.85	0.31	-0.76	-0.33	0.31	0.64	-6.52	-7.44
Rajasthan (08)	41.23	-0.29	-0.34	-0.31	-0.53	0.78	0.45	-0.01
Uttar Pradesh (09)	22.30	-0.61	-0.29	-0.48	-0.52	9.37	-0.41	0.38
Bihar (10)	23.87	-0.79	0.22	-0.08	-0.60	12.13	0.43	0.29
Assam (18)	39.55	0.84	1.25	0.84	0.83	3.34	3.37	3.92
West Bengal (19)	30.53	0.38	0.71	0.73	0.59	5.50	2.16	2.43
Jharkhand (20)	18.70	1.08	0.88	0.76	1.13	16.70	4.69	4.39
Orissa (21)	27.21	-0.18	-0.65	-0.40	-0.21	7.00	1.44	1.66
Chhattisgarh (22)	17.92	-0.83	-1.67	-1.07	-0.96	9.40	1.98	0.12
Madhya Pradesh (23)	33.44	-0.83	-0.18	-0.08	-0.80	5.48	-3.23	-5.23
Gujrat (24)	81.26	0.12	-0.09	0.03	0.11	-2.48	-0.25	0.41
Maharashtra (27)	74.18	0.06	0.08	-0.05	-0.03	-2.20	-1.14	-0.60
Andhra Pradesh (28)	74.46	0.17	-0.29	-0.06	0.10	-3.60	-1.04	-1.55
Karnataka (29)	78.28	0.03	0.46	0.08	0.01	-3.04	-0.85	-0.45
Kerala (32)	94.57	0.04	-0.04	0.07	0.04	-0.63	0.00	0.08
Tamil Nadu (33)	54.38	-0.15	0.05	-0.02	-0.18	-1.79	1.61	2.57
Navigable Waterways								
Jammu & Kashmir (01)	13.07	0.27	0.51	0.27	0.39	12.37	8.17	4.58
Himachal Pradesh (02)	10.82	0.93	0.62	0.99	0.91	14.66	16.12	16.36
Punjab (03)	4.94	-1.44	-1.98	-1.81	-1.44	26.44	10.88	8.62
Uttaranchal (05)	5.20	-2.63	-3.89	-2.03	-2.63	41.02	11.91	11.91
Haryana (06)	3.27	0.57	-6.91	-2.43	0.00	19.31	24.17	24.17
Rajasthan (08)	4.99	-0.02	-0.49	0.34	0.57	33.35	11.94	-4.41
Uttar Pradesh (09)	12.41	-0.40	-1.01	-0.80	-0.62	18.67	1.97	1.66
Bihar (10)	17.58	0.78	0.34	0.34	0.69	17.04	-1.18	-1.96
Assam (18)	6.39	2.83	1.26	2.26	2.89	32.10	16.84	6.12
West Bengal (19)	10.88	-0.01	0.49	0.24	0.16	17.82	10.12	14.24
Jharkhand (20)	9.57	0.62	0.54	0.21	0.51	27.01	7.43	5.93
Orissa (21)	17.43	0.54	0.15	0.53	0.35	12.22	3.13	1.49
Chhattisgarh (22)	91.29	-0.14	-0.32	-0.14	-0.07	-1.01	-0.27	-0.18
Madhya Pradesh (23)	98.43	0.07	0.05	0.06	0.06	-0.56	-0.75	-0.21
Gujrat (24)	66.76	0.06	0.10	0.08	0.07	1.02	4.14	4.37
Maharashtra (27)	6.40	1.22	-0.97	-0.41	0.60	22.87	8.42	-0.29
Andhra Pradesh (28)	6.25	0.89	2.74	1.89	0.97	34.11	-0.17	-13.77
Karnataka (29)	30.10	-0.27	-2.23	-1.26	0.08	3.86	5.31	4.84
Kerala (32)	37.37	-0.17	0.05	0.02	-0.15	0.54	0.68	1.60
Tamil Nadu (33)	16.79	85.11	84.71	84.77	84.57	88.10	75.89	77.20

Table 5.1.2: **RB (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
				Primary School				
Jammu & Kashmir (01)	87.68	0.22	4.81	2.03	0.92	2.28	2.79	7.82
Himachal Pradesh (02)	52.75	1.31	8.79	4.71	1.98	8.25	12.95	15.42
Punjab (03)	91.45	0.73	7.44	4.33	1.35	7.09	3.61	2.15
Uttaranchal (05)	60.21	1.19	17.64	8.25	1.19	9.83	32.84	32.84
Haryana (06)	92.63	0.85	4.81	3.03	1.13	3.69	2.54	2.85
Rajasthan (08)	85.70	1.07	9.83	5.39	2.46	6.92	4.52	6.68
Uttar Pradesh (09)	68.51	0.63	11.96	5.97	1.32	5.79	9.84	11.58
Bihar (10)	72.57	0.52	13.74	6.74	1.06	6.24	12.58	13.92
Assam (18)	84.71	0.37	3.64	1.93	0.82	1.52	3.57	5.76
West Bengal (19)	74.54	1.28	6.45	3.19	1.95	3.60	7.31	11.04
Jharkhand (20)	55.42	1.73	18.17	8.52	2.45	9.00	19.98	21.08
Orissa (21)	71.21	0.96	15.22	6.89	1.77	5.92	8.08	10.10
Chhattisgarh (22)	91.54	0.36	5.95	2.99	0.97	4.91	1.81	1.21
Madhya Pradesh (23)	85.82	1.07	10.50	6.11	2.50	7.75	2.23	2.82
Gujrat (24)	97.79	0.36	1.75	1.22	0.67	1.61	1.20	0.76
Maharashtra (27)	95.26	0.20	3.46	2.17	0.95	2.99	1.82	1.91
Andhra Pradesh (28)	93.86	0.27	3.98	2.06	0.96	2.56	1.64	2.22
Karnataka (29)	84.57	1.20	8.62	4.99	2.47	5.15	3.33	5.35
Kerala (32)	98.46	0.01	0.67	0.29	0.03	0.55	0.11	0.13
Tamil Nadu (33)	90.11	0.11	4.46	1.99	0.62	2.43	1.69	3.04
Secondary School								
Jammu & Kashmir (01))	14.55	0.23	9.68	5.40	2.11	22.51	31.09	35.93
Himachal Pradesh (02)	8.95	0.84	5.55	4.59	1.52	27.14	46.28	49.79
Punjab (03)	18.82	0.45	13.44	7.37	1.22	10.02	19.25	23.08
Uttaranchal (05)	5.58	-1.08	14.92	7.46	-1.08	41.89	113.86	113.86
Haryana (06)	34.37	0.98	16.94	7.11	1.45	5.50	12.95	13.44
Rajasthan (08)	8.98	1.29	18.37	10.73	3.28	13.27	23.81	27.46
Uttar Pradesh (09)	3.97	0.21	16.10	8.75	1.12	39.04	48.09	65.29
Bihar (10)	5.31	1.30	14.53	10.17	1.86	37.83	61.46	58.93
Assam (18)	14.41	0.60	10.50	5.78	1.80	21.88	26.56	27.66
West Bengal (19)	9.57	0.70	3.18	3.12	1.41	26.20	33.20	58.31
Jharkhand (20)	2.06	0.92	7.00	7.85	1.78	35.62	85.53	89.47
Orissa (21)	13.45	0.70	8.15	7.21	1.66	13.17	22.45	25.09
Chhattisgarh (22)	7.28	0.11	14.95	5.80	1.12	12.47	23.63	24.50
Madhya Pradesh (23)	6.35	1.06	46.16	15.62	3.18	7.73	18.70	21.49
Gujrat (24)	20.82	0.51	16.60	7.29	1.94	7.51	13.50	14.90
Maharashtra (27)	21.83	0.30	5.75	4.39	1.30	9.50	16.62	19.26
Andhra Pradesh (28)	21.13	0.20	4.40	4.63	1.58	11.61	15.78	20.21
Karnataka (29)	16.10	1.90	25.11	11.82	3.75	11.01	21.46	24.12
Kerala (32)	78.85	0.01	2.12	0.70	0.09	0.77	2.08	2.04
Tamil Nadu (33)	18.67	0.49	7.85	4.87	1.42	13.90	16.41	20.12

***Table 5.1.2*: RB (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Senior Secondary	**School**							
Jammu & Kashmir (01)	1.72	-1.80	4.32	3.03	-0.21	52.47	66.49	79.11
Himachal Pradesh (02)	3.03	1.64	4.88	5.21	2.16	43.03	62.73	68.41
Punjab (03)	6.30	1.08	12.55	8.54	1.87	22.34	29.99	32.20
Uttaranchal (05)	3.38	0.95	19.03	10.09	0.95	59.85	125.12	124.91
Haryana (06)	13.97	1.11	10.72	6.36	1.55	9.93	18.51	18.53
Rajasthan (08)	2.44	0.56	20.30	10.49	2.79	13.97	31.64	38.63
Uttar Pradesh (09)	2.48	-0.28	15.06	7.63	0.52	41.38	47.61	71.07
Bihar (10)	0.68	1.30	12.66	9.81	2.18	84.01	90.87	82.12
Assam (18)	1.45	-0.77	5.27	5.02	0.43	56.05	67.55	70.43
West Bengal (19)	2.50	-0.25	0.44	1.96	0.41	49.15	61.10	116.29
Jharkhand (20)	0.37	4.55	10.53	11.96	5.82	69.44	124.07	120.13
Orissa (21)	1.66	0.99	5.69	7.81	2.01	40.68	67.27	77.48
Chhattisgarh (22)	4.05	0.22	16.15	5.95	1.15	12.39	24.66	25.54
Madhya Pradesh (23)	3.21	2.15	57.42	16.79	3.77	9.05	26.42	32.05
Gujrat (24)	4.92	0.16	12.85	5.93	0.96	16.57	26.15	28.79
Maharashtra (27)	4.69	0.33	2.96	5.05	1.48	22.83	42.73	54.13
Andhra Pradesh (28)	2.63	1.09	1.97	5.73	2.52	27.18	38.93	42.24
Karnataka (29)	3.68	1.36	29.40	12.52	3.46	21.15	38.81	45.09
Kerala (32)	32.53	0.14	2.67	0.95	0.23	2.53	5.20	5.33
Tamil Nadu (33)	7.86	0.45	6.75	5.02	1.49	21.32	25.11	33.87
Primary Health Centre								
Jammu & Kashmir (01)	5.12	-1.57	3.80	2.21	-0.44	35.11	40.23	42.39
Himachal Pradesh (02)	1.71	0.74	4.15	5.59	1.60	60.97	93.51	95.48
Punjab (03)	5.13	0.13	13.66	6.45	0.83	29.08	38.72	45.86
Uttaranchal (05)	1.16	2.20	17.47	10.63	2.20	75.48	209.34	209.34
Haryana (06)	6.11	0.43	8.63	6.07	0.89	17.72	23.91	27.61
Rajasthan (08)	3.81	1.48	18.43	10.28	3.47	29.24	50.36	59.81
Uttar Pradesh (09)	1.94	-0.49	15.45	7.74	0.41	43.29	52.83	81.51
Bihar (10)	3.06	-0.55	10.84	8.02	0.04	46.81	51.30	55.27
Assam (18)	2.56	1.34	8.49	6.29	2.41	55.40	42.72	44.05
West Bengal (19)	2.97	1.27	2.87	3.63	2.19	52.59	61.58	109.05
Jharkhand (20)	1.59	1.39	11.72	9.39	2.36	63.03	76.62	86.32
Orissa (21)	2.67	0.95	6.46	8.16	1.95	54.86	76.32	79.40
Chhattisgarh (22)	2.55	0.73	27.04	9.06	2.39	17.27	34.09	34.48
Madhya Pradesh (23)	2.33	1.21	62.74	17.82	3.67	13.53	31.17	44.69
Gujrat (24)	6.15	2.25	14.88	7.83	2.95	27.06	38.84	42.32
Maharashtra (27)	4.25	0.27	2.71	4.08	1.25	39.57	66.67	77.23
Andhra Pradesh (28)	7.13	-0.41	8.87	5.53	1.10	70.55	64.84	69.74
Karnataka (29)	8.11	-1.94	15.15	4.47	-0.82	7.20	12.61	17.28
Kerala (32)	60.43	0.03	2.14	0.67	0.10	1.70	3.51	3.45
Tamil Nadu (33)	10.56	0.69	7.21	4.42	1.52	20.49	26.20	32.82

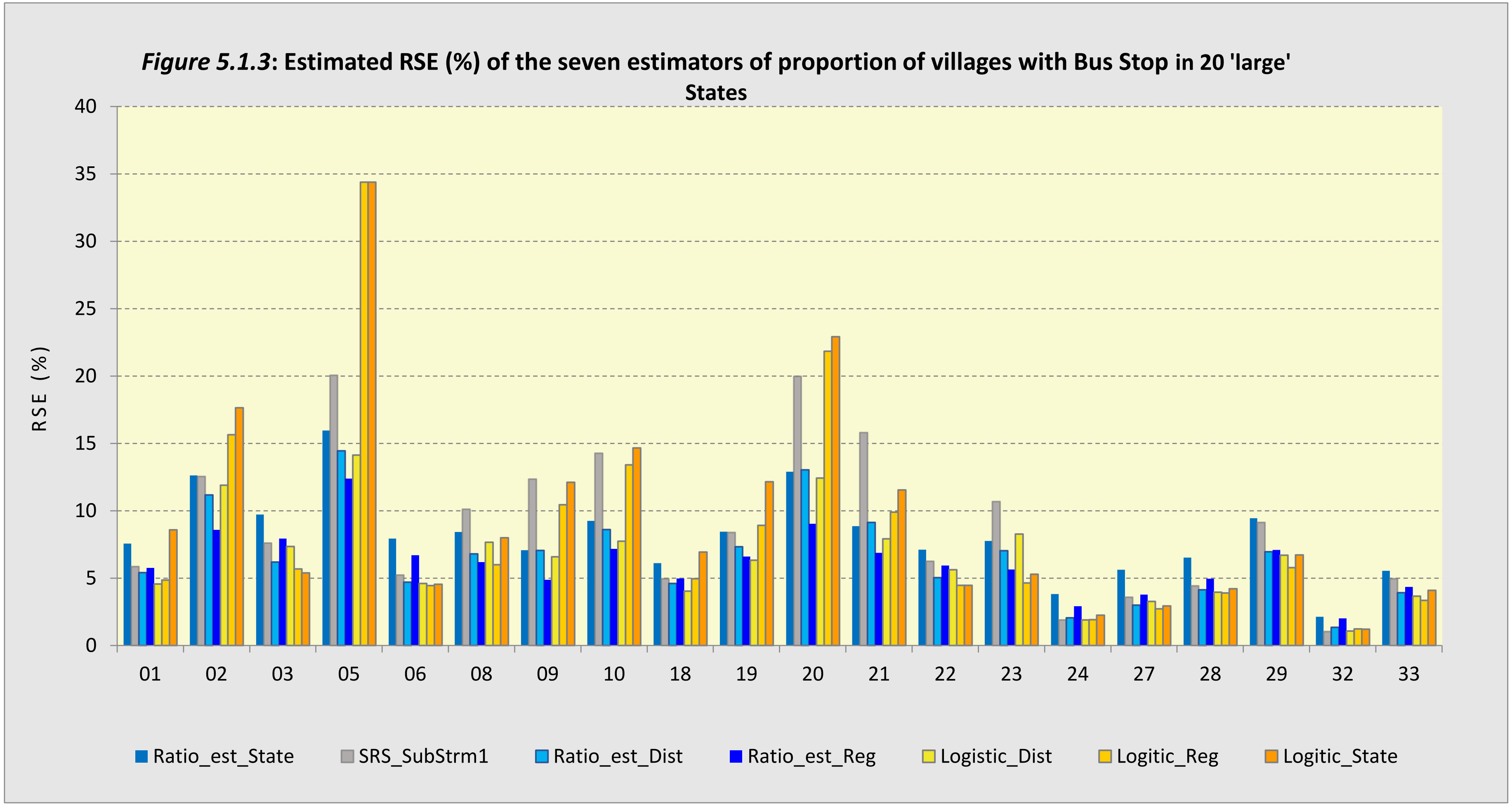
***Table 5.1.2*: RB (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
				Regd.Med.Practitioner				
Jammu & Kashmir (01)	3.60	-0.58	2.46	1.90	0.21	35.33	46.89	49.69
Himachal Pradesh (02)	4.78	0.04	4.39	3.63	0.76	36.77	66.81	71.24
Punjab (03)	35.88	0.53	12.83	6.38	1.21	7.21	12.33	18.81
Uttaranchal (05)	3.00	0.05	21.71	9.26	0.05	56.31	185.03	185.03
Haryana (06)	29.02	0.94	13.28	6.15	1.40	9.13	23.45	25.55
Rajasthan (08)	5.22	0.93	30.95	14.21	3.28	31.22	27.65	27.74
Uttar Pradesh (09)	6.58	1.03	15.69	8.91	2.05	30.16	33.40	38.21
Bihar (10)	4.96	0.21	11.76	7.44	0.78	41.38	46.46	51.07
Assam (18)	0.06	11.75	24.92	18.03	13.45	82.47	129.12	165.50
West Bengal (19)	12.19	-0.23	3.29	1.87	0.47	26.20	28.73	44.34
Jharkhand (20)	1.71	0.56	9.07	6.58	1.34	55.83	84.36	87.09
Orissa (21)	0.61	1.99	6.65	10.24	3.27	54.70	81.45	82.86
Chhattisgarh (22)	6.16	0.32	10.88	4.73	0.50	19.29	32.42	36.86
Madhya Pradesh (23)	5.88	1.01	40.79	14.10	3.35	22.20	38.13	42.43
Gujrat (24)	17.78	0.52	13.27	6.40	1.79	10.94	20.19	22.14
Maharashtra (27)	12.27	0.70	5.97	4.32	1.51	21.02	41.62	48.87
Andhra Pradesh (28)	28.21	0.23	7.72	4.21	1.46	18.87	27.21	37.23
Karnataka (29)	11.11	1.82	18.03	7.72	2.59	11.49	22.53	37.57
Kerala (32)	61.97	0.18	1.75	0.64	0.24	1.57	2.24	2.21
Tamil Nadu (33)	3.39	1.54	7.11	5.45	2.67	29.79	44.49	58.52
Post Office								
Jammu & Kashmir (01)	29.67	-0.46	-0.67	-0.42	-0.48	1.46	-0.30	-0.54
Himachal Pradesh (02)	28.25	-0.03	-0.44	0.15	-0.03	3.30	4.44	5.09
Punjab (03)	24.31	-0.10	-0.09	-0.71	-0.12	7.45	6.50	7.37
Uttaranchal (05)	27.62	-1.14	-0.95	-0.90	-1.14	10.09	6.60	6.60
Haryana (06)	24.15	0.05	-0.97	-0.86	-0.09	9.83	-0.10	-0.41
Rajasthan (08)	26.09	-0.60	0.18	0.05	-0.56	7.69	-0.02	-0.51
Uttar Pradesh (09)	23.92	-0.15	-0.07	-0.15	-0.21	8.66	0.87	0.78
Bihar (10)	28.76	0.11	-0.30	0.21	0.17	7.24	-1.87	-3.15
Assam (18)	21.30	0.85	-0.05	0.27	0.90	9.03	4.16	2.01
West Bengal (19)	23.92	-0.37	-0.33	-0.27	-0.30	6.16	1.46	1.25
Jharkhand (20)	18.83	1.08	-0.08	0.54	0.93	15.54	3.72	3.10
Orissa (21)	22.30	-0.20	0.07	-0.17	-0.19	10.98	2.17	1.42
Chhattisgarh (22)	15.94	0.37	-1.24	0.09	0.43	12.96	4.23	1.43
Madhya Pradesh (23)	25.71	-0.45	-1.26	-0.25	-0.30	9.28	-2.44	-5.04
Gujrat (24)	46.93	0.52	0.04	0.32	0.53	0.31	2.54	2.33
Maharashtra (27)	36.58	-0.18	-0.02	-0.44	-0.40	2.66	0.09	-0.49
Andhra Pradesh (28)	50.32	-0.01	-0.69	-0.34	-0.14	-3.43	-3.23	-2.90
Karnataka (29)	46.98	-0.22	0.83	0.23	-0.23	2.11	0.45	1.39
Kerala (32)	72.91	0.01	0.22	0.12	0.01	-0.59	0.40	0.40
Tamil Nadu (33)	42.09	-0.18	0.60	0.27	-0.14	-1.44	-0.16	0.82

***Table 5.1.2*: RB (%) of the seven estimators for 10 village facilities and 20 'large' States**

State	population proportion	Ratio_ est_State	SRS_Su bStrm1	Ratio_e st_Dist	Ratio_e st_Reg	Logistic _Dist	Logitic_ Reg	Logitic_ State
Commercial Bank								
Jammu & Kashmir (01)	14.23	1.04	0.51	1.22	1.19	13.47	9.09	7.64
Himachal Pradesh (02)	15.13	1.06	0.00	0.69	0.87	10.63	11.28	11.40
Punjab (03)	9.95	0.19	-0.18	-0.38	-0.08	22.50	10.05	10.69
Uttaranchal (05)	10.08	-3.54	-4.50	-2.99	-3.54	28.25	8.16	8.16
Haryana (06)	8.02	0.26	-6.11	-1.71	-0.01	18.75	5.18	5.59
Rajasthan (08)	8.58	0.89	1.59	1.33	1.24	30.49	6.76	-2.22
Uttar Pradesh (09)	13.79	-0.64	-0.43	-0.23	-0.49	18.02	1.96	1.79
Bihar (10)	16.17	-0.38	0.13	0.20	-0.21	18.24	0.52	-1.77
Assam (18)	8.31	1.42	1.92	1.31	1.61	27.29	13.20	7.08
West Bengal (19)	12.82	-0.20	0.49	0.08	-0.05	15.44	8.03	12.09
Jharkhand (20)	11.87	0.70	1.30	0.71	0.65	25.47	7.60	6.16
Orissa (21)	9.47	-0.54	-0.69	-0.53	-0.47	26.64	4.17	1.95
Chhattisgarh (22)	4.62	-2.71	-3.70	-2.50	-2.39	27.08	18.52	7.07
Madhya Pradesh (23)	9.33	-0.82	-1.69	-0.89	-0.50	25.64	8.16	-0.41
Gujrat (24)	12.10	0.31	-1.58	-0.39	0.22	18.17	5.04	0.54
Maharashtra (27)	11.93	-0.32	-0.02	-0.66	-0.57	15.83	1.46	-3.15
Andhra Pradesh (28)	17.05	0.90	0.08	0.89	0.98	8.94	0.07	-0.04
Karnataka (29)	18.97	0.13	1.43	0.30	0.09	17.00	5.91	4.55
Kerala (32)	14.02	-0.47	-0.01	-0.51	-0.51	4.32	0.61	-0.01
Tamil Nadu (33)	8.99	-0.72	-0.28	-0.30	-0.54	13.94	3.95	2.44
Power Supply								
Jammu & Kashmir (01)	87.86	-0.16	-0.07	-0.16	-0.16	-1.95	-1.28	-0.95
Himachal Pradesh (02)	89.26	-0.07	-0.02	-0.09	-0.07	-1.70	-2.03	-2.01
Punjab (03)	84.64	0.02	0.04	0.00	0.00	-1.12	0.22	-0.09
Uttaranchal (05)	82.50	0.70	0.09	0.37	0.70	-3.41	0.72	0.72
Haryana (06)	76.55	0.03	0.60	0.29	0.05	-1.78	-2.01	-1.05
Rajasthan (08)	78.19	0.11	0.07	0.06	0.03	-2.96	-0.52	0.30
Uttar Pradesh (09)	62.25	-0.07	0.11	0.01	-0.04	-1.39	0.27	0.17
Bihar (10)	36.04	0.23	0.96	0.46	0.30	4.46	1.23	1.55
Assam (18)	65.71	-0.10	-0.04	-0.07	-0.10	-2.66	-1.26	-1.38
West Bengal (19)	50.75	-0.04	0.26	0.17	0.08	-0.46	-3.50	-6.77
Jharkhand (20)	26.19	0.12	-0.65	-0.08	0.16	6.79	6.18	5.28
Orissa (21)	62.09	-0.31	0.14	-0.08	-0.30	-1.68	-0.19	0.24
Chhattisgarh (22)	88.09	0.08	0.09	0.10	0.13	-2.18	0.02	0.60
Madhya Pradesh (23)	89.66	-0.04	-0.01	-0.04	-0.10	-2.52	-1.21	-0.47
Gujrat (24)	93.91	-0.02	-0.02	0.01	-0.02	-1.52	-0.83	-0.45
Maharashtra (27)	93.07	-0.04	0.13	0.08	0.00	-1.41	-0.39	0.26
Andhra Pradesh (28)	94.73	-0.12	-0.13	-0.15	-0.13	-2.07	-0.30	0.45
Karnataka (29)	91.45	-0.24	-0.14	-0.15	-0.18	-2.86	-1.13	-0.40
Kerala (32)	96.18	-0.06	-0.08	-0.06	-0.06	-0.39	-0.39	-0.32
Tamil Nadu (33)	57.69	-0.08	0.20	0.04	-0.10	-1.53	2.37	2.51

APPENDIX II: Estimated RSE (%) of the seven estimators of proportion of villages for 20 'large' States



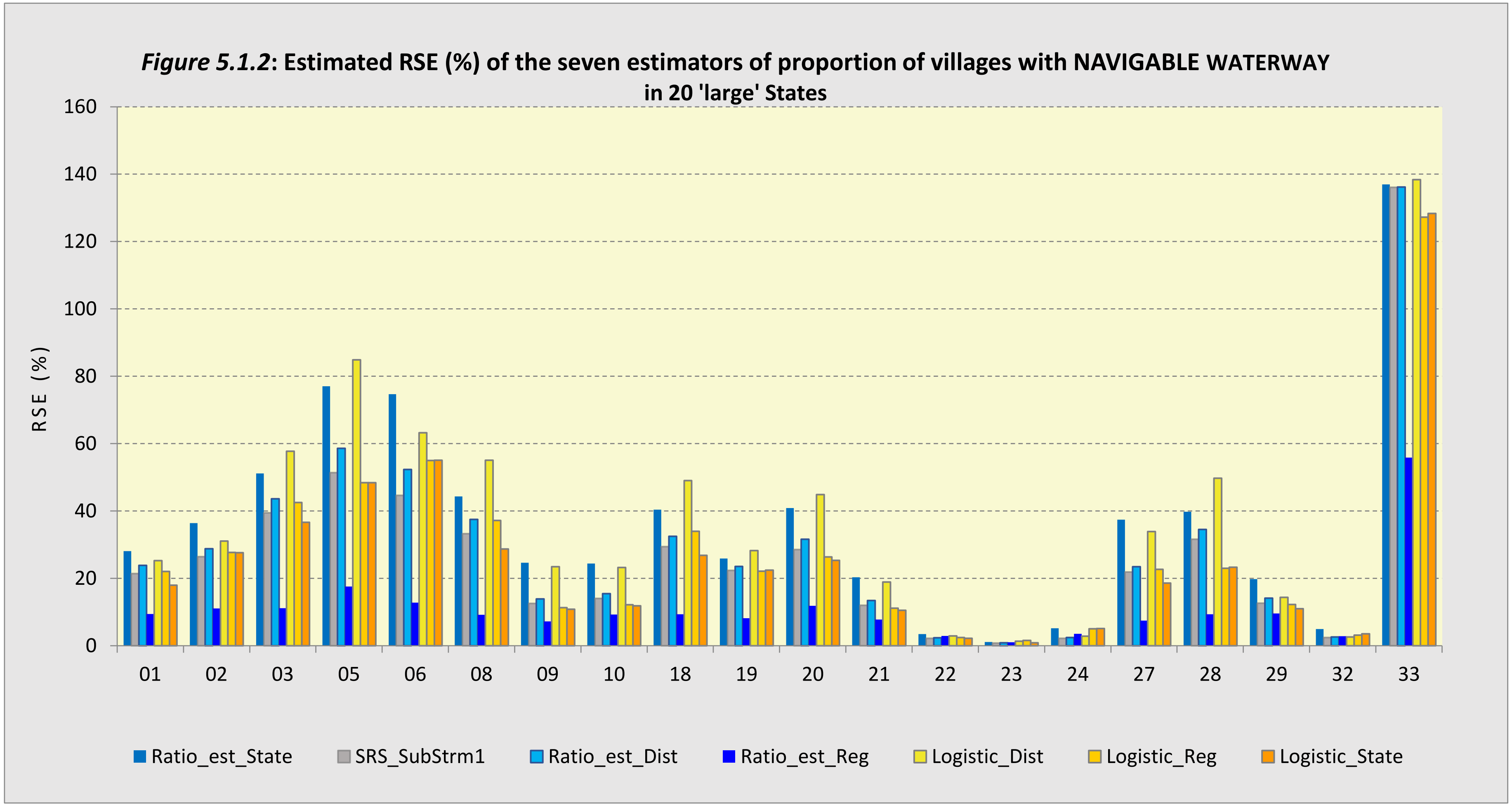
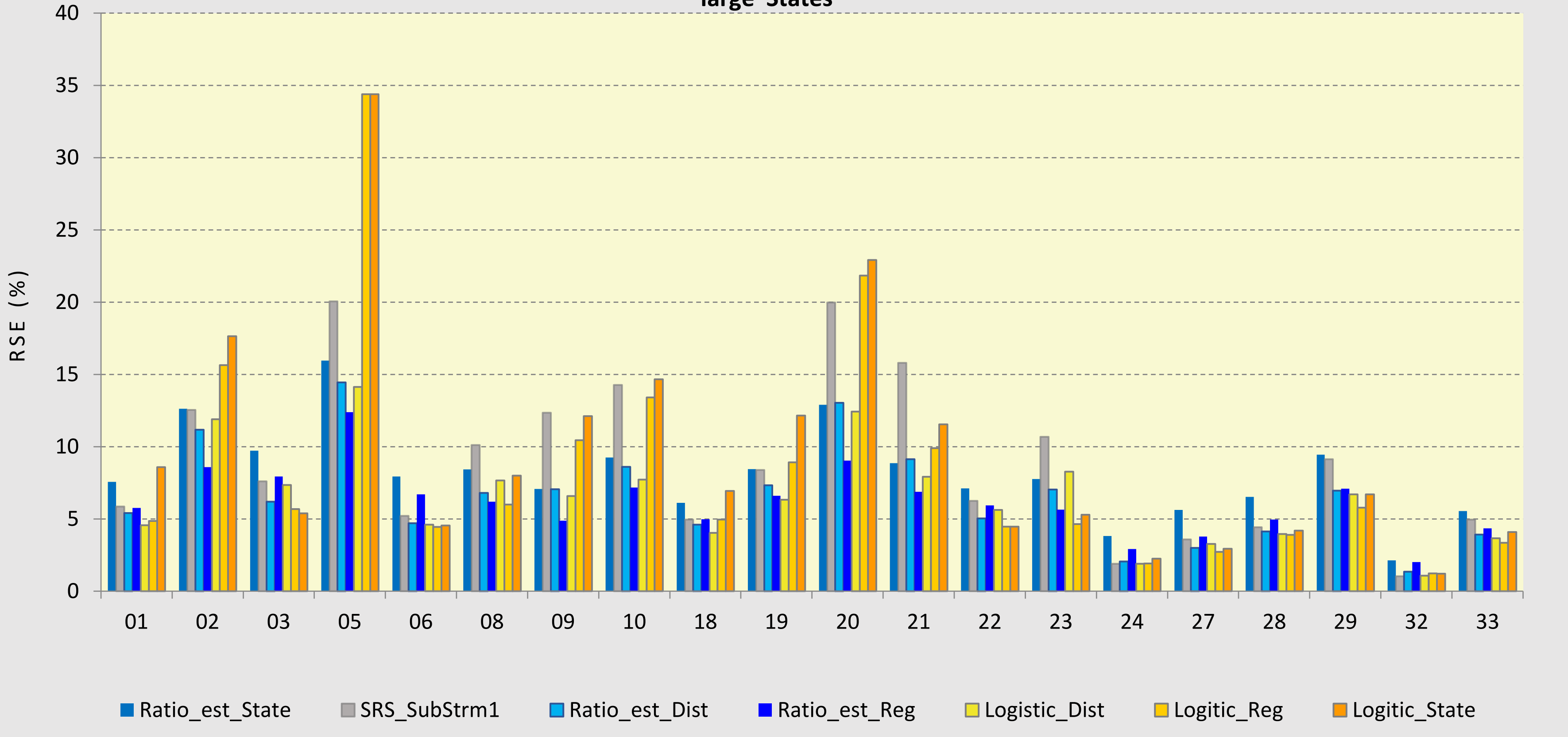


Figure 5.1.2: Estimated RSE (%) of the seven estimators of proportion of villages with NAVIGABLE WATERWAY in 20 'large' States
RSE (%)
0
20
40
60
80
100
120
140
160
01 02 03 05 06 08 09 10 18 19 20 21 22 23 24 27 28 29 32 33
Ratio_est_State
SRS_SubStrm1
Ratio_est_Dist
Ratio_est_Reg
Logistic_Dist
Logistic_Reg
Logistic_State

***Figure 5.1.3*: Estimated RSE (%) of the seven estimators of proportion of villages with PRIMARY SCHOOL in 20 'large' States**



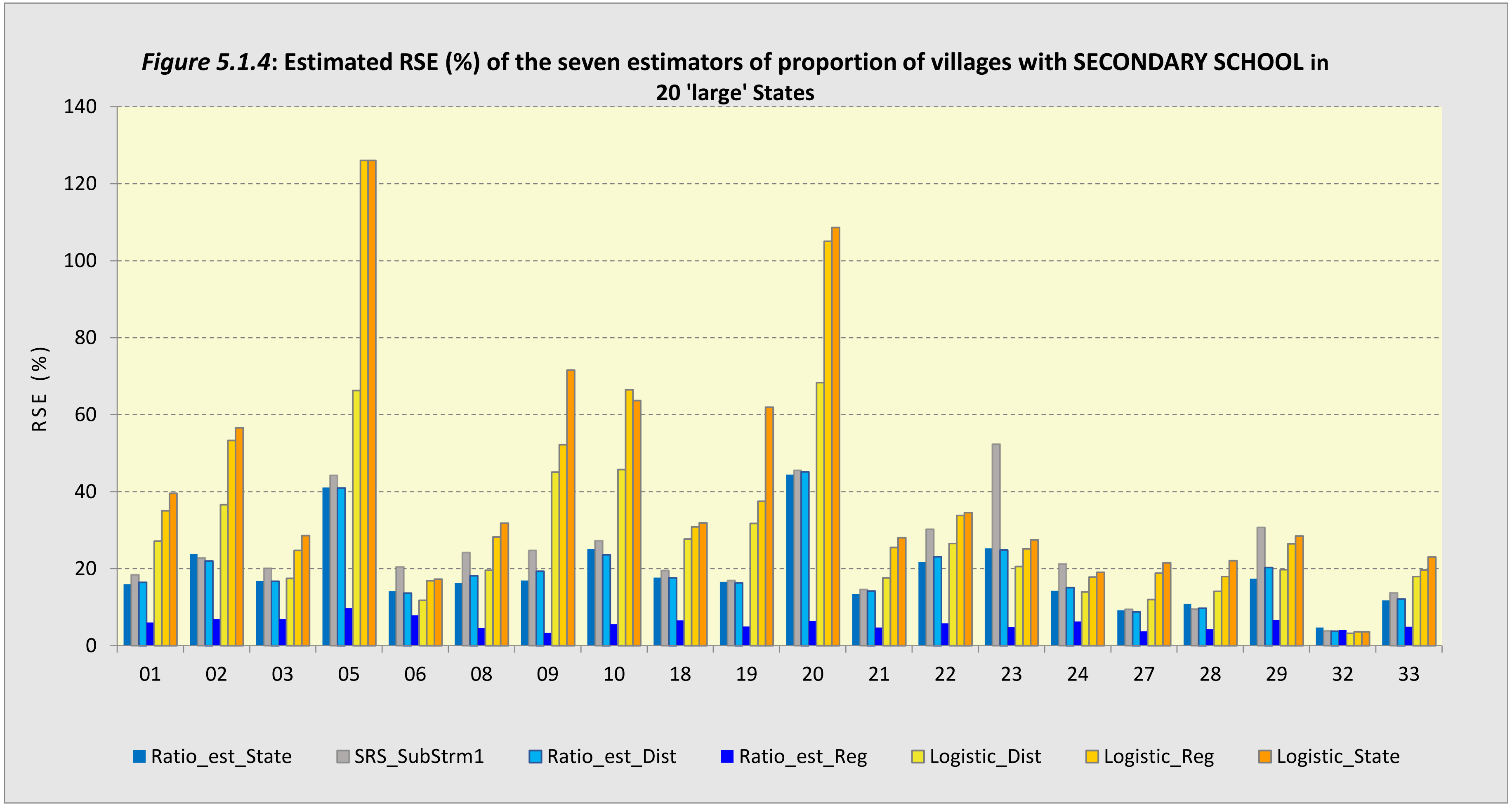
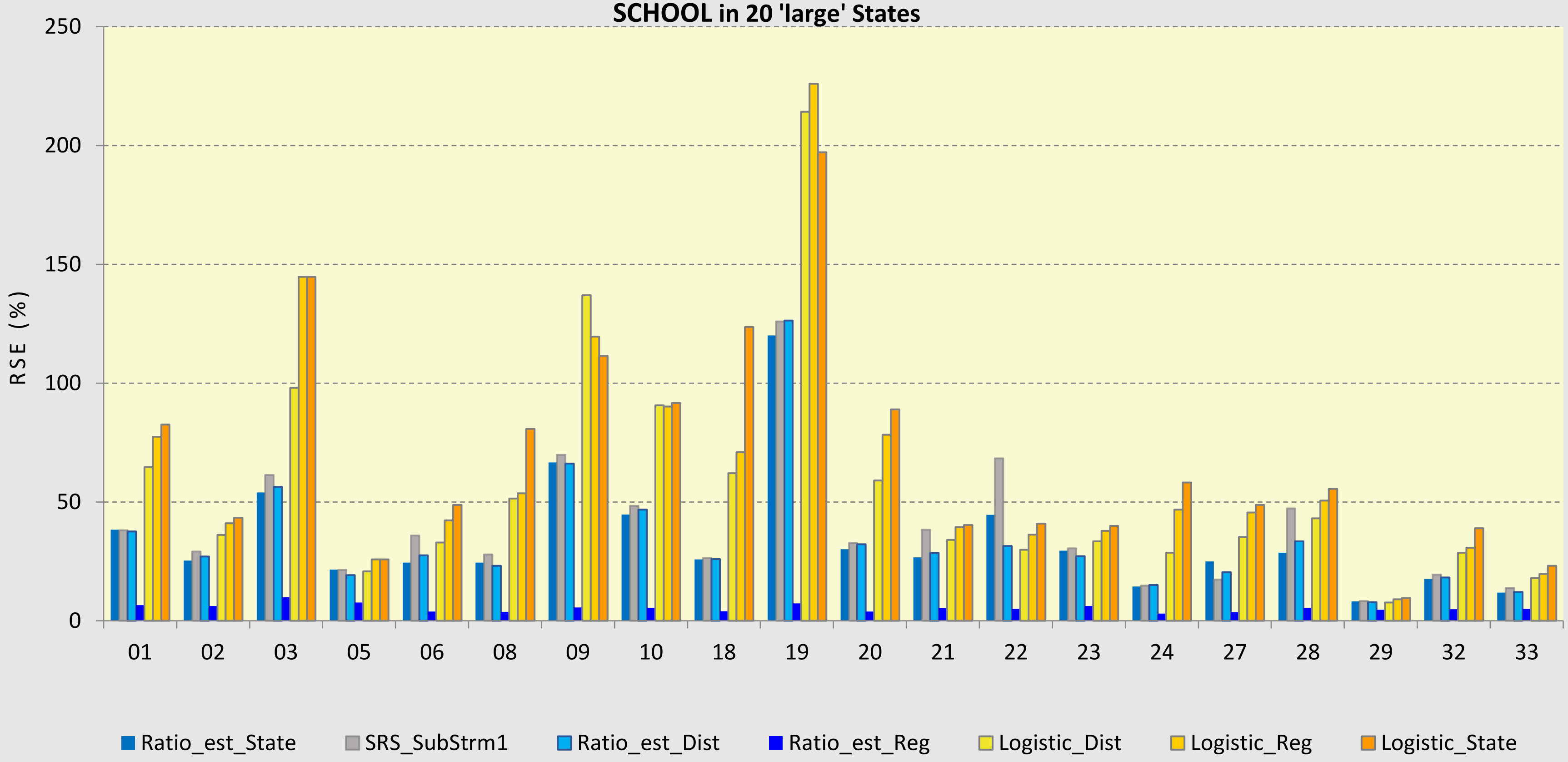


Figure 5.1.4: Estimated RSE (%) of the seven estimators of proportion of villages with SECONDARY SCHOOL in 20 'large' States
RSE (%)
140
120
100
80
60
40
20
0
01 02 03 05 06 08 09 10 18 19 20 21 22 23 24 27 28 29 32 33
Ratio_est_State
SRS_SubStrm1
Ratio_est_Dist
Ratio_est_Reg
Logistic_Dist
Logistic_Reg
Logistic_State

***Figure 5.1.5*: Estimated RSE (%) of the seven estimators of proportion of villages with SENIOR SECONDARY SCHOOL in 20 'large' States**



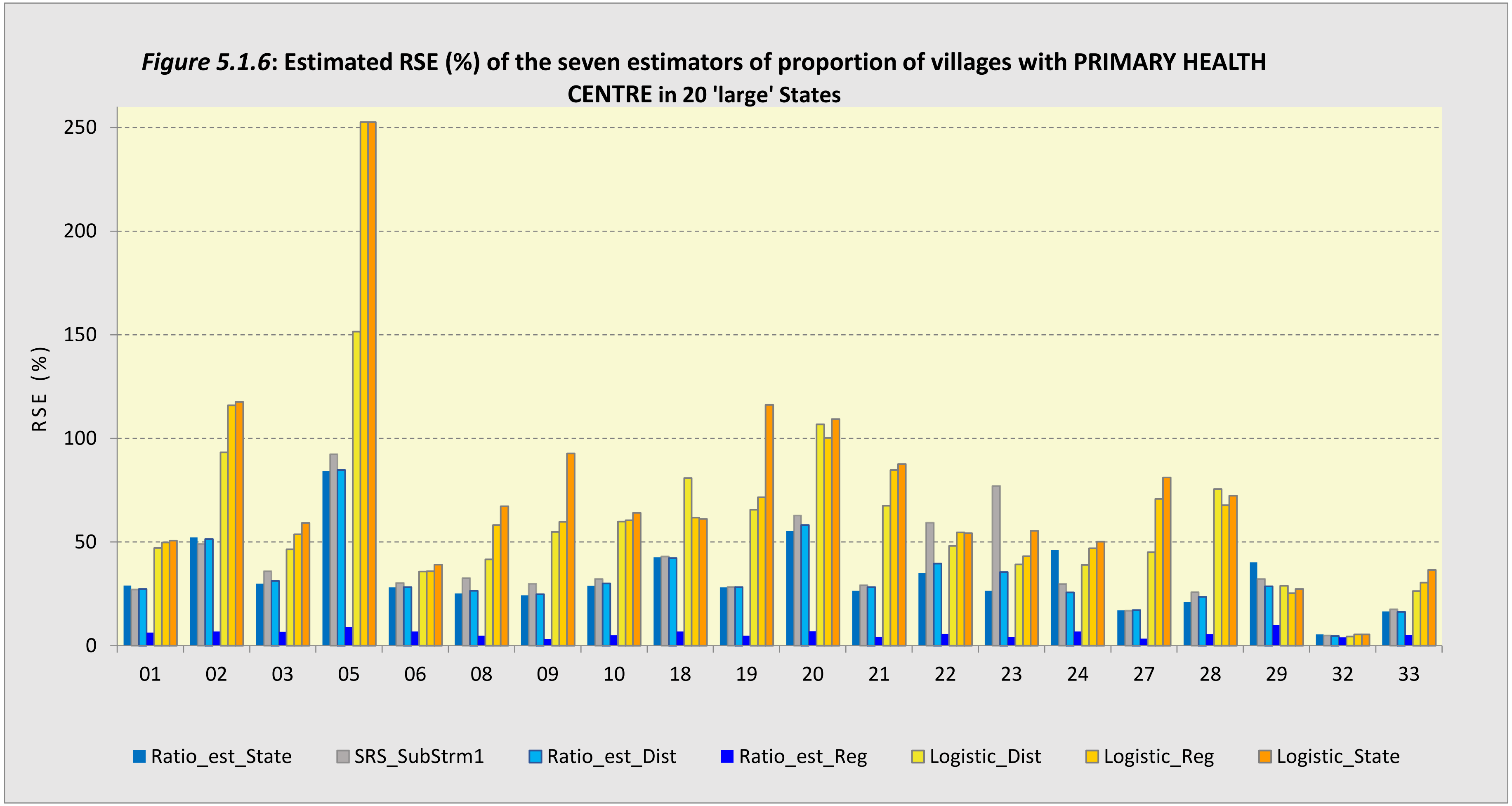


Figure 5.1.6: Estimated RSE (%) of the seven estimators of proportion of villages with PRIMARY HEALTH CENTRE in 20 'large' States
RSE (%)
0
50
100
150
200
250
01
02
03
05
06
08
09
10
18
19
20
21
22
23
24
27
28
29
32
33
Ratio_est_State
SRS_SubStrm1
Ratio_est_Dist
Ratio_est_Reg
Logistic_Dist
Logistic_Reg
Logistic_State

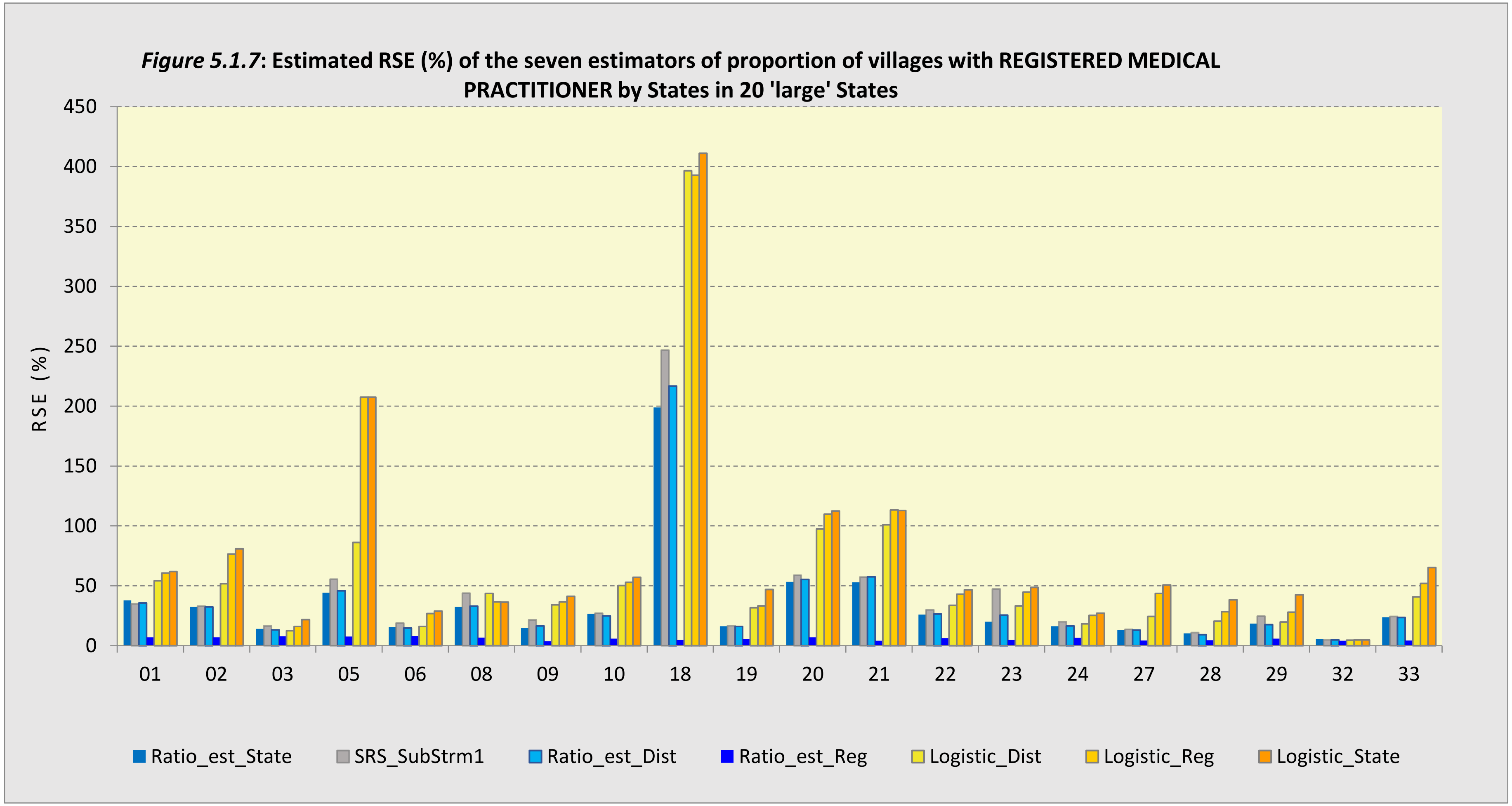


Figure 5.1.7: Estimated RSE (%) of the seven estimators of proportion of villages with REGISTERED MEDICAL PRACTITIONER by States in 20 'large' States
RSE (%)
0
50
100
150
200
250
300
350
400
450
01
02
03
05
06
08
09
10
18
19
20
21
22
23
24
27
28
29
32
33
Ratio_est_State
SRS_SubStrm1
Ratio_est_Dist
Ratio_est_Reg
Logistic_Dist
Logistic_Reg
Logistic_State

Figure 5.1.8: **Estimated RSE (%) of the seven estimators of proportion of villages with POST OFFICE in 20 'large' States**

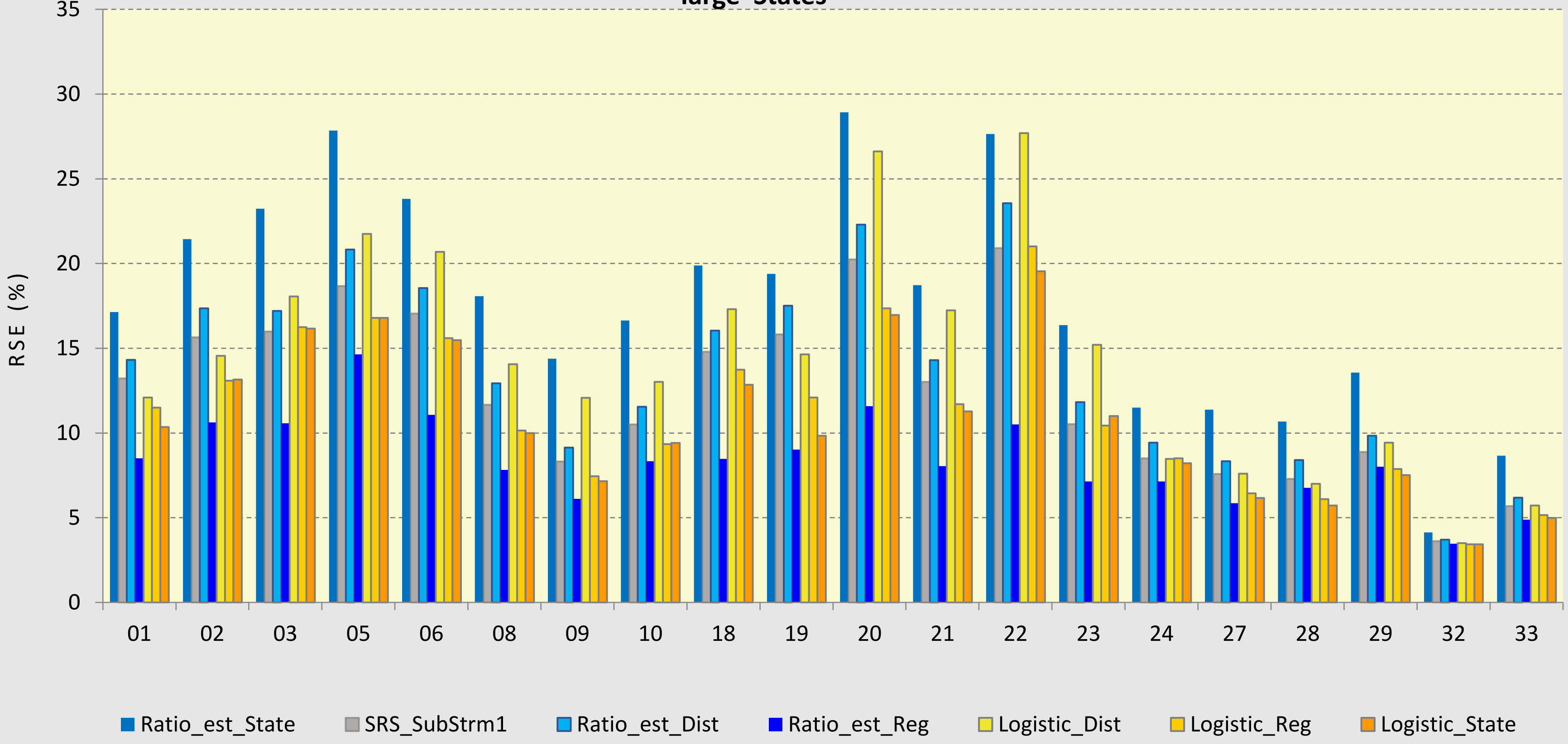
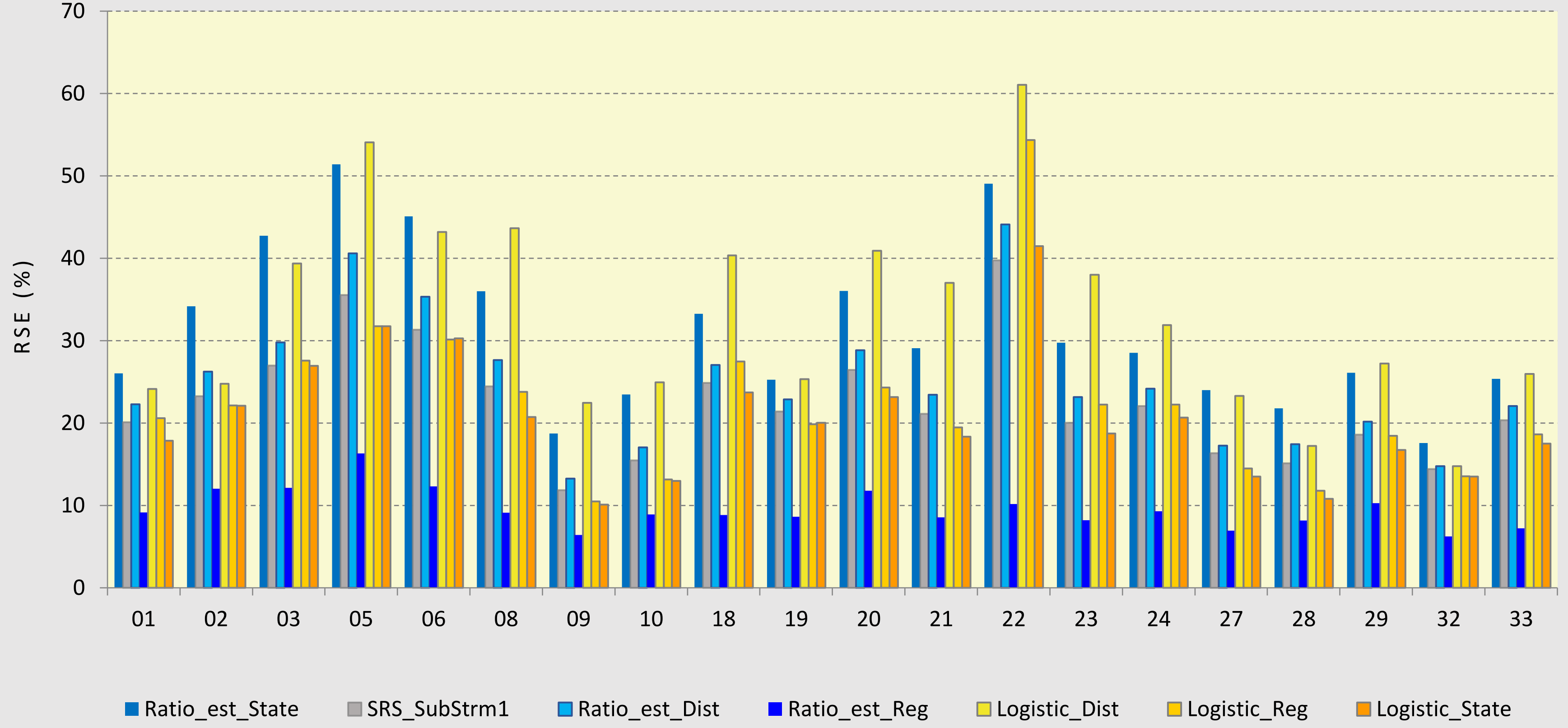


Figure 5.1.9: **Estimated RSE (%) of the seven estimators of proportion of villages with COMMERCIAL BANK in 20 'large' States**



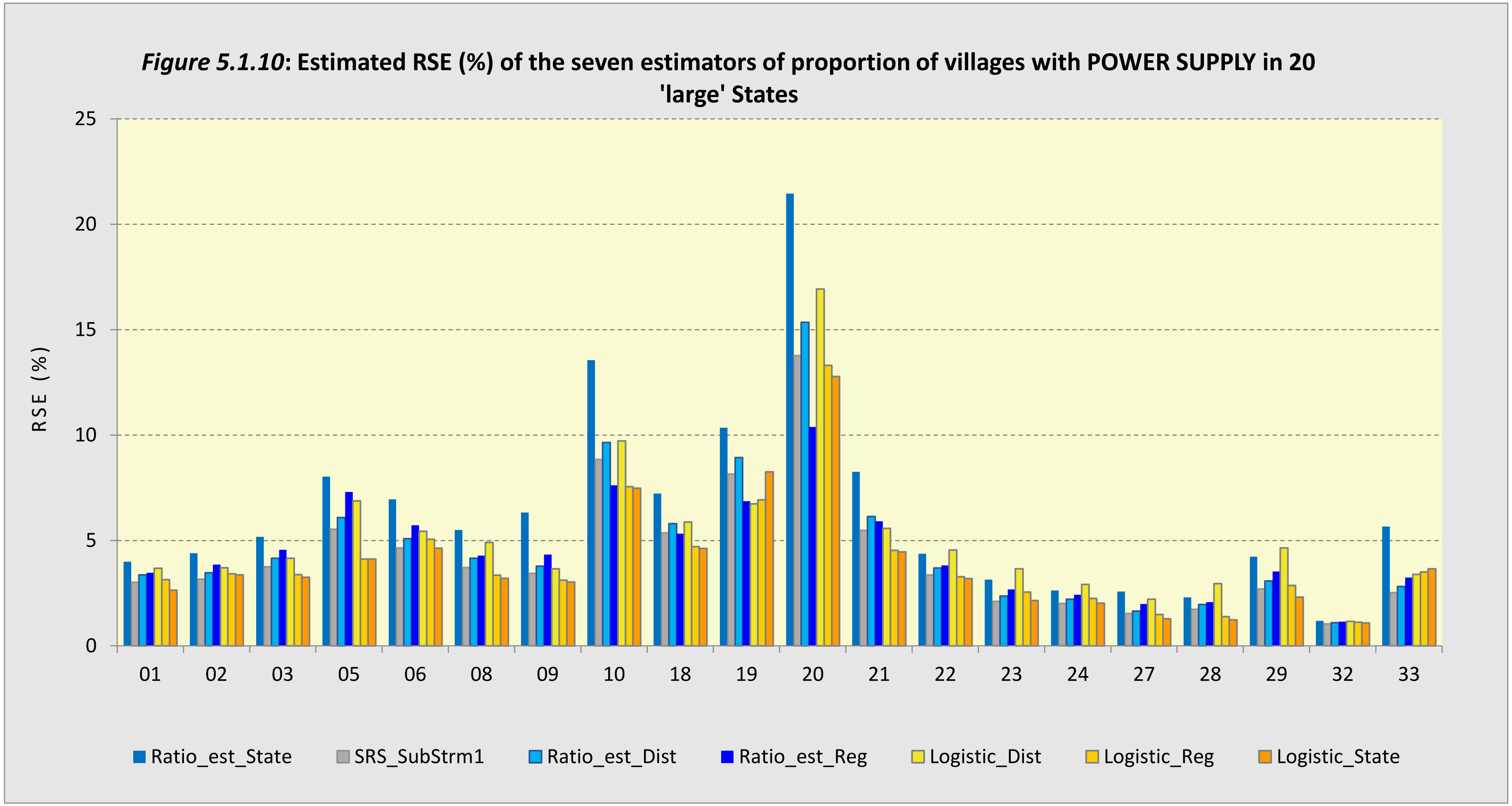
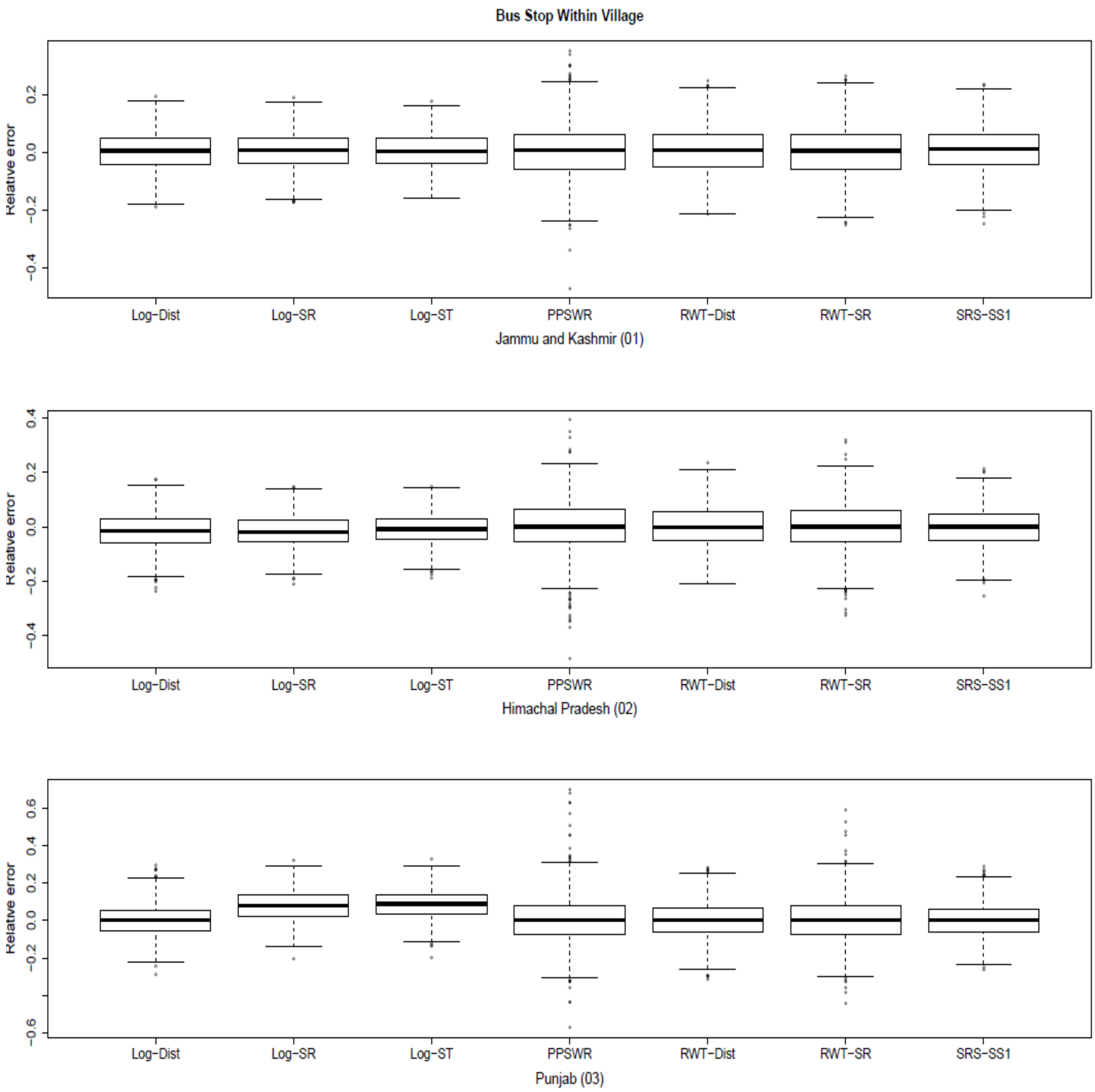
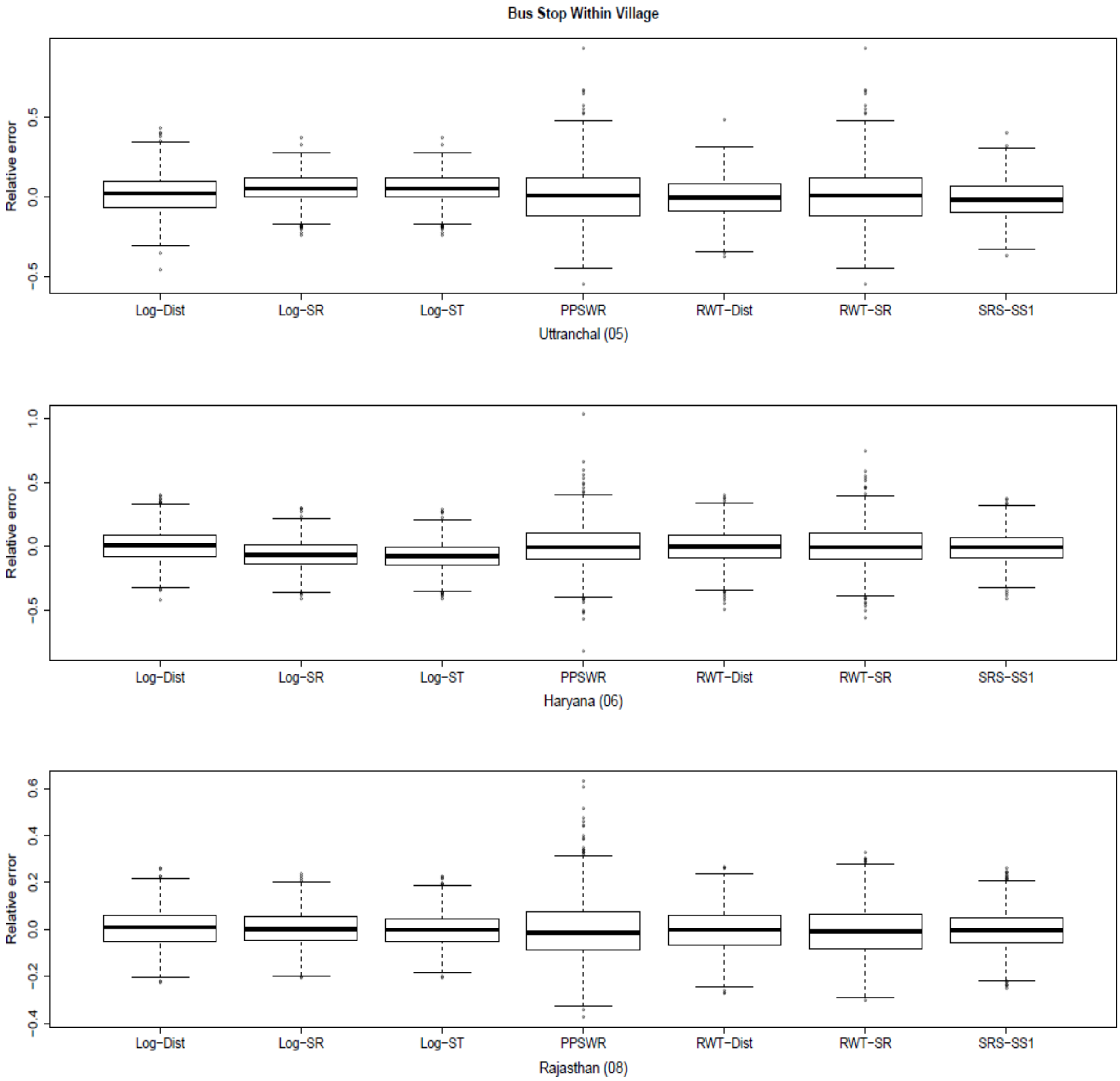


Figure 5.1.10: Estimated RSE (%) of the seven estimators of proportion of villages with POWER SUPPLY in 20 'large' States
R S E (%)
0
5
10
15
20
25
01
02
03
05
06
08
09
10
18
19
20
21
22
23
24
27
28
29
32
33
Ratio_est_State
SRS_SubStrm1
Ratio_est_Dist
Ratio_est_Reg
Logistic_Dist
Logistic_Reg
Logistic_State

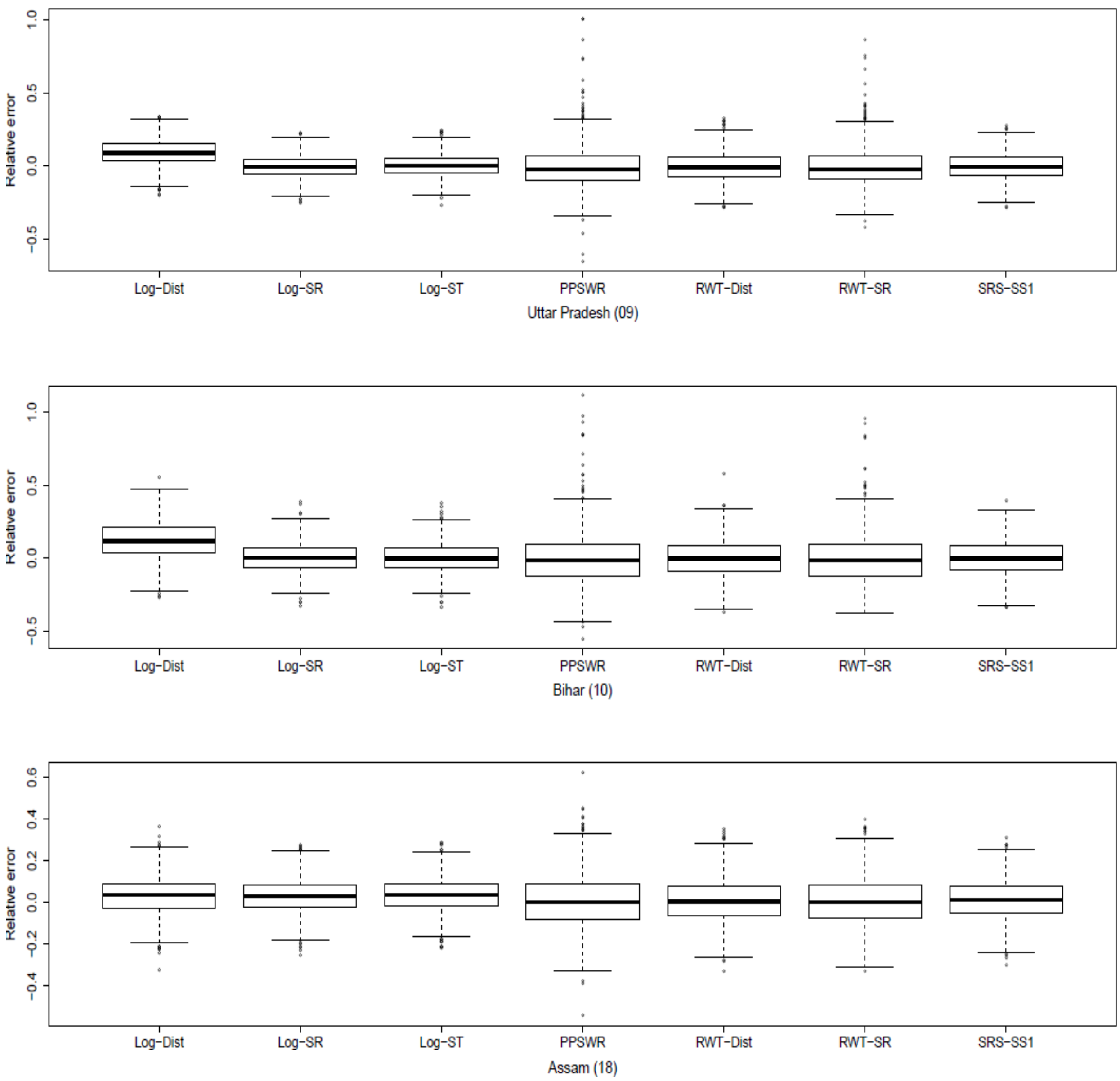
APPENDIX III: Box Plots

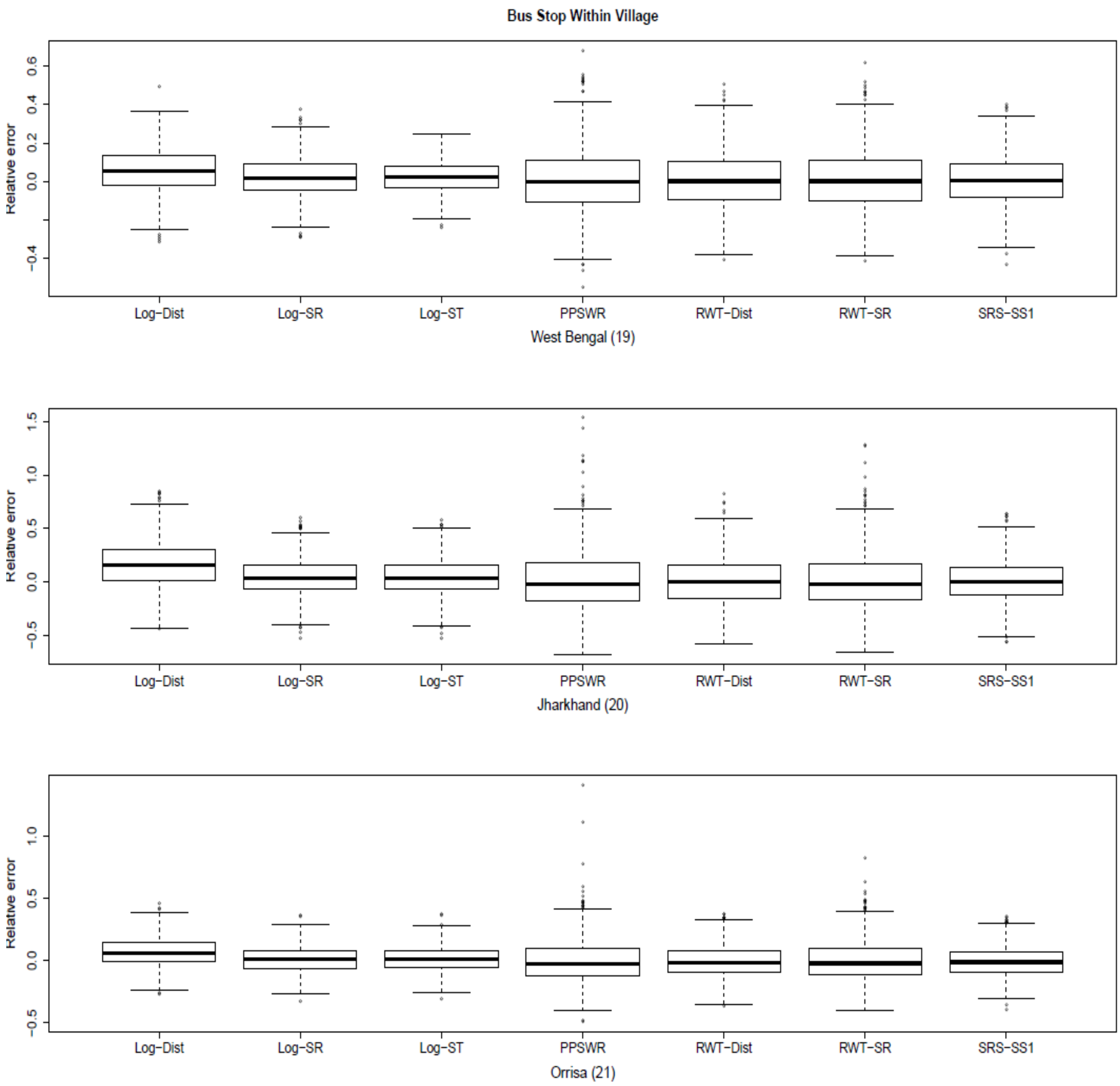
Box plots of estimates of the 10 village level characteristics from 1000 samples of the seven estimators of 20 ‘Large States’ examined in the study.


Bus Stop Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Jammu and Kashmir (01)
Himachal Pradesh (02)
Punjab (03)

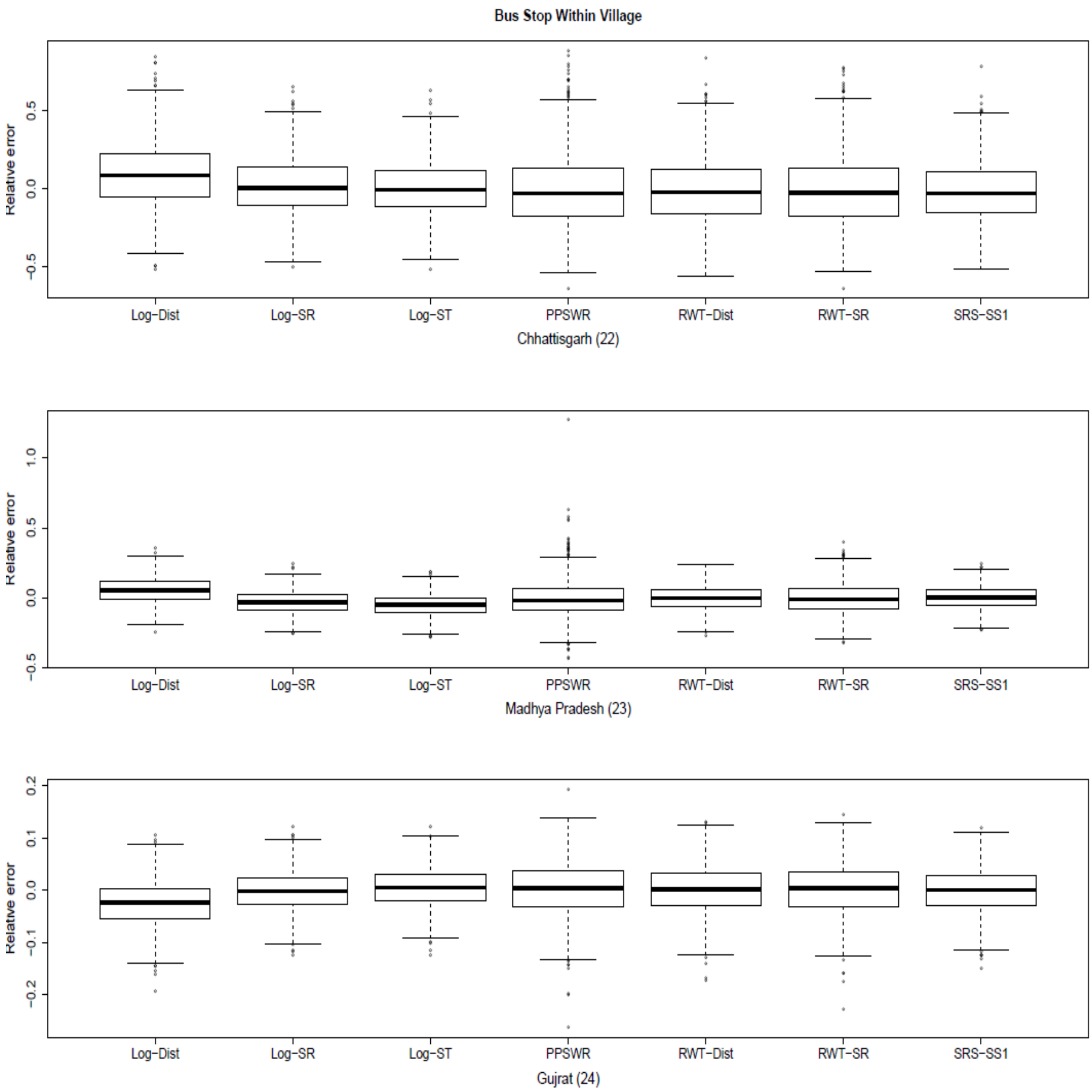

Bus Stop Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)

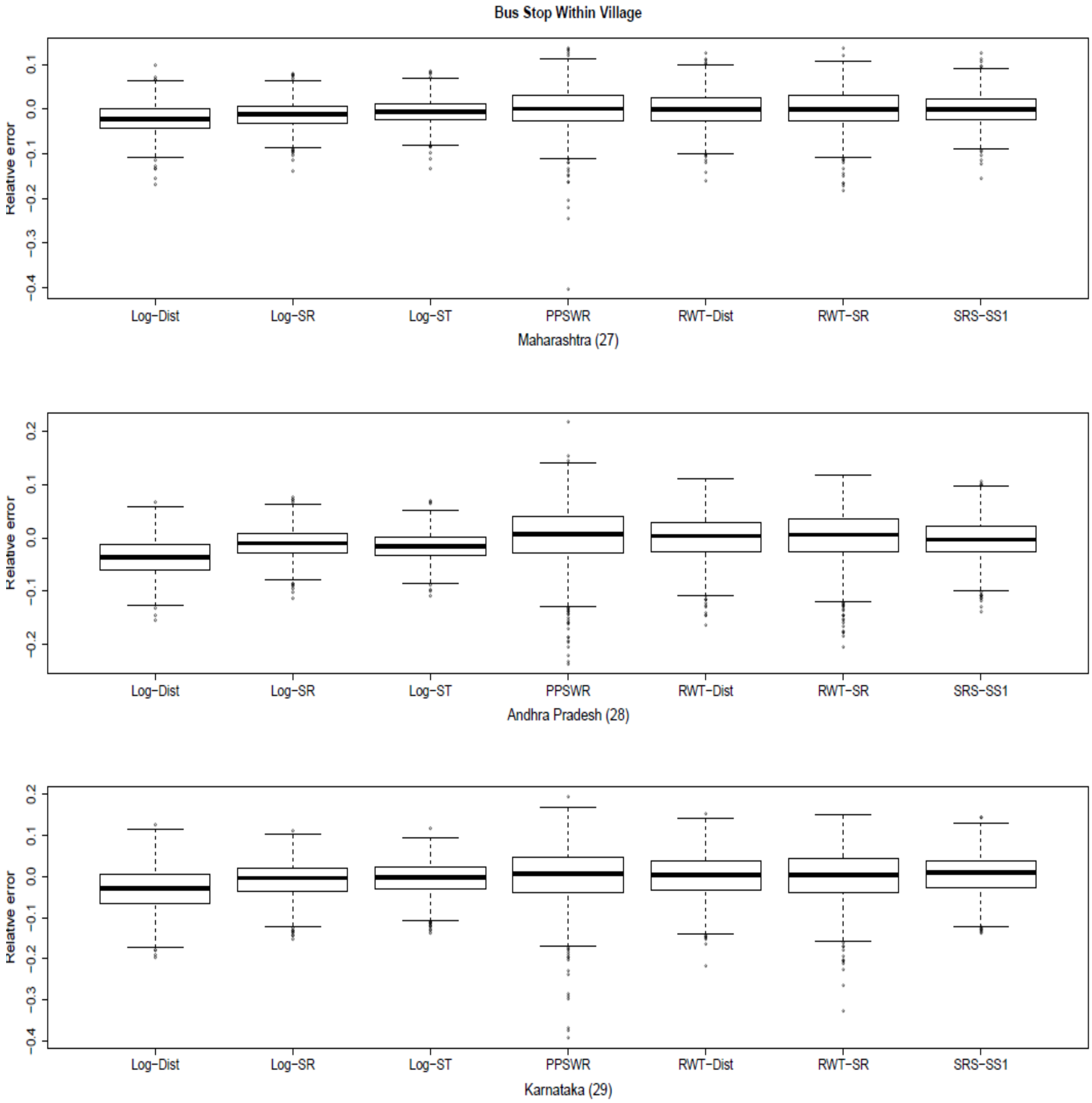
Bus Stop Within Village

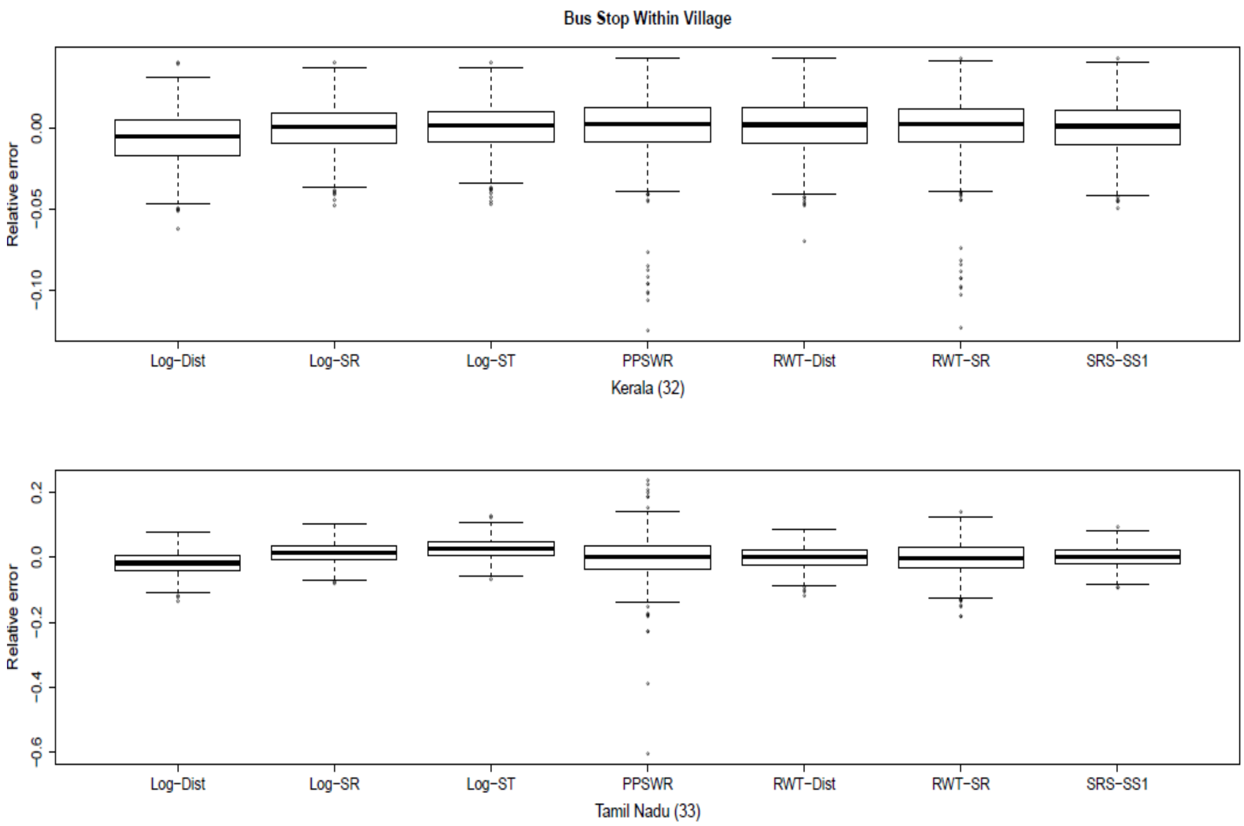




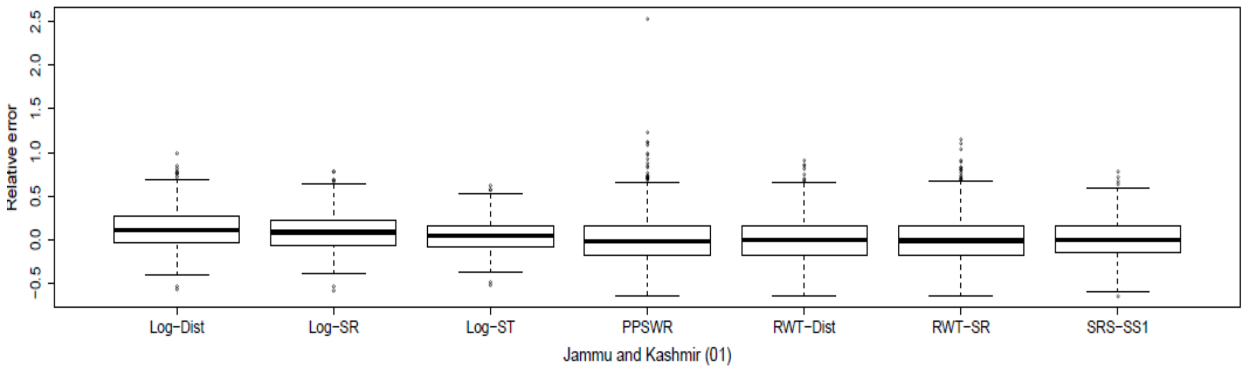
Bus Stop Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
West Bengal (19)
Jharkhand (20)
Orrisa (21)

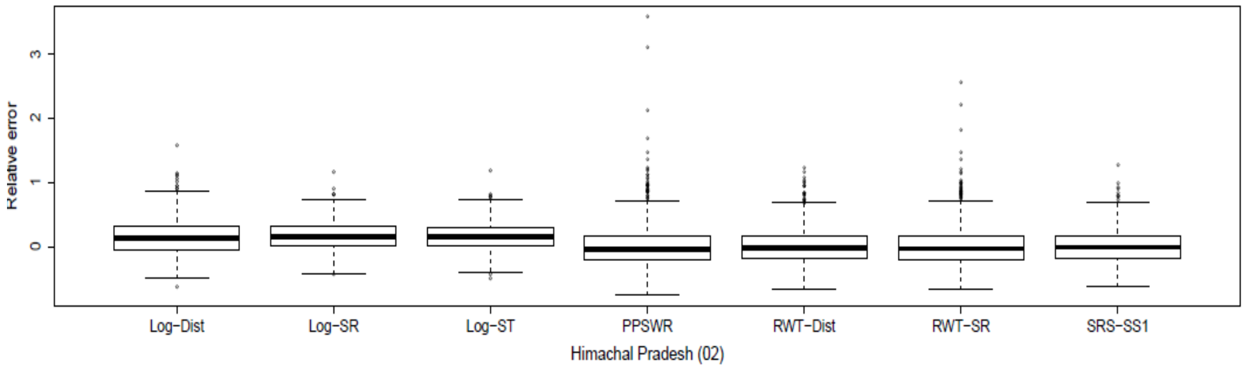

Bus Stop Within Village
Relative error
-0.5
0.0
0.5
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Chhattisgarh (22)
Relative error
-0.5
0.0
0.5
1.0
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Madhya Pradesh (23)
Relative error
-0.2
-0.1
0.0
0.1
0.2
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Gujrat (24)

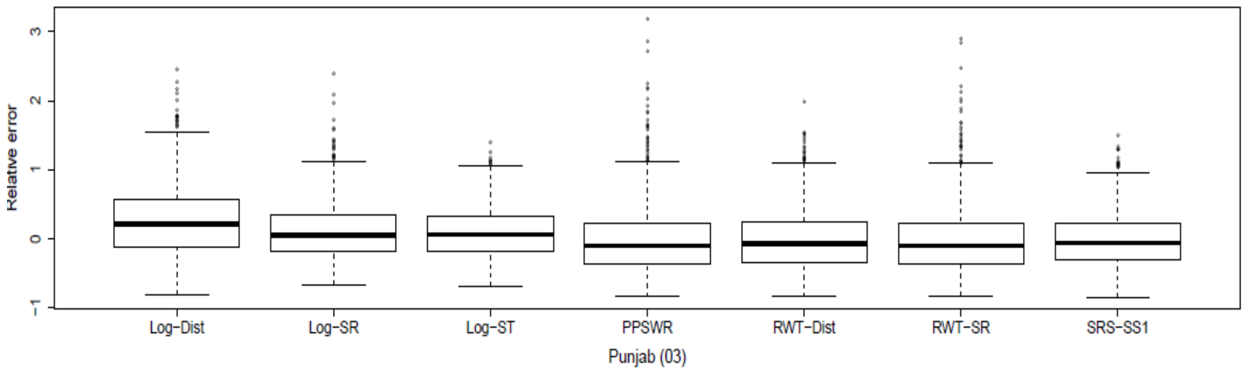

Bus Stop Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Andhra Pradesh (28)
Karnataka (29)

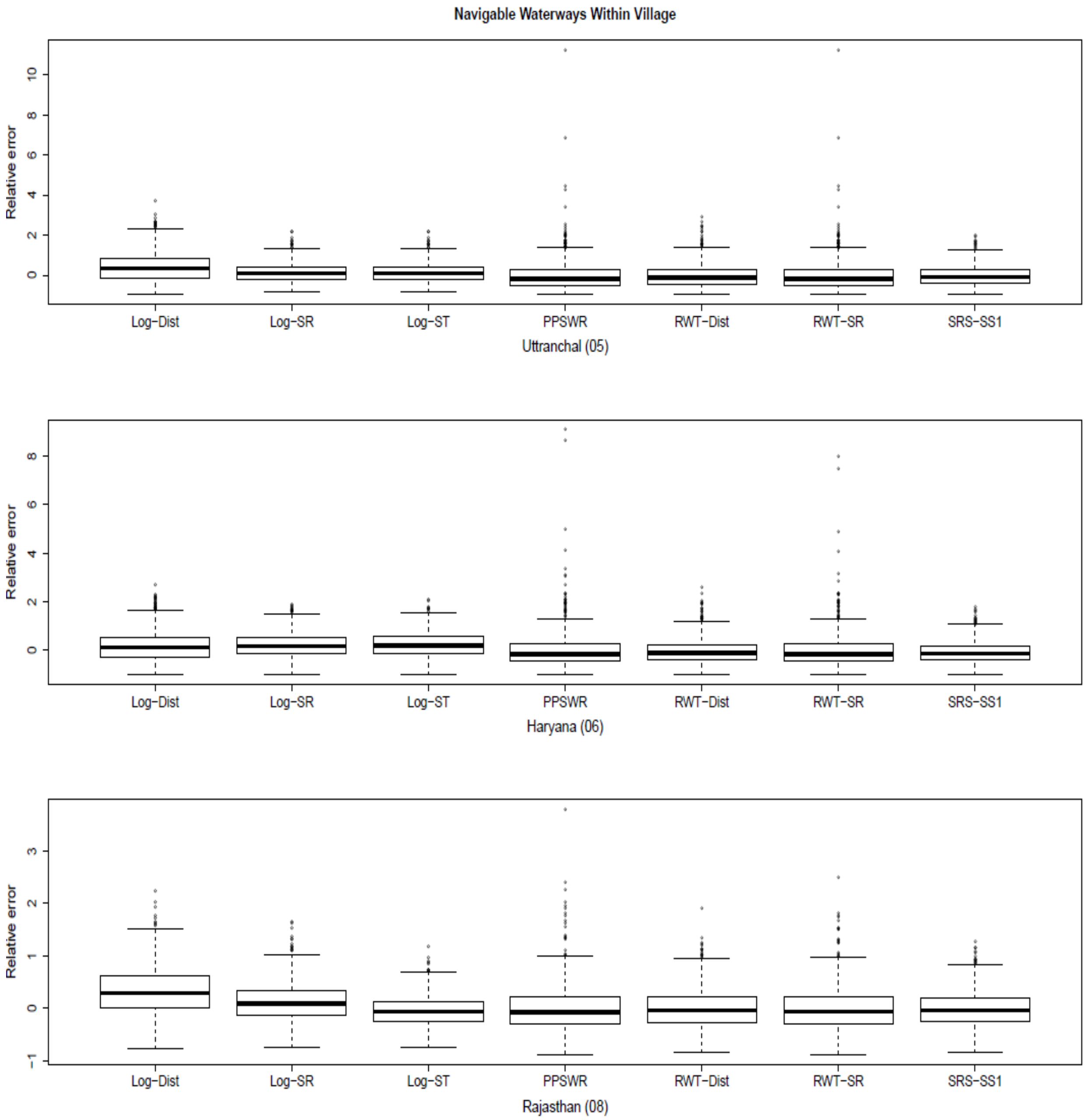

Bus Stop Within Village
Relative error
0.00
−0.05
−0.10
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
0.2
0.0
−0.2
−0.4
−0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)

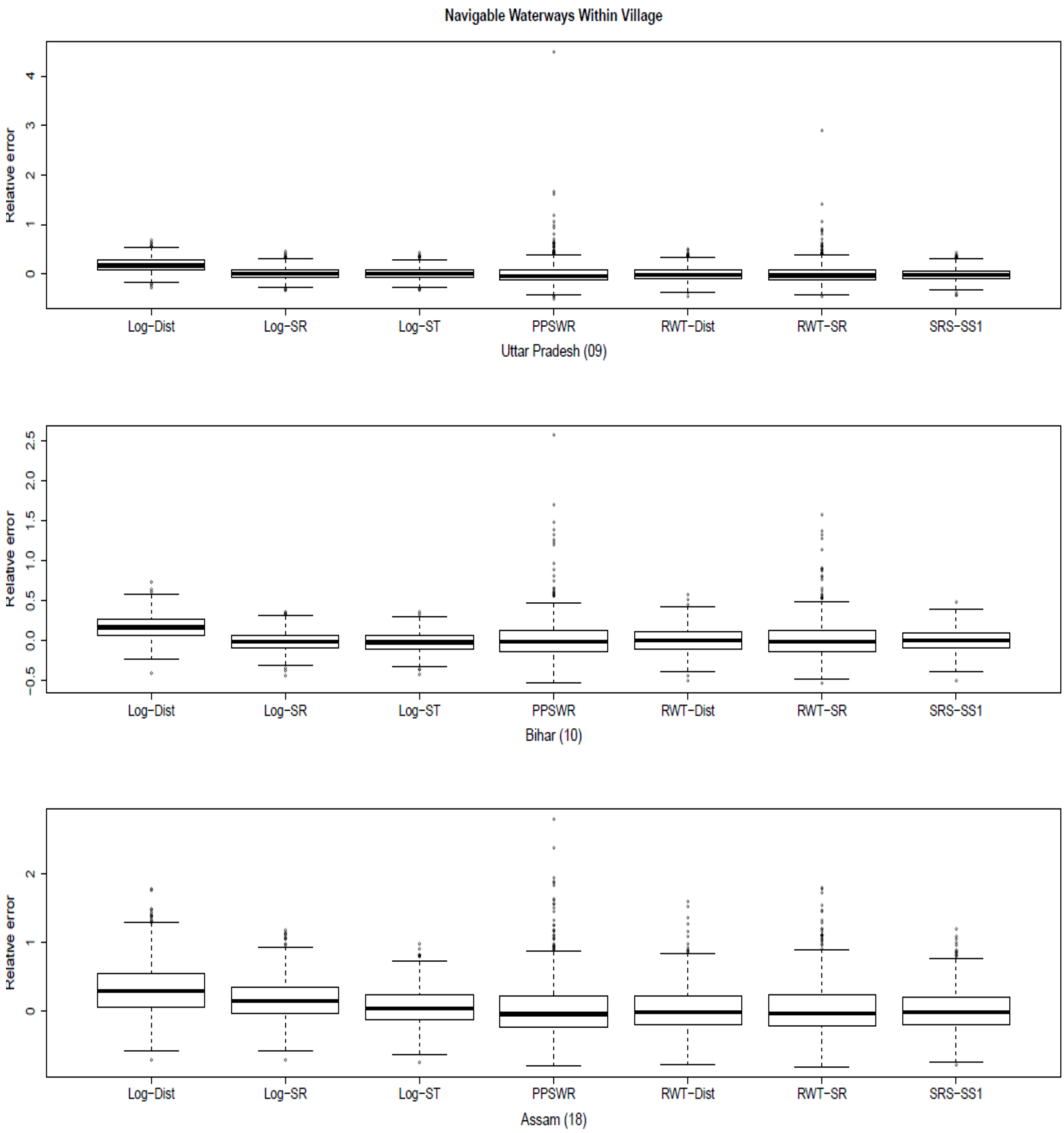
Navigable Waterways Within Village

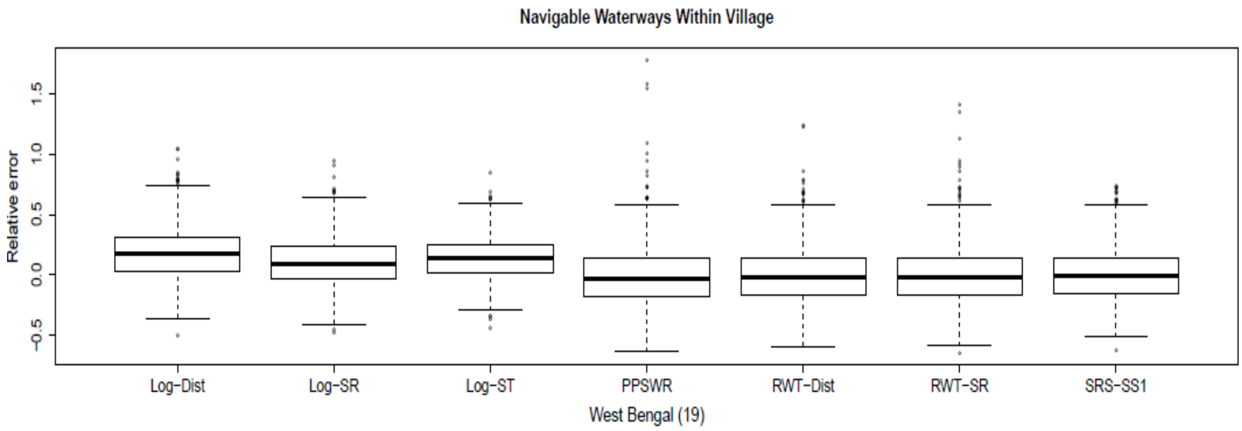


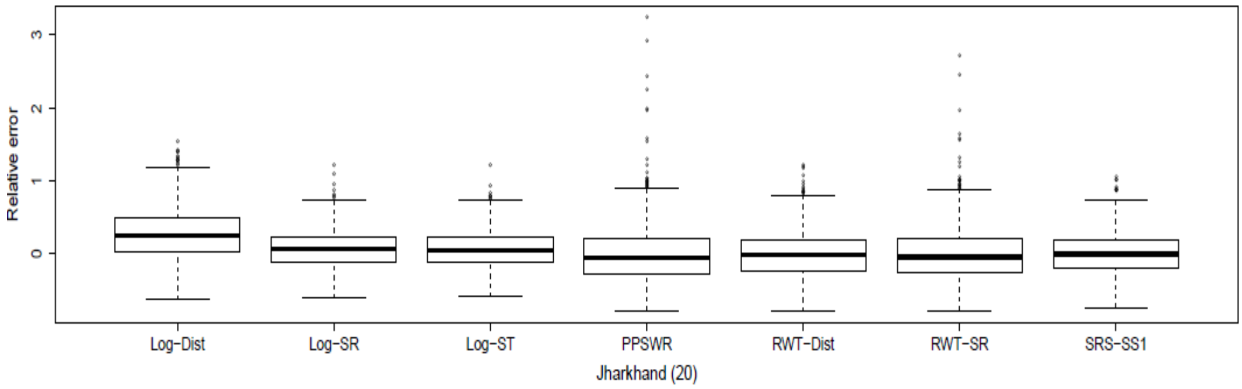


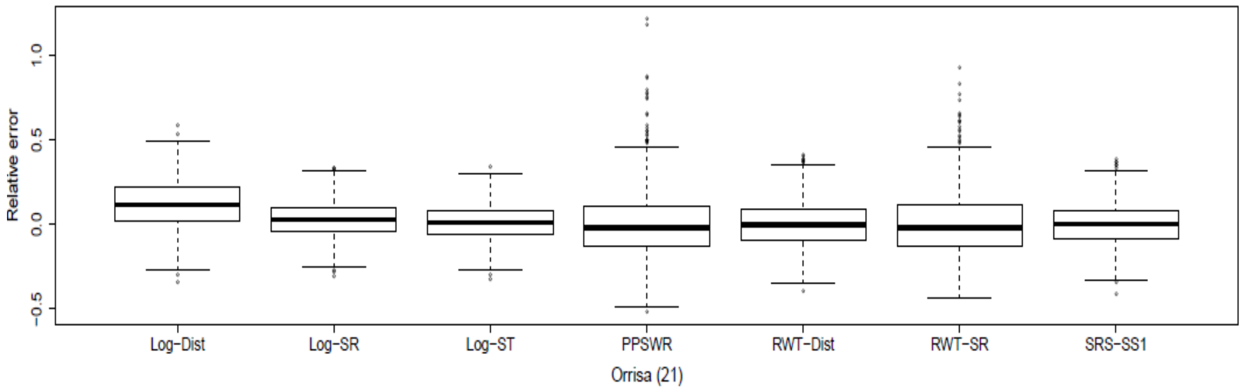


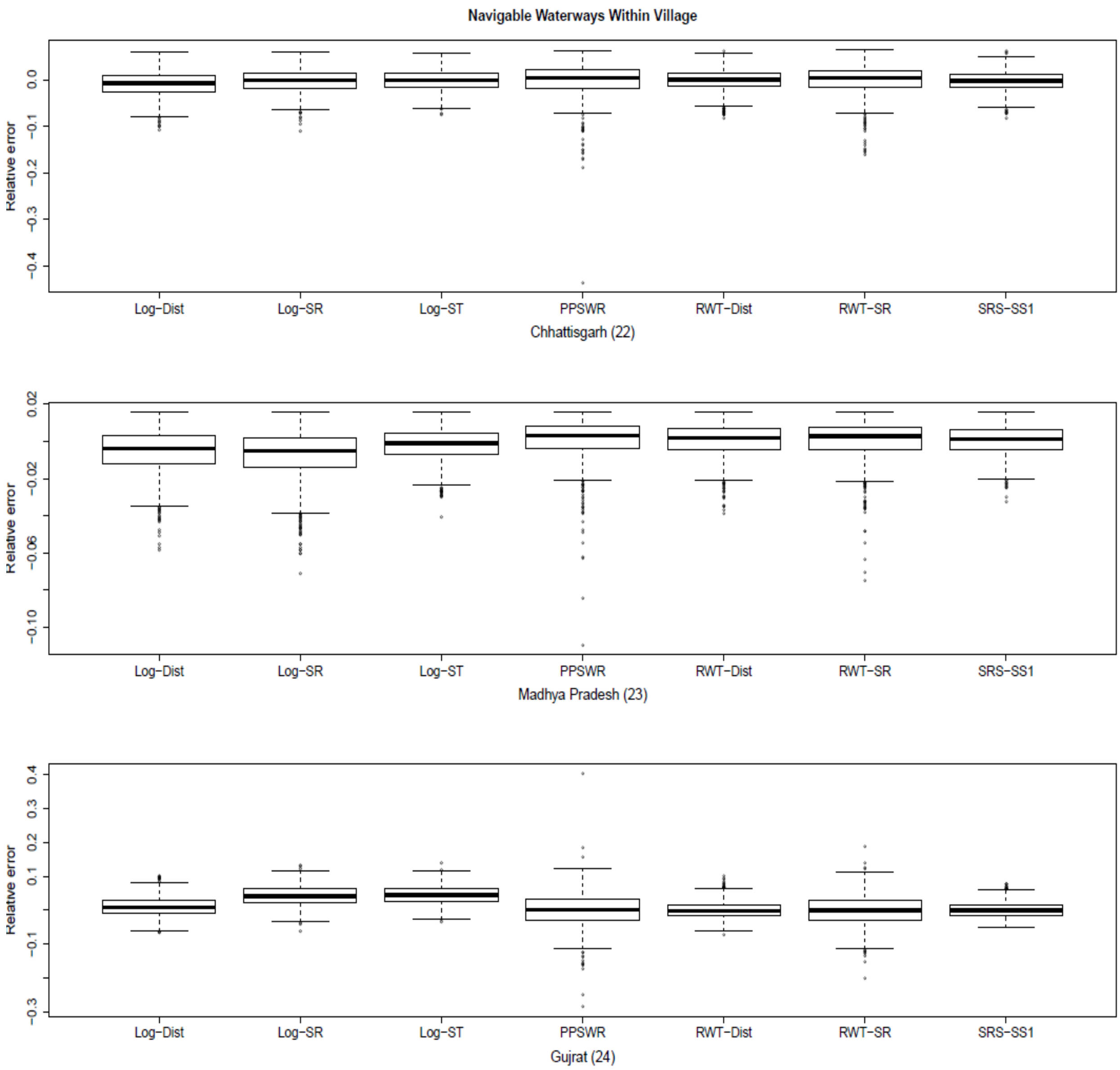

Navigable Waterways Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttranchal (05)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Haryana (06)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Rajasthan (08)


Navigable Waterways Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Bihar (10)
Assam (18)

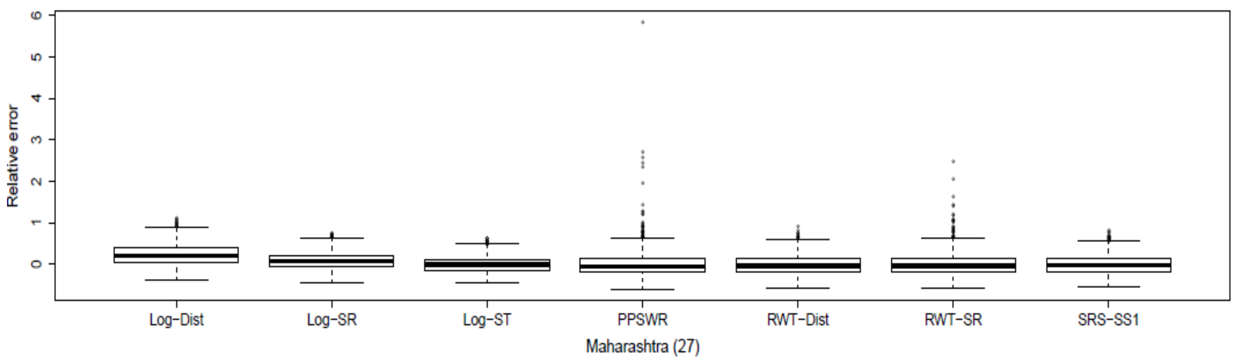

Navigable Waterways Within Village
Relative error
-0.5
0.0
0.5
1.0
1.5
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
West Bengal (19)

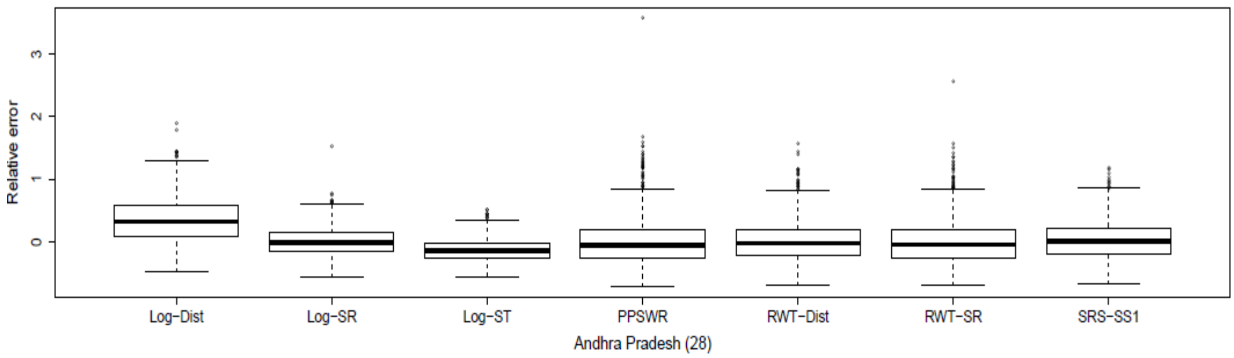

Relative error
0
1
2
3
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Jharkhand (20)

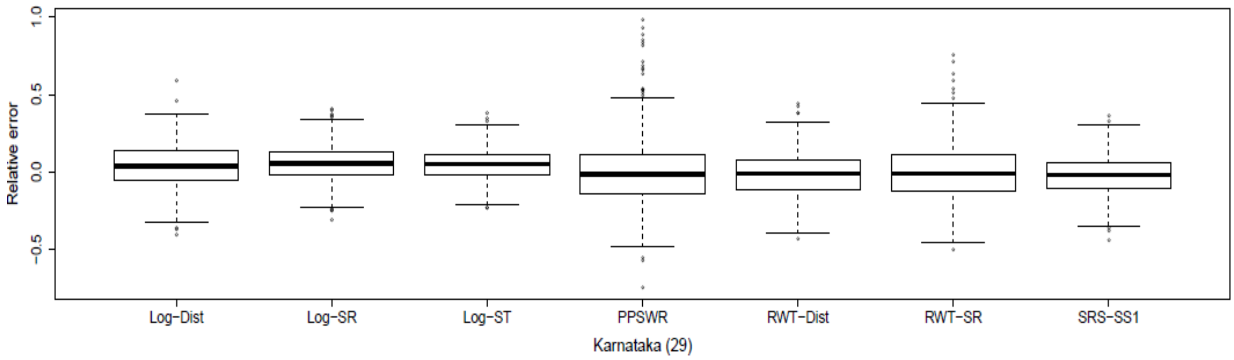

Relative error
-0.5
0.0
0.5
1.0
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Orrisa (21)

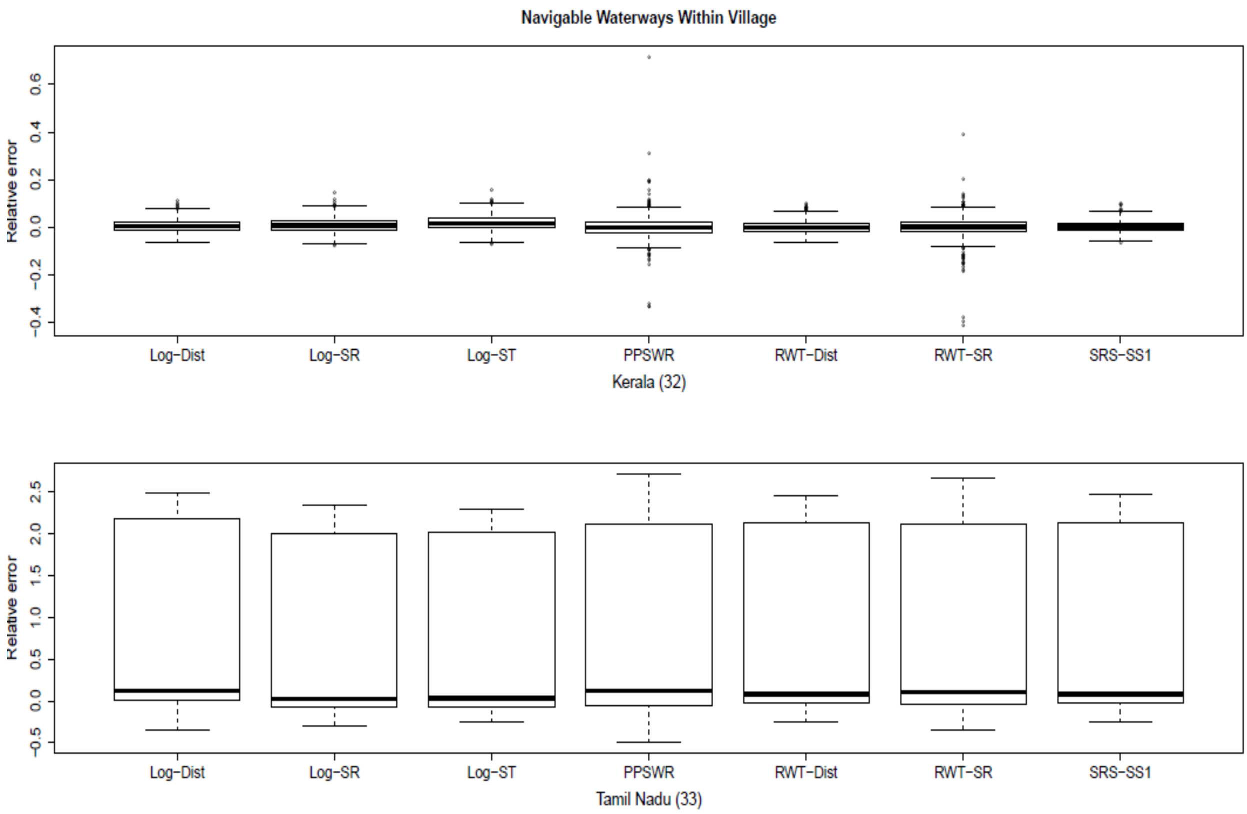

Navigable Waterways Within Village
Relative error
0.0
-0.1
-0.2
-0.3
-0.4
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Chhattisgarh (22)
Relative error
0.02
-0.02
-0.06
-0.10
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Madhya Pradesh (23)
Relative error
0.4
0.3
0.2
0.1
-0.1
-0.3
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Gujrat (24)

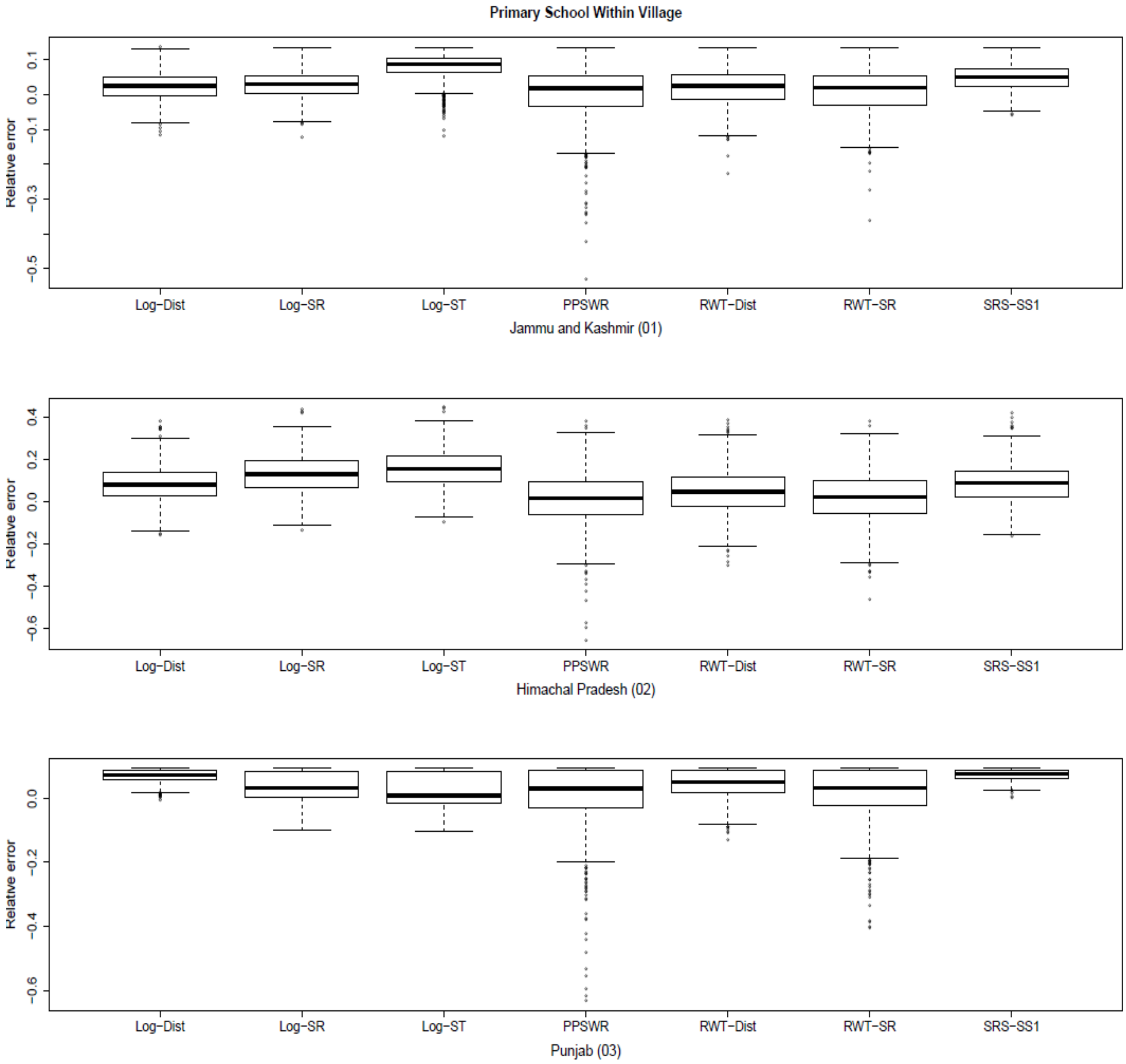
Navigable Waterways Within Village

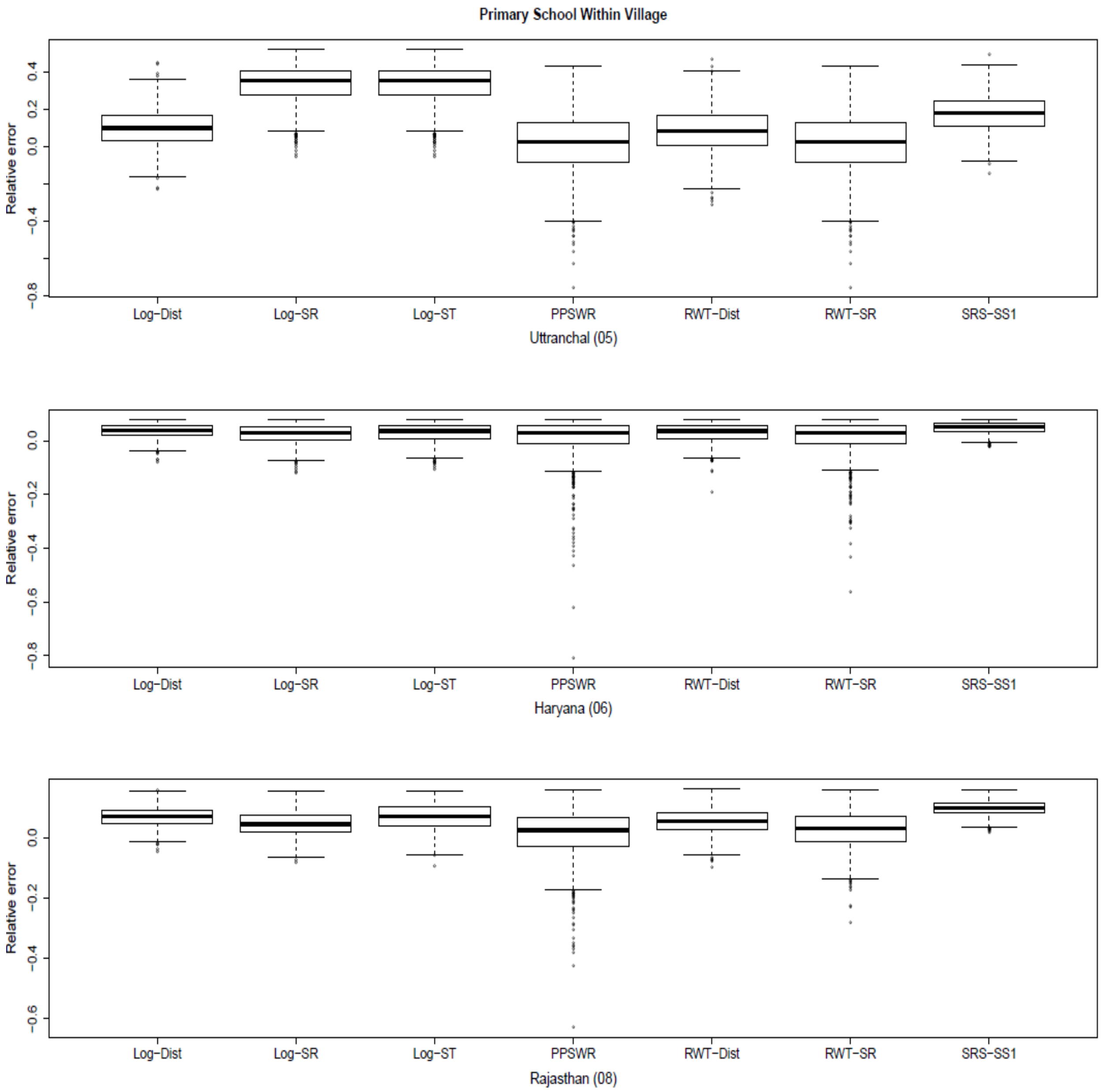


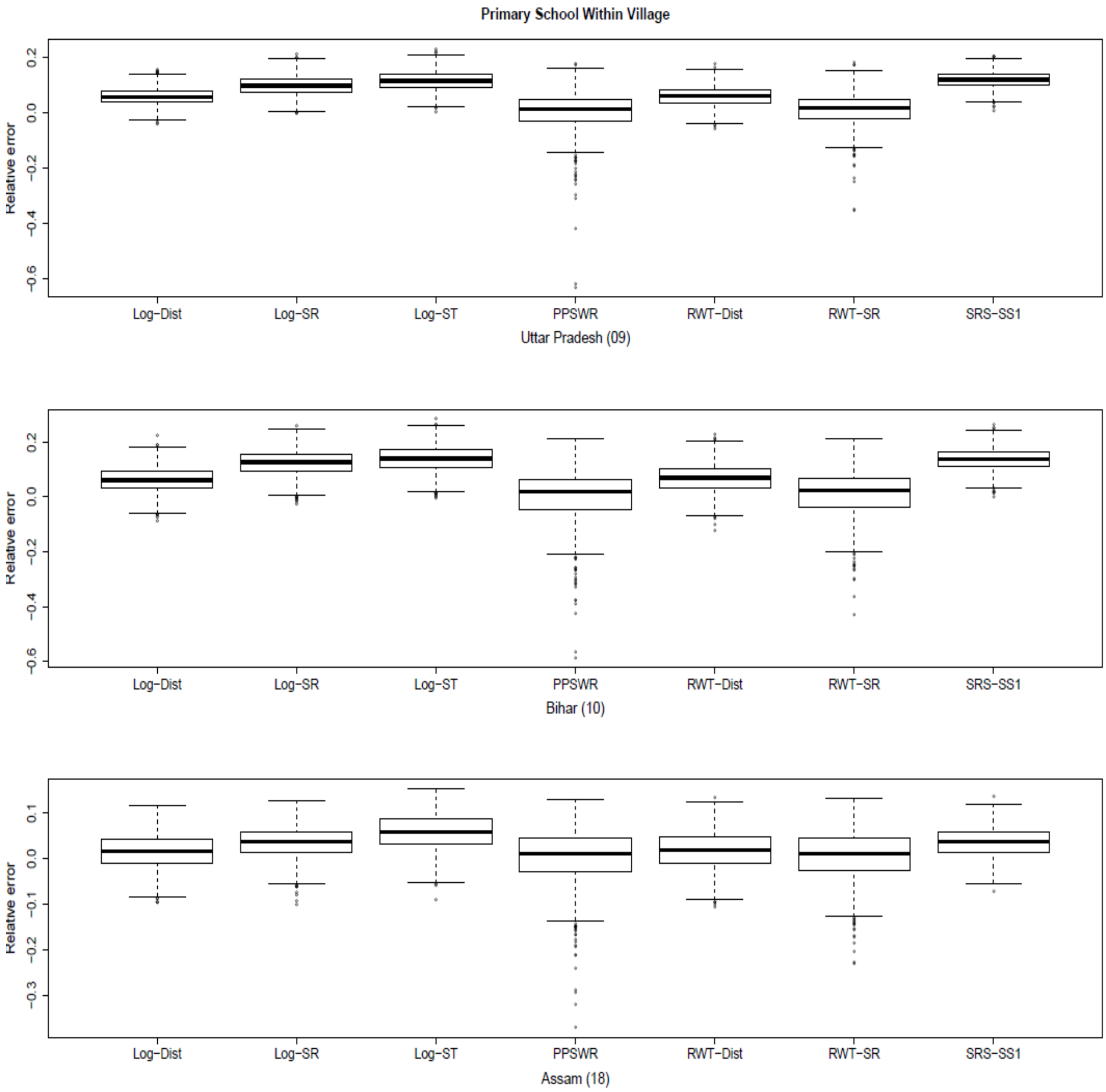


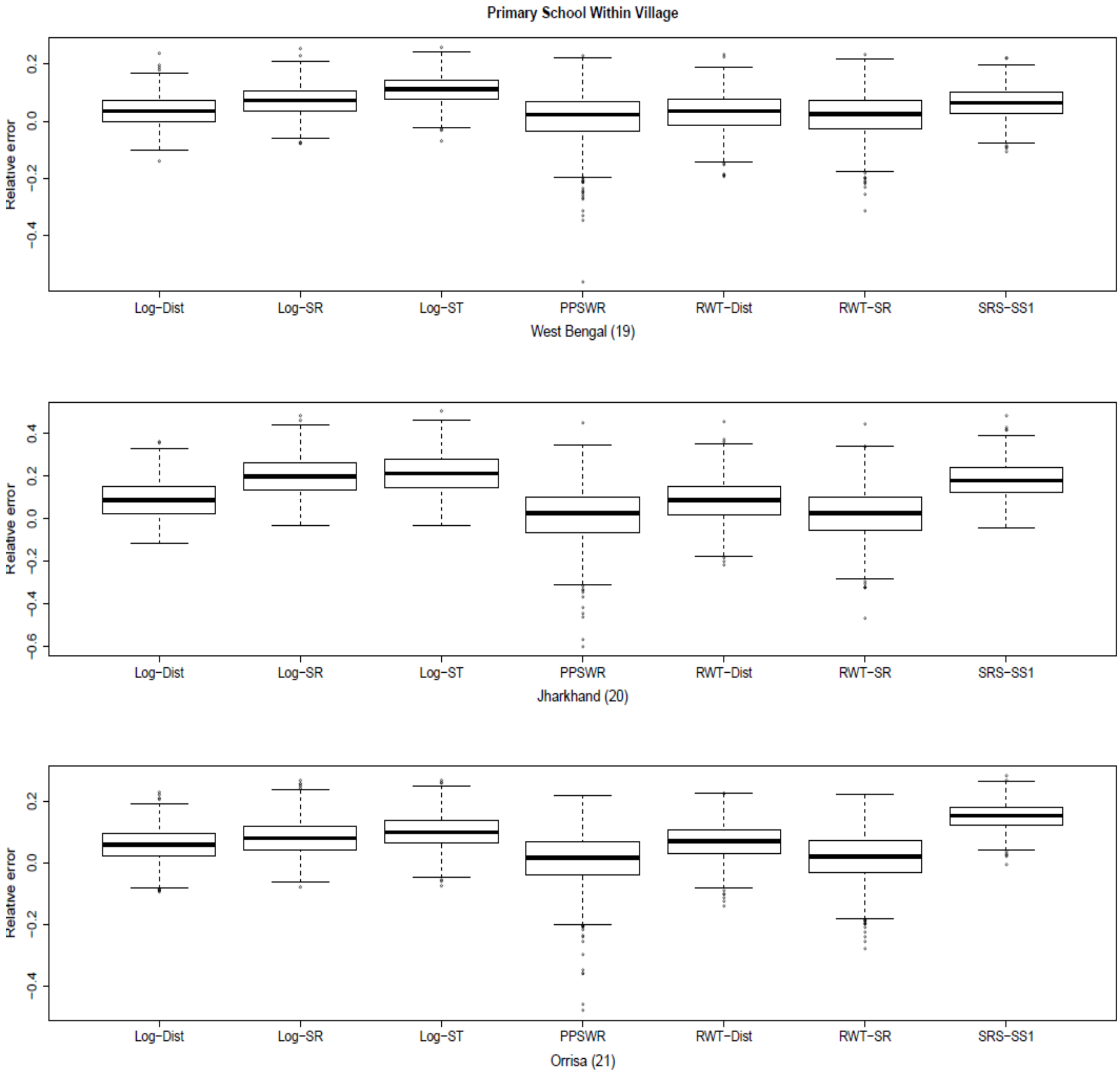


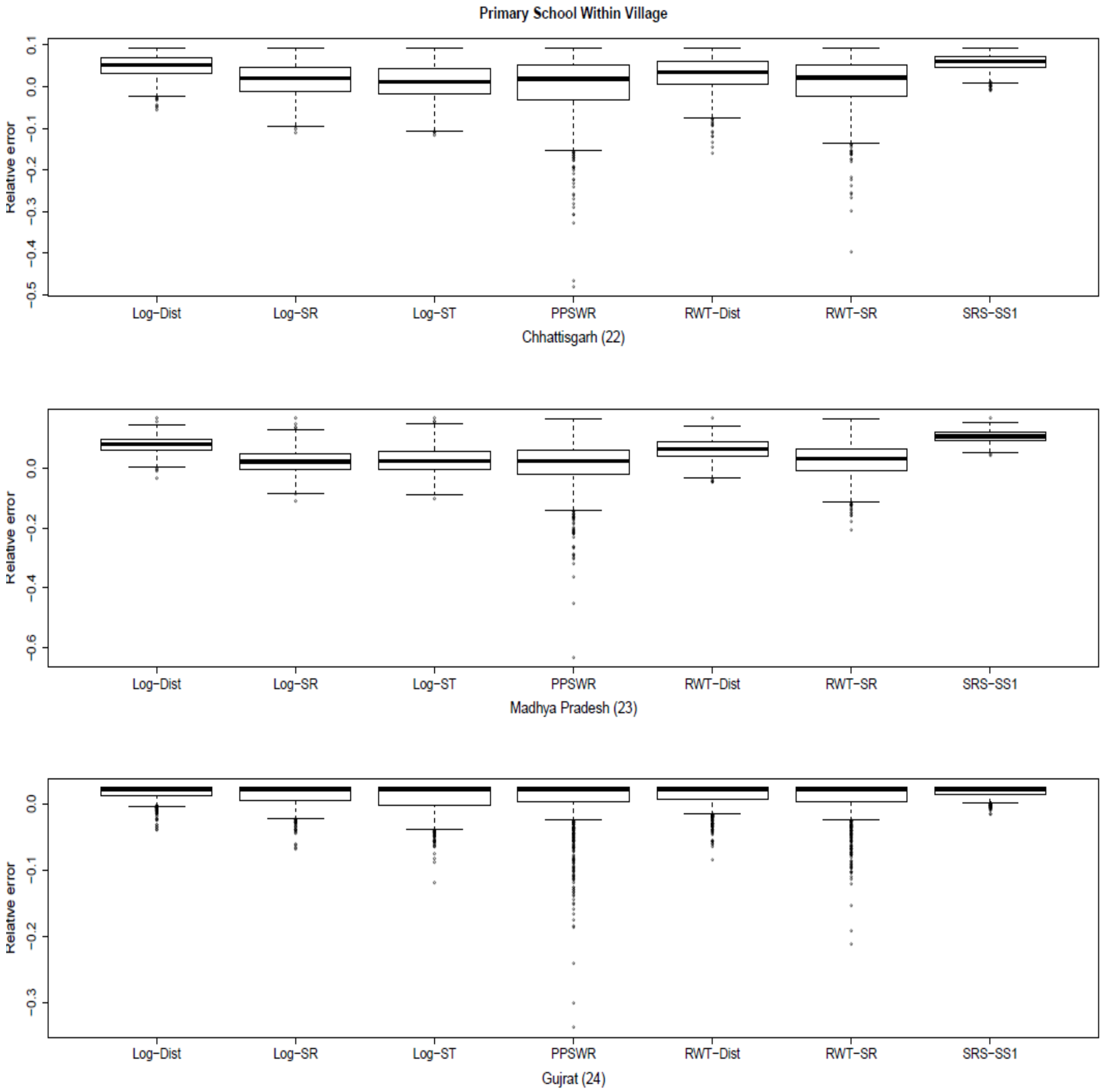

Navigable Waterways Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)


Primary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Jammu and Kashmir (01)
Himachal Pradesh (02)
Punjab (03)

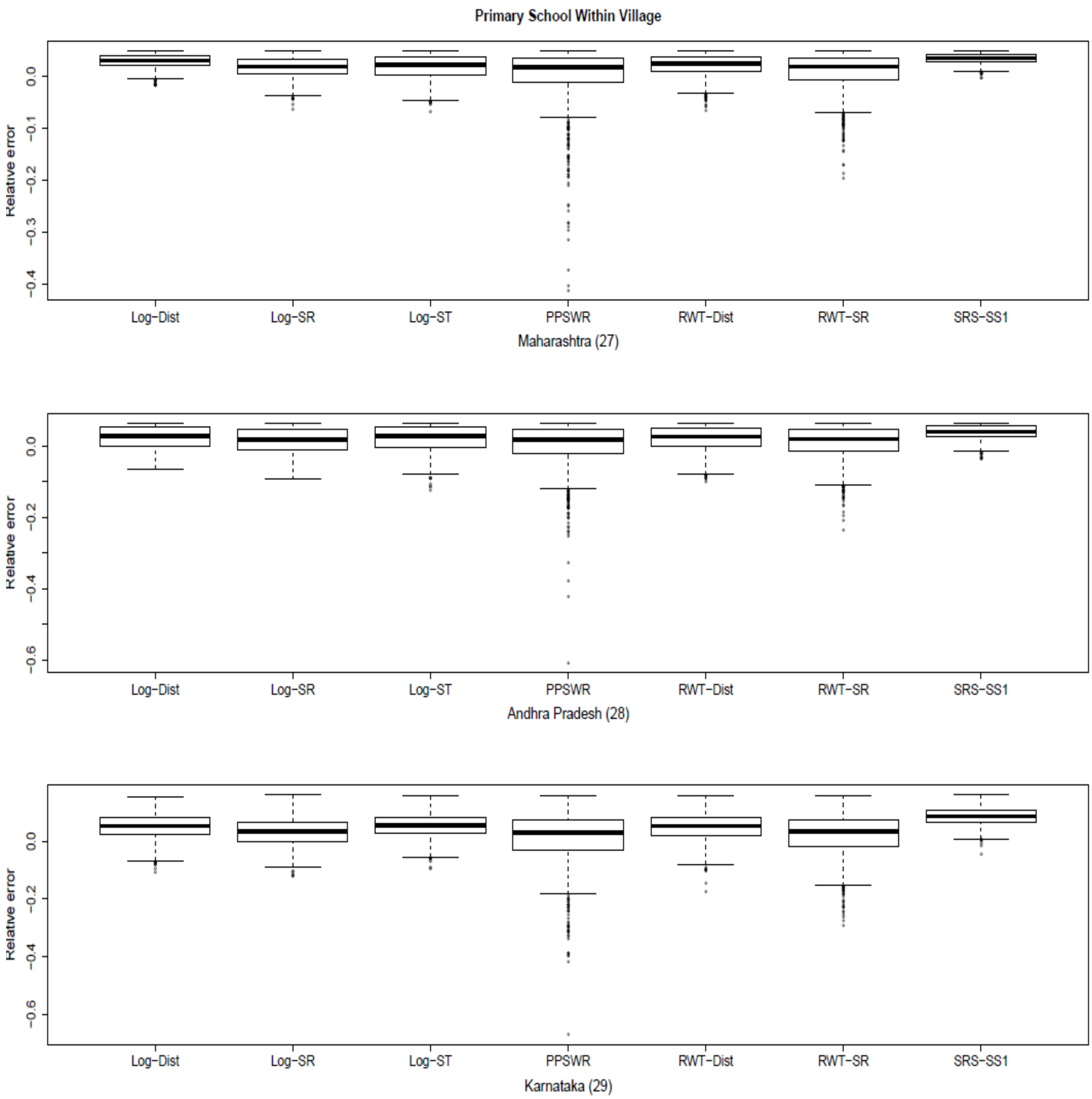

Primary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)

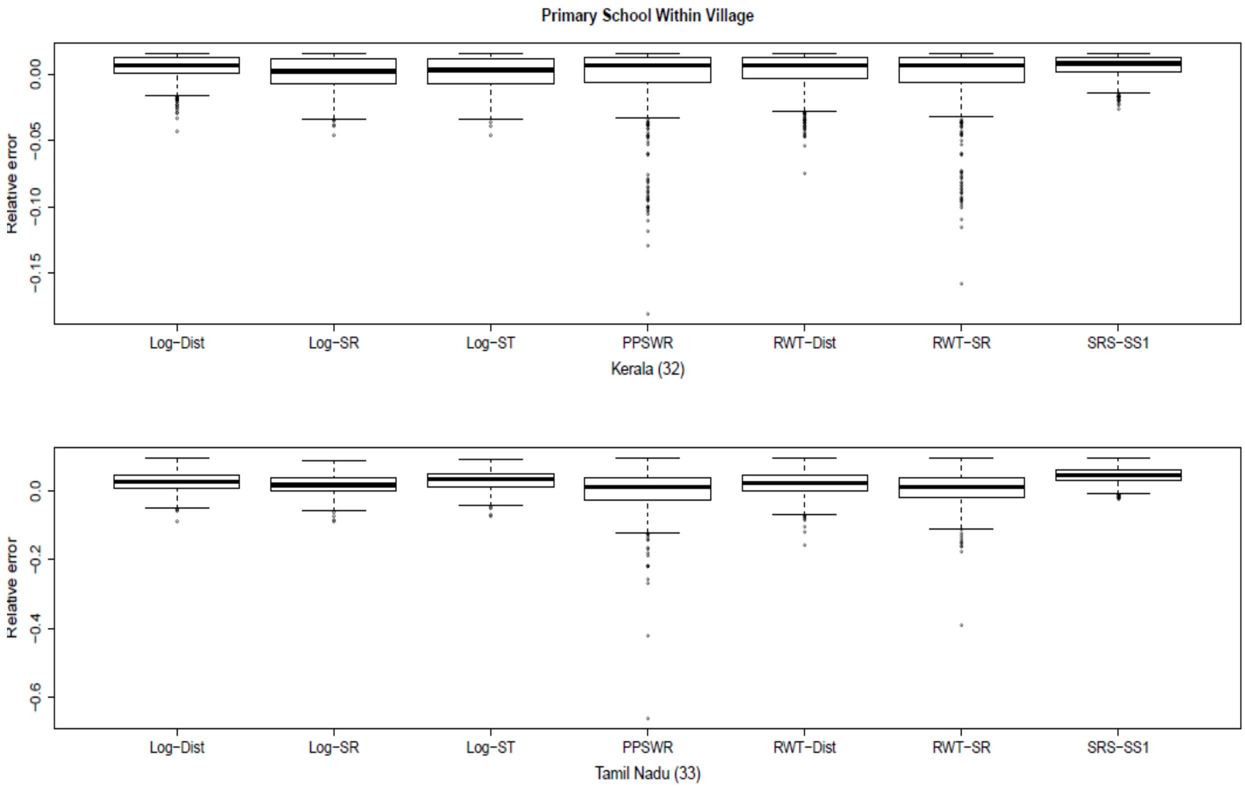

Primary School Within Village
Relative error
0.2
0.0
−0.2
−0.4
−0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Bihar (10)
0.1
−0.1
−0.3
Assam (18)


Primary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
West Bengal (19)
Jharkhand (20)
Orrisa (21)

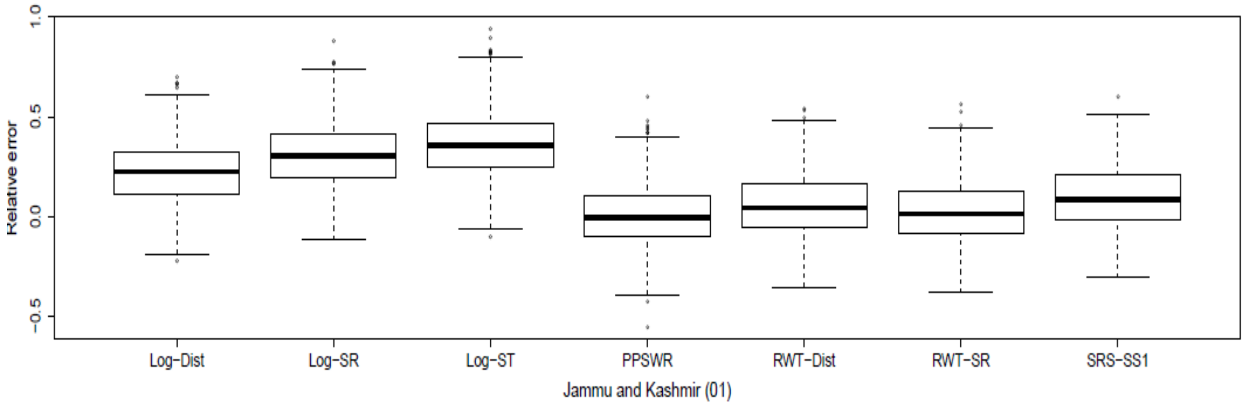


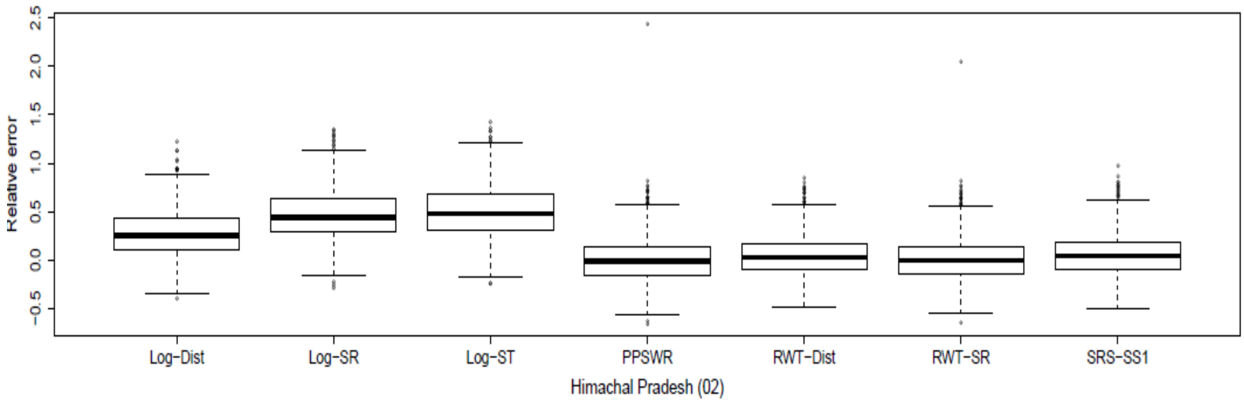
Primary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Chhattisgarh (22)
Madhya Pradesh (23)
Gujrat (24)

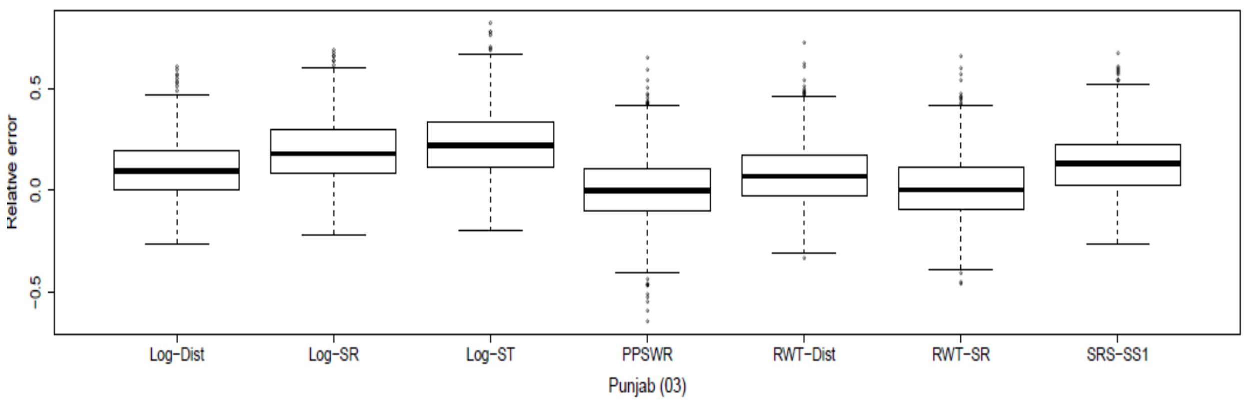

Primary School Within Village
Relative error
0.0
−0.1
−0.2
−0.3
−0.4
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Relative error
0.0
−0.2
−0.4
−0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Andhra Pradesh (28)
Relative error
0.0
−0.2
−0.4
−0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Karnataka (29)

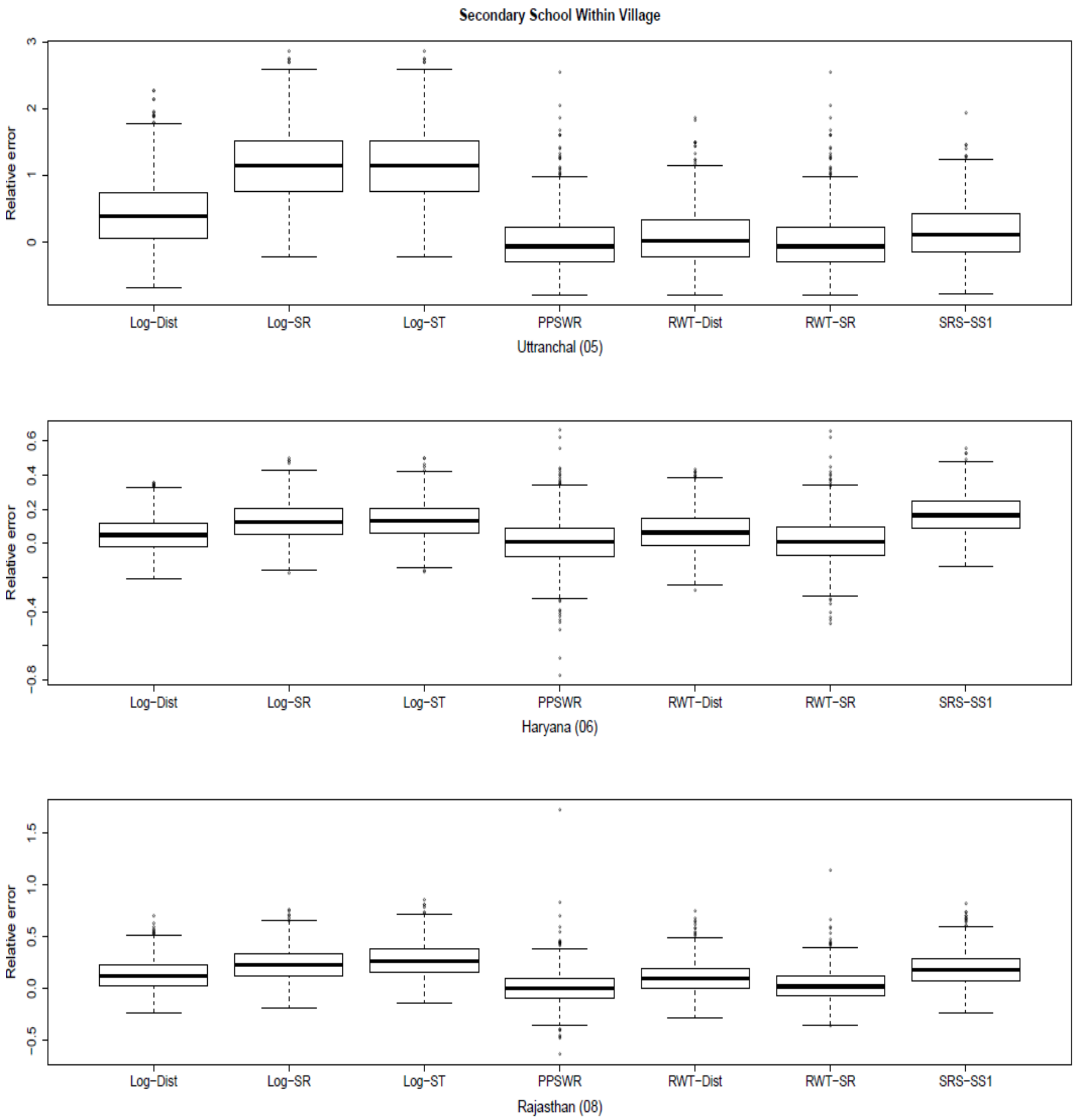

Primary School Within Village
Relative error
0.00
−0.05
−0.10
−0.15
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
0.0
−0.2
−0.4
−0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)

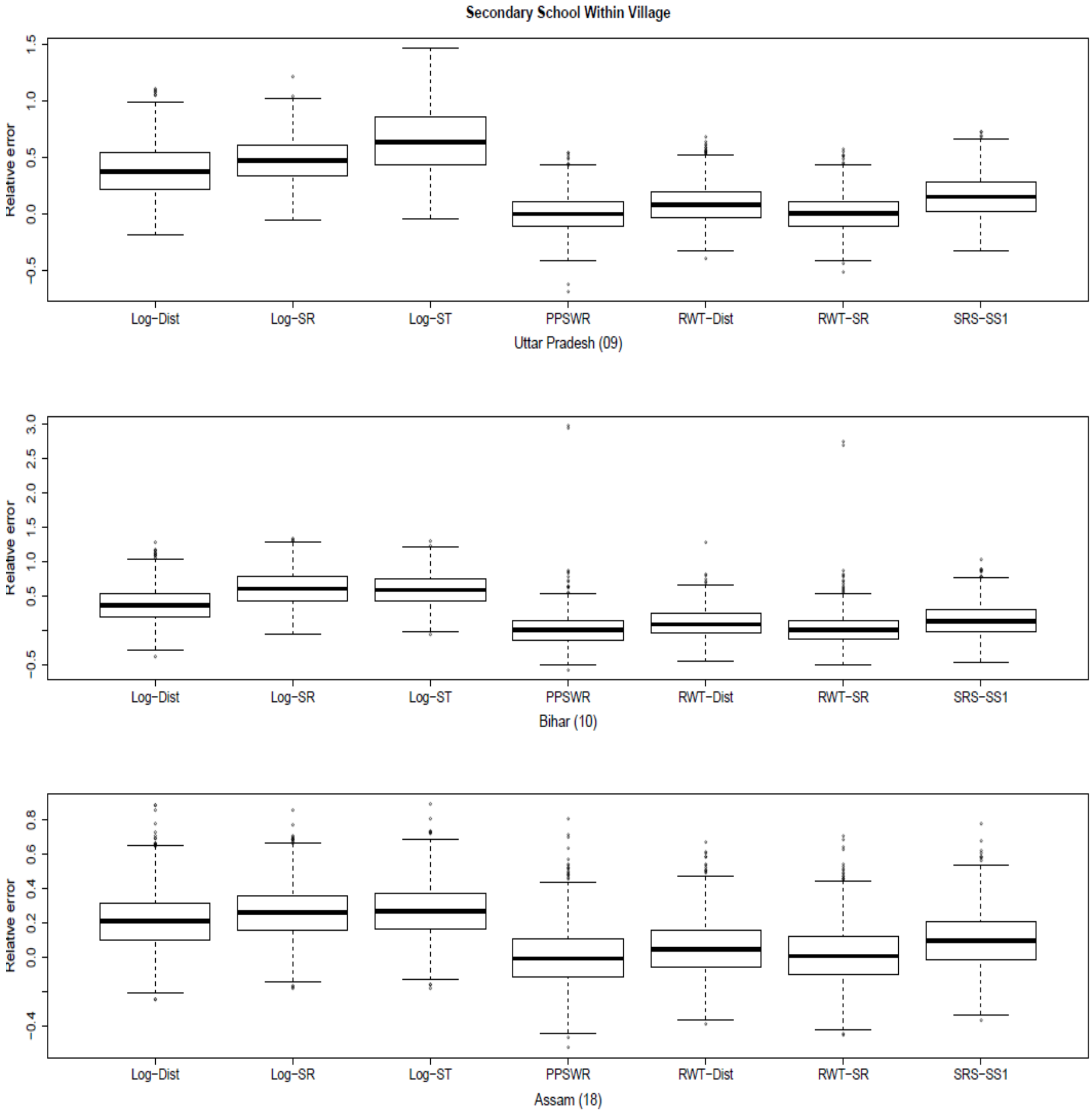
Secondary School Within Village

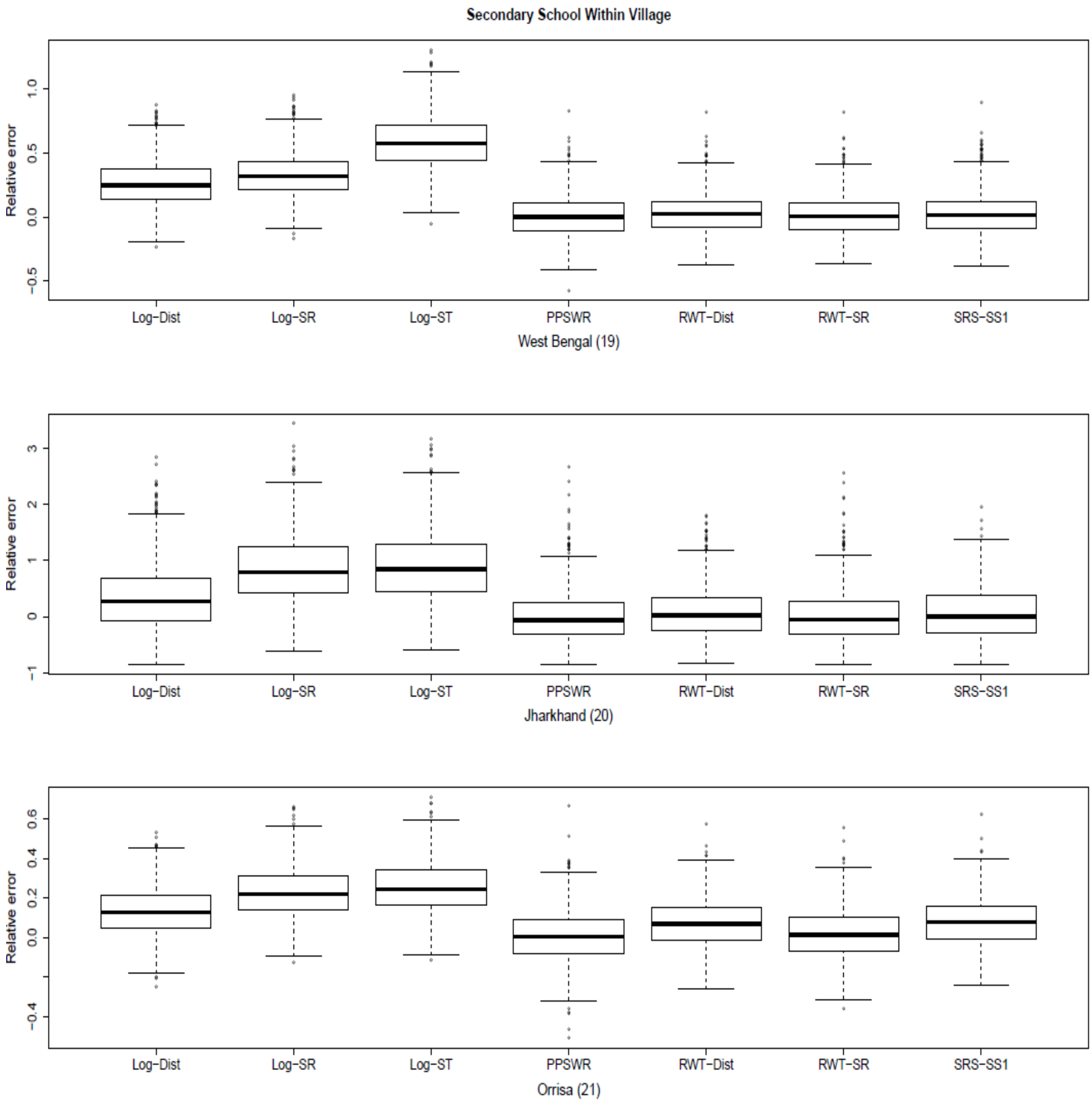


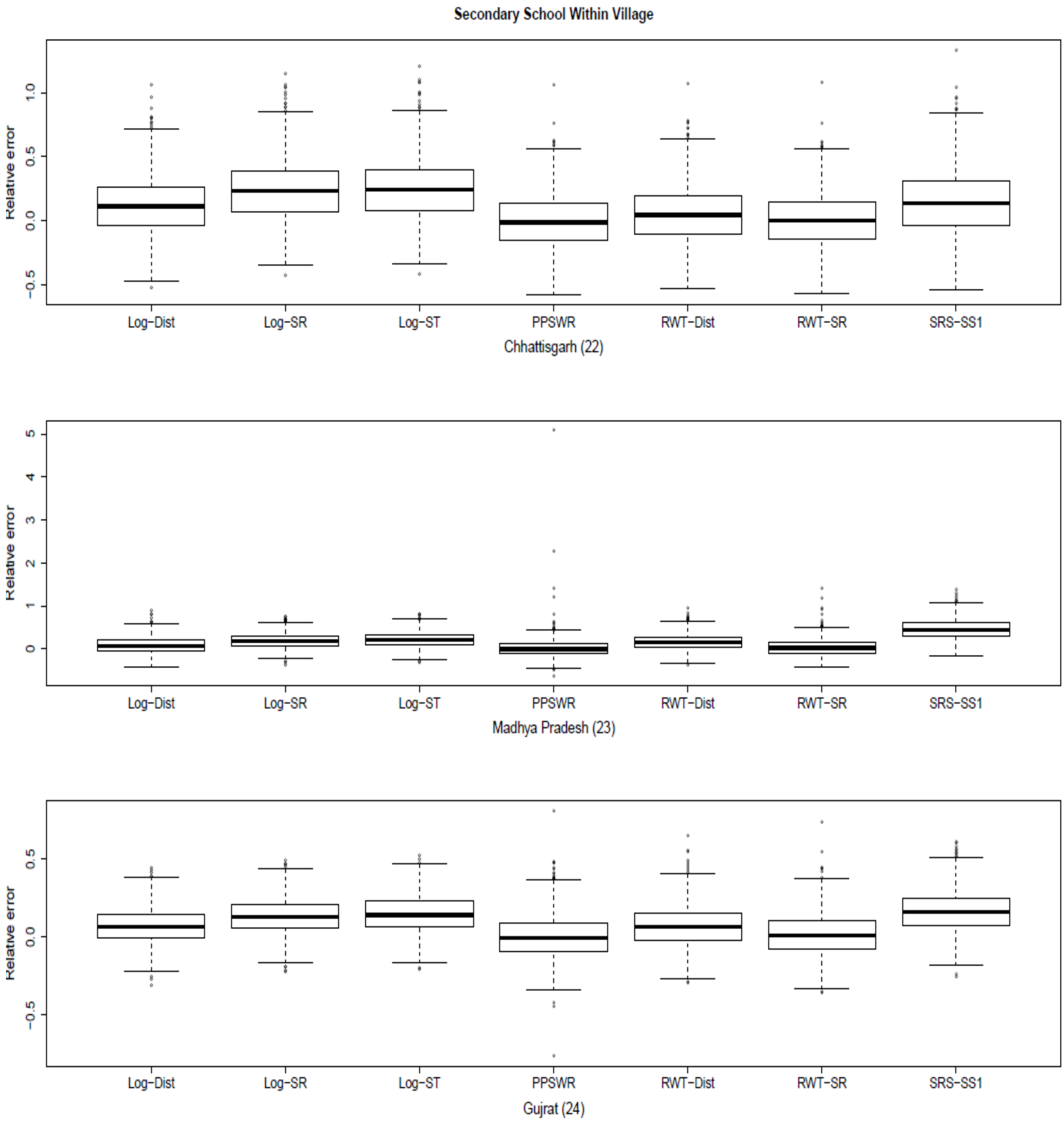


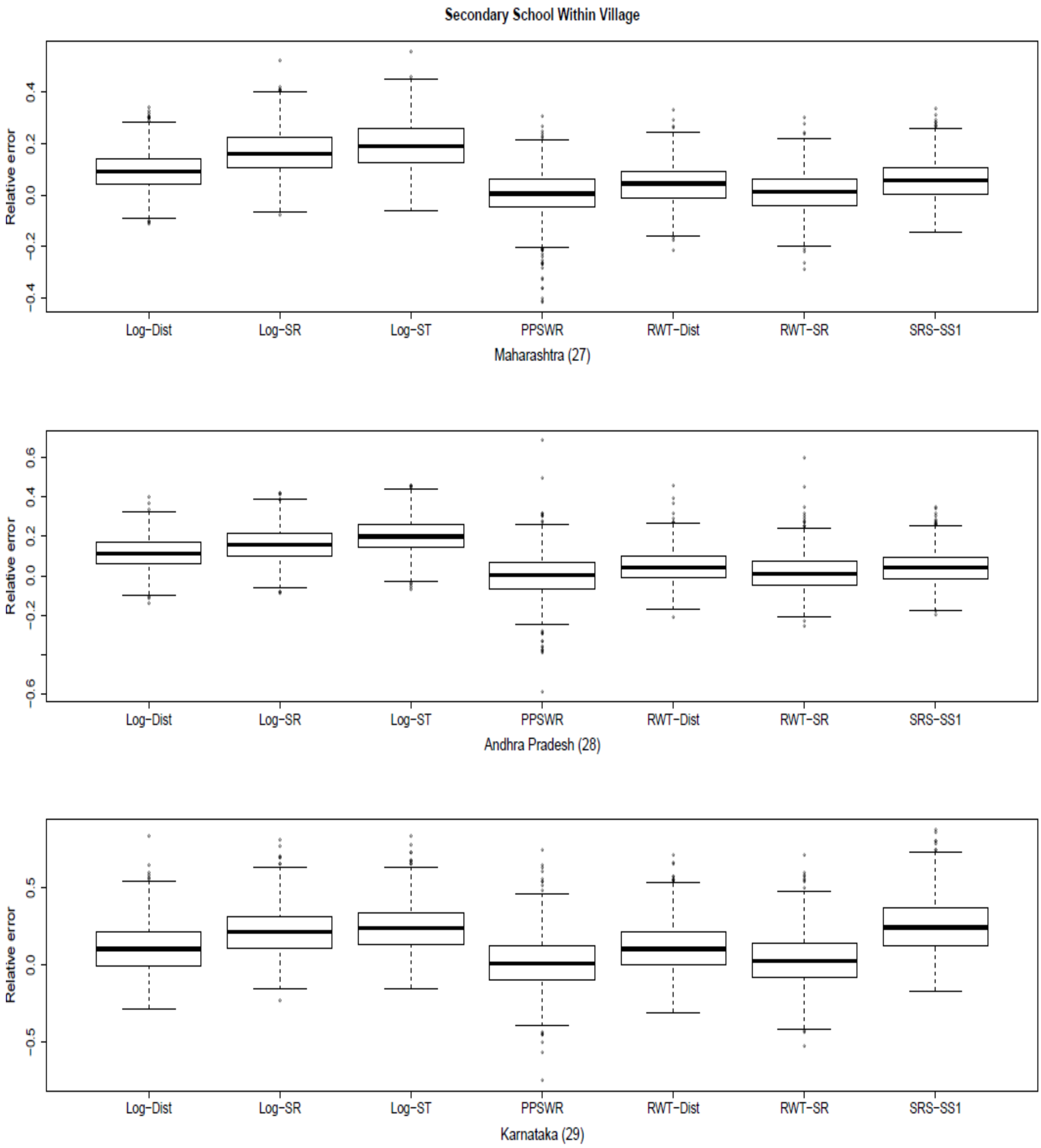


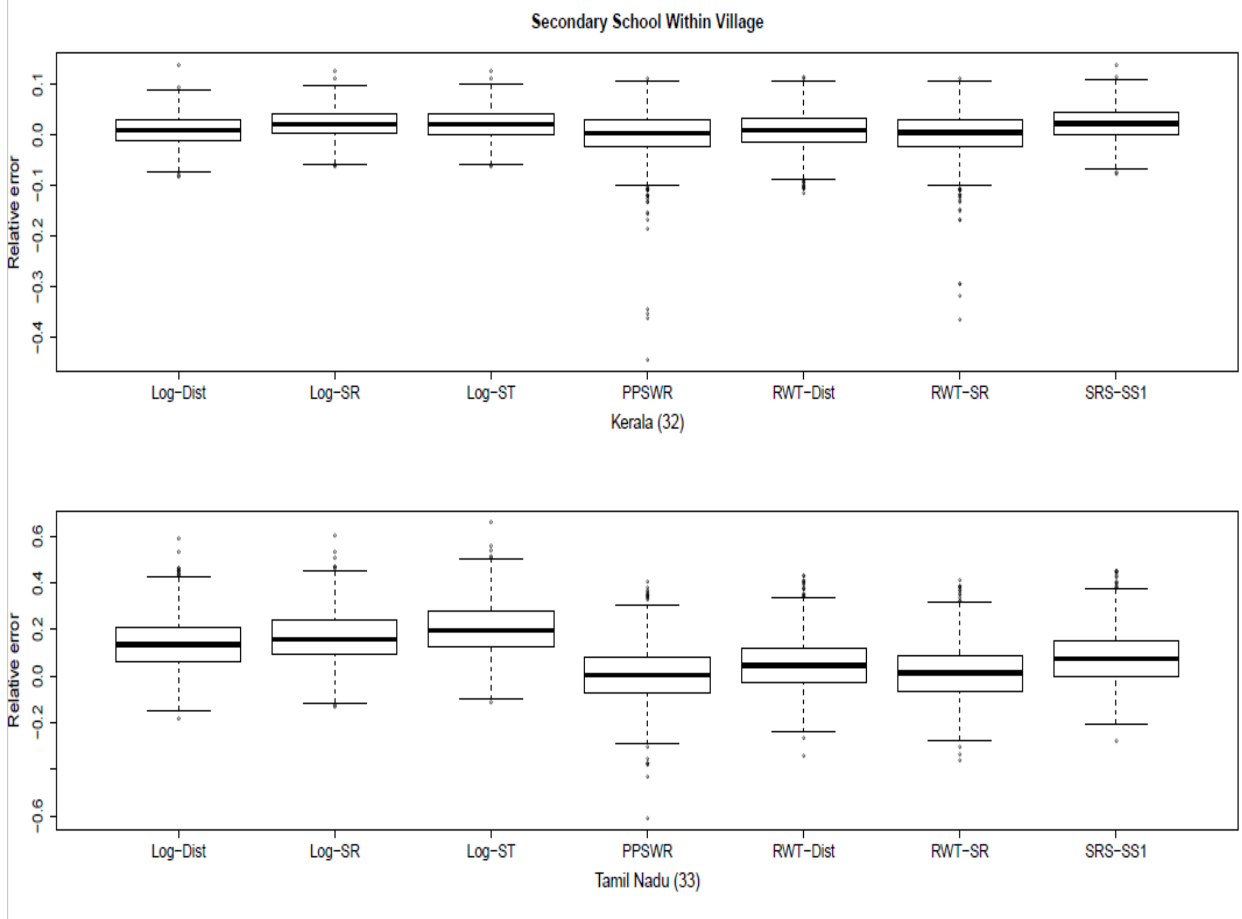

Secondary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)

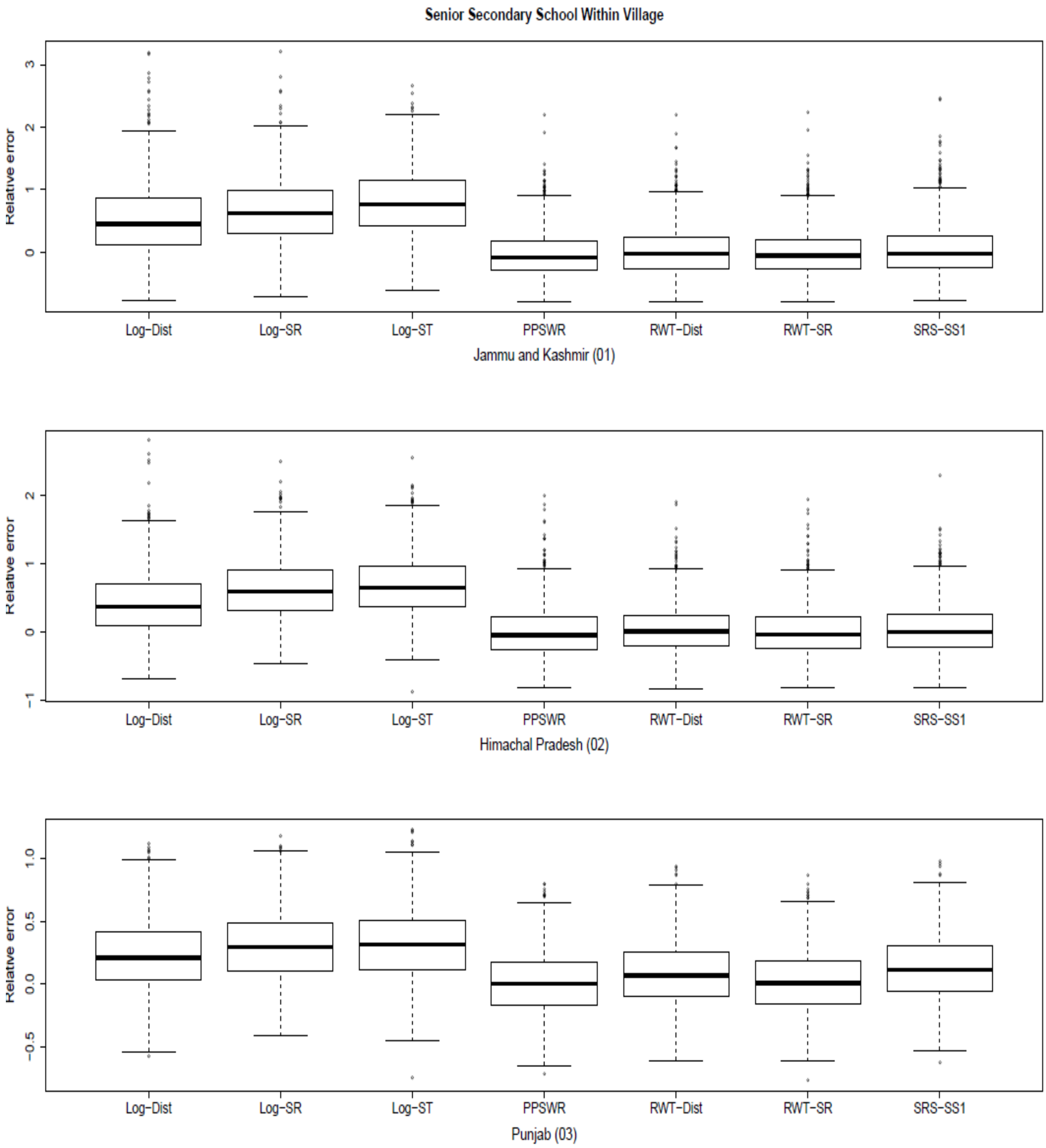

Secondary School Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Uttar Pradesh (09)
Bihar (10)
Assam (18)

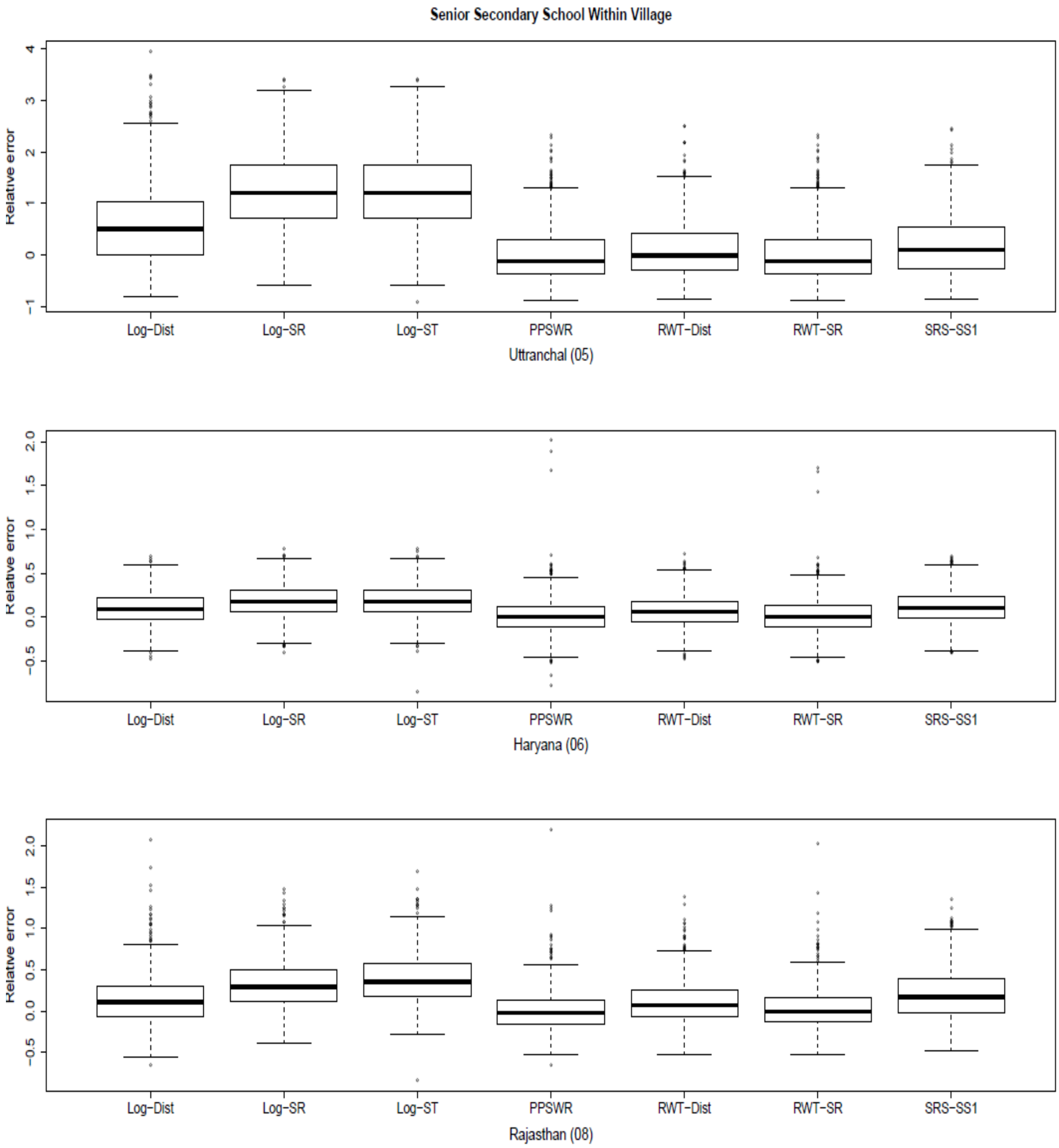

Secondary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
West Bengal (19)
Jharkhand (20)
Orrisa (21)

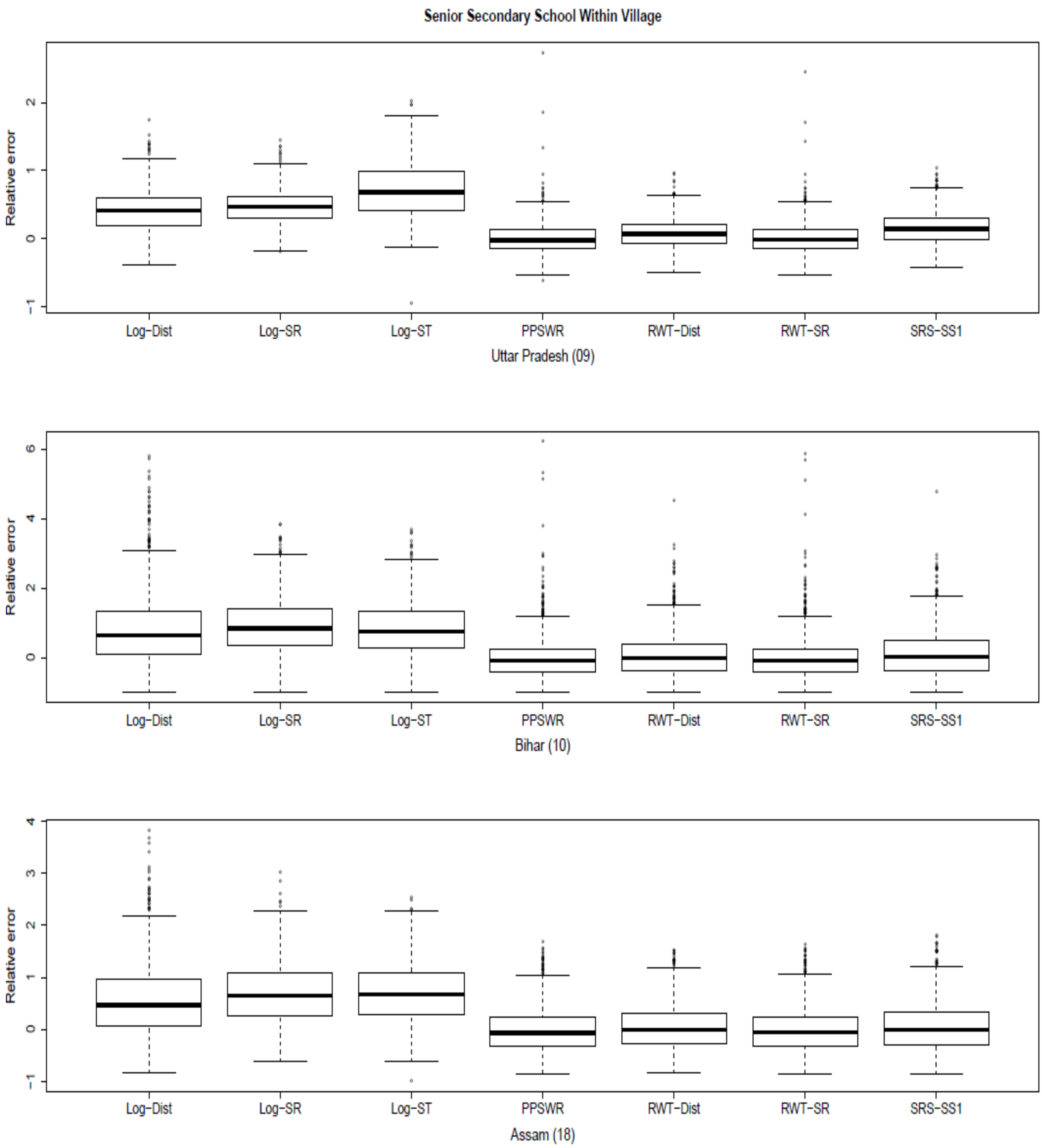

Secondary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Chhattisgarh (22)
Madhya Pradesh (23)
Gujrat (24)


Secondary School Within Village
Relative error
-0.4
-0.2
0.0
0.2
0.4
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Relative error
-0.6
-0.2
0.0
0.2
0.4
0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Andhra Pradesh (28)
Relative error
-0.5
0.0
0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Karnataka (29)

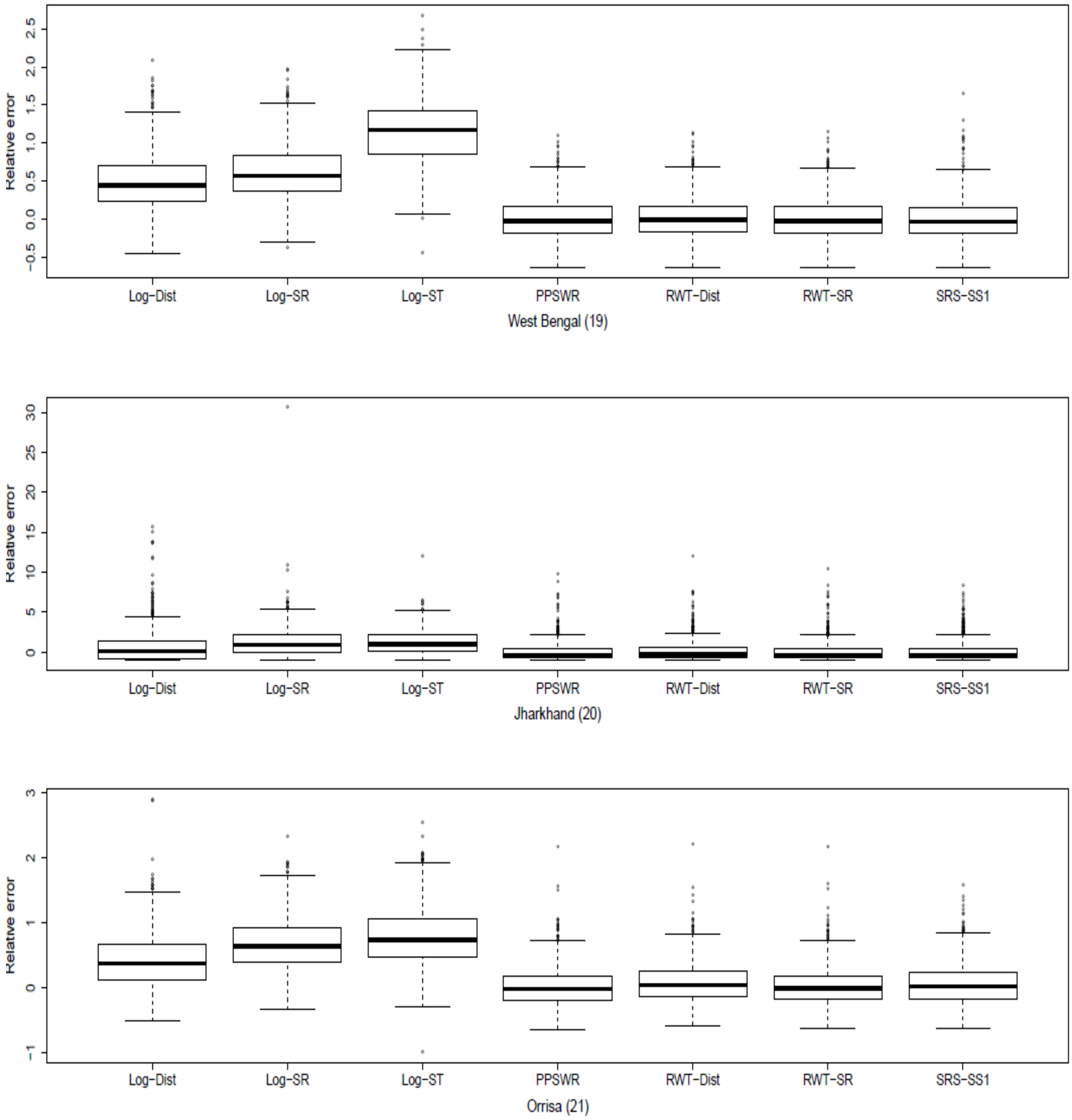

Secondary School Within Village
Relative error
0.1
0.0
-0.1
-0.2
-0.3
-0.4
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Kerala (32)
Relative error
0.6
0.4
0.2
0.0
-0.2
-0.6
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Tamil Nadu (33)

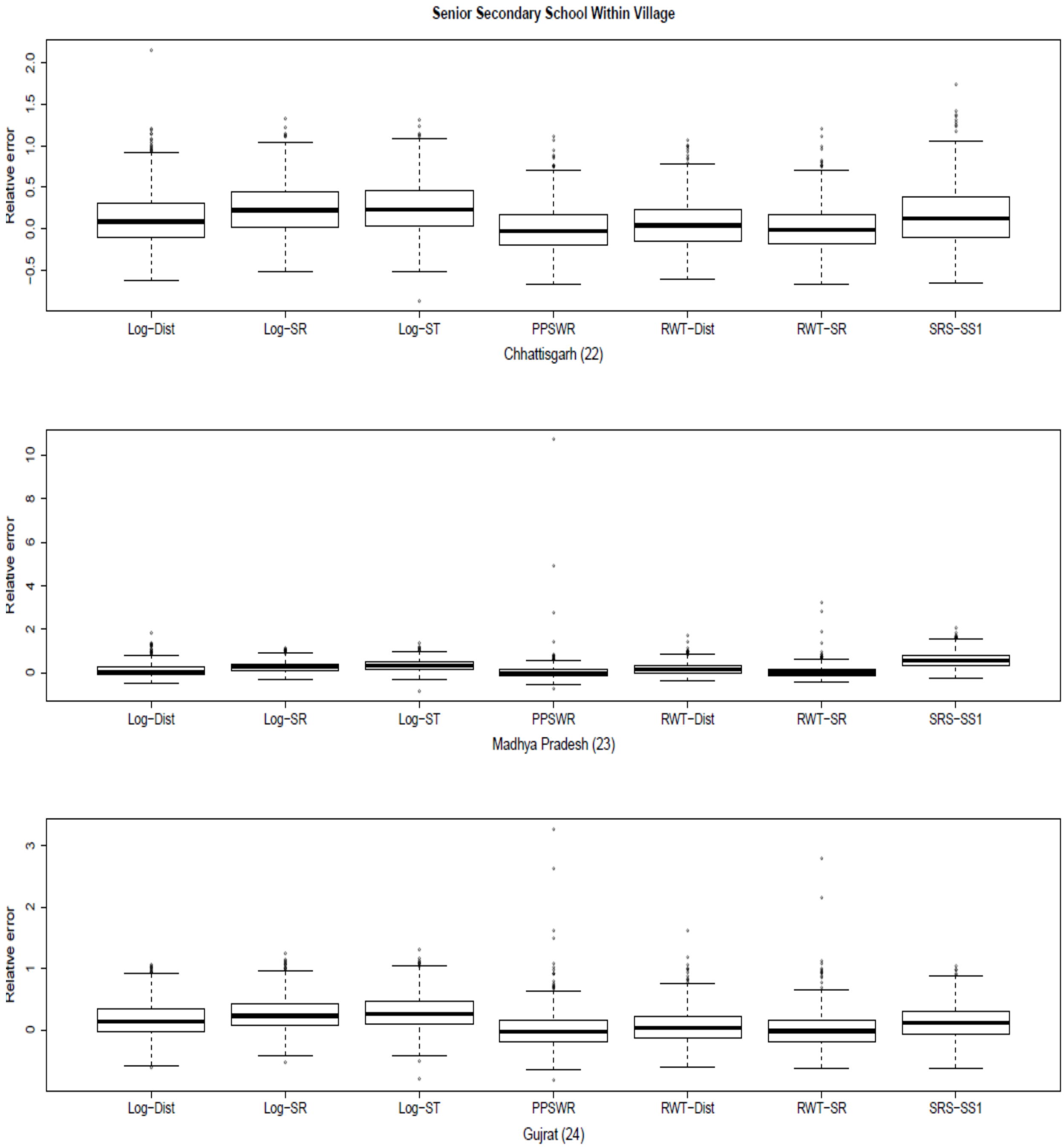

Senior Secondary School Within Village
Relative error
0
1
2
3
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Jammu and Kashmir (01)
Relative error
−1
0
1
2
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Himachal Pradesh (02)
Relative error
−0.5
0.0
0.5
1.0
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Punjab (03)

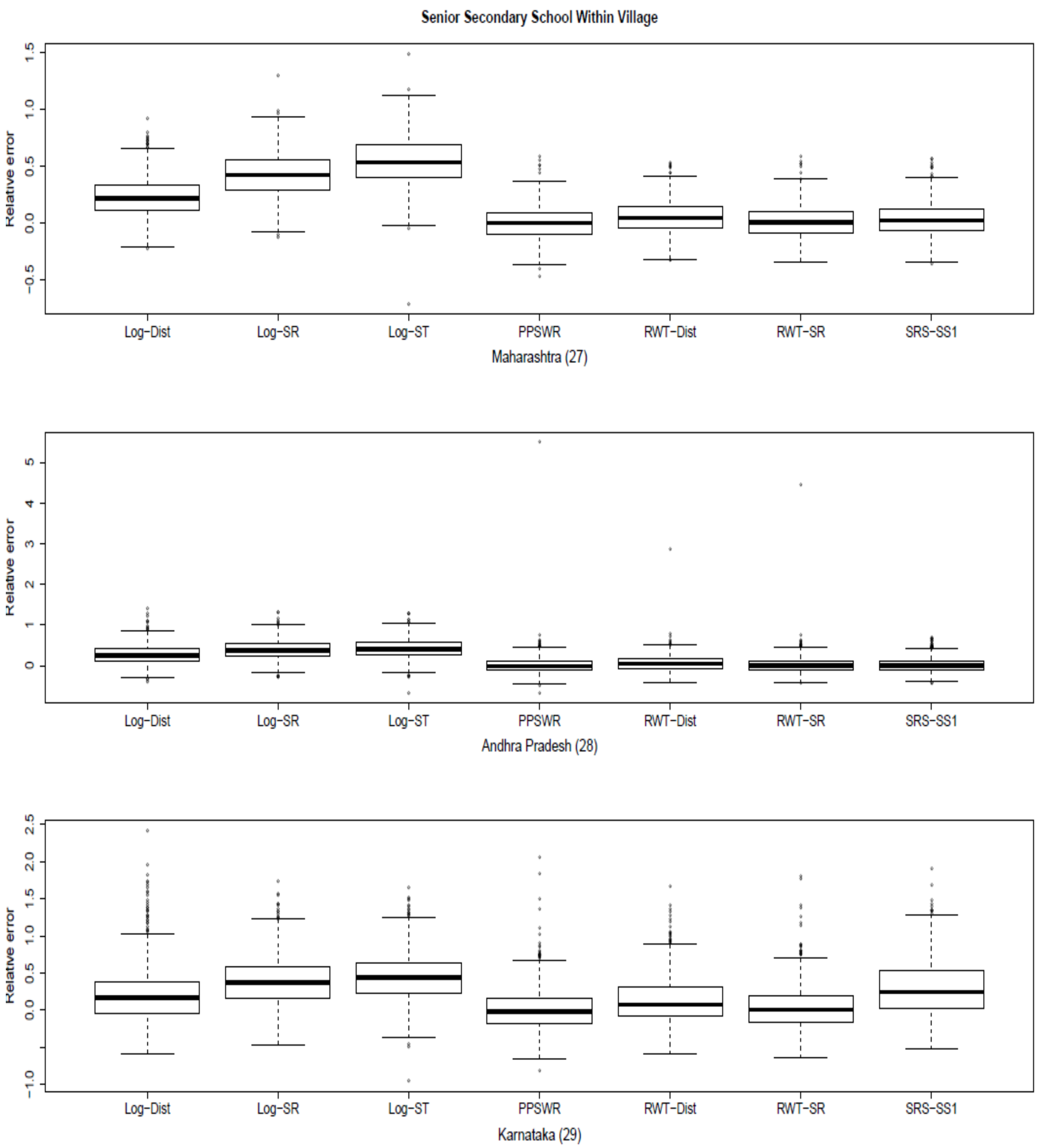

Senior Secondary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)

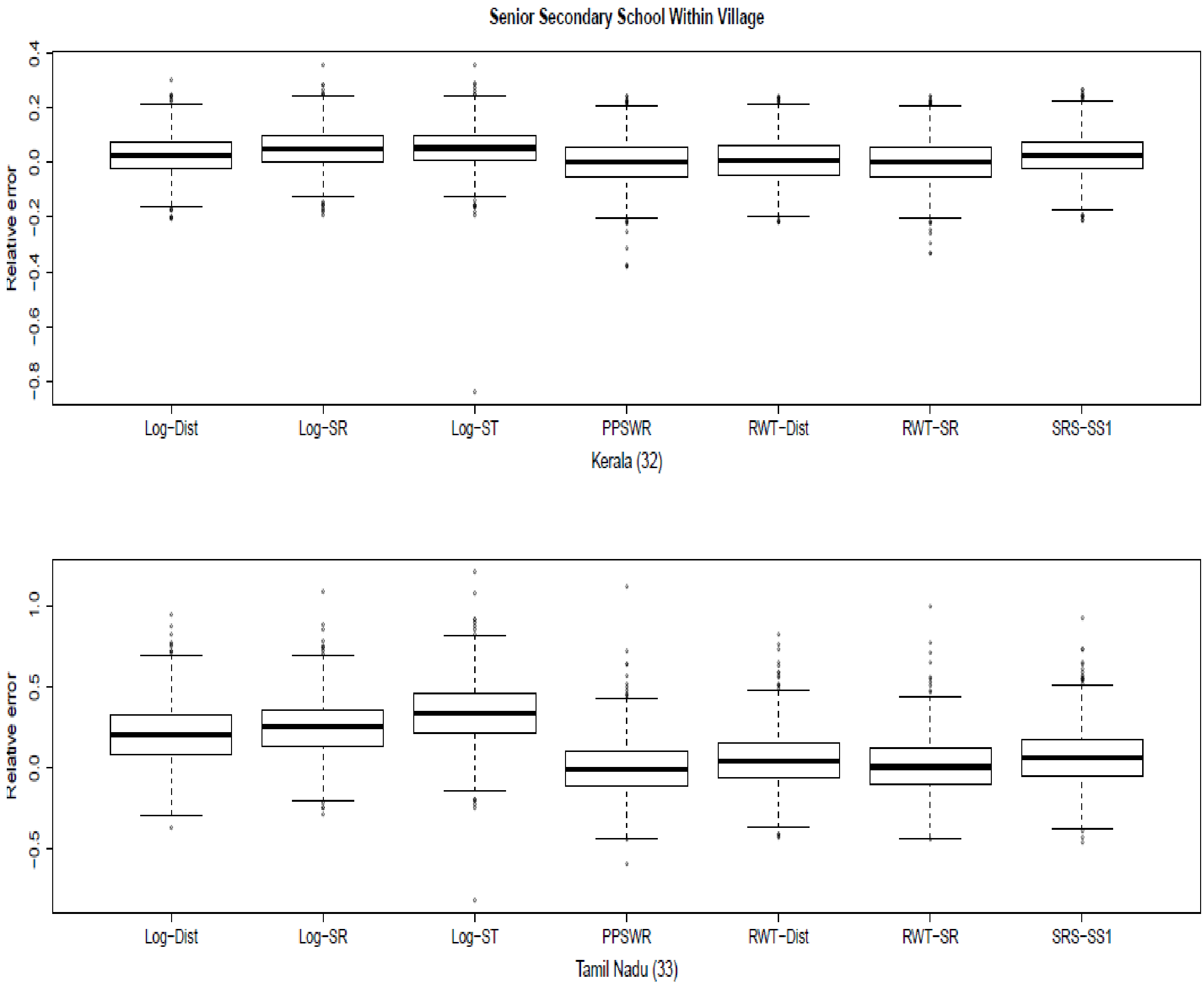

Senior Secondary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Bihar (10)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Assam (18)

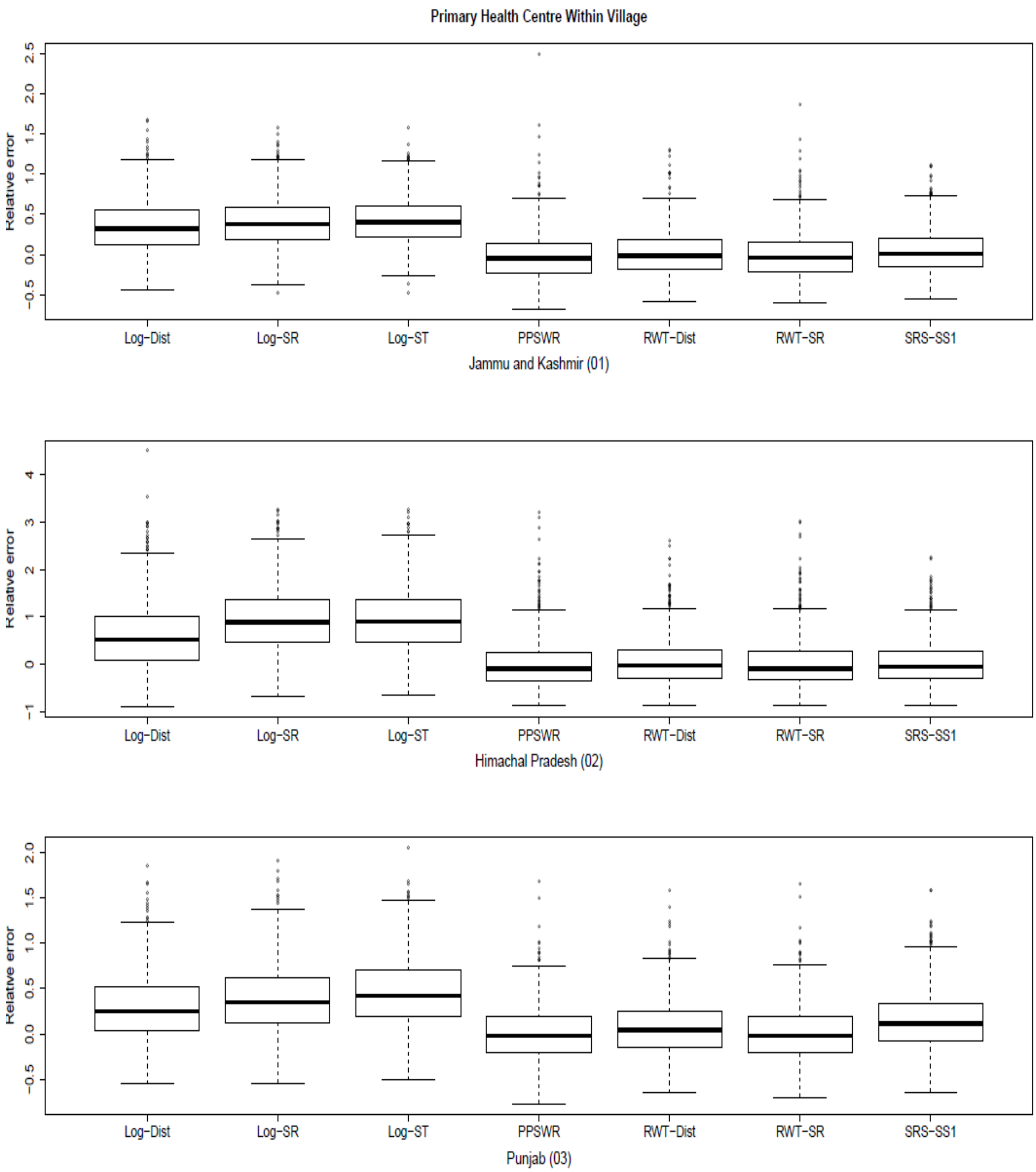
Senior Secondary School Within Village

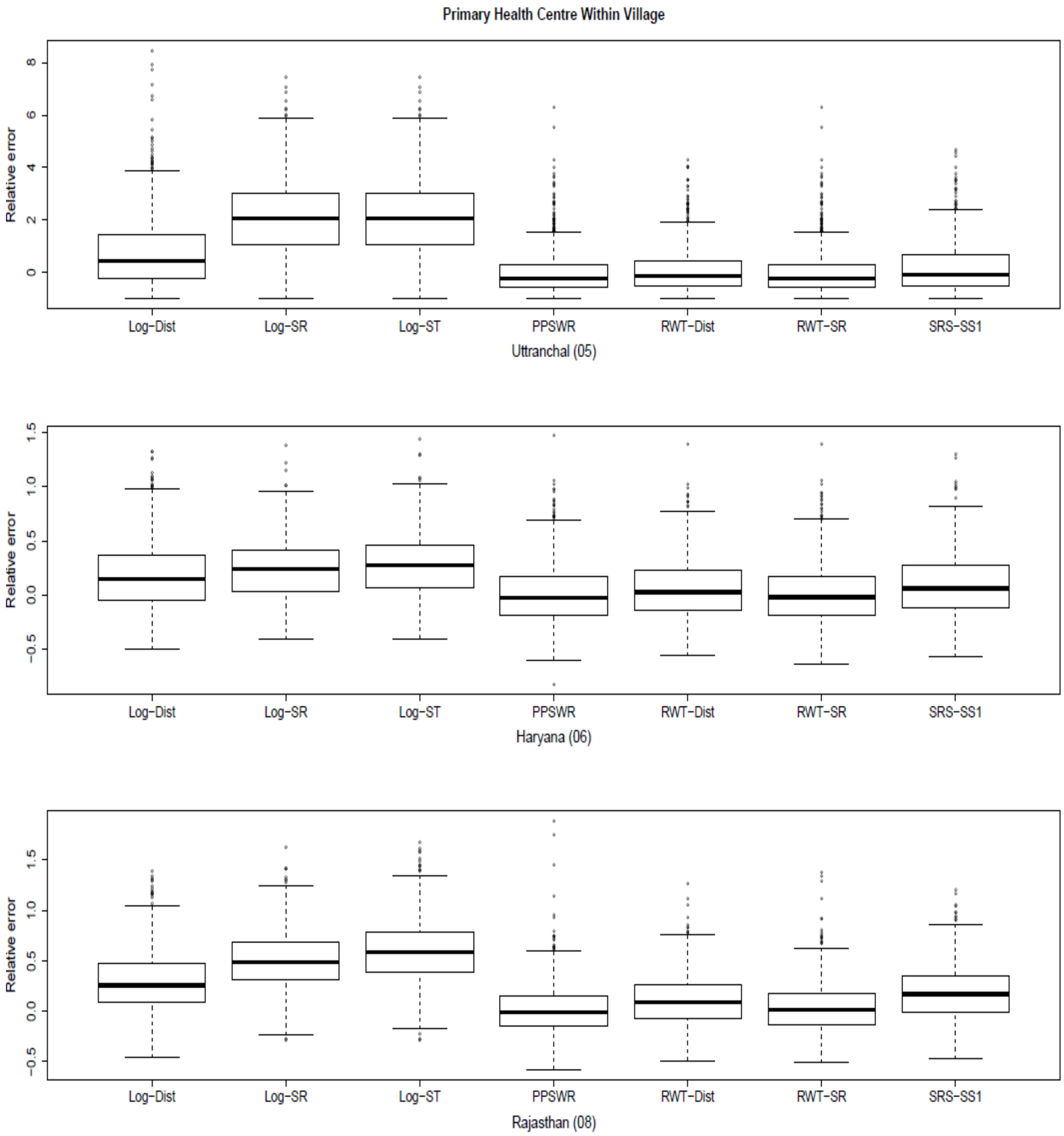


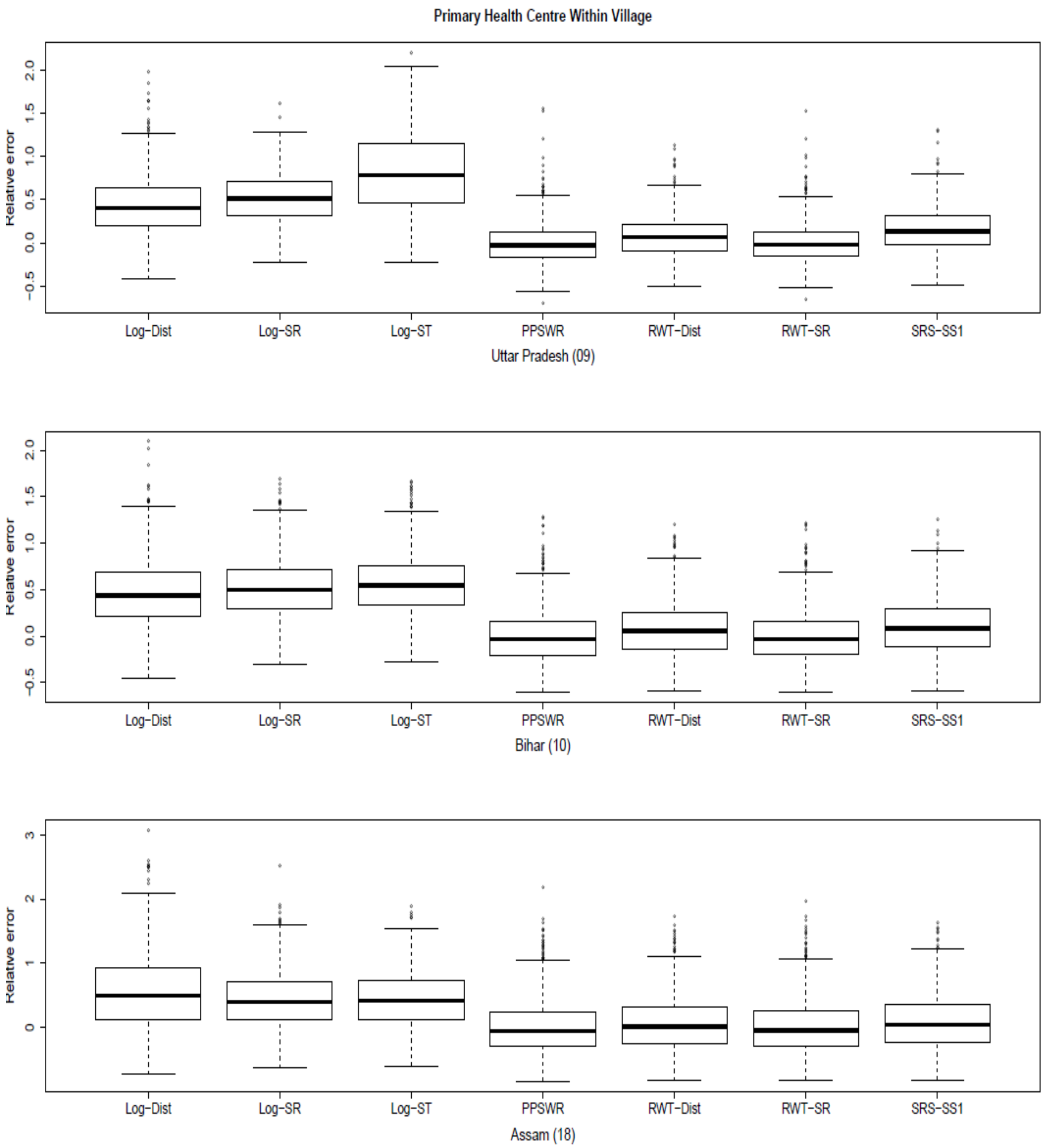

Senior Secondary School Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Chhattisgarh (22)
Madhya Pradesh (23)
Gujrat (24)

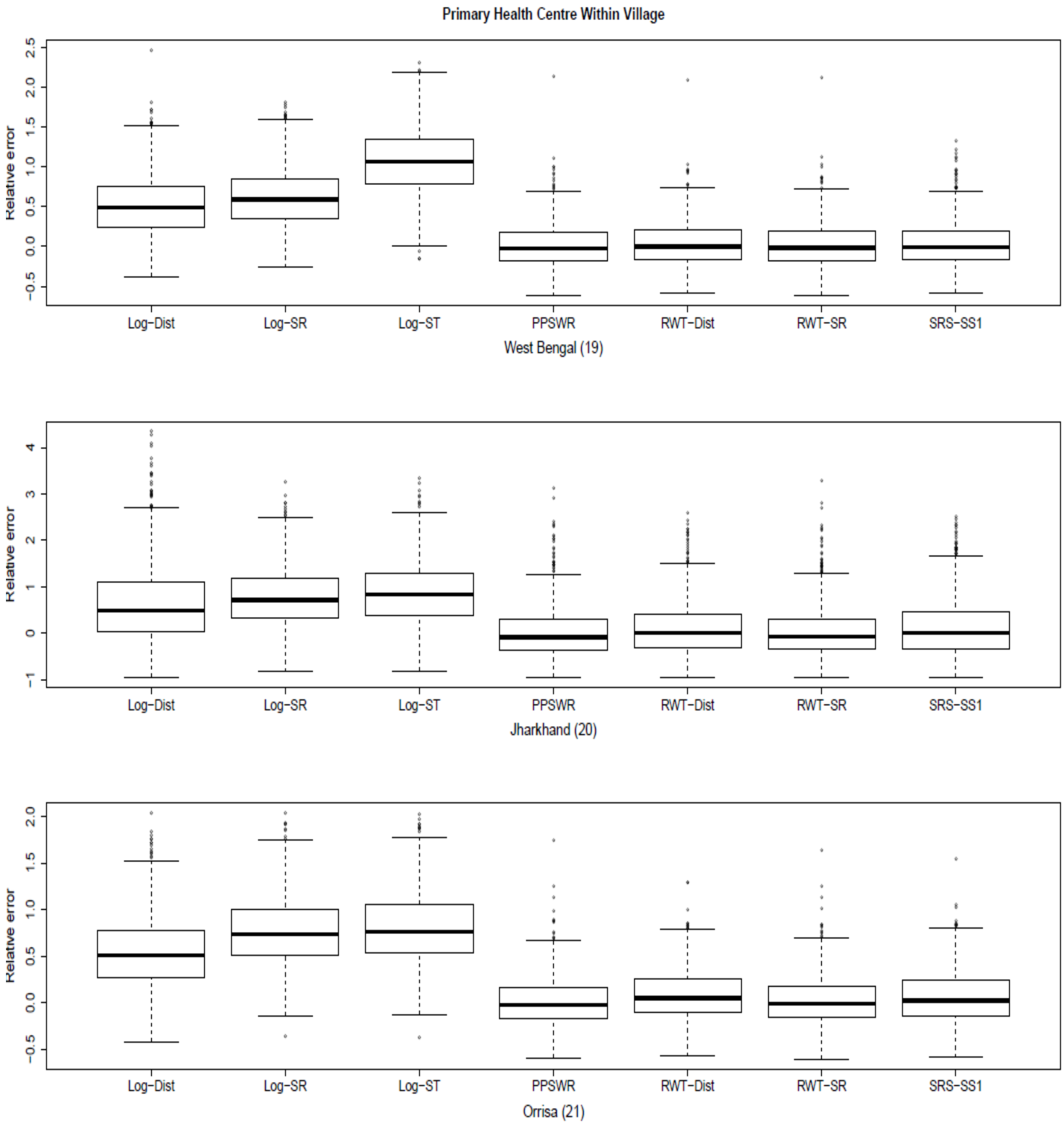

Senior Secondary School Within Village
Relative error
1.5
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Relative error
5
4
3
2
1
0
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Andhra Pradesh (28)
Relative error
2.5
2.0
1.5
1.0
0.5
0.0
−1.0
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Karnataka (29)


Senior Secondary School Within Village
Relative error
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)


Primary Health Centre Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Jammu and Kashmir (01)
Himachal Pradesh (02)
Punjab (03)

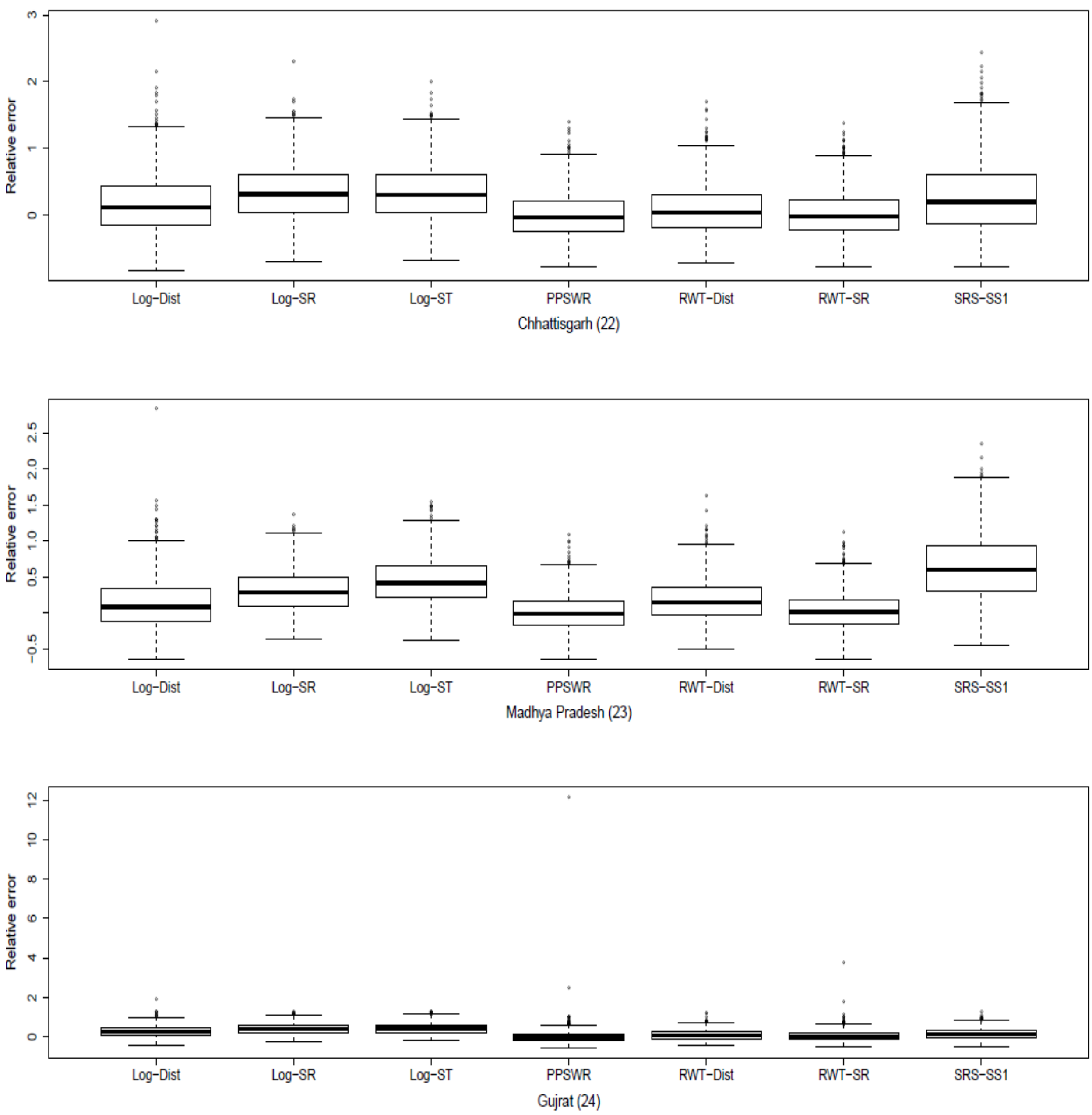

Primary Health Centre Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)

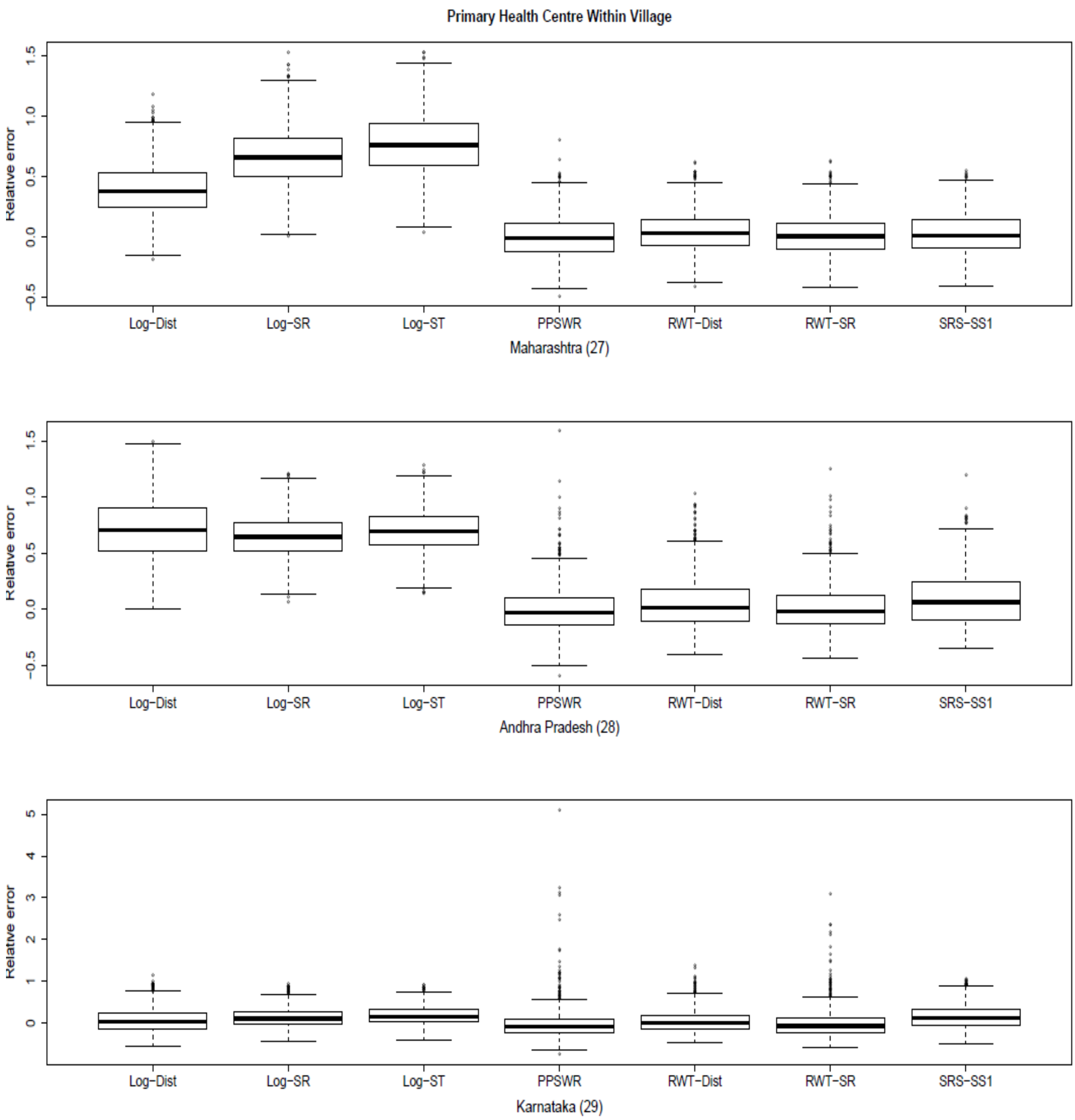

Primary Health Centre Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Bihar (10)
Assam (18)

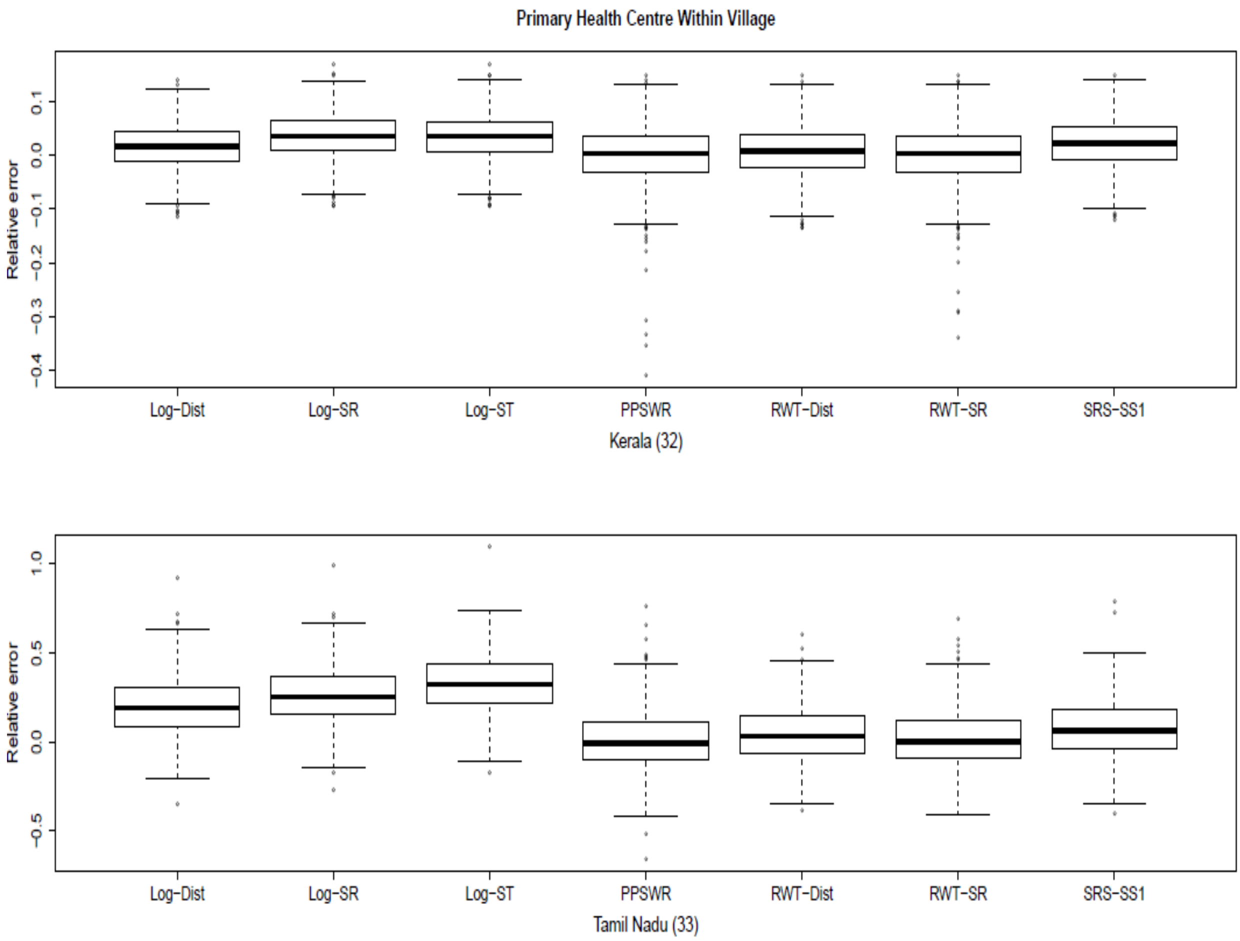


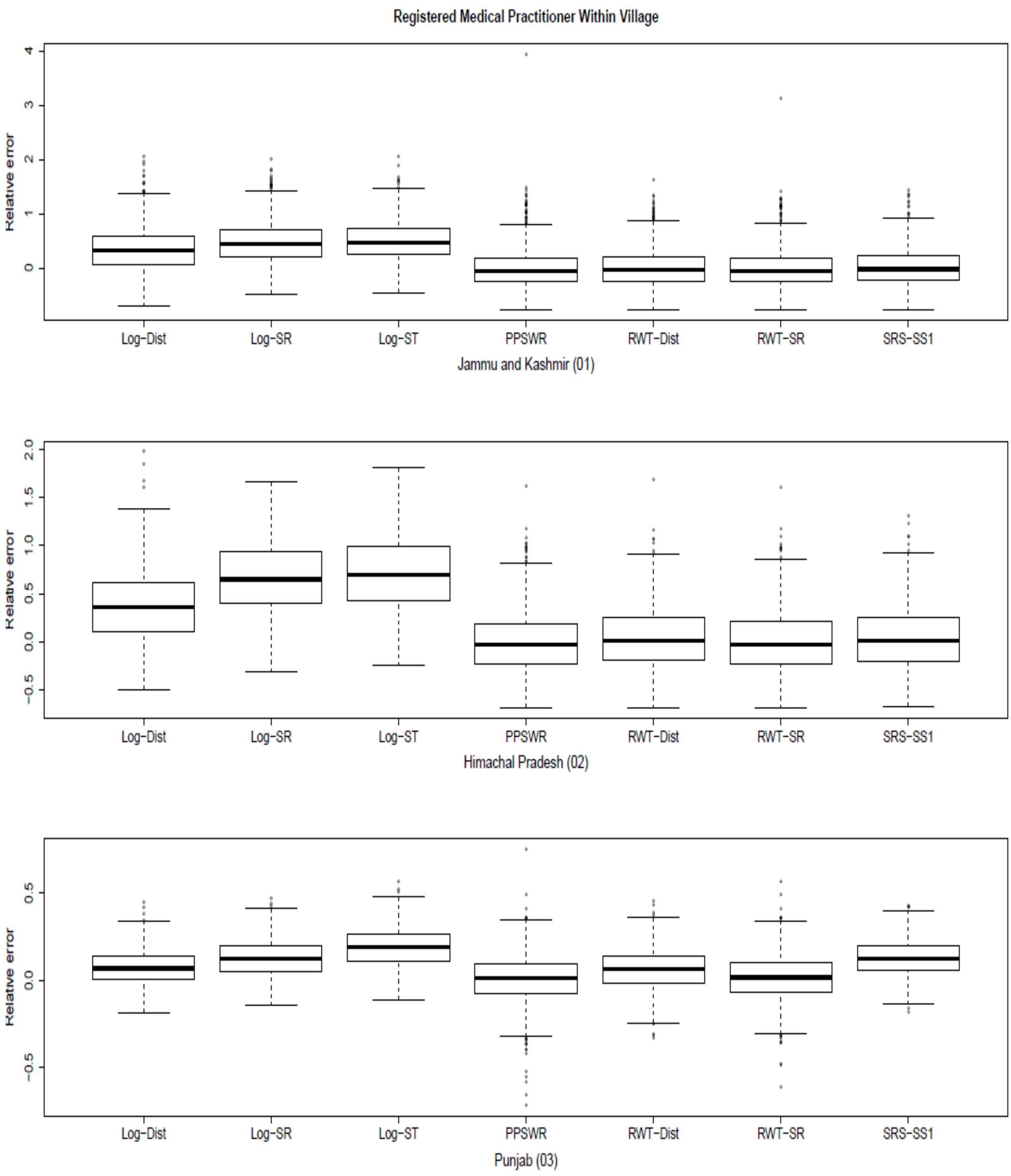
Primary Health Centre Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
West Bengal (19)
Jharkhand (20)
Orrisa (21)

Primary Health Centre Within Village

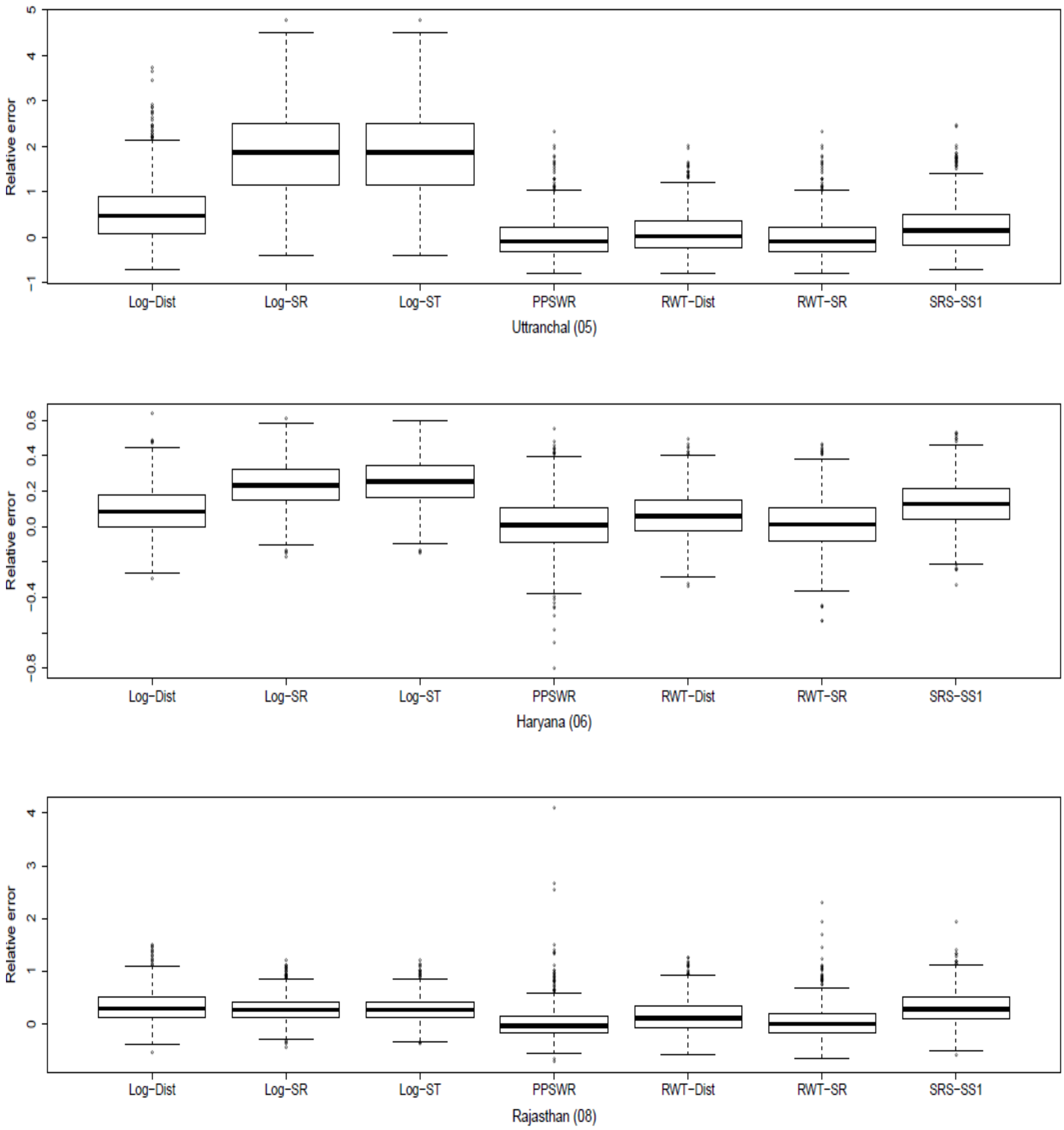


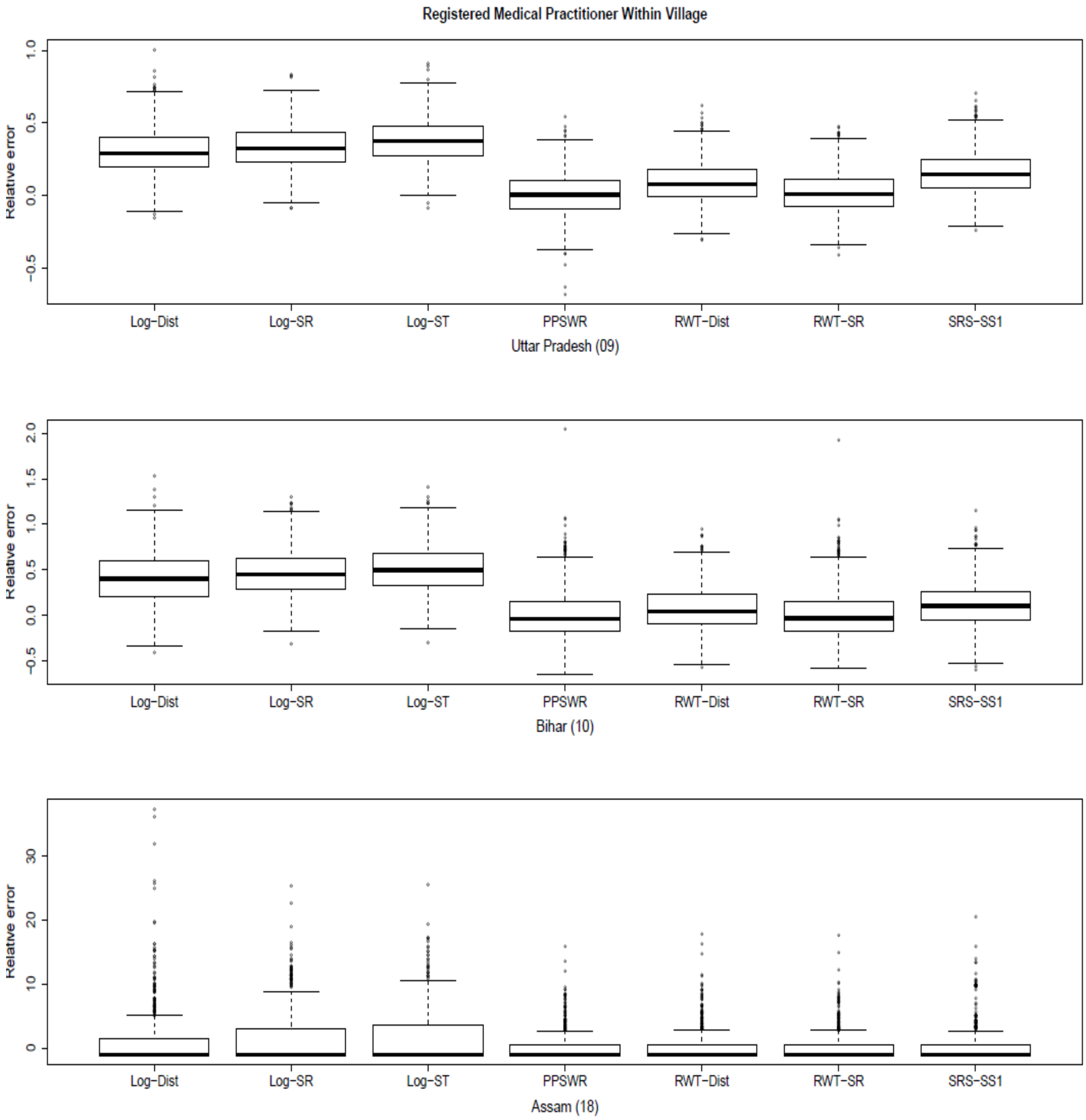

Primary Health Centre Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Andhra Pradesh (28)
Karnataka (29)

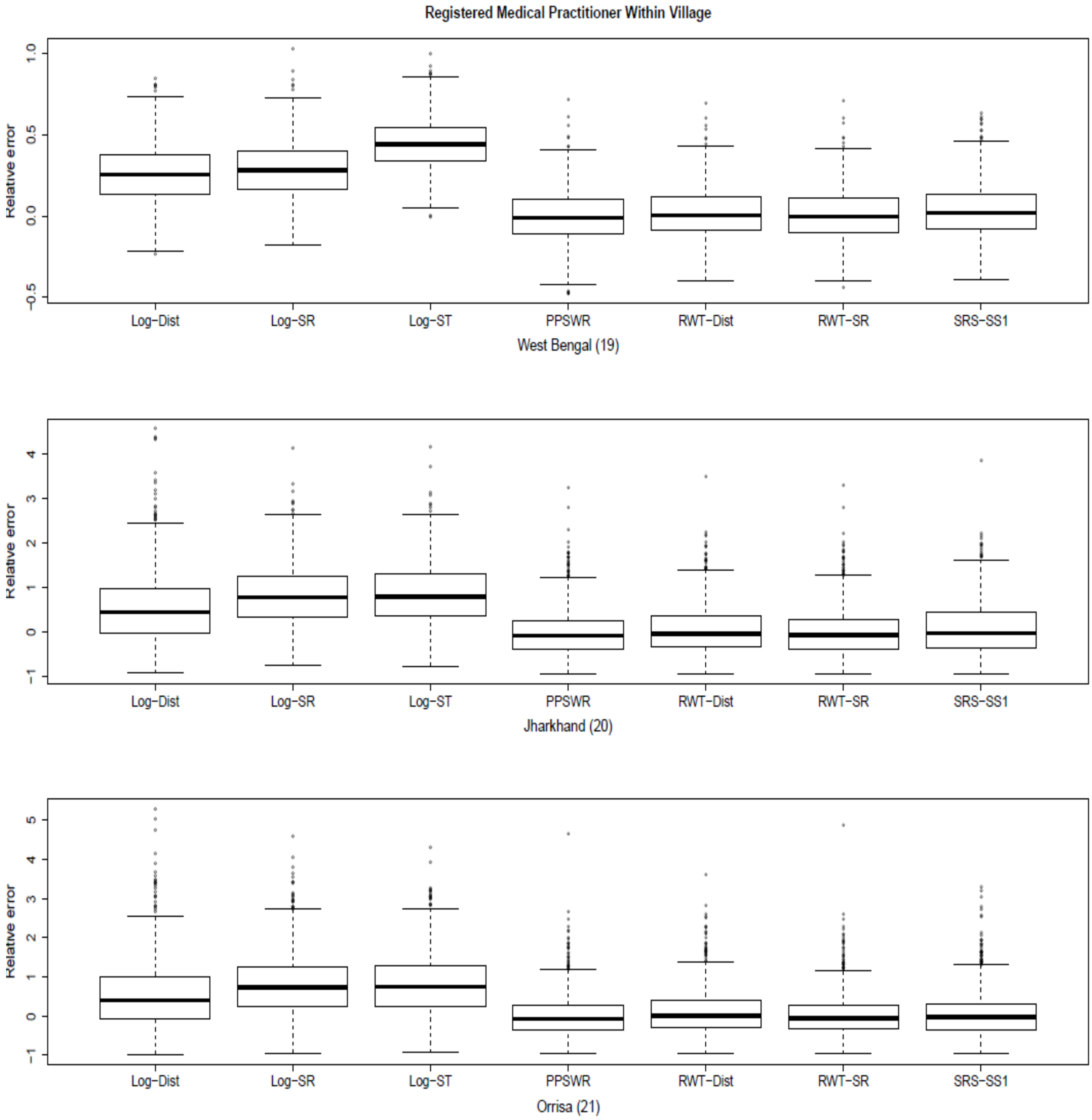

Primary Health Centre Within Village
Relative error
0.1
0.0
−0.1
−0.2
−0.3
−0.4
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)

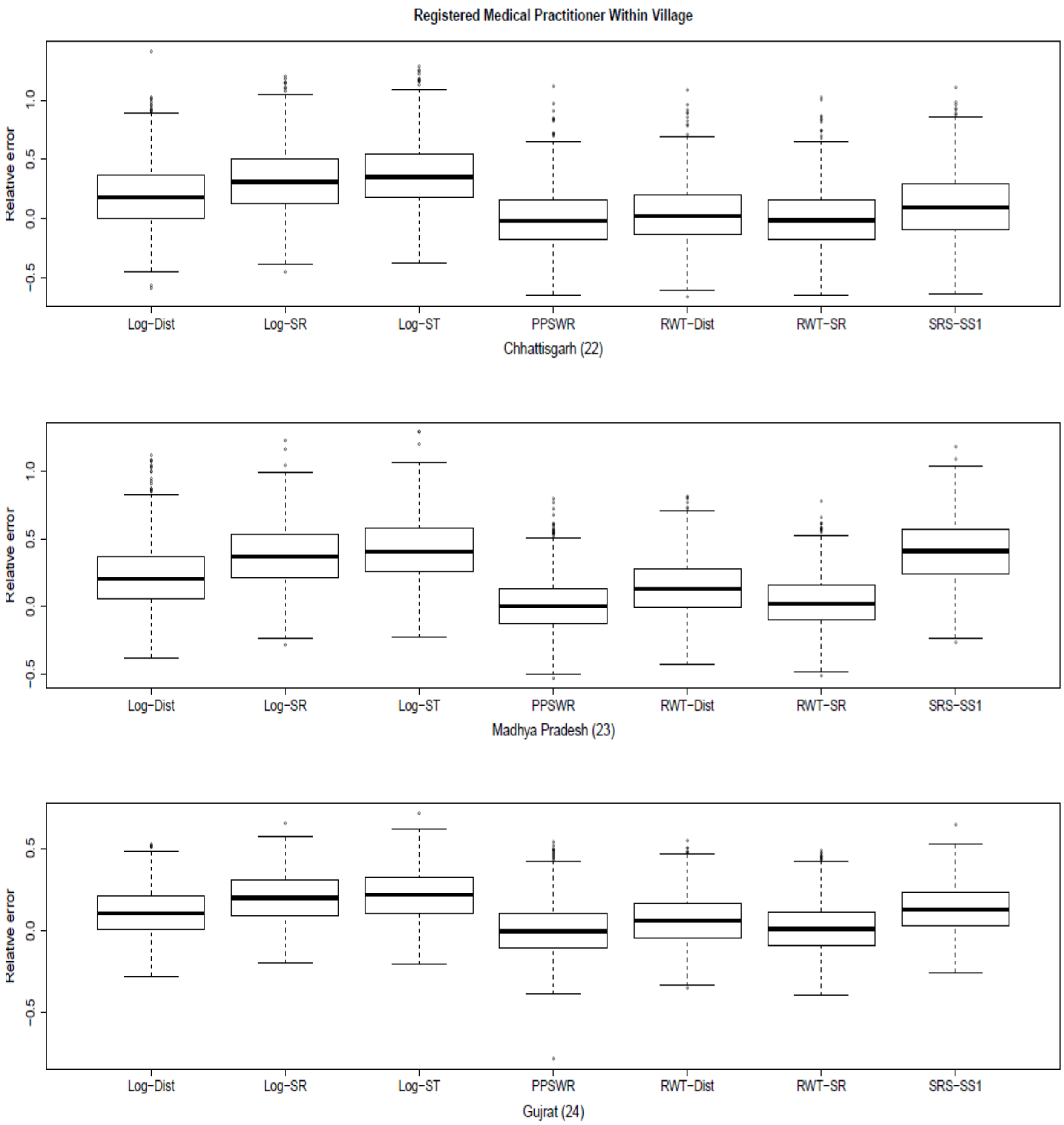

Registered Medical Practitioner Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Jammu and Kashmir (01)
Himachal Pradesh (02)
Punjab (03)

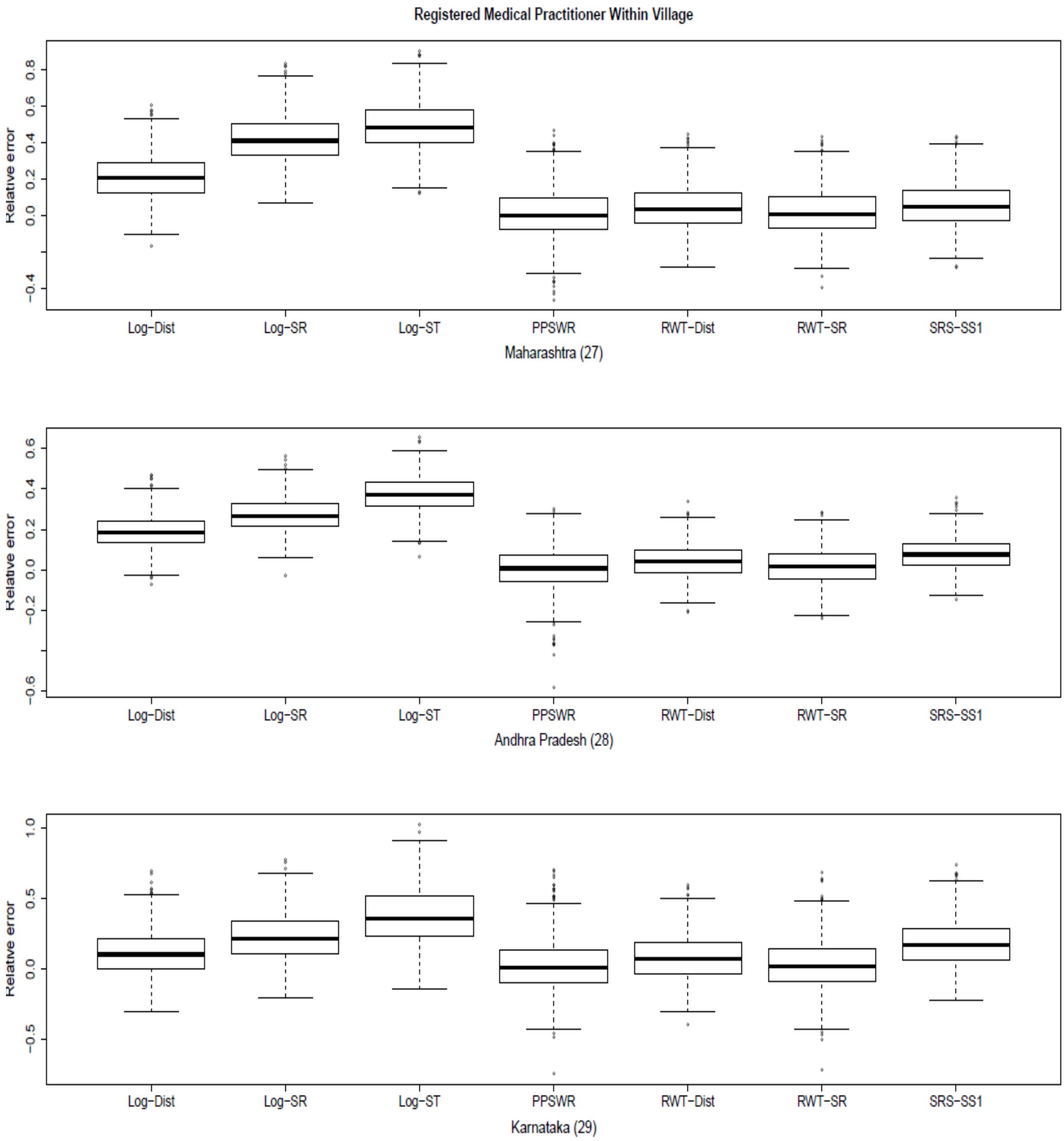
Registered Medical Practitioner Within Village



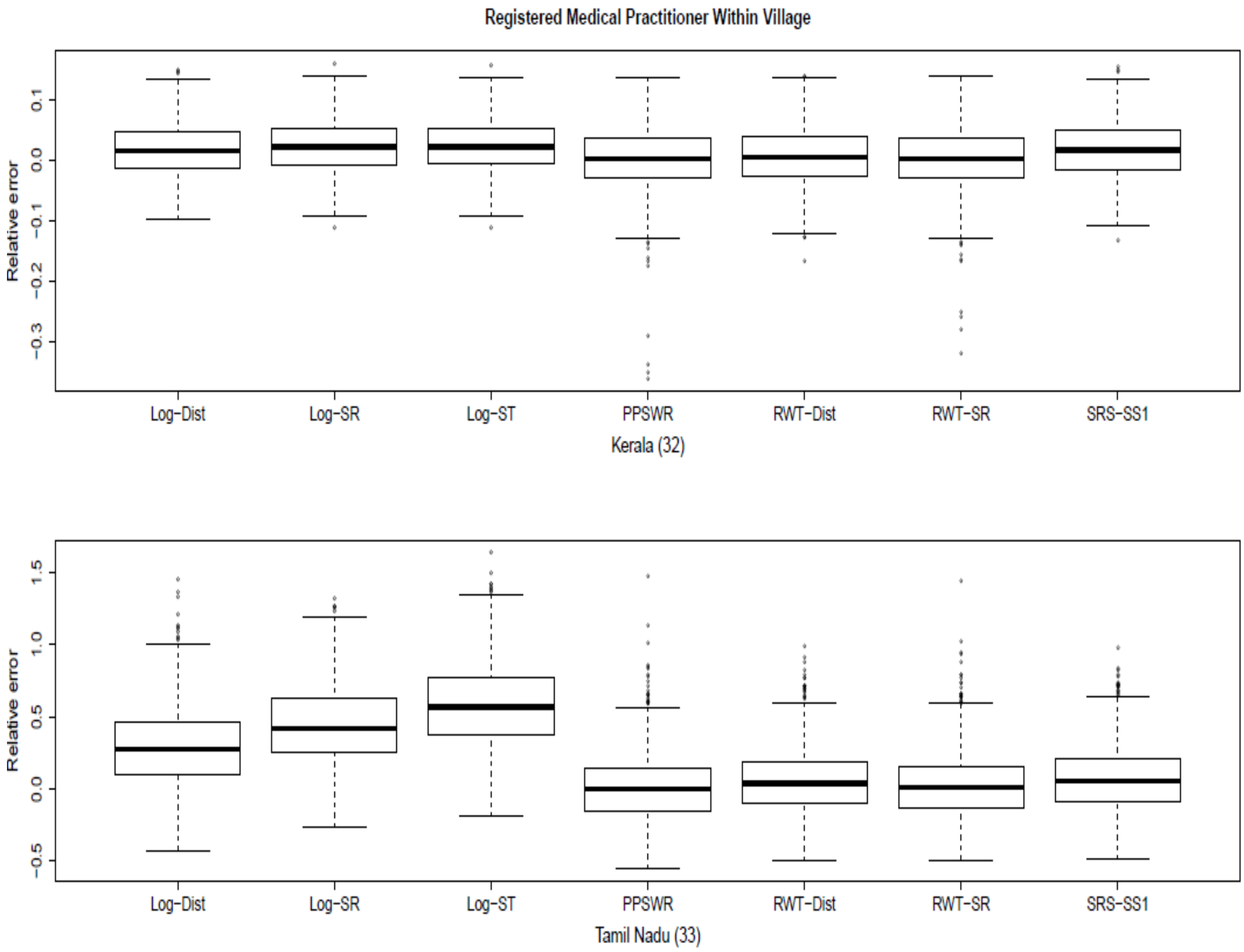

Registered Medical Practitioner Within Village
Relative error
-0.5
0.0
0.5
1.0
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Relative error
-0.5
0.0
0.5
1.0
1.5
2.0
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Bihar (10)
Relative error
0
10
20
30
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Assam (18)


Registered Medical Practitioner Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
West Bengal (19)
Jharkhand (20)
Orrisa (21)

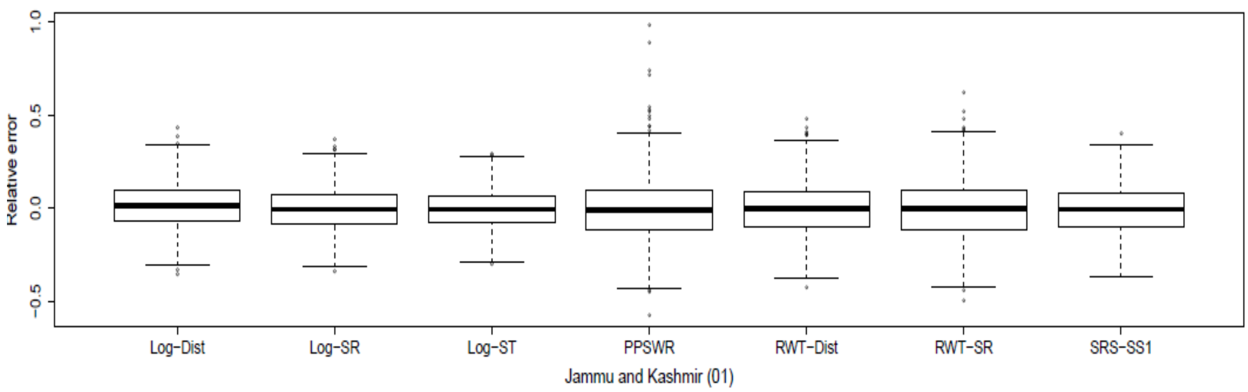

Registered Medical Practitioner Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Chhattisgarh (22)
Madhya Pradesh (23)
Gujrat (24)

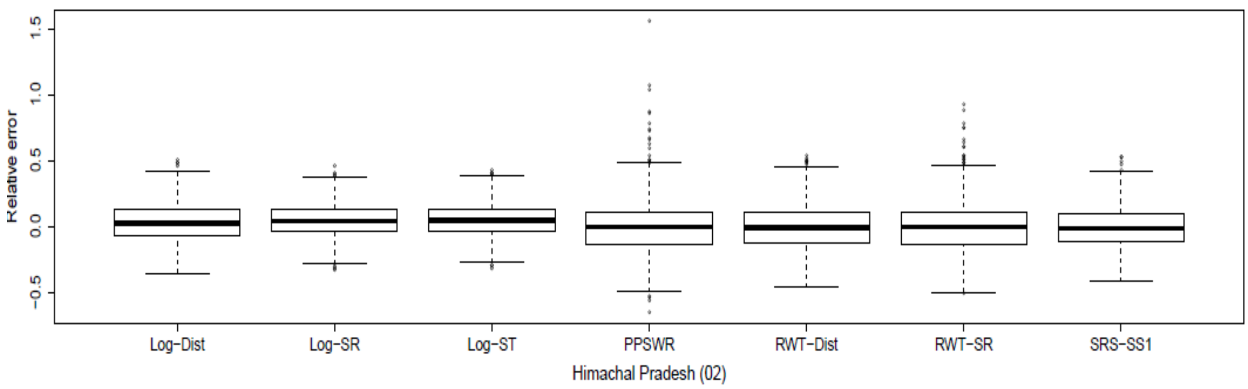


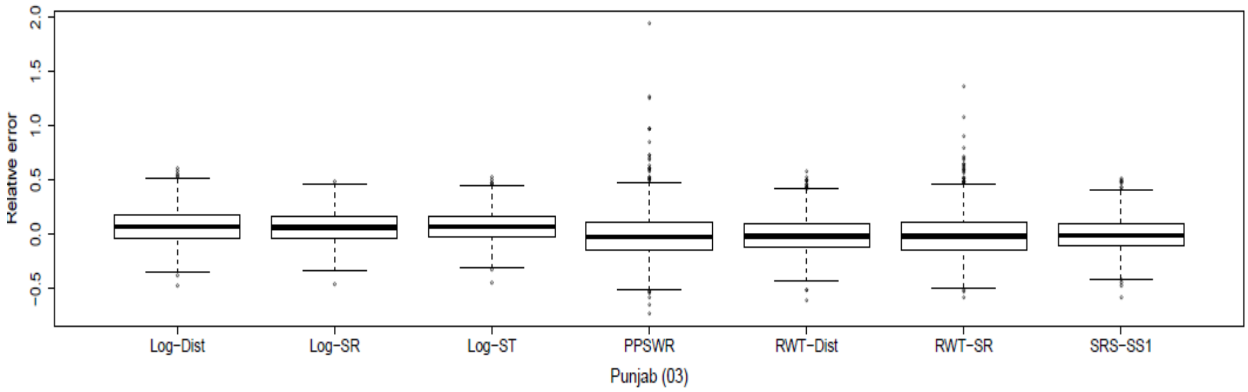
Registered Medical Practitioner Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Maharashtra (27)
Andhra Pradesh (28)
Karnataka (29)

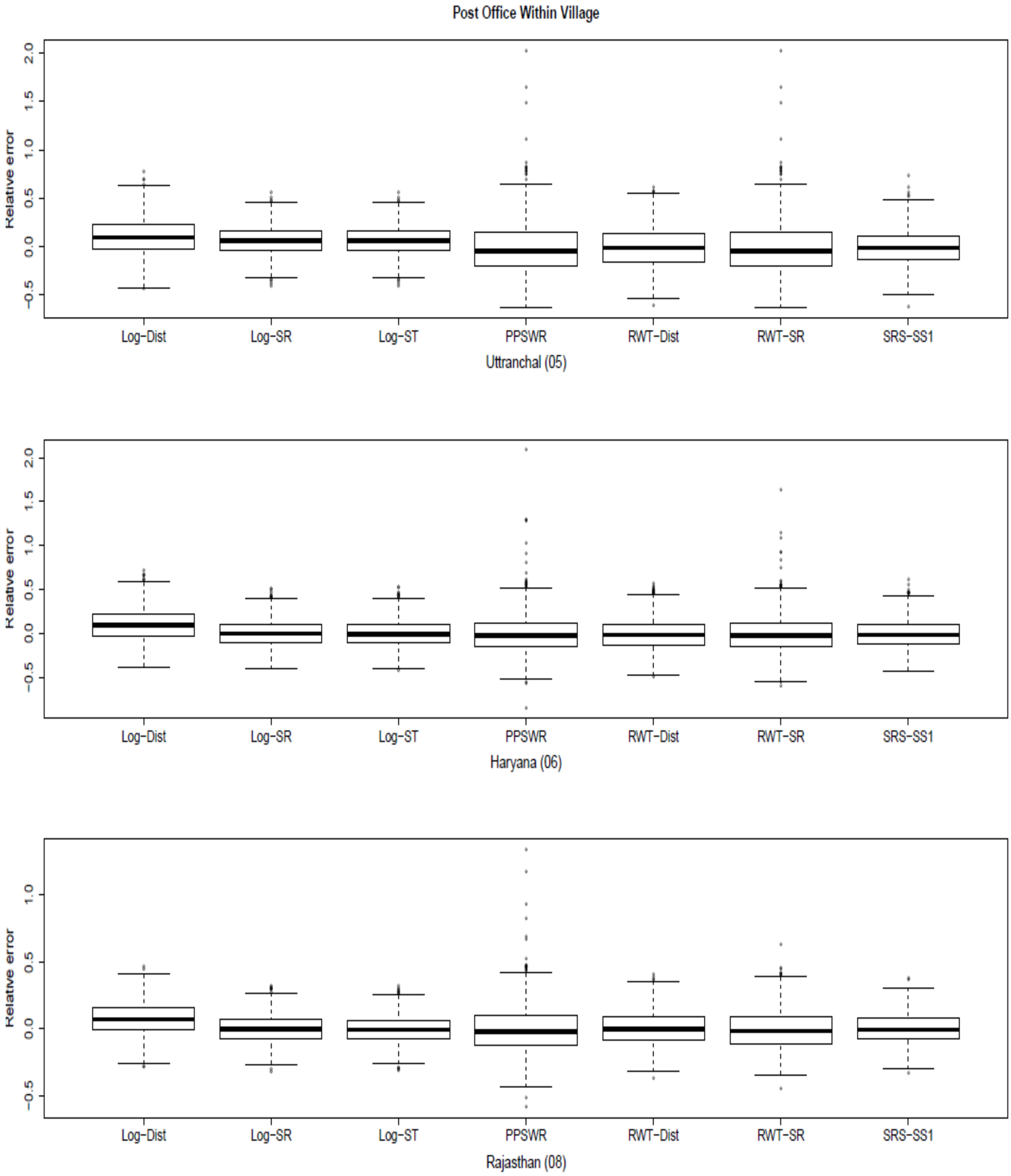

Registered Medical Practitioner Within Village
Relative error
0.1
0.0
−0.1
−0.2
−0.3
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
1.5
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)

Post Office Within Village

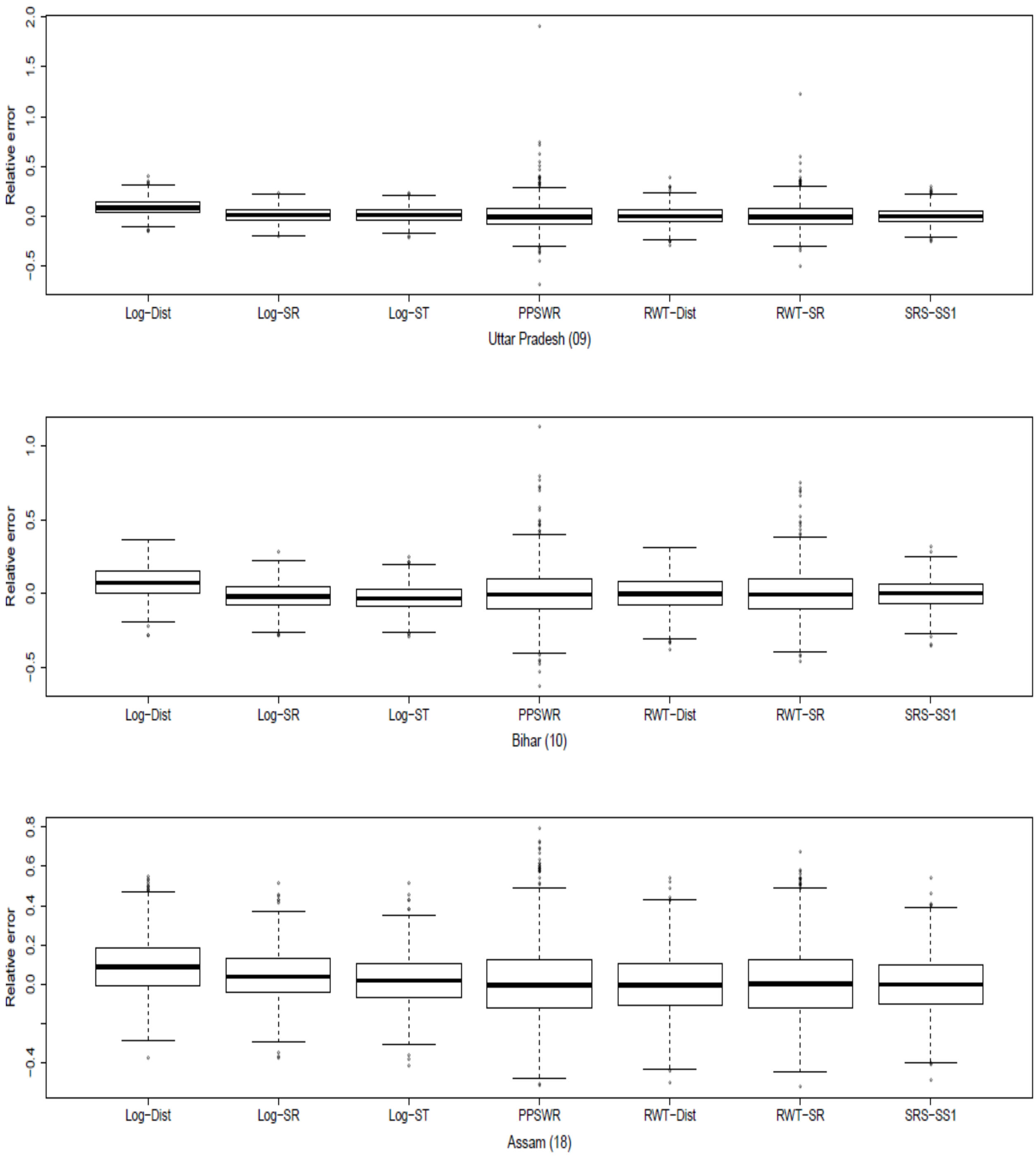




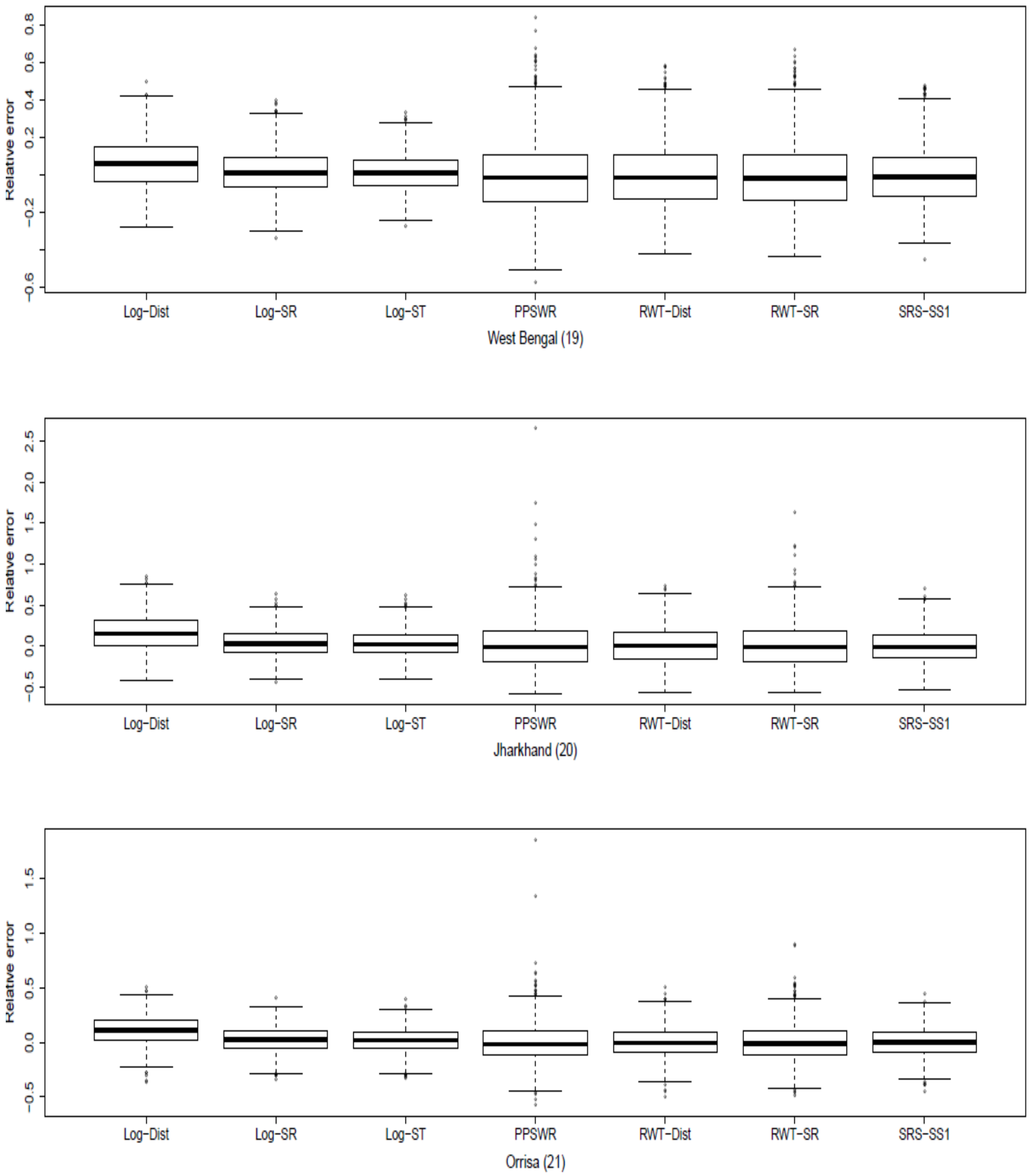



Post Office Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)

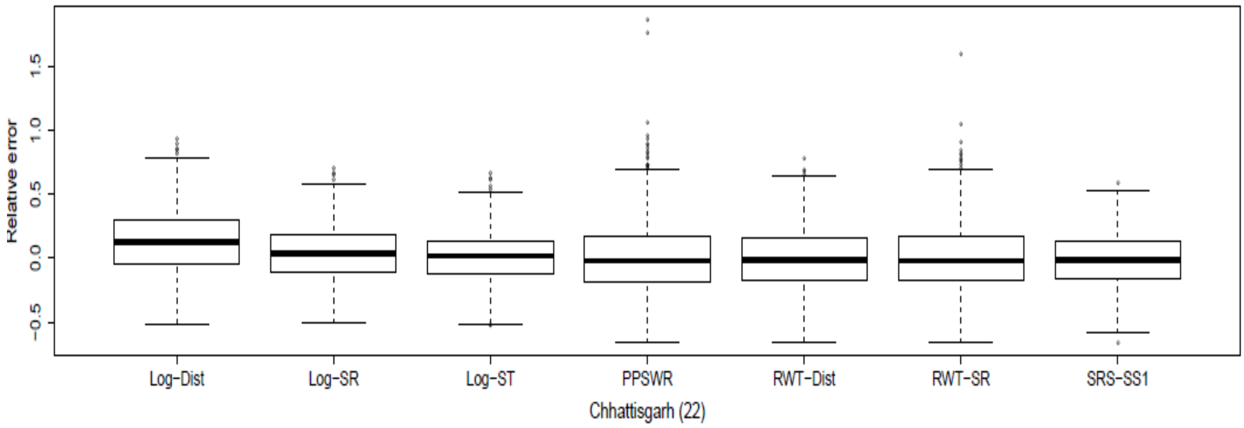
Post Office Within Village

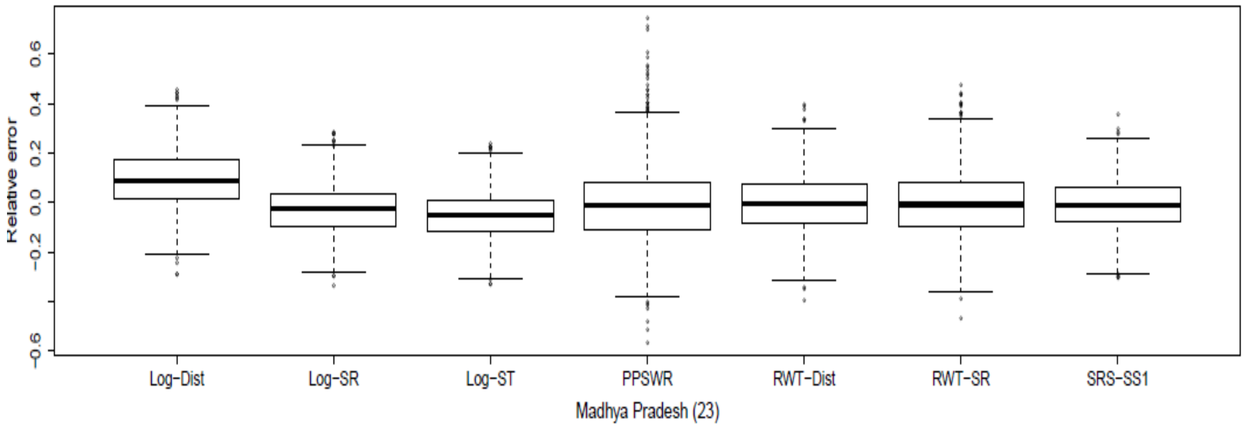


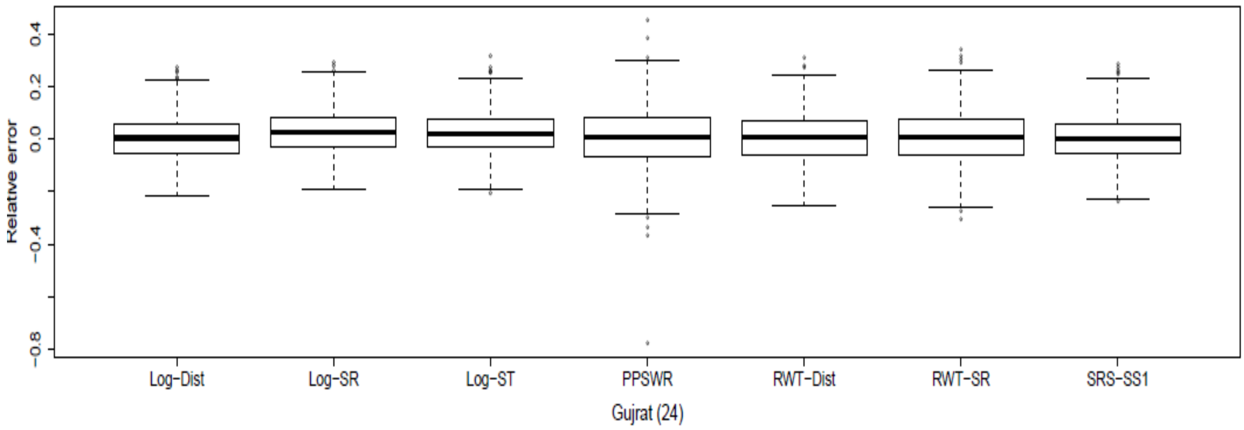
Post Office Within Village



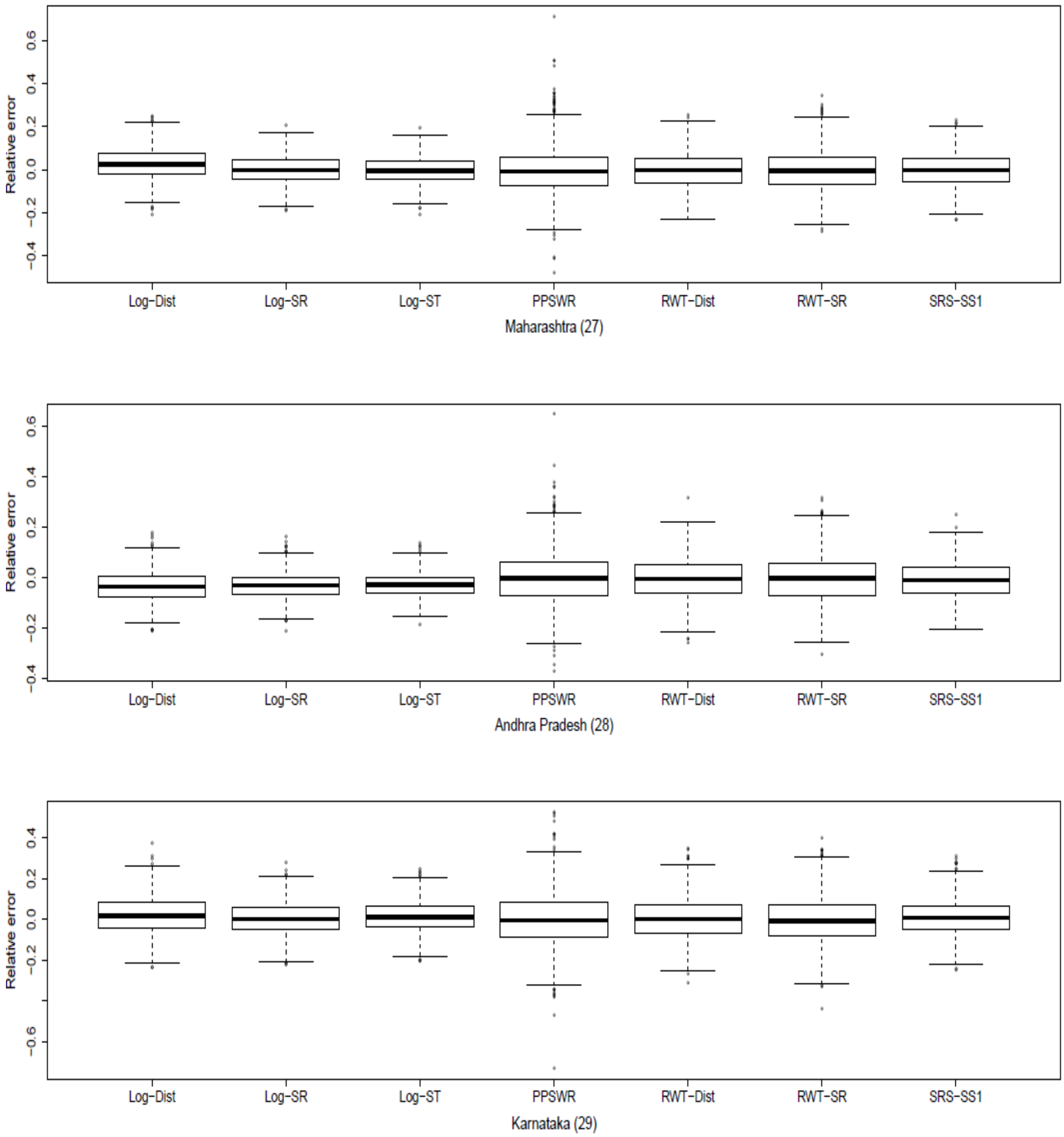
Post Office Within Village

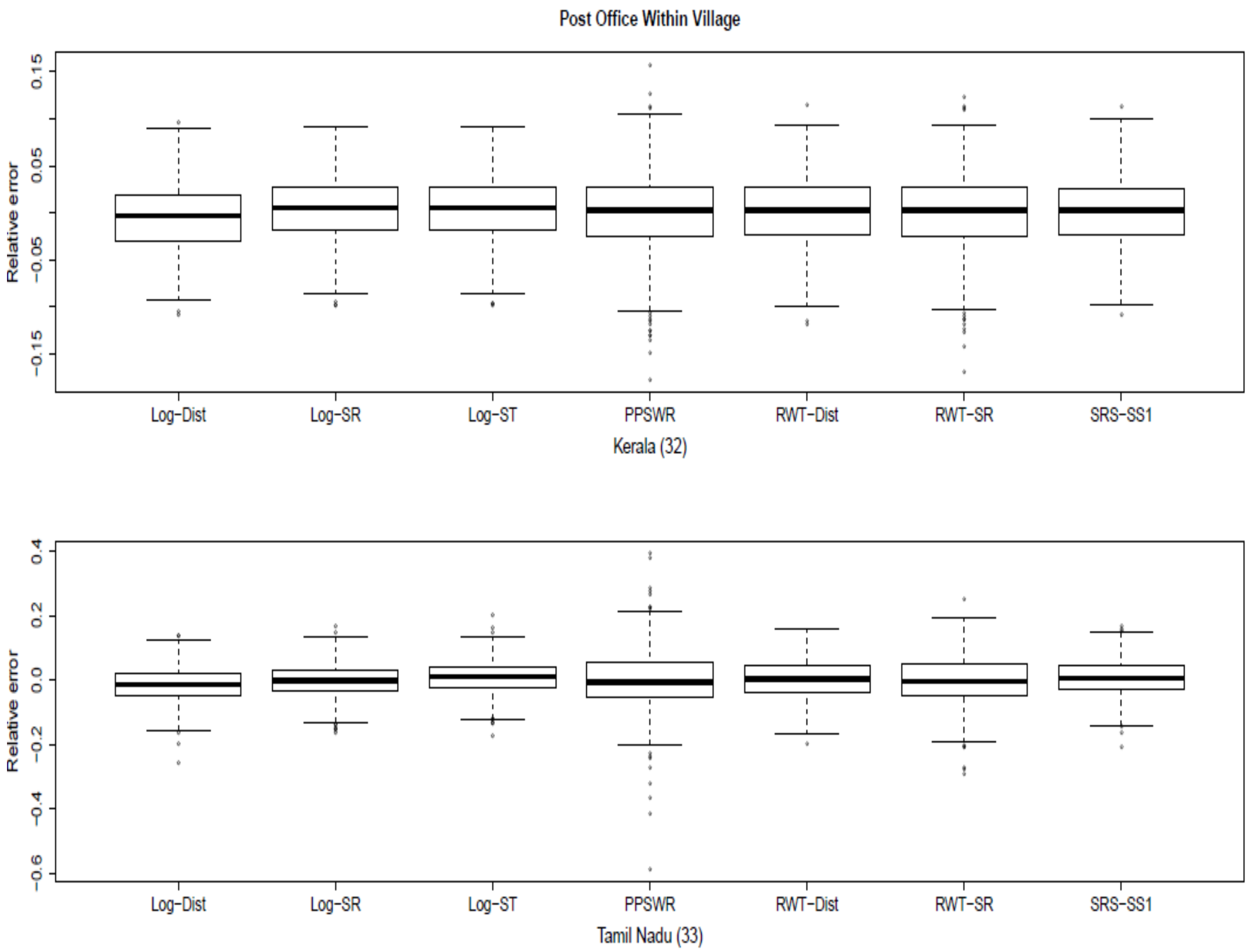


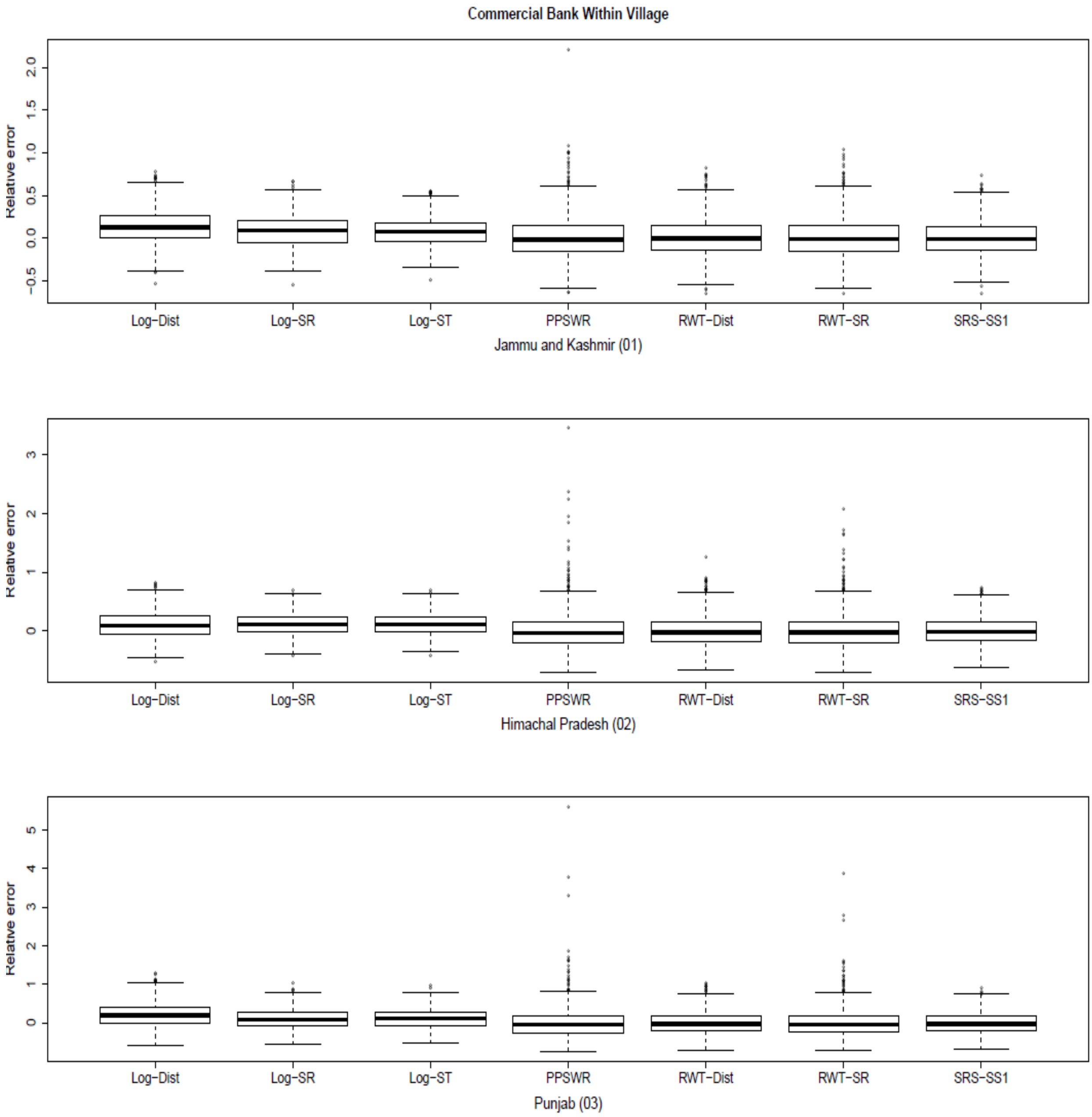


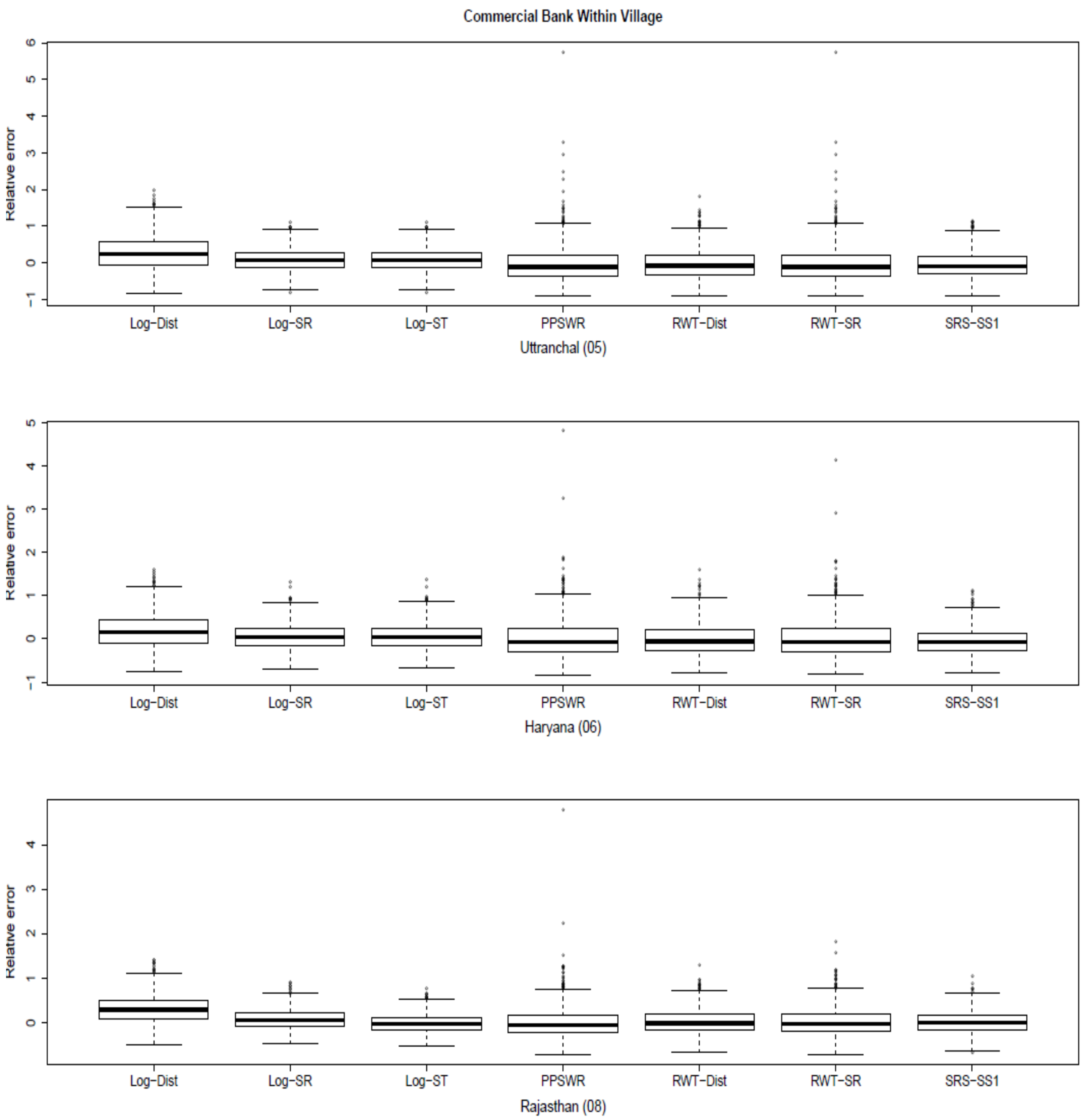


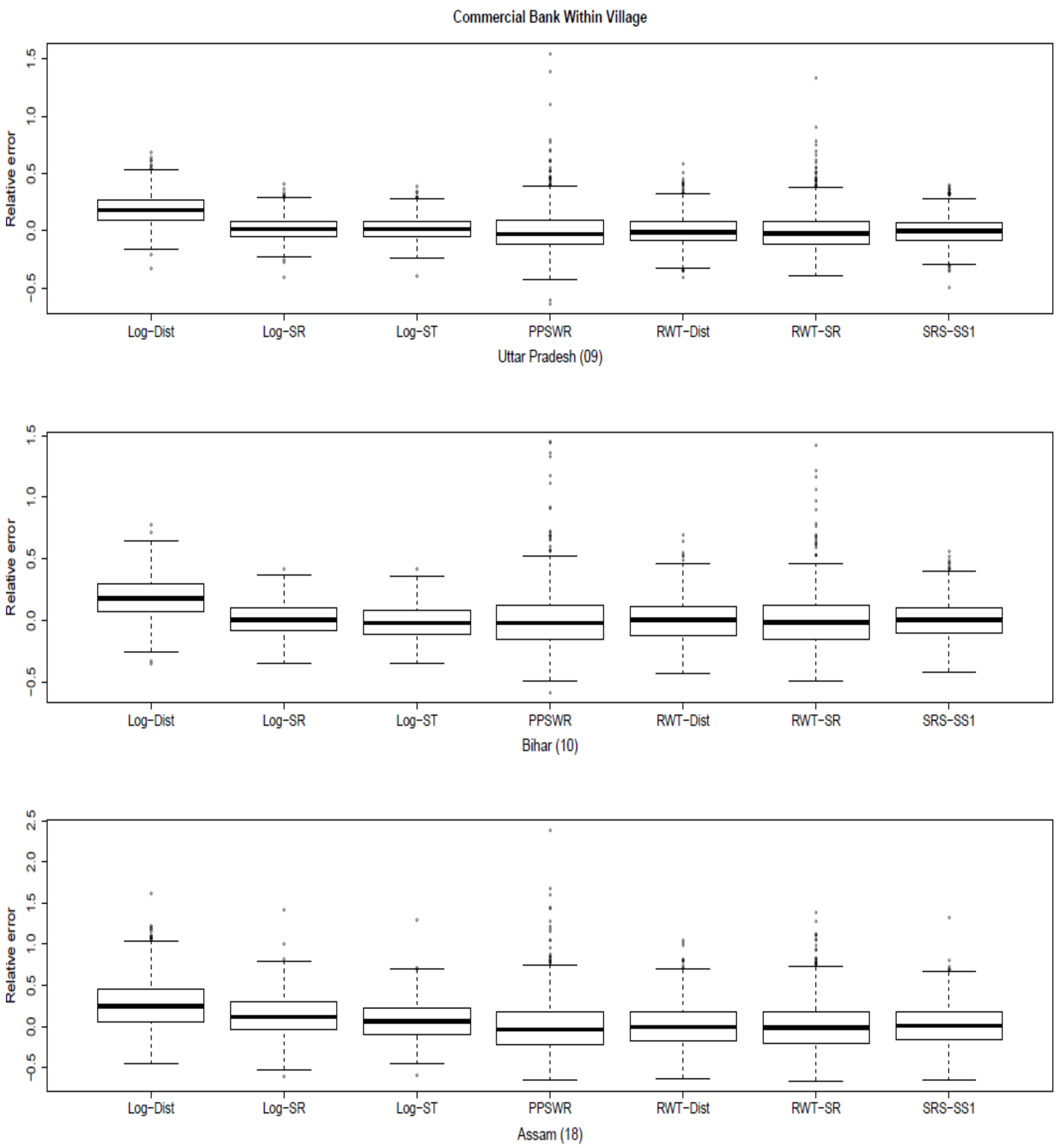
Post Office Within Village




Post Office Within Village
Relative error
0.15
0.05
-0.05
-0.15
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Kerala (32)
Relative error
0.4
0.2
0.0
-0.2
-0.4
-0.6
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Tamil Nadu (33)

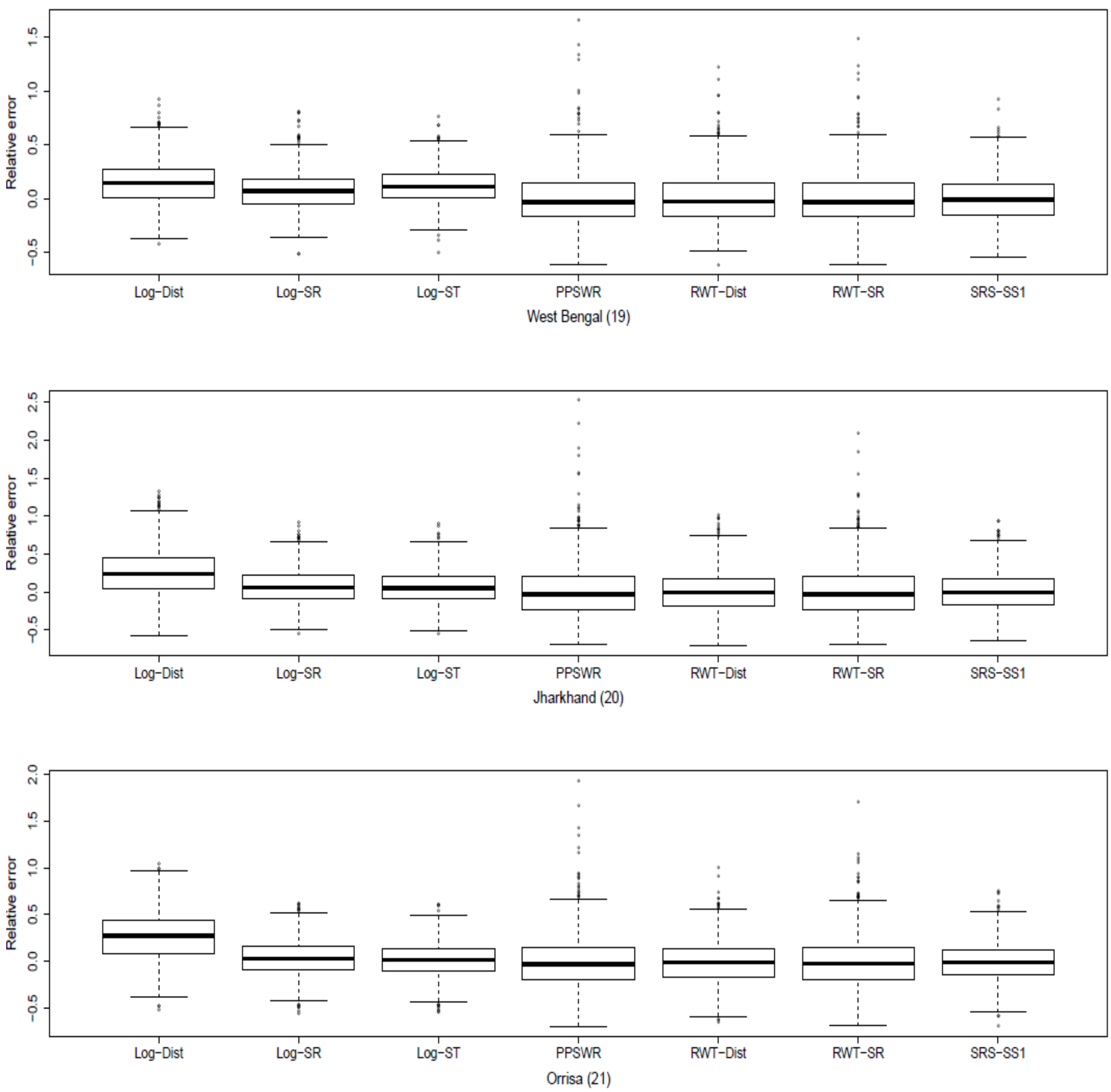

Commercial Bank Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Jammu and Kashmir (01)
Himachal Pradesh (02)
Punjab (03)

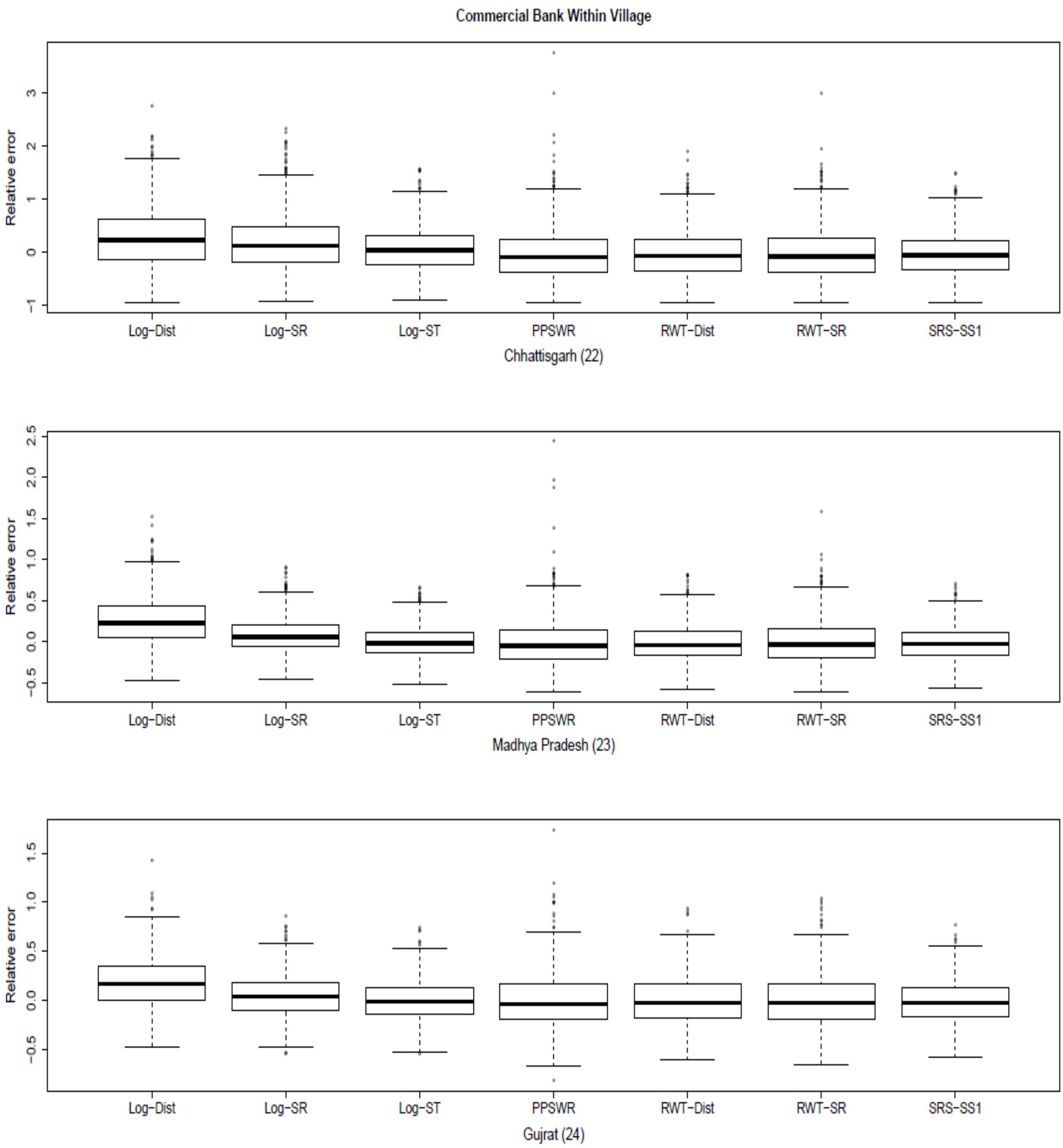

Commercial Bank Within Village
Relative error
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Uttranchal (05)
Haryana (06)
Rajasthan (08)



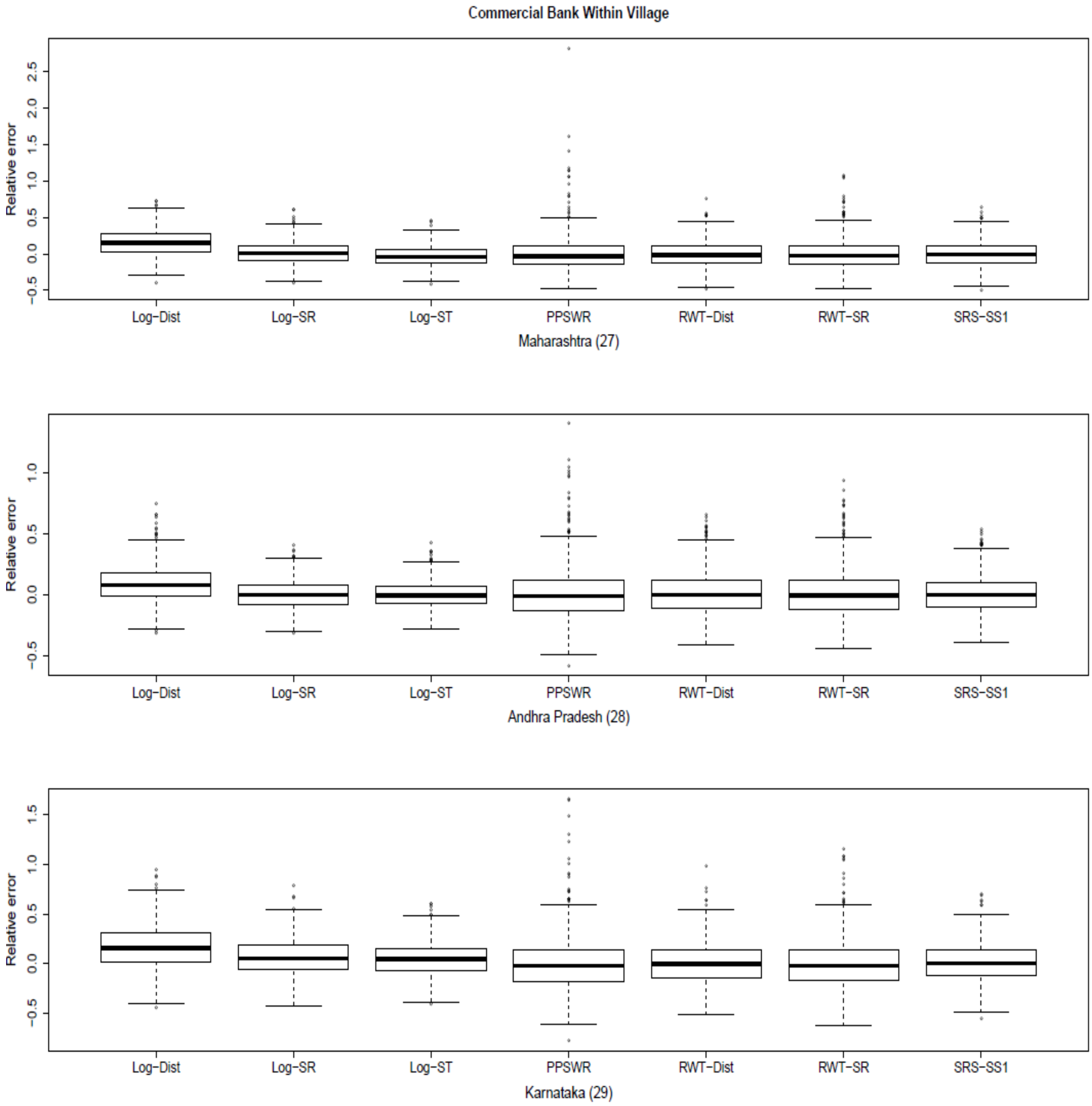
Commercial Bank Within Village
Relative error
1.5
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Relative error
1.5
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Bihar (10)
Relative error
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Assam (18)

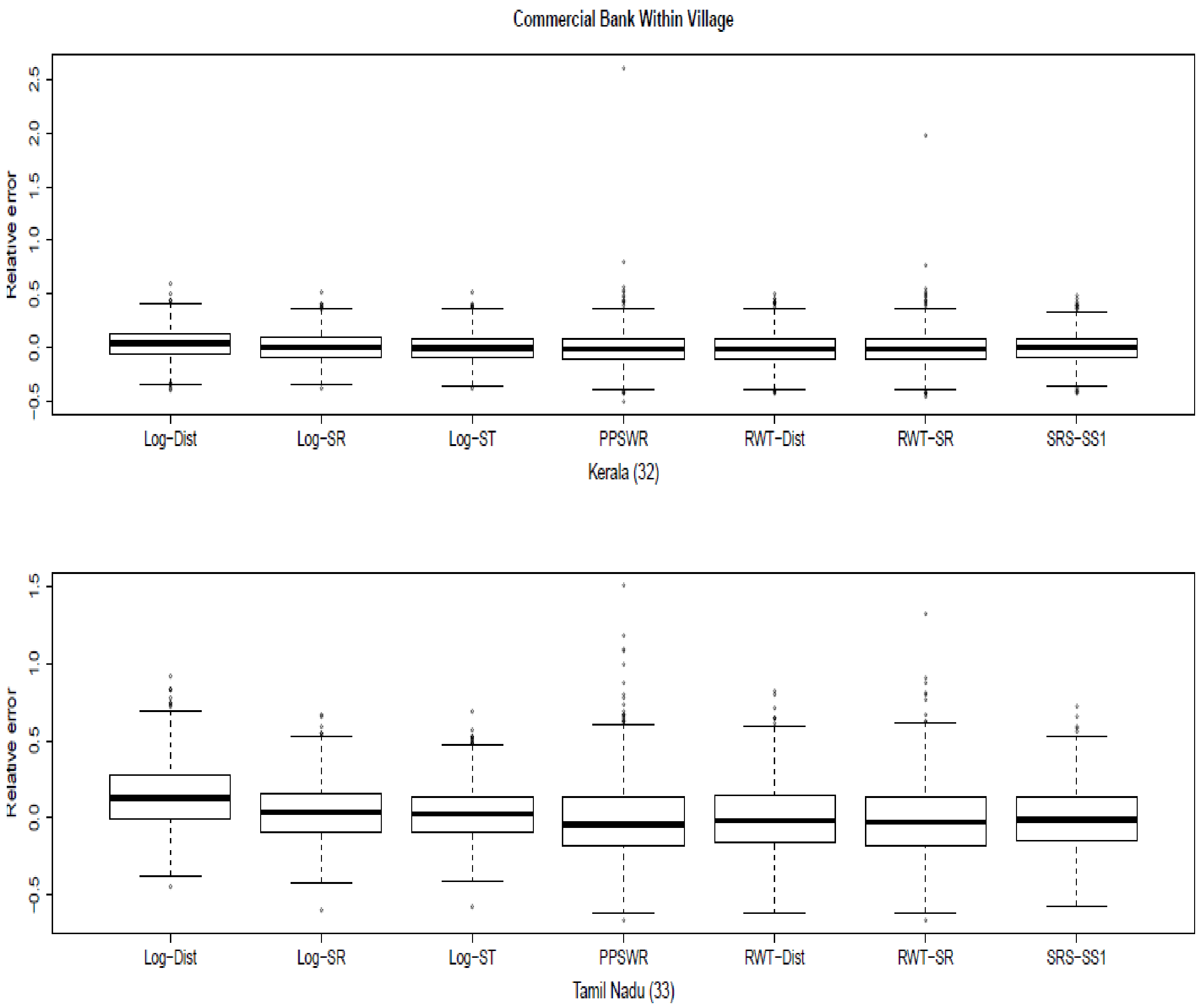
Commercial Bank Within Village

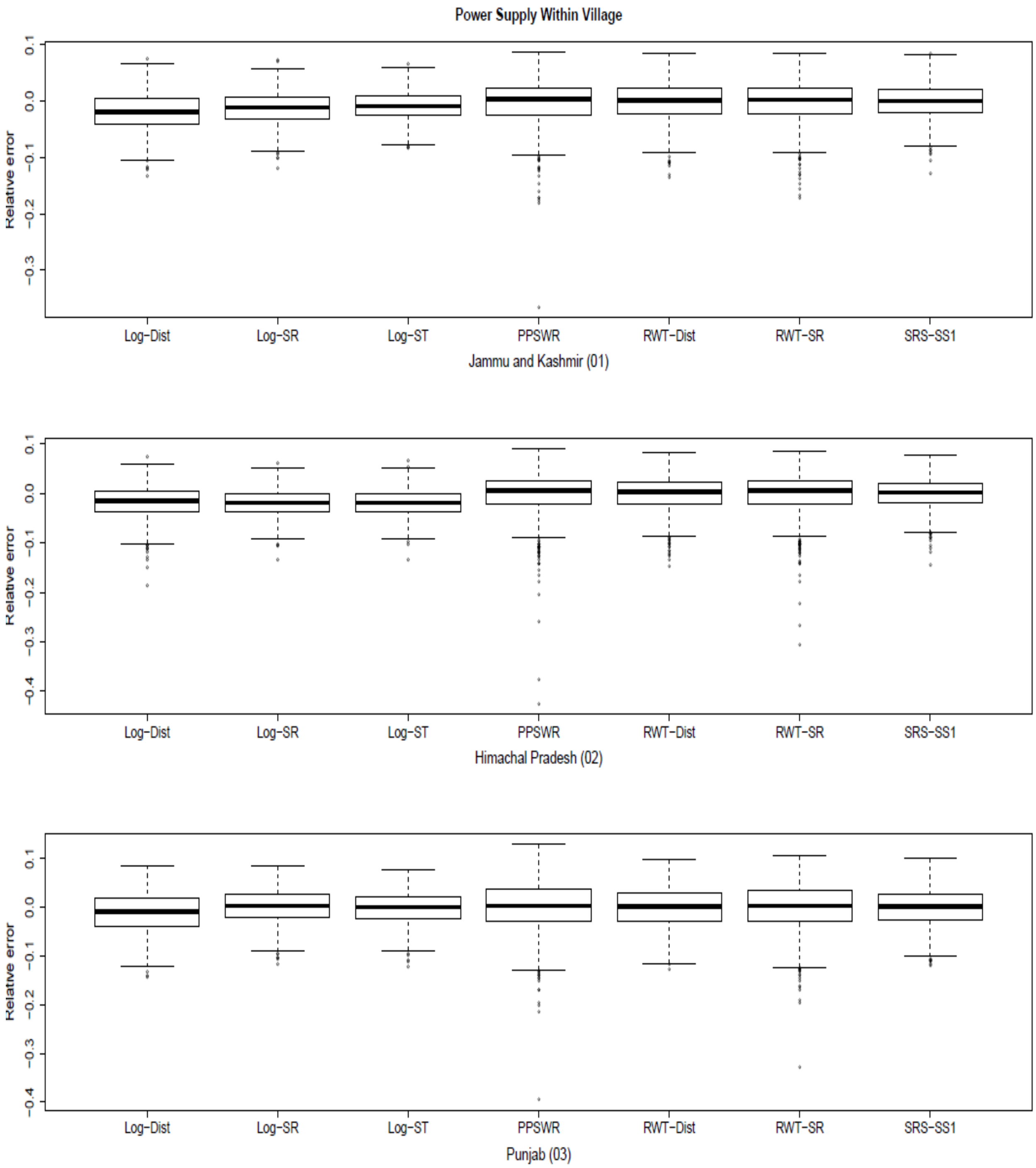




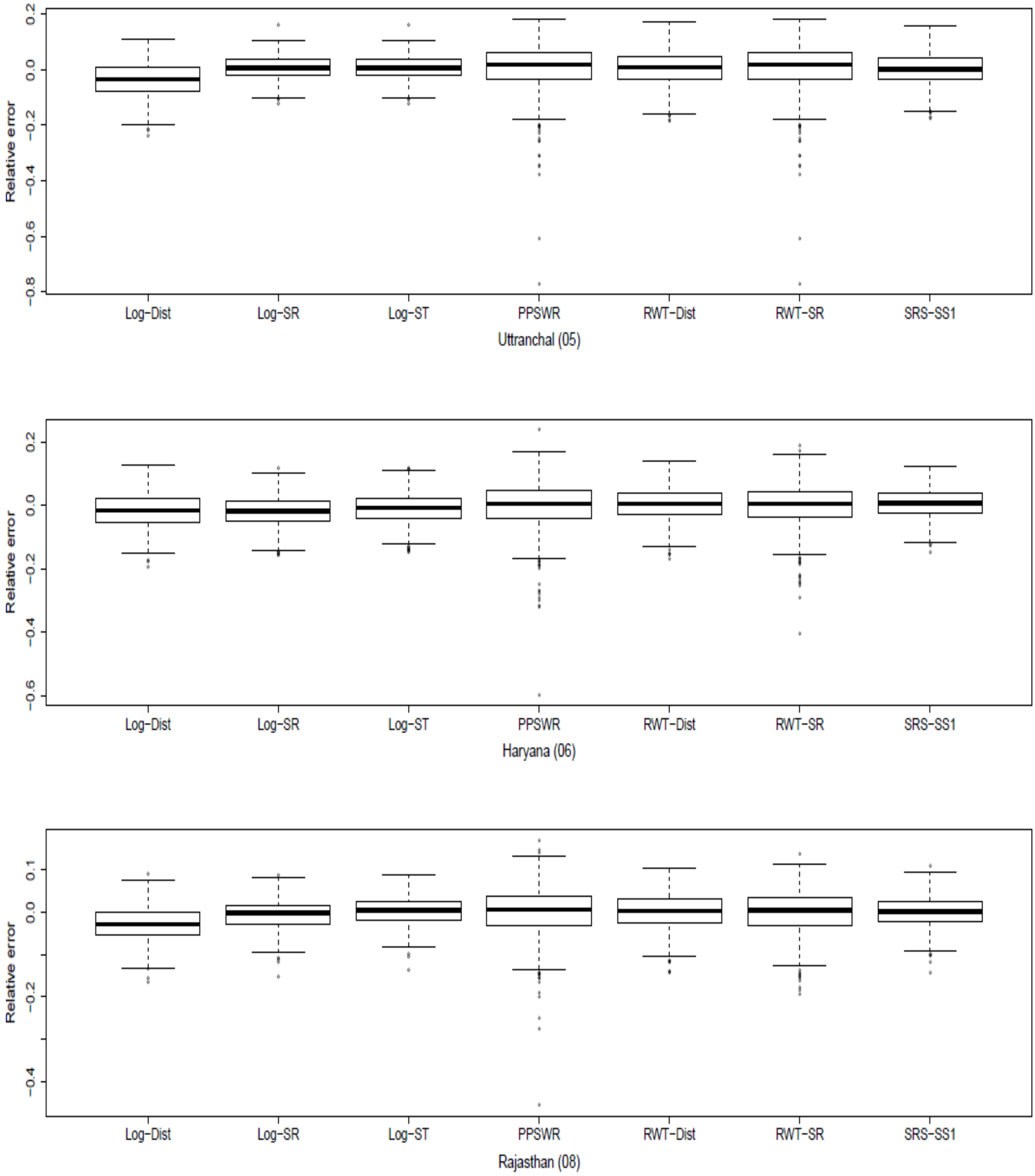
Commercial Bank Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Chhattisgarh (22)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Madhya Pradesh (23)
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Gujrat (24)

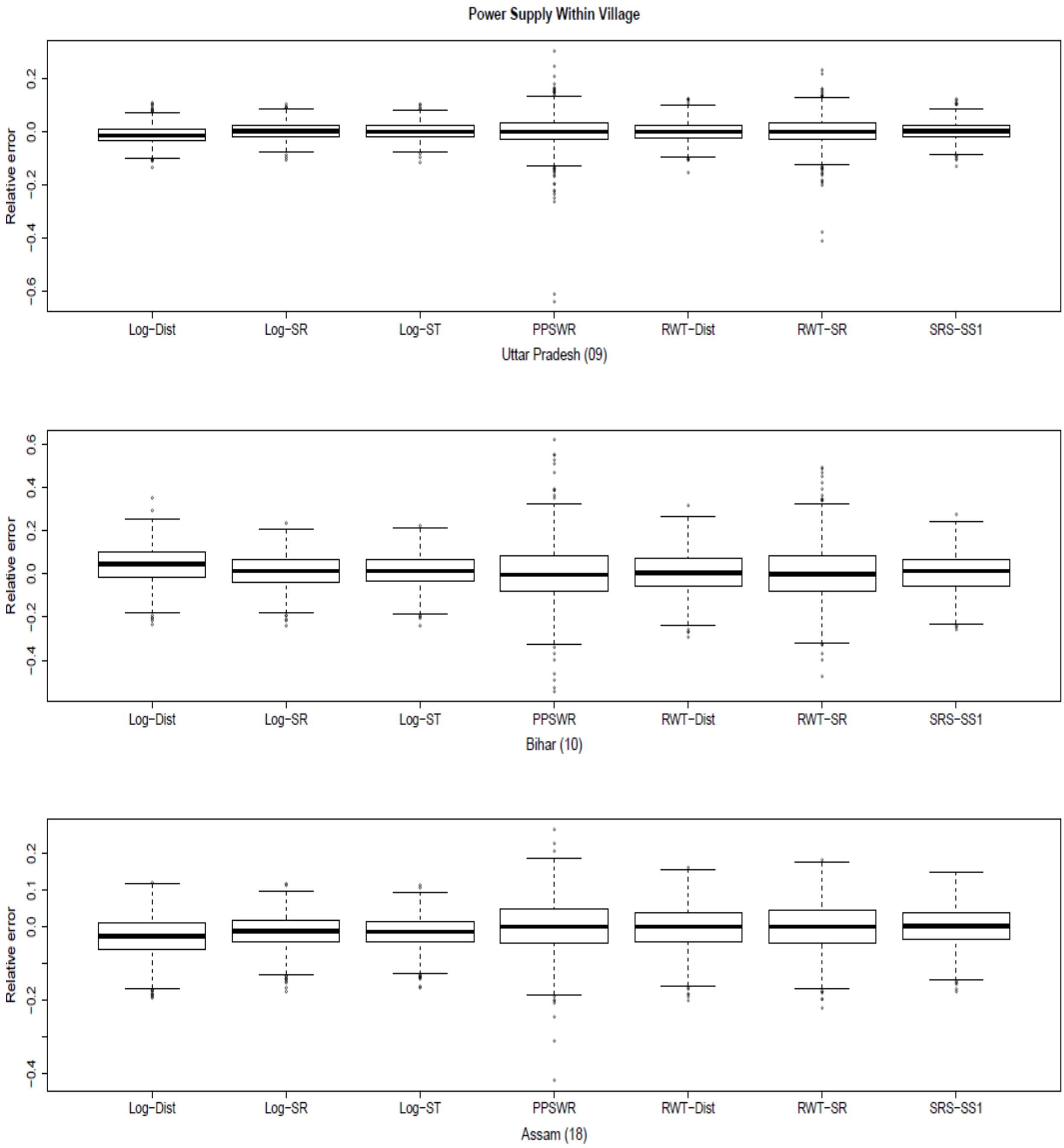

Commercial Bank Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Andhra Pradesh (28)
Karnataka (29)

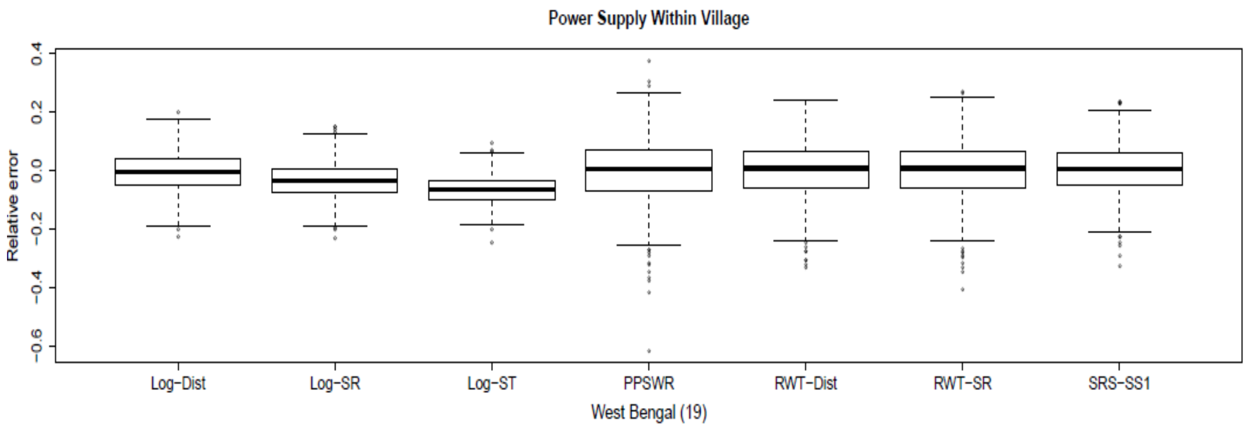

Commercial Bank Within Village
Relative error
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Kerala (32)
Relative error
1.5
1.0
0.5
0.0
-0.5
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Tamil Nadu (33)

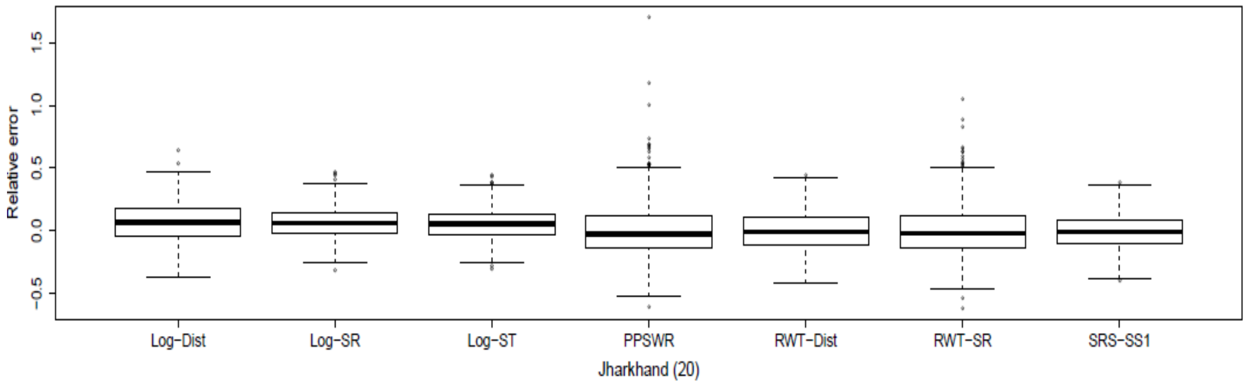

Power Supply Within Village
Relative error
0.1
0.0
-0.1
-0.2
-0.3
-0.4
Log-Dist
Log-SR
Log-ST
PPSWR
RWT-Dist
RWT-SR
SRS-SS1
Jammu and Kashmir (01)
Himachal Pradesh (02)
Punjab (03)

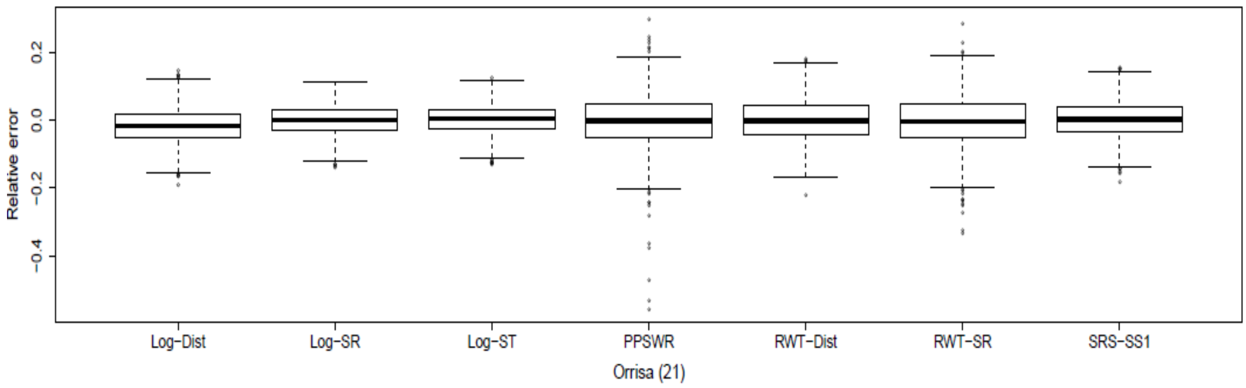
Power Supply Within Village



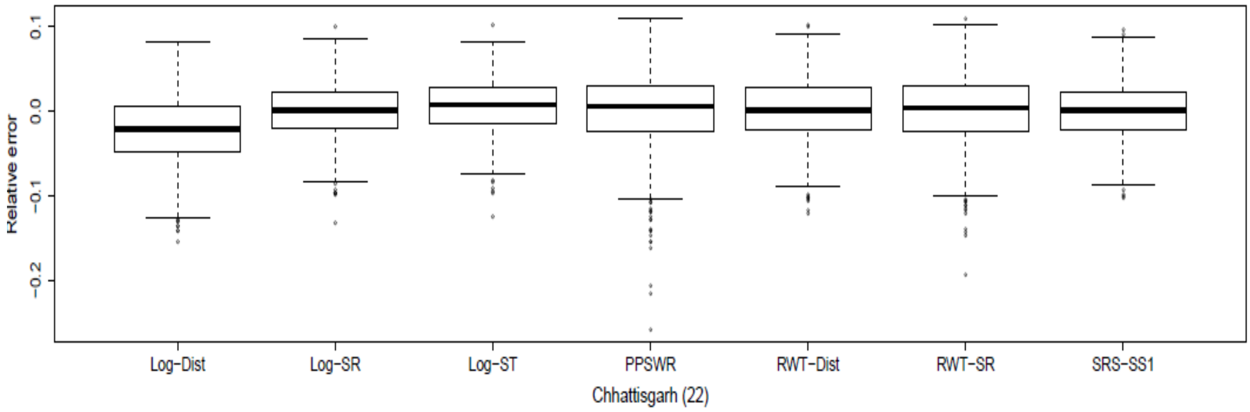

Power Supply Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Uttar Pradesh (09)
Bihar (10)
Assam (18)

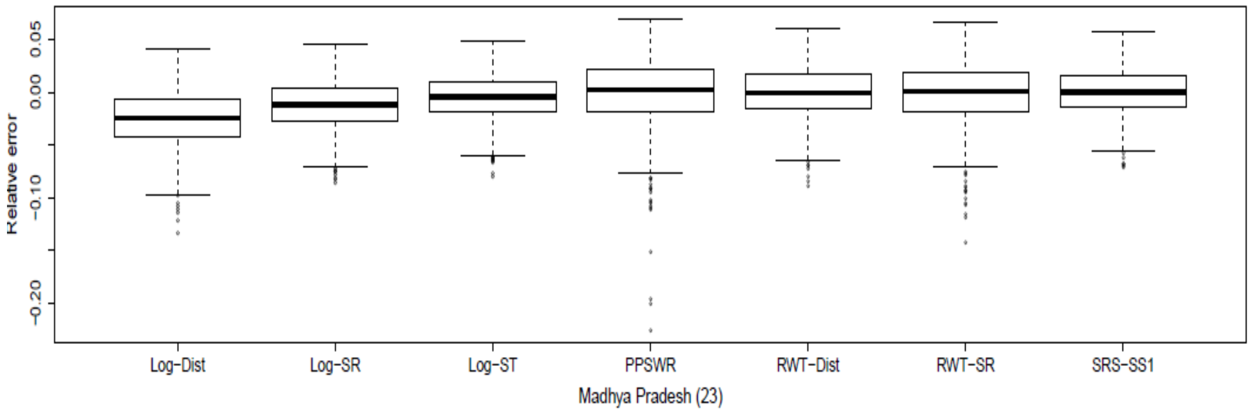

Power Supply Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
West Bengal (19)

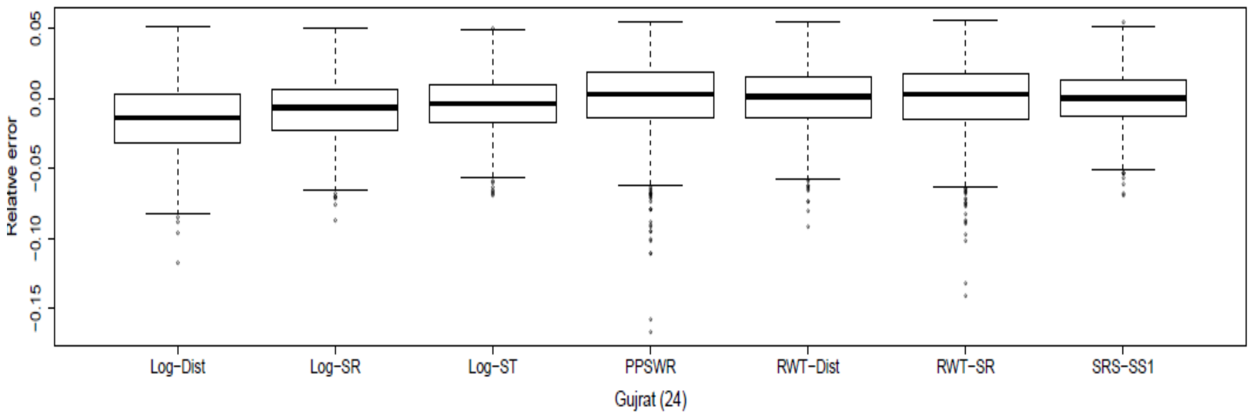

Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Jharkhand (20)

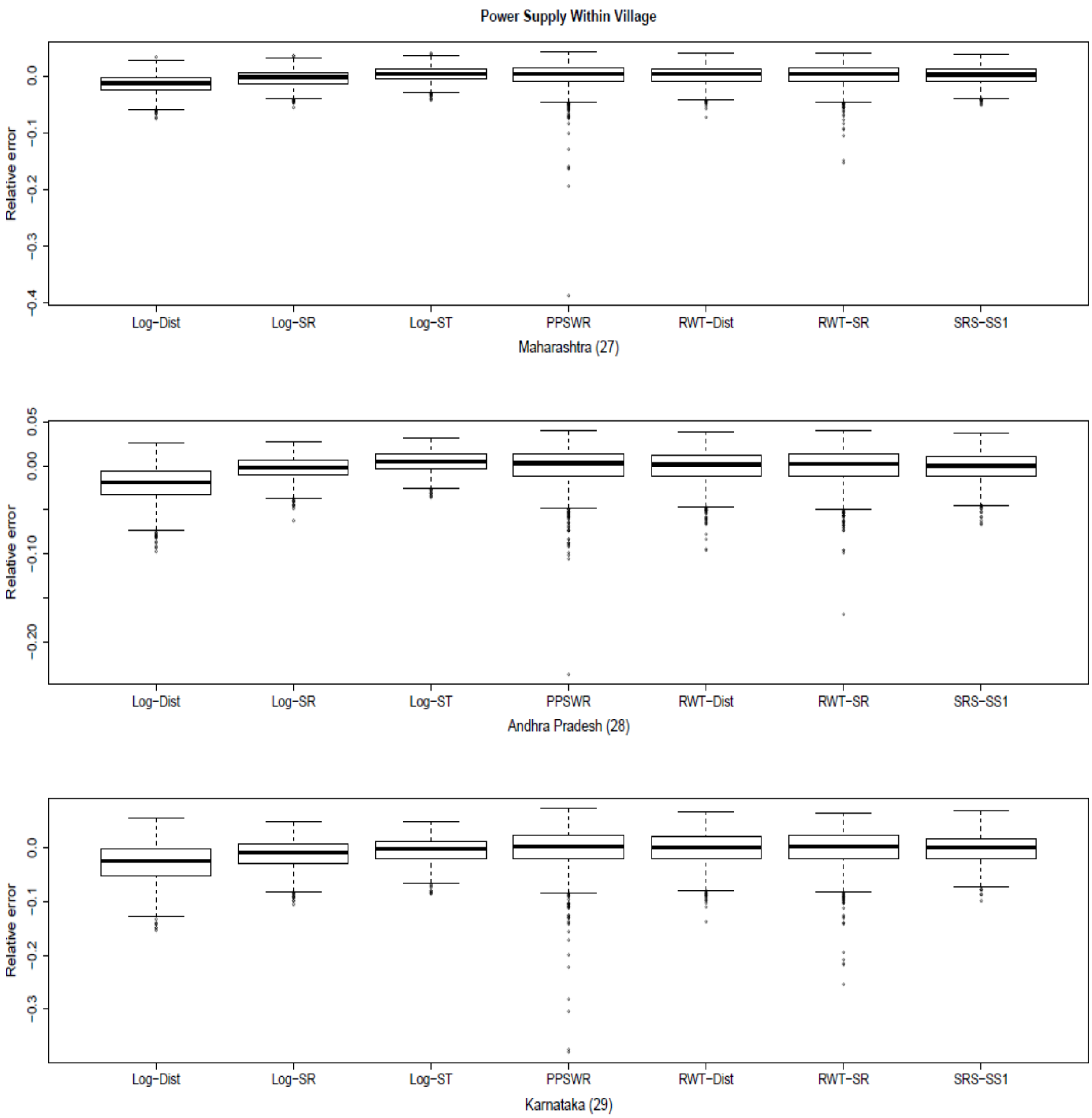

Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Orrisa (21)

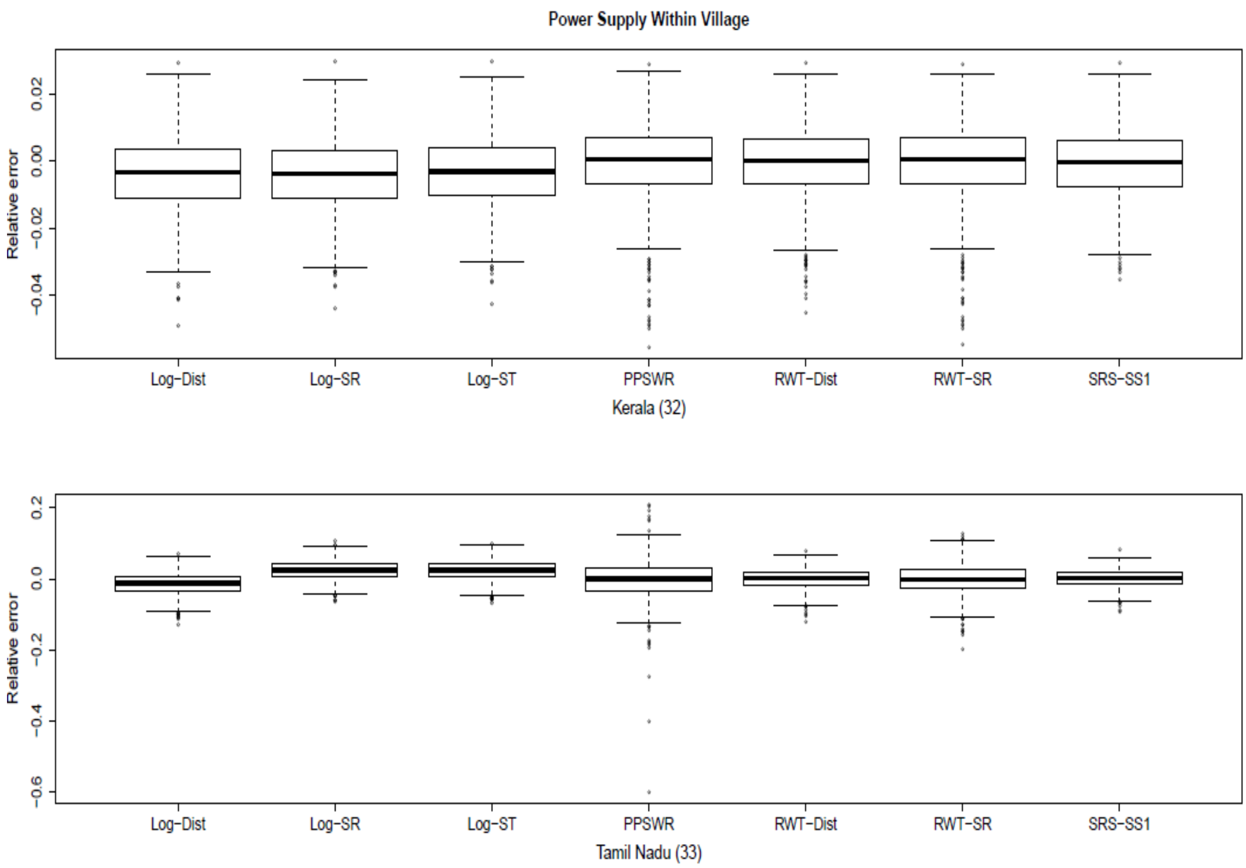
Power Supply Within Village








Power Supply Within Village
Relative error
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Maharashtra (27)
Andhra Pradesh (28)
Karnataka (29)


Power Supply Within Village
Relative error
0.02
0.00
−0.02
−0.04
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Kerala (32)
Relative error
0.2
0.0
−0.2
−0.4
−0.6
Log−Dist
Log−SR
Log−ST
PPSWR
RWT−Dist
RWT−SR
SRS−SS1
Tamil Nadu (33)

APPENDIX IV: Table 5.2.1

Table 5.2.1: Design based estimates (in %) 10 village level characteristics for 20 'Large States' examined in the study – 69^{th}, 70^{th}, 71^{st} and 72^{nd} NSS Rounds.

State code	Rounds	Bus-Stop					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	64.20	24.60	11.19	64.34	24.06	11.60
	70	66.08	24.34	9.58	66.08	24.34	9.58
	71	40.80	40.58	18.62	42.24	36.85	20.91
	72	64.40	23.84	11.75	64.12	24.41	11.47
02	69	64.84	34.77	0.39	63.85	35.73	0.42
	70	48.28	45.86	5.87	48.28	45.86	5.87
	71	56.93	42.25	0.82	56.66	42.49	0.86
	72	60.56	31.73	7.71	60.17	31.95	7.88
03	69	60.69	38.01	1.29	60.76	38.02	1.22
	70	62.75	30.78	6.46	62.75	30.78	6.46
	71	65.27	31.37	3.36	66.93	28.93	4.14
	72	61.26	35.65	3.09	61.32	35.60	3.08
05	69	28.01	34.07	37.92	28.01	34.07	37.92
	70	29.95	28.10	41.95	29.95	28.10	41.95
	71	14.64	67.16	18.21	14.64	67.16	18.21
	72	20.88	51.68	27.44	20.88	51.68	27.44
06	69	59.32	33.38	7.31	59.29	33.31	7.39
	70	48.18	39.71	12.11	48.18	39.71	12.11
	71	56.46	35.48	8.06	56.12	35.35	8.54
	72	53.44	40.15	6.41	53.32	40.25	6.43
08	69	39.68	48.41	11.91	45.83	39.89	14.28
	70	47.80	37.05	15.15	47.80	37.05	15.15
	71	39.74	38.61	21.65	41.35	38.13	20.53
	72	49.21	39.89	10.90	49.82	39.45	10.73
09	69	20.89	52.79	26.32	21.00	52.84	26.17
	70	19.27	50.96	29.78	19.27	50.96	29.78
	71	17.19	54.67	28.15	17.36	54.53	28.11
	72	18.78	54.25	26.97	18.77	54.26	26.97
10	69	29.63	48.44	21.93	29.58	48.42	22.00
	70	22.88	51.94	25.18	22.88	51.94	25.18
	71	25.41	55.76	18.83	26.00	54.97	19.03
	72	27.80	48.67	23.52	27.85	48.66	23.49
18	69	21.68	51.82	26.50	21.02	52.59	26.39
	70	19.65	51.72	28.63	19.65	51.72	28.63
	71	25.76	49.61	24.63	25.70	49.69	24.61
	72	23.30	53.26	23.44	22.65	53.40	23.95
19	69	26.66	59.24	14.10	26.93	58.68	14.39
	70	29.59	50.16	20.26	29.59	50.16	20.26
	71	32.00	47.58	20.43	32.08	47.37	20.56
	72	28.70	47.66	23.45	28.83	47.26	23.72

State code	Rounds	Bus-Stop					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	12.68	41.94	45.38	12.67	41.95	45.38
	70	10.70	48.96	40.33	10.70	48.96	40.33
	71	21.84	35.24	42.92	21.78	35.25	42.97
	72	23.75	50.02	25.23	23.76	49.99	25.23
21	69	19.67	56.57	23.76	19.58	56.73	23.69
	70	29.19	45.93	24.88	29.19	45.93	24.88
	71	22.59	46.45	30.96	23.31	45.74	30.94
	72	27.22	47.64	25.15	27.04	47.36	25.60
22	69	32.66	41.20	26.14	34.53	39.91	25.57
	70	32.31	33.55	34.14	32.31	33.55	34.14
	71	34.00	37.51	28.49	34.78	36.40	28.83
	72	29.36	41.95	28.69	29.35	42.17	28.49
23	69	39.95	43.01	17.03	40.24	42.73	17.03
	70	36.57	43.40	20.03	36.57	43.40	20.03
	71	38.11	40.04	21.86	38.28	39.96	21.76
	72	41.33	37.02	21.65	41.26	36.75	21.99
24	69	74.80	19.58	5.62	74.49	19.67	5.84
	70	73.34	21.68	4.98	73.34	21.68	4.98
	71	68.80	25.30	5.91	70.44	24.04	5.52
	72	70.00	21.11	8.89	69.98	21.00	9.03
27	69	52.78	34.43	12.79	53.22	34.17	12.61
	70	60.12	30.41	9.47	60.12	30.41	9.47
	71	58.01	31.73	10.27	57.81	32.15	10.05
	72	60.47	31.54	7.99	60.51	31.38	8.11
28	69	62.93	24.53	12.55	62.62	25.12	12.27
	70	64.99	22.73	12.28	64.99	22.73	12.28
	71	66.55	21.63	11.83	68.13	20.64	11.23
	72	59.38	24.61	16.01	59.58	23.92	16.50
29	69	69.00	29.50	1.49	68.26	30.41	1.33
	70	71.66	27.55	0.79	71.66	27.55	0.79
	71	73.14	23.15	3.71	72.74	23.53	3.73
	72	68.74	28.19	3.06	69.66	27.38	2.96
32	69	91.89	8.11	0.00	91.89	8.11	0.00
	70	95.92	4.08	0.00	95.92	4.08	0.00
	71	94.20	5.80	0.00	94.20	5.80	0.00
	72	93.85	5.52	0.63	93.85	5.52	0.63
33	69	82.18	13.50	4.33	82.74	13.19	4.07
	70	86.76	12.23	1.01	86.76	12.23	1.01
	71	79.17	19.76	1.07	80.75	18.08	1.16
	72	86.52	13.37	0.11	86.64	13.25	0.10

State code	Rounds	Boat-Jetty					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	4.58	7.55	87.86	4.34	7.13	88.52
	70	1.20	6.53	92.27	1.20	6.53	92.27
	71	2.72	8.03	89.25	3.17	7.15	89.68
	72	2.67	7.73	89.54	2.60	7.24	90.09
02	69	0.41	9.68	89.92	0.38	9.11	90.51
	70	0.81	5.64	93.54	0.81	5.64	93.54
	71	0.24	5.92	93.84	0.25	5.85	93.90
	72	2.50	2.23	95.27	2.57	2.08	95.35
03	69	0.45	4.08	95.47	0.47	4.00	95.53
	70	0.00	7.95	92.05	0.00	7.95	92.05
	71	2.75	5.15	92.10	2.58	5.12	92.30
	72	1.42	0.30	98.28	1.43	0.29	98.28
05	69	0.00	0.00	100.00	0.00	0.00	100.00
	70	6.52	5.48	88.00	6.52	5.48	88.00
	71	3.47	0.11	96.41	3.47	0.11	96.41
	72	1.10	1.90	97.00	1.10	1.90	97.00
06	69	0.21	1.26	98.53	0.21	1.24	98.54
	70	3.83	0.00	96.17	3.83	0.00	96.17
	71	1.71	0.49	97.81	1.52	0.52	97.96
	72	2.61	1.63	95.77	2.59	1.63	95.77
08	69	1.10	0.53	98.37	1.11	0.47	98.41
	70	1.39	3.51	95.09	1.39	3.51	95.09
	71	2.02	4.61	93.37	2.18	4.83	92.99
	72	1.02	0.82	98.16	1.01	0.80	98.19
09	69	4.27	15.38	80.34	4.38	15.42	80.20
	70	4.18	14.93	80.89	4.18	14.93	80.89
	71	3.95	14.74	81.31	4.00	14.57	81.42
	72	3.95	12.32	83.70	3.98	12.72	83.27
10	69	10.96	21.06	67.31	11.24	20.95	67.11
	70	9.96	19.93	68.80	9.96	19.93	68.80
	71	8.85	9.42	81.73	9.17	9.93	80.89
	72	9.63	18.80	71.56	9.65	18.84	71.50
18	69	19.14	16.35	64.14	19.57	15.97	64.15
	70	12.10	14.42	71.33	12.10	14.42	71.33
	71	5.87	12.04	81.17	5.81	12.20	81.08
	72	7.06	14.94	78.00	6.95	14.70	78.35
19	69	4.33	13.55	82.12	3.98	13.48	82.54
	70	6.12	17.06	76.02	6.12	17.06	76.02
	71	9.45	12.31	77.92	9.36	12.27	78.05
	72	6.92	13.06	79.84	6.80	13.29	79.71

State code	Rounds	Boat-Jetty					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	0.49	3.94	94.86	0.49	3.93	94.86
	70	1.38	1.77	96.85	1.38	1.77	96.85
	71	1.13	1.72	96.75	1.13	1.71	96.76
	72	1.91	2.54	94.03	1.90	2.56	94.01
21	69	2.86	8.54	88.60	2.92	8.67	88.41
	70	5.54	14.71	79.43	5.54	14.71	79.43
	71	3.88	10.71	85.41	3.97	10.51	85.52
	72	2.28	12.68	85.04	2.18	12.60	85.21
22	69	1.29	4.88	93.83	1.36	5.35	93.30
	70	1.57	7.82	90.61	1.57	7.82	90.61
	71	2.68	2.48	94.84	2.71	2.61	94.68
	72	3.18	5.46	91.35	3.33	5.54	91.13
23	69	2.12	7.48	90.40	2.24	7.71	90.05
	70	3.86	8.24	87.91	3.86	8.24	87.91
	71	4.23	5.99	89.79	4.14	5.96	89.90
	72	3.98	6.26	89.65	4.13	6.57	89.17
24	69	1.37	2.21	96.43	1.26	2.09	96.65
	70	3.55	3.98	92.47	3.55	3.98	92.47
	71	5.48	1.82	92.70	5.44	1.85	92.71
	72	2.06	2.03	95.91	2.05	2.01	95.94
27	69	3.02	3.25	93.72	2.90	2.98	94.12
	70	1.92	6.64	91.44	1.92	6.64	91.44
	71	4.44	4.09	91.47	4.14	4.07	91.79
	72	4.32	3.62	91.82	4.31	3.70	91.76
28	69	1.79	3.79	94.42	1.79	4.34	93.87
	70	3.39	2.74	93.87	3.39	2.74	93.87
	71	4.56	4.08	91.36	4.63	3.90	91.47
	72	2.92	0.30	96.78	3.20	0.30	96.50
29	69	8.83	2.28	88.89	7.98	2.38	89.64
	70	0.99	3.61	95.40	0.99	3.61	95.40
	71	3.13	4.00	92.87	3.24	3.95	92.81
	72	2.03	2.27	95.70	2.24	2.46	95.30
32	69	7.64	8.67	83.70	7.70	8.67	83.63
	70	3.82	7.75	88.43	3.82	7.75	88.43
	71	4.26	4.61	91.13	4.26	4.61	91.13
	72	7.99	3.71	88.31	7.99	3.71	88.31
33	69	2.86	1.50	95.64	3.17	1.49	95.34
	70	3.49	1.53	94.98	3.49	1.53	94.98
	71	1.22	0.70	98.08	1.09	0.79	98.12
	72	0.66	0.87	98.47	0.64	0.88	98.48

State code	Rounds	Primary School					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	98.17	1.83	0.00	98.30	1.70	0.00
	70	89.22	10.78	0.00	89.22	10.78	0.00
	71	99.87	0.00	0.13	99.87	0.00	0.13
	72	97.38	2.62	0.00	97.50	2.50	0.00
02	69	52.20	45.40	2.40	52.81	44.62	2.57
	70	35.77	64.23	0.00	35.77	64.23	0.00
	71	45.30	49.57	5.13	45.57	49.09	5.35
	72	72.24	27.76	0.00	72.51	27.49	0.00
03	69	98.83	1.17	0.00	98.90	1.10	0.00
	70	85.30	14.70	0.00	85.30	14.70	0.00
	71	100.00	0.00	0.00	100.00	0.00	0.00
	72	92.16	7.00	0.84	92.17	7.01	0.83
05	69	74.77	25.23	0.00	74.77	25.23	0.00
	70	82.68	17.32	0.00	82.68	17.32	0.00
	71	79.43	20.57	0.00	79.43	20.57	0.00
	72	97.58	2.42	0.00	97.58	2.42	0.00
06	69	100.00	0.00	0.00	100.00	0.00	0.00
	70	92.26	7.74	0.00	92.26	7.74	0.00
	71	100.00	0.00	0.00	100.00	0.00	0.00
	72	94.47	5.53	0.00	94.44	5.56	0.00
08	69	76.04	23.70	0.26	87.47	12.28	0.25
	70	94.72	3.96	1.32	94.72	3.96	1.32
	71	89.74	10.26	0.00	90.49	9.51	0.00
	72	90.49	9.51	0.00	98.29	1.19	0.53
09	69	84.46	15.54	0.00	84.23	15.77	0.00
	70	80.67	19.33	0.00	80.67	19.33	0.00
	71	83.53	16.28	0.18	83.85	15.96	0.19
	72	83.46	15.26	1.28	83.30	15.34	1.36
10	69	88.63	10.91	0.45	88.84	10.70	0.47
	70	84.05	15.28	0.67	84.05	15.28	0.67
	71	74.57	24.73	0.70	75.81	23.54	0.64
	72	86.03	12.64	1.33	86.04	12.62	1.34
18	69	76.15	23.85	0.00	75.27	24.73	0.00
	70	89.53	9.23	1.24	89.53	9.23	1.24
	71	95.80	4.20	0.00	95.79	4.21	0.00
	72	90.40	9.60	0.00	90.31	9.69	0.00
19	69	88.56	11.44	0.00	88.73	11.27	0.00
	70	82.60	17.40	0.00	82.60	17.40	0.00
	71	92.56	7.44	0.00	92.58	7.42	0.00
	72	86.47	13.26	0.00	86.62	13.12	0.00

State code	Rounds	Primary School					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	81.53	18.47	0.00	81.52	18.48	0.00
	70	83.78	14.95	1.27	83.78	14.95	1.27
	71	95.82	4.18	0.00	95.82	4.18	0.00
	72	94.46	4.54	0.00	94.44	4.55	0.00
21	69	69.85	30.15	0.00	69.83	30.17	0.00
	70	81.96	18.04	0.00	81.96	18.04	0.00
	71	75.64	24.36	0.00	75.79	24.21	0.00
	72	87.01	12.99	0.00	87.43	12.57	0.00
22	69	100.00	0.00	0.00	100.00	0.00	0.00
	70	96.94	3.06	0.00	96.94	3.06	0.00
	71	100.00	0.00	0.00	100.00	0.00	0.00
	72	98.14	1.86	0.00	98.23	1.77	0.00
23	69	92.82	7.18	0.00	92.54	7.46	0.00
	70	94.33	5.67	0.00	94.33	5.67	0.00
	71	98.08	1.02	0.90	98.18	0.96	0.86
	72	98.59	1.41	0.00	98.64	1.36	0.00
24	69	96.88	3.12	0.00	100.00	0.00	0.00
	70	96.88	3.12	0.00	96.88	3.12	0.00
	71	98.39	1.17	0.44	98.49	1.09	0.41
	72	95.66	4.34	0.00	96.46	3.54	0.00
27	69	98.68	1.32	0.00	98.57	1.43	0.00
	70	95.71	4.29	0.00	95.71	4.29	0.00
	71	95.98	2.19	1.83	96.23	1.99	1.78
	72	94.74	5.26	0.00	94.91	5.09	0.00
28	69	97.42	2.58	0.00	97.49	2.51	0.00
	70	95.36	4.35	0.29	95.36	4.35	0.29
	71	97.87	2.13	0.00	97.91	2.09	0.00
	72	95.90	1.69	2.41	95.93	1.44	2.64
29	69	92.37	7.63	0.00	91.95	8.05	0.00
	70	97.10	2.90	0.00	97.10	2.90	0.00
	71	88.76	11.24	0.00	88.76	11.24	0.00
	72	98.34	1.66	0.00	98.01	1.99	0.00
32	69	71.63	28.37	0.00	71.70	28.30	0.00
	70	72.04	27.46	0.50	72.04	27.46	0.50
	71	79.03	18.53	2.44	79.03	18.53	2.44
	72	72.10	26.38	1.52	72.10	26.38	1.52
33	69	92.22	7.32	0.46	92.41	7.17	0.42
	70	90.70	9.30	0.00	90.70	9.30	0.00
	71	89.84	10.16	0.00	90.83	9.17	0.00
	72	83.85	15.92	0.23	84.21	15.57	0.22

State code	Rounds	Secondary School					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	36.58	47.00	16.42	35.94	46.65	17.41
	70	33.69	45.53	20.78	33.69	45.53	20.78
	71	44.43	43.35	12.21	46.93	39.00	14.07
	72	42.10	40.94	16.96	41.79	42.14	16.06
02	69	19.71	76.74	3.54	19.47	76.73	3.79
	70	10.79	65.87	23.34	10.79	65.87	23.34
	71	19.15	74.97	5.89	19.24	74.63	6.13
	72	38.17	57.05	4.78	38.29	56.61	5.10
03	69	37.89	54.35	7.76	37.77	54.25	7.98
	70	20.65	73.20	6.15	20.65	73.20	6.15
	71	39.29	57.37	3.34	44.28	52.91	2.81
	72	33.19	60.33	6.47	33.13	60.37	6.50
05	69	16.10	76.73	7.17	16.10	76.73	7.17
	70	33.86	53.21	12.93	33.86	53.21	12.93
	71	21.77	61.03	17.20	21.77	61.03	17.20
	72	34.87	56.67	8.46	34.87	56.67	8.46
06	69	51.60	43.65	4.75	51.56	43.59	4.84
	70	43.20	45.92	10.88	43.20	45.92	10.88
	71	61.08	31.71	7.21	61.46	31.17	7.36
	72	52.59	39.26	8.15	52.54	39.30	8.16
08	69	22.26	60.07	17.67	26.05	52.13	21.82
	70	25.83	56.33	17.84	25.83	56.33	17.84
	71	27.16	60.04	12.80	27.44	58.84	13.72
	72	29.09	55.31	15.60	29.43	54.69	15.88
09	69	33.82	55.76	10.42	33.98	55.73	10.30
	70	30.34	55.72	13.94	30.34	55.72	13.94
	71	36.29	53.04	10.66	36.81	53.30	9.89
	72	30.63	56.12	13.25	30.55	56.56	12.89
10	69	24.01	54.48	20.83	24.04	54.30	20.97
	70	24.94	56.79	17.85	24.94	56.79	17.85
	71	31.02	59.12	9.87	31.63	58.10	10.27
	72	31.36	56.79	11.85	31.40	56.78	11.82
18	69	15.98	71.10	12.92	16.40	71.08	12.53
	70	18.77	62.77	18.46	18.77	62.77	18.46
	71	23.73	55.58	20.69	23.78	55.85	20.38
	72	20.01	62.64	17.36	19.56	62.58	17.85
19	69	14.85	72.49	12.66	14.57	72.70	12.73
	70	18.14	68.18	13.67	18.14	68.18	13.67
	71	15.21	79.14	5.65	15.25	79.05	5.70
	72	17.22	74.28	8.31	17.24	74.26	8.31

State code	Rounds	Secondary School					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	24.58	43.22	32.20	24.58	43.21	32.21
	70	22.97	55.33	21.69	22.97	55.33	21.69
	71	26.81	49.70	23.48	26.82	49.68	23.49
	72	27.59	54.24	17.17	27.61	54.15	17.22
21	69	13.39	64.04	22.57	13.42	64.03	22.55
	70	21.50	62.02	16.48	21.50	62.02	16.48
	71	16.97	69.09	13.94	17.19	68.92	13.90
	72	20.33	70.26	9.42	20.04	70.28	9.69
22	69	40.19	37.71	22.10	43.72	39.16	17.11
	70	36.90	45.00	18.10	36.90	45.00	18.10
	71	49.24	38.47	12.29	49.96	37.74	12.31
	72	28.07	48.88	23.05	27.42	49.45	23.12
23	69	33.04	50.01	16.95	33.32	50.10	16.58
	70	30.05	49.92	20.03	30.05	49.92	20.03
	71	38.53	46.18	15.29	38.74	45.98	15.28
	72	37.42	48.14	14.44	37.69	47.92	14.40
24	69	26.93	48.57	24.50	26.34	47.61	26.05
	70	26.79	44.24	28.97	26.79	44.24	28.97
	71	33.56	45.75	20.69	33.92	45.07	21.02
	72	28.81	46.52	24.68	29.17	45.77	25.06
27	69	29.57	44.40	26.03	29.92	44.41	25.67
	70	29.10	46.05	24.85	29.10	46.05	24.85
	71	31.27	48.57	20.16	31.46	48.73	19.81
	72	34.04	48.45	17.52	33.87	48.48	17.65
28	69	38.84	42.54	18.62	38.28	43.00	18.71
	70	30.98	39.83	29.19	30.98	39.83	29.19
	71	37.32	41.23	21.45	38.11	40.19	21.71
	72	34.00	41.36	24.64	34.02	41.05	24.94
29	69	27.40	52.13	20.47	27.11	52.83	20.06
	70	30.72	54.83	14.44	30.72	54.83	14.44
	71	28.85	56.07	15.08	28.75	55.93	15.31
	72	25.35	53.96	20.68	25.62	53.25	21.13
32	69	31.93	52.24	15.84	32.02	52.16	15.82
	70	28.39	58.86	12.75	28.39	58.86	12.75
	71	37.81	55.22	6.97	37.81	55.22	6.97
	72	37.47	55.80	6.73	37.47	55.80	6.73
33	69	27.50	50.77	21.73	27.84	50.98	21.18
	70	30.85	54.25	14.90	30.85	54.25	14.90
	71	32.22	40.48	27.30	33.30	40.80	25.90
	72	28.23	50.76	21.01	28.58	50.65	20.77

State code	Rounds	Higher Secondary School					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	16.49	43.82	39.68	15.90	44.15	39.94
	70	9.52	30.42	60.06	9.52	30.42	60.06
	71	9.65	65.14	25.21	10.21	62.11	27.68
	72	8.03	40.12	51.85	7.93	41.44	50.63
02	69	12.27	71.33	16.40	12.13	71.04	16.83
	70	12.24	45.99	41.77	12.24	45.99	41.77
	71	8.29	62.69	29.01	8.17	62.24	29.59
	72	14.47	57.63	27.90	14.44	57.02	28.54
03	69	17.93	46.86	35.22	17.47	46.92	35.61
	70	8.87	56.10	35.03	8.87	56.10	35.03
	71	19.06	62.55	18.39	21.87	59.67	18.47
	72	10.16	63.88	25.96	10.14	63.82	26.03
05	69	9.95	61.66	28.39	9.95	61.66	28.39
	70	7.85	66.69	25.47	7.85	66.69	25.47
	71	9.05	63.38	27.56	9.05	63.38	27.56
	72	7.38	54.27	38.35	7.38	54.27	38.35
06	69	14.91	46.66	38.43	14.87	46.51	38.62
	70	20.29	53.44	26.27	20.29	53.44	26.27
	71	32.29	46.49	21.22	32.61	45.94	21.45
	72	29.03	48.93	22.04	29.00	48.95	22.05
08	69	6.81	35.54	57.65	8.12	37.28	54.60
	70	6.42	35.94	57.64	6.42	35.94	57.64
	71	8.88	49.43	41.69	9.04	48.06	42.89
	72	13.31	41.88	44.82	13.46	41.60	44.94
09	69	11.44	54.32	34.25	11.56	54.46	33.98
	70	8.57	57.24	34.19	8.57	57.24	34.19
	71	11.36	59.77	28.87	11.49	60.17	28.33
	72	12.65	52.86	34.50	12.54	53.58	33.88
10	69	6.03	32.49	61.48	6.00	32.29	61.71
	70	1.96	46.18	51.86	1.96	46.18	51.86
	71	4.51	47.25	48.24	4.55	46.43	49.01
	72	5.53	41.16	53.32	5.54	41.15	53.31
18	69	4.03	50.85	45.13	4.04	51.24	44.73
	70	4.43	37.88	57.69	4.43	37.88	57.69
	71	6.62	39.80	53.58	6.62	39.94	53.44
	72	3.45	34.88	61.67	3.42	34.27	62.31
19	69	8.75	67.70	23.55	8.64	67.53	23.83
	70	9.24	64.42	26.34	9.24	64.42	26.34
	71	10.52	67.17	22.31	10.38	67.14	22.48
	72	11.52	68.47	19.82	11.58	68.44	19.78

State code	Rounds	Higher Secondary School					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	1.81	31.25	66.94	1.81	31.25	66.94
	70	0.75	24.54	74.72	0.75	24.54	74.72
	71	1.63	23.43	74.94	1.64	23.45	74.91
	72	3.26	35.69	60.05	3.25	35.66	60.07
21	69	2.16	25.85	71.99	2.18	26.30	71.52
	70	2.23	31.13	66.64	2.23	31.13	66.64
	71	1.75	27.42	70.83	1.75	27.38	70.87
	72	2.55	29.01	68.44	2.51	28.42	69.07
22	69	5.24	35.90	58.86	5.48	37.31	57.21
	70	8.21	29.94	61.85	8.21	29.94	61.85
	71	9.70	38.42	51.89	9.97	38.05	51.98
	72	10.10	37.23	52.67	10.07	36.73	53.20
23	69	5.20	27.00	67.79	5.29	27.20	67.51
	70	4.18	31.88	63.94	4.18	31.88	63.94
	71	6.64	37.28	56.08	6.66	37.33	56.01
	72	7.99	30.18	61.70	8.07	30.53	61.27
24	69	11.20	40.84	47.96	11.09	39.63	49.27
	70	6.30	29.23	64.47	6.30	29.23	64.47
	71	13.36	30.27	56.37	13.47	30.12	56.41
	72	10.18	34.60	55.22	10.01	33.16	56.84
27	69	8.89	25.38	65.74	9.17	25.55	65.28
	70	6.49	26.46	67.06	6.49	26.46	67.06
	71	10.79	35.39	53.81	10.78	36.15	53.07
	72	11.08	35.99	52.93	10.95	35.98	53.06
28	69	5.48	18.98	75.54	5.27	18.55	76.18
	70	4.84	25.35	69.81	4.84	25.35	69.81
	71	6.97	14.99	78.04	7.25	14.41	78.34
	72	5.22	17.60	77.18	5.32	18.12	76.56
29	69	5.00	42.52	52.48	4.94	42.81	52.25
	70	8.14	35.79	56.07	8.14	35.79	56.07
	71	6.20	34.93	58.87	6.17	34.91	58.92
	72	7.00	31.87	61.14	7.32	31.61	61.07
32	69	20.01	48.95	31.03	20.07	48.88	31.06
	70	17.64	52.82	29.54	17.64	52.82	29.54
	71	25.32	53.09	21.60	25.32	53.09	21.60
	72	25.38	55.93	18.69	25.38	55.93	18.69
33	69	11.74	50.06	38.20	11.93	50.06	38.00
	70	15.41	50.67	33.92	15.41	50.67	33.92
	71	15.05	40.10	44.85	15.89	40.41	43.70
	72	13.70	43.73	42.57	13.81	43.77	42.42

State code	Rounds	Primary Health Centre					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	13.57	43.91	42.51	13.57	42.95	43.48
	70	11.25	42.58	46.17	11.25	42.58	46.17
	71	7.64	70.60	21.76	7.18	68.00	24.82
	72	13.01	37.46	49.53	12.84	38.71	48.45
02	69	1.70	42.62	55.69	1.64	42.43	55.93
	70	2.63	52.31	45.06	2.63	52.31	45.06
	71	3.52	44.56	51.92	3.61	44.35	52.04
	72	8.92	49.51	41.57	9.07	48.48	42.45
03	69	10.50	51.96	37.54	10.68	51.87	37.46
	70	7.47	47.74	44.80	7.47	47.74	44.80
	71	11.53	43.34	45.13	12.00	42.43	45.57
	72	12.02	45.19	42.79	12.00	45.17	42.83
05	69	7.11	47.90	45.00	7.11	47.90	45.00
	70	7.08	28.64	64.28	7.08	28.64	64.28
	71	5.29	61.57	33.14	5.29	61.57	33.14
	72	7.20	33.88	58.93	7.20	33.88	58.93
06	69	13.41	45.98	40.61	13.50	45.76	40.74
	70	15.35	43.61	41.04	15.35	43.61	41.04
	71	14.18	35.71	50.10	14.43	35.35	50.22
	72	15.63	41.58	42.79	15.60	41.60	42.80
08	69	6.07	31.05	62.88	7.31	32.80	59.90
	70	7.41	36.81	55.78	7.41	36.81	55.78
	71	6.38	49.35	44.27	6.26	48.00	45.74
	72	8.27	37.19	54.55	8.43	36.57	55.00
09	69	4.01	44.22	51.76	3.97	44.48	51.54
	70	4.43	48.42	47.15	4.43	48.42	47.15
	71	4.99	50.45	44.56	5.03	51.19	43.78
	72	5.36	42.98	51.66	5.32	43.26	51.43
10	69	8.54	42.02	49.44	8.58	42.18	49.24
	70	4.68	46.96	48.35	4.68	46.96	48.35
	71	9.20	39.59	51.22	9.10	40.85	50.04
	72	7.30	39.66	53.04	7.32	39.69	53.00
18	69	5.73	54.13	40.15	6.03	54.75	39.22
	70	8.81	46.97	44.21	8.81	46.97	44.21
	71	17.44	50.06	32.50	17.52	50.09	32.39
	72	10.35	49.06	40.59	10.24	48.79	40.96
19	69	9.50	46.72	43.78	9.36	46.15	44.49
	70	10.55	47.01	42.44	10.55	47.01	42.44
	71	13.93	48.26	37.80	14.01	47.95	38.03
	72	11.14	48.94	39.65	11.15	48.65	39.94

State code	Rounds	Primary Health Centre					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	9.95	48.05	42.00	9.95	48.05	42.00
	70	5.20	28.97	65.84	5.20	28.97	65.84
	71	5.94	29.83	64.23	5.95	29.83	64.22
	72	10.06	40.49	48.44	10.06	40.43	48.49
21	69	5.02	22.99	71.99	5.00	23.37	71.64
	70	3.10	34.35	62.55	3.10	34.35	62.55
	71	2.63	31.30	66.06	2.72	30.79	66.49
	72	4.09	38.11	57.80	4.05	37.25	58.70
22	69	5.62	20.74	73.65	6.18	22.20	71.62
	70	2.04	27.65	70.31	2.04	27.65	70.31
	71	4.54	26.24	69.21	4.67	25.92	69.41
	72	8.45	28.83	62.71	8.51	28.67	62.83
23	69	3.28	20.48	76.24	3.34	20.31	76.35
	70	2.35	27.70	69.95	2.35	27.70	69.95
	71	3.71	23.81	72.48	3.75	24.03	72.22
	72	5.29	22.72	72.00	5.49	22.92	71.60
24	69	10.14	41.07	48.79	9.91	39.87	50.21
	70	17.55	35.64	46.81	17.55	35.64	46.81
	71	15.67	28.42	55.91	16.42	28.48	55.10
	72	14.44	35.51	50.05	14.76	34.15	51.09
27	69	8.12	24.20	67.68	8.42	23.92	67.66
	70	9.59	24.82	65.59	9.59	24.82	65.59
	71	9.83	26.58	63.60	9.94	26.70	63.36
	72	7.40	32.99	59.61	7.35	32.95	59.69
28	69	15.40	29.06	55.54	15.23	28.58	56.20
	70	11.27	34.09	54.63	11.27	34.09	54.63
	71	12.24	24.98	62.78	12.44	24.63	62.93
	72	11.63	27.13	61.24	11.63	27.56	60.81
29	69	9.28	56.29	34.43	9.35	57.40	33.25
	70	10.30	50.95	38.75	10.30	50.95	38.75
	71	10.12	46.96	42.92	10.06	46.89	43.05
	72	8.70	39.65	51.65	8.89	39.65	51.46
32	69	27.60	52.23	20.17	27.69	52.13	20.17
	70	24.79	57.58	17.63	24.79	57.58	17.63
	71	27.53	57.21	15.26	27.53	57.21	15.26
	72	30.42	56.29	13.29	30.42	56.29	13.29
33	69	21.82	40.61	37.57	22.09	40.65	37.26
	70	18.77	43.78	37.45	18.77	43.78	37.45
	71	16.40	43.20	40.40	17.73	43.33	38.94
	72	15.79	49.17	35.04	15.86	49.50	34.64

State code	Rounds	Private Doctor/Clinic					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	15.57	42.90	41.54	14.93	42.82	42.25
	70	17.45	41.30	41.25	17.45	41.30	41.25
	71	5.47	57.99	36.54	5.53	55.50	38.98
	72	11.09	36.01	52.90	11.49	36.94	51.57
02	69	16.97	41.15	41.88	16.19	41.18	42.63
	70	6.36	27.61	66.03	6.36	27.61	66.03
	71	5.53	48.05	46.42	5.45	47.68	46.87
	72	13.40	37.18	49.41	13.18	36.53	50.29
03	69	37.72	39.30	22.98	37.74	39.44	22.82
	70	15.83	53.03	31.14	15.83	53.03	31.14
	71	38.74	40.62	20.65	41.70	38.04	20.25
	72	30.56	38.48	30.96	30.40	38.57	31.03
05	69	4.96	26.80	68.24	4.96	26.80	68.24
	70	0.38	29.67	69.95	0.38	29.67	69.95
	71	8.09	59.90	32.01	8.09	59.90	32.01
	72	13.82	39.04	47.14	13.82	39.04	47.14
06	69	56.43	32.30	11.28	56.41	32.23	11.37
	70	46.37	31.15	22.49	46.37	31.15	22.49
	71	47.87	29.61	22.52	47.49	30.37	22.13
	72	38.88	33.95	27.17	38.90	34.00	27.10
08	69	13.13	23.73	63.13	15.44	22.97	61.60
	70	10.84	40.56	48.60	10.84	40.56	48.60
	71	12.50	27.48	60.01	12.27	27.06	60.67
	72	13.20	29.38	57.42	13.19	28.56	58.25
09	69	18.77	46.72	34.52	18.76	46.88	34.37
	70	14.85	52.21	32.93	14.85	52.21	32.93
	71	15.75	54.39	29.85	16.04	54.40	29.56
	72	13.00	48.82	38.02	13.16	49.54	37.15
10	69	16.71	33.02	50.27	16.97	33.15	49.88
	70	12.39	37.80	49.81	12.39	37.80	49.81
	71	10.39	30.36	59.25	10.31	31.33	58.36
	72	14.86	36.37	48.77	14.86	36.41	48.72
18	69	3.38	44.27	52.09	3.38	46.55	49.85
	70	6.20	39.88	53.93	6.20	39.88	53.93
	71	6.76	34.72	58.51	6.76	34.55	58.70
	72	4.87	33.39	61.74	4.90	33.21	61.89
19	69	23.90	40.68	35.42	24.25	39.80	35.95
	70	14.58	47.21	38.21	14.58	47.21	38.21
	71	18.55	46.12	35.33	18.41	46.02	35.57
	72	15.10	48.15	36.56	14.80	47.97	37.03

State code	Rounds	Private Doctor/Clinic					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	8.69	33.96	57.35	8.69	33.96	57.35
	70	9.99	37.71	52.29	9.99	37.71	52.29
	71	10.27	19.85	69.88	10.28	19.87	69.86
	72	15.08	31.00	52.91	15.13	30.94	52.92
21	69	5.03	31.95	63.02	5.08	32.38	62.54
	70	2.59	36.81	60.59	2.59	36.81	60.59
	71	2.85	37.73	59.42	2.95	38.32	58.73
	72	4.20	38.23	57.58	4.05	37.56	58.39
22	69	10.79	31.34	57.87	12.28	33.06	54.66
	70	16.80	19.55	63.66	16.80	19.55	63.66
	71	21.56	21.53	56.91	21.93	21.23	56.84
	72	20.08	27.18	52.74	19.57	26.89	53.53
23	69	25.95	41.08	32.96	25.97	40.57	33.46
	70	16.84	31.55	51.61	16.84	31.55	51.61
	71	19.98	35.78	44.24	20.06	35.81	44.13
	72	19.20	32.49	48.31	19.32	32.61	48.07
24	69	27.94	26.20	45.86	27.17	26.12	46.71
	70	24.90	34.70	40.40	24.90	34.70	40.40
	71	22.11	37.22	40.68	22.47	36.76	40.77
	72	27.53	31.81	40.67	28.16	31.19	40.65
27	69	33.23	28.70	38.07	33.79	28.39	37.82
	70	32.38	26.22	41.39	32.38	26.22	41.39
	71	35.46	25.93	38.61	35.27	26.03	38.70
	72	35.38	36.67	27.96	35.31	36.55	28.15
28	69	36.28	26.03	37.68	35.03	26.21	38.76
	70	27.74	30.48	41.78	27.74	30.48	41.78
	71	24.52	19.22	56.27	24.78	18.31	56.92
	72	26.53	24.13	49.34	25.85	24.18	49.97
29	69	20.30	48.97	30.73	19.09	49.90	31.01
	70	28.05	41.38	30.56	28.05	41.38	30.56
	71	17.21	42.43	40.36	17.18	42.24	40.58
	72	21.04	33.47	45.50	21.80	33.32	44.88
32	69	50.37	42.48	7.14	50.52	42.31	7.17
	70	54.30	35.34	10.36	54.30	35.34	10.36
	71	54.09	35.74	10.17	54.09	35.74	10.17
	72	49.91	44.54	5.55	49.91	44.54	5.55
33	69	15.05	36.70	48.25	15.10	36.72	48.18
	70	14.41	37.47	48.12	14.41	37.47	48.12
	71	13.60	37.38	49.02	14.47	37.76	47.77
	72	14.45	43.71	41.85	14.41	44.04	41.55

State code	Rounds	Post Office					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	27.36	52.23	20.41	27.35	51.90	20.76
	70	17.68	58.52	23.80	17.68	58.52	23.80
	71	15.11	63.85	21.04	15.41	61.14	23.45
	72	23.17	40.88	35.95	23.43	42.09	34.48
02	69	12.44	78.68	8.88	12.09	79.10	8.81
	70	7.87	71.79	20.34	7.87	71.79	20.34
	71	17.70	75.82	6.48	17.60	75.69	6.70
	72	20.24	62.33	17.44	20.15	61.72	18.13
03	69	32.42	59.60	7.98	32.69	59.21	8.09
	70	26.94	54.95	18.10	26.94	54.95	18.10
	71	37.59	55.41	6.56	38.38	54.19	6.83
	72	28.46	62.84	8.69	28.41	62.97	8.62
05	69	17.87	80.38	1.75	17.87	80.38	1.75
	70	31.78	44.98	23.23	31.78	44.98	23.23
	71	17.28	65.44	17.29	17.28	65.44	17.29
	72	20.25	59.96	19.80	20.25	59.96	19.80
06	69	28.99	61.52	9.50	28.98	61.55	9.47
	70	33.71	57.55	8.74	33.71	57.55	8.74
	71	38.54	53.36	8.10	38.09	53.45	8.46
	72	38.69	47.28	14.03	38.59	47.40	14.01
08	69	14.74	64.58	20.68	17.82	57.66	24.52
	70	20.92	54.70	24.38	20.92	54.70	24.38
	71	18.31	63.32	18.37	18.79	61.92	19.29
	72	21.82	60.57	17.61	22.25	59.66	18.09
09	69	17.98	68.00	14.02	17.90	68.23	13.88
	70	15.07	75.51	9.42	15.07	75.51	9.42
	71	20.56	69.59	9.85	20.63	69.54	9.82
	72	17.87	70.78	11.36	17.71	71.09	11.20
10	69	21.46	69.60	8.94	21.52	69.49	8.99
	70	14.74	76.81	8.45	14.74	76.81	8.45
	71	17.20	71.10	11.69	17.57	70.14	12.29
	72	21.19	70.57	8.25	21.19	70.56	8.25
18	69	13.82	71.96	14.22	13.85	71.92	14.23
	70	18.63	61.16	20.21	18.63	61.16	20.21
	71	20.68	59.68	18.54	20.65	59.62	18.61
	72	20.77	66.97	12.26	20.56	67.39	12.05
19	69	19.64	72.18	8.18	19.55	72.30	8.16
	70	20.73	70.89	8.38	20.73	70.89	8.38
	71	20.99	73.01	6.00	20.97	73.01	6.02
	72	19.86	73.64	6.31	19.81	73.63	6.37

State code	Rounds	Post Office					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	5.02	60.38	34.60	5.02	60.38	34.60
	70	8.80	70.26	20.94	8.80	70.26	20.94
	71	10.78	52.69	36.53	10.76	52.69	36.56
	72	13.30	62.51	23.18	13.34	62.45	23.19
21	69	15.04	69.38	15.57	15.11	69.24	15.64
	70	18.45	65.98	15.58	18.45	65.98	15.58
	71	13.79	63.24	22.97	13.99	62.90	23.12
	72	19.40	69.81	10.79	19.25	69.44	11.31
22	69	14.80	50.46	34.74	17.39	52.18	30.43
	70	16.75	44.96	38.29	16.75	44.96	38.29
	71	23.15	49.14	27.71	23.67	48.39	27.94
	72	21.79	48.46	29.75	21.92	49.02	29.06
23	69	13.36	49.19	37.46	13.41	49.35	37.23
	70	11.18	56.68	32.13	11.18	56.68	32.13
	71	13.43	54.19	32.38	13.58	53.93	32.50
	72	15.87	51.02	32.61	15.98	51.05	32.48
24	69	44.99	48.01	6.99	46.12	46.74	7.15
	70	49.28	40.09	10.63	49.28	40.09	10.63
	71	47.17	42.03	10.80	48.17	41.10	10.73
	72	40.48	44.17	15.36	41.61	42.77	15.61
27	69	27.65	47.27	25.07	27.90	47.39	24.71
	70	30.02	42.94	27.03	30.02	42.94	27.03
	71	31.24	42.30	26.46	30.84	42.74	26.42
	72	32.64	50.20	17.16	32.51	50.25	17.24
28	69	53.25	35.39	11.36	52.53	35.88	11.59
	70	48.90	38.64	12.46	48.90	38.64	12.46
	71	56.71	32.15	11.14	57.96	30.98	11.06
	72	57.43	26.65	15.92	58.54	25.72	15.74
29	69	31.72	62.42	5.86	31.51	62.90	5.58
	70	30.02	56.96	13.02	30.02	56.96	13.02
	71	27.52	61.65	10.84	27.55	61.66	10.79
	72	31.88	53.43	14.69	32.59	52.78	14.64
32	69	51.03	45.12	3.85	51.10	45.04	3.86
	70	50.10	42.77	7.13	50.10	42.77	7.13
	71	47.90	46.60	5.50	47.90	46.60	5.50
	72	53.50	44.32	2.18	53.50	44.32	2.18
33	69	56.45	32.11	11.44	56.75	32.48	10.77
	70	56.78	39.41	3.80	56.78	39.41	3.80
	71	49.98	32.79	17.23	51.85	32.63	15.52
	72	57.24	38.10	4.66	57.97	37.38	4.65

State code	Rounds	Commercial Bank					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
01	69	18.75	44.47	36.77	18.75	44.47	36.77
	70	10.35	43.28	46.37	10.35	43.28	46.37
	71	8.32	43.61	48.07	8.43	43.63	47.94
	72	8.76	34.82	56.42	8.74	35.75	55.51
02	69	7.82	48.51	43.68	7.54	47.91	44.55
	70	3.62	48.69	47.70	3.62	48.69	47.70
	71	2.38	47.43	50.19	2.39	47.47	50.14
	72	7.27	46.30	46.43	7.29	45.73	46.98
03	69	9.16	66.24	24.59	9.22	66.81	23.96
	70	6.38	67.26	26.36	6.38	67.26	26.36
	71	14.54	63.42	21.60	15.14	60.14	24.11
	72	18.21	61.83	19.96	18.24	61.93	19.83
05	69	3.35	38.98	57.67	3.35	38.98	57.67
	70	0.66	35.04	64.30	0.66	35.04	64.30
	71	0.65	47.03	52.33	0.65	47.03	52.33
	72	4.74	33.69	61.57	4.74	33.69	61.57
06	69	10.31	50.62	39.08	10.30	50.71	38.99
	70	13.84	52.38	33.77	13.84	52.38	33.77
	71	22.56	40.66	36.78	23.23	40.66	36.11
	72	19.95	48.06	31.99	19.93	48.17	31.90
08	69	3.92	26.27	69.82	4.75	27.52	67.73
	70	5.99	35.67	58.34	5.99	35.67	58.34
	71	4.43	33.33	62.24	4.53	31.91	63.56
	72	7.65	27.14	65.20	7.81	26.56	65.63
09	69	5.32	57.77	36.90	5.25	58.23	36.52
	70	4.06	61.36	34.58	4.06	61.36	34.58
	71	8.27	62.57	29.16	8.36	63.05	28.59
	72	8.46	54.03	37.51	8.35	54.29	37.36
10	69	9.62	48.84	41.54	9.76	48.82	41.42
	70	7.19	57.83	34.98	7.19	57.83	34.98
	71	8.40	55.16	36.44	8.47	54.95	36.58
	72	10.06	52.64	37.31	10.07	52.66	37.27
18	69	1.01	39.58	59.41	1.00	40.42	58.58
	70	2.92	31.42	65.66	2.92	31.42	65.66
	71	2.74	26.52	70.49	2.72	26.57	70.46
	72	2.53	27.10	70.37	2.46	27.10	70.44
19	69	7.17	50.65	42.18	7.36	49.94	42.70
	70	6.75	53.62	39.62	6.75	53.62	39.62
	71	7.72	56.60	35.67	7.68	56.31	36.01
	72	8.58	59.27	31.96	8.58	58.91	32.32

State code	Rounds	Commercial Bank					
		Design-Based Estimates			State-Region Reweighted Estimates		
		Within Village	<5 kms	>5 kms	Within Village	<5 kms	>5 kms
20	69	1.72	37.49	60.80	1.72	37.48	60.80
	70	2.60	29.25	68.15	2.60	29.25	68.15
	71	4.12	19.78	76.10	4.14	19.82	76.05
	72	4.25	36.19	58.55	4.25	36.16	58.57
21	69	2.90	44.16	52.94	2.90	44.16	52.94
	70	3.75	37.62	58.63	3.75	37.62	58.63
	71	2.15	33.96	63.89	2.19	34.38	63.42
	72	3.59	40.38	56.03	3.55	39.34	57.12
22	69	2.69	15.45	81.87	2.77	16.91	80.32
	70	3.71	18.60	77.69	3.71	18.60	77.69
	71	3.86	22.33	73.81	4.02	22.61	73.37
	72	5.15	23.98	70.87	5.24	23.54	71.22
23	69	3.42	20.70	75.89	3.38	20.91	75.72
	70	2.92	23.74	73.34	2.92	23.74	73.34
	71	4.20	22.45	73.35	4.25	22.43	73.32
	72	5.70	22.14	72.16	5.75	22.02	72.23
24	69	8.83	32.76	58.42	8.98	31.88	59.14
	70	12.09	39.15	48.75	12.09	39.15	48.75
	71	15.97	31.64	52.40	16.56	31.34	52.10
	72	14.74	28.94	56.32	14.98	28.59	56.43
27	69	7.04	27.83	65.13	7.20	27.61	65.20
	70	6.21	25.50	68.29	6.21	25.50	68.29
	71	10.05	31.05	58.90	9.99	30.86	59.15
	72	8.86	35.75	55.39	8.75	35.61	55.64
28	69	12.81	36.52	50.67	12.53	37.42	50.05
	70	11.30	32.70	56.00	11.30	32.70	56.00
	71	13.27	22.70	64.03	13.63	22.52	63.85
	72	14.16	29.96	55.88	14.41	29.94	55.65
29	69	9.15	44.05	46.80	9.21	44.41	46.38
	70	11.98	41.45	46.57	11.98	41.45	46.57
	71	10.37	38.59	51.04	10.32	38.63	51.05
	72	8.46	35.53	56.01	8.64	35.80	55.56
32	69	21.50	61.56	16.94	21.60	61.51	16.89
	70	27.84	53.11	19.05	27.84	53.11	19.05
	71	31.55	49.70	18.75	31.55	49.70	18.75
	72	28.24	58.00	13.76	28.24	58.00	13.76
33	69	15.43	40.72	43.86	15.55	41.03	43.42
	70	13.30	46.11	40.59	13.30	46.11	40.59
	71	11.24	43.71	45.05	11.69	45.26	43.05
	72	15.47	45.21	39.32	15.71	45.03	39.25

State code	Rounds	Electricity Connection							
		Design-Based Estimates				**State-Region Reweighted Estimates**			
		P < 25%	25% <= P <= 50%	P >= 50%	no connection	P < 25%	25% <= P <= 50%	P >= 50%	no connection
01	69	3.35	6.89	89.76	0.00	3.28	6.81	89.91	0.00
	70	0.95	4.49	93.70	0.86	0.95	4.49	93.70	0.86
	71	3.71	0.86	95.43	0.00	4.06	0.92	95.02	0.00
	72	6.77	8.82	82.61	1.67	6.85	8.47	82.93	1.63
02	69	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00
	70	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00
	71	0.00	2.83	97.17	0.00	0.00	2.95	97.05	0.00
	72	2.51	1.69	95.80	0.00	2.36	1.79	95.85	0.00
03	69	0.15	0.00	99.85	0.00	0.16	0.00	99.84	0.00
	70	0.00	2.16	97.84	0.00	0.00	2.16	97.84	0.00
	71	0.84	3.02	93.95	2.19	1.13	3.25	93.77	1.84
	72	4.63	2.77	92.60	0.00	4.60	2.76	92.64	0.00
05	69	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00
	70	0.00	0.00	97.94	2.06	0.00	0.00	97.94	2.06
	71	1.22	0.62	90.15	8.01	1.22	0.62	90.15	8.01
	72	0.03	0.32	93.71	5.94	0.03	0.32	93.71	5.94
06	69	6.90	0.00	93.10	0.00	6.82	0.00	93.18	0.00
	70	4.54	1.23	94.24	0.00	4.54	1.23	94.24	0.00
	71	3.17	1.49	95.33	0.00	3.17	1.53	95.31	0.00
	72	2.21	3.95	93.84	0.00	2.20	3.93	93.86	0.00
08	69	4.52	17.13	78.34	0.00	4.79	19.56	75.64	0.00
	70	7.42	12.90	77.16	2.52	7.42	12.90	77.16	2.52
	71	6.00	12.88	76.66	4.46	6.85	13.23	75.40	4.52
	72	3.84	8.80	86.63	0.74	3.76	9.00	86.40	0.83
09	69	21.98	23.49	49.90	4.62	22.17	23.74	49.36	4.73
	70	17.74	23.44	55.56	3.08	17.74	23.44	55.56	3.08
	71	19.51	16.35	62.89	1.25	19.93	16.52	62.26	1.29
	72	14.01	21.03	62.68	2.28	13.37	21.29	63.25	2.09
10	69	32.63	19.97	32.98	13.88	32.61	20.09	32.57	14.19
	70	21.68	29.02	38.52	10.78	21.68	29.02	38.52	10.78
	71	13.87	30.19	41.54	14.40	14.73	30.25	40.58	14.44
	72	14.61	23.39	50.61	11.39	14.67	23.42	50.53	11.38
18	69	5.07	26.36	50.36	18.21	4.96	27.17	49.46	18.40
	70	6.81	27.20	51.83	13.46	6.81	27.20	51.83	13.46
	71	11.16	29.96	53.87	5.01	10.82	29.98	54.23	4.97
	72	7.15	16.47	67.97	8.41	7.41	17.00	66.96	8.62

State code	Rounds	Electricity Connection							
		Design-Based Estimates				State-Region Reweighted Estimates			
		P < 25%	25% <= P <= 50%	P >= 50%	no connection	P < 25%	25% <= P <= 50%	P >= 50%	no connection
19	69	2.93	16.70	77.71	2.46	3.02	16.07	78.47	2.26
	70	5.33	9.40	82.91	2.35	5.33	9.40	82.91	2.35
	71	1.52	4.73	93.39	0.36	1.51	4.85	93.30	0.34
	72	1.73	4.37	92.91	0.45	1.73	4.37	92.91	0.45
20	69	18.70	10.03	38.89	32.38	18.71	10.03	38.88	32.37
	70	0.64	15.40	74.68	9.28	0.64	15.40	74.68	9.28
	71	10.19	7.01	64.05	18.75	10.20	7.01	64.06	18.73
	72	5.78	13.71	68.81	10.69	5.79	13.69	68.82	10.69
21	69	3.17	14.14	72.09	10.60	3.11	14.01	72.26	10.62
	70	3.26	13.57	77.29	5.88	3.26	13.57	77.29	5.88
	71	6.59	18.78	73.10	1.52	6.13	18.40	74.09	1.39
	72	2.58	16.78	78.12	2.52	2.70	17.49	77.12	2.69
22	69	2.31	19.28	78.41	0.00	2.96	13.51	83.54	0.00
	70	4.98	6.58	86.44	2.00	4.98	6.58	86.44	2.00
	71	10.54	7.36	79.84	2.26	10.07	6.83	81.19	1.90
	72	3.99	10.61	83.87	1.54	3.80	10.74	83.76	1.70
23	69	5.62	10.53	80.30	3.55	5.78	10.72	79.84	3.66
	70	5.34	11.04	78.90	4.72	5.34	11.04	78.90	4.72
	71	7.82	9.75	78.27	4.16	7.89	9.94	77.86	4.31
	72	8.51	12.68	76.18	2.63	8.51	13.25	75.51	2.72
24	69	1.01	0.22	98.77	0.00	0.99	0.22	98.79	0.00
	70	4.19	3.38	92.43	0.00	4.19	3.38	92.43	0.00
	71	6.54	3.07	90.39	0.00	6.46	3.44	90.10	0.00
	72	0.76	0.86	98.39	0.00	0.76	0.85	98.39	0.00
27	69	2.61	8.57	86.20	2.62	2.43	8.42	86.64	2.51
	70	2.50	4.78	90.21	2.51	2.50	4.78	90.21	2.51
	71	0.87	6.53	91.88	0.71	0.90	6.52	91.84	0.74
	72	2.04	3.47	94.23	0.11	2.06	3.48	94.19	0.12
28	69	6.13	2.56	91.31	0.00	6.45	2.46	91.09	0.00
	70	3.69	0.16	96.15	0.00	3.69	0.16	96.15	0.00
	71	1.69	0.85	97.46	0.00	1.77	1.00	97.23	0.00
	72	3.24	1.26	94.67	0.83	3.22	1.11	94.84	0.84
29	69	2.53	0.00	97.47	0.00	2.29	0.00	97.71	0.00
	70	0.96	0.26	98.78	0.00	0.96	0.26	98.78	0.00
	71	0.96	1.98	95.42	1.64	0.94	1.97	95.35	1.74
	72	2.48	2.95	94.57	0.00	2.46	2.99	94.55	0.00

State code	Rounds	Electricity Connection							
		Design-Based Estimates				**State-Region Reweighted Estimates**			
		P < 25%	25% <= P <= 50%	P >= 50%	no connection	P < 25%	25% <= P <= 50%	P >= 50%	no connection
32	69	1.42	0.00	98.58	0.00	1.42	0.00	98.58	0.00
	70	0.00	1.20	98.35	0.45	0.00	1.20	98.35	0.45
	71	0.74	0.67	98.58	0.00	0.74	0.67	98.58	0.00
	72	1.96	0.53	97.50	0.00	1.96	0.53	97.50	0.00
33	69	1.73	5.91	92.36	0.00	1.67	5.79	92.54	0.00
	70	3.62	1.77	93.45	1.15	3.62	1.77	93.45	1.15
	71	1.29	0.59	97.87	0.25	1.16	0.68	97.95	0.21
	72	3.52	1.09	94.86	0.54	3.48	1.09	94.85	0.58

P: percentage of households in the village having electricity

ANNEX

Project Team

The work of the project began with the team as reported in the Inception report. Later, it got augmented as follows:

Dr. Nachiketa Chattopadhyay	Project Director
Dr. Kajal Dihidar	Technical Adviser
Dr. Debasis Sengupta	Technical Adviser
Mr. Aloke Kar	Expert
Mr. Prabir Chaudhury	Expert
Ms. Anindita Das	Project Assistant
Ms. Kristhi Das	Project Assistant
Ms. Pramita Bedokta	Project Assistant
Mr. Ashutosh Maurya	Project Assistant

Revision of the original time frame

The time stipulated for completion of the project was one year. But certain unforeseen circumstances prevented uninterrupted progress of the study, causing delay in completion of the project. A total of nine months' extension was granted by the Screening Committee, in view of certain unforeseen circumstances. Other reasons for delay in completion of the study and departures made from the initial proposal are as follows:

1. The preparatory processing of Village Directory data of Population Census 2011 (PC2011) and Population Census 2001 (PC2001) and the four rounds of NSS data on village characteristics took much more time than initially thought. Matching the datasets was necessary for the proposed approach of creating a simulated/ experimental population using village directory data of PC2011 & PC2001. The difficulties faced in the process were:
    a. Problems of matching the PC2001 & PC2011 Village Directory data with the sampling frames used for 69^{th}, 70^{th}, 71^{st} and 72^{nd} rounds by the NSS. These took unduly long time to resolve.
    b. Unduly long time had to be spent on sorting out the large volume of discrepancies (mainly between codes for availability of facility and availability of information on the facility) in the Village Directory data of PC2001 & PC2011.
    c. The NSS datasets did not have multipliers posted in them. These had to be worked out from sample lists and sampling frames of the four rounds, which were provided by the NSSO at the request from the project team.
2. As initially proposed, a number of design-based ratio estimation procedures were explored in the project. Results were encouraging but not altogether satisfactory. At the all-India level, the estimates were found largely consistent over the four rounds. But, for the large (20) States, the estimates were not found to be stable. This led to further exploration of (logistic) model-based estimation procedures. As the errors involved in the model-based estimation cannot be handled easily algebraically, comparing the relative efficiencies of the estimators required estimating the MSEs from a large number (1000) samples drawn from the experimental population. Having found the preliminary results encouraging, the project team found it necessary to examine the model-based approach further. This took considerable time to complete.