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Estimation of the Finite Population Mean, using Median based Estimators in Stratified Random Sampling

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Abstract: In this paper we have suggested some median based estimators in absence of the auxiliary information in stratified random sampling. Expressions for the bias and mean square error are derived for the proposed estimators and comparison is made with the existing estimators. An empirical study is conducted to observe the efficiency of estimators.

Keywords: Bias, Efficiency, Mean, Median, MSE

1 Introduction

Consider a large population and draw a lage sample of size N randomly, now consider it a complete finite population having N units divided into L strata with hth stratum such that $\sum_{h=1}^{L} N_h = N$. We draw a sample of size n_h from each stratum such that $\sum_{h=1}^{L} n_h = n$. Let y_{hi} and x_{hi} be the ith units in the hth stratum of the study variable (y) and the auxiliary variable (x) respectively.

Let $\bar{Y}_h = \frac{1}{N_h}\sum_{i=1}^{N_h} y_{hi}$ and $\bar{X}_h = \frac{1}{N_h}\sum_{i=1}^{N_h} x_{hi}$ be the stratum means corresponding to y and x respectively.

Let $\bar{y}_{st} = \sum_{h=1}^{L} W_h \bar{y}_h$ and $\bar{x}_{st} = \sum_{h=1}^{L} W_h \bar{x}_h$ be the combined means of y and x respectively; W_h is the known stratum weight and $\bar{y}_h = \frac{1}{n_h}\sum_{i=1}^{n_h} y_{hi}$ and $\bar{x}_h = \frac{1}{n_h}\sum_{i=1}^{n_h} x_{hi}$.

Let $S_{hy}^2 = \frac{1}{N_h-1}\sum_{i=1}^{N_h}(y_{hi}-\bar{Y}_h)^2$ and $S_{hx}^2 = \frac{1}{N_h-1}\sum_{i=1}^{N_h}(x_{hi}-\bar{X}_h)^2$ be the variances of y and x in the hth stratum respectively and $S_{hyx} = \frac{1}{N_h-1}\sum_{i=1}^{N_h}(y_{hi}-\bar{Y}_h)(x_{hi}-\bar{X}_h)$ be the covariance between y and x in the hth stratum.

In absence of the auxiliary variable, the variance of $\bar{y}_{st}$, is given by

$$V(\bar{y}_{st}) = \sum_{h=1}^{L} W_h^2 \lambda_h S_{hy}^2, \tag{1}$$

where $\lambda_h = \left(\frac{1}{n_h} - \frac{1}{N_h}\right)$.

Let

$$\bar{y}_{st} = \sum_{h=1}^{L} W_h \bar{y}_h = \bar{Y}(1+e_0) \qquad \text{and} \qquad \bar{x}_{st} = \sum_{h=1}^{L} W_h \bar{x}_h = \bar{X}(1+e_1)$$

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such that

$$E(e_0)=E(e_1)=0,\qquad E(e_0^2)=\sum_{h=1}^{L}W_h^2\lambda_h\frac{S_{hy}^2}{Y^2}=V_{20},\qquad E(e_1^2)=\sum_{h=1}^{L}W_h^2\lambda_h\frac{S_{hx}^2}{X^2}=V_{02},$$

$$\text{and}\qquad E(e_0e_1)=\sum_{h=1}^{L}W_h^2\lambda_h\frac{S_{hyx}}{YX}=V_{11},\qquad \text{where}\qquad V_{rs}=\sum_{h=1}^{L}W_h^{r+s}\lambda_h\frac{E(\bar{y}_{hi}-\bar{Y}_h)^r(\bar{x}_{hi}-\bar{X}_h)^s}{Y^rX^s}.$$

Ratio estimator is widely used when correlation between the study and the auxiliary variables is positive. The classical ratio estimator suggested by [1], under stratified sampling is given by

$$\hat{\bar{Y}}_{Rst}=\bar{y}_{st}\left(\frac{\bar{X}}{\bar{x}_{st}}\right), \tag{2}$$

where $\bar{X}$ is the known population mean of x.
To first order of approximation, bias and MSE of $\hat{\bar{Y}}_{Rst}$, are given by

$$B(\hat{\bar{Y}}_{Rst})\cong\bar{Y}\left[V_{02}-V_{11}\right], \tag{3}$$

and

$$MSE(\hat{\bar{Y}}_{Rst})\cong\bar{Y}^2\left[V_{20}+V_{02}-2V_{11}\right]. \tag{4}$$

The usual combined regression estimator, is given by

$$\hat{\bar{Y}}_{lrst}=\bar{y}_{st}+b_{st}(\bar{X}-\bar{x}_{st}), \tag{5}$$

where b_{st} is the sample regression coefficient across the strata.
The MSE of $\hat{\bar{Y}}_{lrst}$, is given by

$$MSE(\hat{\bar{Y}}_{lrst})=V_{20}(1-\rho_{st}^2), \tag{6}$$

where $\rho_{st}=\frac{V_{11}}{\sqrt{V_{20}}\sqrt{V_{02}}}$ is the population correlation coefficient across the strata.
[2] estimator in stratified sampling, is given by

$$\hat{\bar{Y}}_{BTst}=\bar{y}_{st}\,exp\left(\frac{\bar{X}-\bar{x}_{st}}{\bar{X}+\bar{x}_{st}}\right). \tag{7}$$

The bias and MSE of $\hat{\bar{Y}}_{BTst}$, to first order of approximation, is given by

$$B(\hat{\bar{Y}}_{BTst})\cong\bar{Y}\left[\frac{3}{8}V_{02}-\frac{1}{2}V_{11}\right] \tag{8}$$

and

$$MSE(\hat{\bar{Y}}_{BTst})\cong\bar{Y}^2\left[V_{20}+\frac{1}{4}V_{02}-V_{11}\right]. \tag{9}$$

[3] estimator in stratified sampling, is given by

$$\hat{\bar{Y}}_{Raost}=k_1\bar{y}_{st}+k_2(\bar{X}-\bar{x}_{st}), \tag{10}$$

where k_1 and k_2 are constants.
The MSE of $\hat{\bar{Y}}_{Raost}$, at optimum values of k_1 and k_2 i.e.

$$k_{1(opt)}=\frac{1}{1+V_{20}(1-\rho_{st}^2)}\qquad\text{and}\qquad k_{2(opt)}=\frac{V_{11}R_1}{V_{02}\left[1+V_{20}(1-\rho_{st}^2)\right]}$$

where $R_1 = \frac{\bar{Y}}{\bar{X}}$, is given by

$$MSE\left(\hat{\bar{Y}}_{Raost}\right) \cong \frac{\bar{Y}^2 V_{20}\left(1-\rho_{st}^2\right)}{1+V_{20}\left(1-\rho_{st}^2\right)}. \tag{11}$$

[4] defined the following estimator, under stratified sampling it is, given by

$$\hat{\bar{Y}}_{GKst} = [k_3 \bar{y}_{st} + k_4(\bar{X} - \bar{x}_{st})]\, exp\left(\frac{\bar{X} - \bar{x}_{st}}{\bar{X} + \bar{x}_{st}}\right), \tag{12}$$

where k_3 and k_4 are constants.
The bias and MSE of $\hat{\bar{Y}}_{GKst}$, to first order of approximation are given

$$B(\hat{\bar{Y}}_{GKst}) \cong \bar{Y}(k_3 - 1) + \left(\frac{3}{8}k_3\bar{Y} + \frac{1}{2}k_4\bar{X}\right)V_{02} - \frac{1}{2}k_3\bar{Y}V_{11}, \tag{13}$$

and

$$MSE\left(\hat{\bar{Y}}_{GKst}\right) \cong \frac{\bar{Y}^2 V_{20}\left(1-\rho_{st}^2\right)}{1+V_{20}\left(1-\rho_{st}^2\right)} - \frac{\bar{Y}^2 V_{02}\left[V_{20}\left(1-\rho_{st}^2\right) + \frac{V_{02}}{4}\right]}{16\left[1+V_{20}\left(1-\rho_{st}^2\right)\right]}. \tag{14}$$

2 Proposed estimators in stratified sampling

On the lines of [2], we propose the following estimator, to estimate the finite population mean $(\bar{Y})$ by using average of medians of samples taken from the study variable under simple random sampling with out replacement (SRSWOR), is given by

$$\hat{\bar{Y}}_{BTst(m)} = \bar{y}_{st}\, exp\left(\frac{\bar{M} - m_{st}}{\bar{M} + m_{st}}\right). \tag{15}$$

Define

$$\bar{y}_{st} = \sum_{h=1}^{L} W_h \bar{y}_h = \bar{Y}(1+e_0) \qquad \text{and} \qquad m_{st} = \sum_{h=1}^{L} W_h \bar{m}_h = \bar{M}(1+e_1)$$

such that

$$E(e_0) = E(e_1) = 0, \qquad E(e_0^2) = \sum_{h=1}^{L} W_h^2 \lambda_h \frac{S_{h\bar{y}}^2}{\bar{Y}^2} = V_{20}^*,$$

$$E(e_1^2) = \sum_{h=1}^{L} W_h^2 \lambda_h \frac{S_{hm}^2}{\bar{M}^2} = V_{02}^*, \qquad \text{and} \qquad E(e_0 e_1) = \sum_{h=1}^{L} W_h^2 \lambda_h \frac{S_{h\bar{y}m}}{\bar{Y}\bar{M}} = V_{11}^*,$$

where

$$S_{h\bar{y}}^2 = \frac{1}{{}^{N_h}C_{n_h} - 1} \sum_{i=1}^{{}^{N_h}C_{n_h}} (\bar{y}_{hi} - \bar{Y}_h)^2, \qquad S_{hm}^2 = \frac{1}{{}^{N_h}C_{n_h} - 1} \sum_{i=1}^{{}^{N_h}C_{n_h}} (m_{hi} - \bar{M}_h)^2,$$

$$S_{h\bar{y}m} = \frac{1}{{}^{N_h}C_{n_h} - 1} \sum_{i=1}^{{}^{N_h}C_{n_h}} (\bar{y}_{hi} - \bar{Y}_h)(m_{hi} - \bar{M}_h), \qquad \text{and} \qquad \rho_{st}^* = \frac{V_{11}^*}{\sqrt{V_{20}^*}\sqrt{V_{02}^*}}.$$

Eq.(15) in terms of errors, can be written as:

$$\begin{aligned} \hat{\bar{Y}}_{BTst(m)} &= \bar{Y}(1+e_0)\, exp\left(\frac{-e_1}{2+e_1}\right) \\ &= \bar{Y}(1+e_0)\, exp\left[\frac{-e_1}{2}\left(1+\frac{e_1}{2}\right)^{-1}\right] \end{aligned} \tag{16}$$

Solve (16), up to first order of approximation and subtracting $\bar{Y}$ from both sides, we get

$$\hat{\bar{Y}}_{BTst(m)} - \bar{Y} = \bar{Y}\left(e_0 - \frac{1}{2}e_1 + \frac{3}{8}e_1^2 - \frac{1}{2}e_0e_1\right) \tag{17}$$

Using (17), the bias of $\hat{\bar{Y}}_{BTst(m)}$ under stratified sampling, is given by

$$B(\hat{\bar{Y}}_{BTst(m)}) \cong \bar{Y}\left[\frac{3}{8}V_{02}^* - \frac{1}{2}V_{11}^*\right]. \tag{18}$$

Using (17), the MSE of $\hat{\bar{Y}}_{BTst(m)}$, is given by

$$MSE(\hat{\bar{Y}}_{BTst(m)}) \cong \bar{Y}^2\left[V_{20}^* + \frac{1}{4}V_{02}^* - V_{11}^*\right]. \tag{19}$$

Another unbiased difference type median based estimator to estimate finite population mean, a combined difference type estimator, is given by

$$\hat{\bar{Y}}_{dst(m)} = \bar{y}_{st} + k''(\bar{M} - m_{st}), \tag{20}$$

where k'' is a constant.
Eq.(20) can be written as:

$$\hat{\bar{Y}}_{dst(m)} - \bar{Y} = \bar{Y}e_0 - k''\bar{M}e_1 \tag{21}$$

The minimum MSE of $\hat{\bar{Y}}_{dst(m)}$ at optimum value of $k''_{(opt)} = \frac{V_{11}^*}{V_{02}^*}R_2$, is given by

$$MSE(\hat{\bar{Y}}_{dst(m)})_{(min)} = \bar{Y}^2V_{20}(1 - \rho_{st}^{*2}). \tag{22}$$

On the line of [3], we can define the following difference type estimator

$$\hat{\bar{Y}}_{Raost(m)} = k_1''\bar{y}_{st} + k_2''(\bar{M} - m_{st}), \tag{23}$$

where k_1'' and k_2'' are constants.
Eq.(23) in terms of errors can be written as:

$$\hat{\bar{Y}}_{Raost(m)} - \bar{Y} = (k_1'' - 1)\bar{Y} + k_1''\bar{Y}e_0 - k_2''\bar{M}e_1 \tag{24}$$

Using (24), the bias of $\hat{\bar{Y}}_{Raost(m)}$ is given by

$$B(\hat{\bar{Y}}_{Raost(m)}) = (k_1'' - 1)\bar{Y}, \tag{25}$$

The minimum MSE of $\hat{\bar{Y}}_{Raost(m)}$ at optimum values of k_1'' and k_2'' i.e.

$$k''_{1(opt)} = \frac{1}{1 + V_{20}^*(1 - \rho_{st}^{*2})} \qquad \text{and} \qquad k''_{2(opt)} = \frac{V_{11}^*R_2}{V_{02}^*\left[1 + V_{20}^*(1 - \rho_{st}^{*2})\right]}$$

is given by

$$MSE(\hat{\bar{Y}}_{Raost(m)})_{(min)} = \frac{\bar{Y}^2V_{20}^*(1 - \rho_{st}^{*2})}{1 + V_{20}^*(1 - \rho_{st}^{*2})}. \tag{26}$$

On the lines of [4], we propose following median based estimator to estimate finite population mean, under stratified random sampling is given by

$$\hat{\bar{Y}}_{Pst(m)} = \left[k_3''\bar{y}_{st} + k_4''(\bar{M} - m_{st})\right] exp\left(\frac{\bar{M} - m_{st}}{\bar{M} + m_{st}}\right), \tag{27}$$

where k_3'' and k_4'' are constants.
To first order of approximation, $\hat{\bar{Y}}_{Pst(m)}$ can be written as

$$\hat{\bar{Y}}_{Pst(m)} \cong \left[k_3''\bar{Y}(1+e_0) - k_4''\bar{M}e_1\right]\left(1 - \frac{1}{2}e_1 + \frac{3}{8}e_1^2\right),$$

or

$$\hat{\bar{Y}}_{Pst(m)} \cong \bar{Y}\left[k_3'' + k_3''e_0 - \frac{k_3''}{2}(e_1 + e_0e_1) + \frac{3}{8}k_3''e_1^2\right] + k_4''\bar{M}\left(\frac{e_1^2}{2} - e_1\right). \quad (28)$$

The bias of $\hat{\bar{Y}}_{Pst(m)}$ under stratified sampling, is given

$$B(\hat{\bar{Y}}_{Pst(m)}) \cong \bar{Y}\left[(k_3''-1) + \frac{3}{8}k_3''V_{02}^* - \frac{1}{2}k_3''V_{11}^*\right] + \frac{1}{2}k_4''\bar{M}V_{02}^*. \quad (29)$$

Squaring on both sides of (28), we get

$$(\hat{\bar{Y}}_{Pst(m)} - \bar{Y})^2 \cong \bar{Y}^2\left[(k_3''-1)^2 + k_3''^2e_0^2 + \frac{k_3''^2}{4}e_1^2 - k_3''(2k_3''-1)e_0e_1 + \frac{3}{4}k_3''(k_3''-1)e_1^2\right]$$
$$+ k_4''^2\bar{M}^2e_1^2 + 2k_4''\bar{Y}\bar{M}\left[k_3''\left(\frac{1}{2}e_1^2 - e_0e_1\right) + \frac{1}{2}(k_3''-1)e_1^2\right] \quad (30)$$

Using (30) the MSE of $\hat{\bar{Y}}_{Pst(m)}$, is given as

$$MSE(\hat{\bar{Y}}_{Pst(m)}) \cong \bar{Y}^2(k_3''-1)^2 + k_3''^2\bar{Y}^2V_{20}^* + \left[(k_3''\bar{Y} + k_4''\bar{M})^2 - \frac{3}{4}k_3''\bar{Y}^2 - k_4''\bar{Y}\bar{M}\right]V_{02}^*$$
$$+ \left[k_3''(1-2k_3'')\bar{Y}^2 - 2k_3''k_4''\bar{Y}\bar{M}\right]V_{11}^* \quad (31)$$

The minimum MSE of $\hat{\bar{Y}}_{Pst(m)}$ at optimum values of k_3'' and k_4'' i.e.

$$k''_{3(opt)} = \frac{1 - \frac{1}{8}V_{02}^*}{1 + V_{20}^*(1-\rho_{st}^{*2})} \qquad \text{and} \qquad k''_{4(opt)} = \left[k''_{3(opt)}\left(\frac{V_{11}^*}{V_{02}^*} - 1\right) + \frac{1}{2}\right]R_2$$

is given by

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(opt)} = \frac{\bar{Y}^2V_{20}^*(1-\rho_{st}^{*2})}{1 + V_{20}^*(1-\rho_{st}^{*2})} - \frac{\bar{Y}^2V_{02}^*\left[V_{20}^*(1-\rho_{st}^{*2}) + \frac{1}{4}V_{02}^*\right]}{16\left[1 + V_{20}^*(1-\rho_{st}^{*2})\right]}. \quad (32)$$

3 Efficiency conditions

In this section the proposed median based estimator is compared in terms of MSE with all existing estimators in stratified random sampling.
Let

$$A = \frac{\bar{Y}^2V_{20} + \bar{Y}^2\left[V_{20} - 1\right]V_{20}^*(1-\rho_{st}^{*2})}{1 + V_{20}^*(1-\rho_{st}^{*2})}, \qquad B = \frac{\bar{Y}^2V_{20}^*(1-\rho_{st}^{*2})}{1 + V_{20}^*(1-\rho_{st}^{*2})} \geq 0,$$

$$C = \frac{\bar{Y}^2V_{20}(1-\rho_{st}^2)}{1 + V_{20}(1-\rho_{st}^2)} \geq 0, \qquad \text{and} \qquad D = \frac{\bar{Y}^2V_{20}^* + \bar{Y}^2\left[1 - V_{20}^*\right]V_{20}^*\rho_{st}^{*2}}{1 + V_{20}^*(1-\rho_{st}^{*2})}.$$

Condition 1: Using (1) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq V(\bar{y}_{st}) \qquad \text{if}$$
$$A + B \geq 0.$$

Condition 2: Using (4) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{Rst}) \quad \text{if}$$
$$\bar{Y}^2 \left[V_{02} - 2V_{11}\right] + A + B \geq 0.$$

Condition 3: Using (6) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq V(\hat{\bar{Y}}_{lrst}) \quad \text{if}$$
$$A - \bar{Y}^2 V_{20}\rho_{st}^2 + B \geq 0.$$

Condition 4: Using (9) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{BTst}) \quad \text{if}$$
$$\bar{Y}^2 \left[\frac{1}{4}V_{02} - V_{11}\right] + A + B \geq 0.$$

Condition 5: Using (11) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{Raost}) \quad \text{if}$$
$$\frac{\bar{Y}^2 V_{20}(1-\rho_{st}^2) - \bar{Y}^2 V_{20}^*(1-\rho_{st}^{*2})}{\left[1+V_{20}(1-\rho_{st}^2)\right]\left[1+V_{20}^*(1-\rho_{st}^{*2})\right]} + B \geq 0.$$

Condition 6: Using (14) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{GKst})_{(min)} \quad \text{if}$$
$$\frac{\bar{Y}^2 V_{20}(1-\rho_{st}^2) - \bar{Y}^2 V_{20}^*(1-\rho_{st}^{*2})}{\left[1+V_{20}(1-\rho_{st}^2)\right]\left[1+V_{20}^*(1-\rho_{st}^{*2})\right]} + B - C \geq 0.$$

Condition 7: Using (19) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{BTst(m)}) \quad \text{if}$$
$$\bar{Y}^2 \left[\frac{1}{4}V_{02}^* - V_{11}^*\right] + D + B \geq 0.$$

Condition 8: Using (22) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{dst(m)}) \quad \text{if}$$
$$\frac{\bar{Y}^2 V_{20}^{*2}(1-\rho_{st}^{*2})^2}{1+V_{20}^*(1-\rho_{st}^{*2})} + B \geq 0, \qquad \text{always true.}$$

Condition 9: Using (26) and (32)

$$MSE(\hat{\bar{Y}}_{Pst(m)})_{(min)} \leq MSE(\hat{\bar{Y}}_{Raost(m)}) \quad \text{if}$$
$$B \geq 0, \qquad \text{always true.}$$

Conditions 1,8 and 9 are always true.

4 Numerical comparison

In this section we compare MSE of median based proposed class of estimators with sample mean, ratio, linear regression and all existing estimators, in stratified random sampling.

4.1 Data sets

Data sets (Source: [5]):

In this data set Sweden is divided into municipalities in eight regions vary considerably in size and other characteristics. The revenues from 1985 municipal taxation (in millions of kronor) is considered as study variable and number of social-democratic seats in municipal council is considered as auxiliary variable.
In second data set population in 1985 is considered as study variable and number of social-democratic seats in municipal council is considered as auxiliary variable. The results are given in Tables 1-3.

Table 1: Summery statistics for both populations

Parameters	Population 1	Population 2
N	284	284
$\bar{Y}$	245.088	29.363
$\bar{X}$	22.186	22.186
S_y^2	355612.5	2658.098
S_x^2	52.5622	52.5622
S_{yx}	1732.468	177.505
ρ_{yx}	0.4007	0.4749

Table 2: Variance/MSE of different estimators for different sample size in stratified sampling.

Estimator	Population 1		Population 2	
	n=20	n=25	n=20	n=25
$\bar{y}_{st}$	15425.63	13500.94	113.186	101.468
Using auxiliary variable.				
$\hat{\bar{Y}}_{Rst}$	13826.41	12151.77	94.3410	85.6169
$\hat{\bar{Y}}_{regst}$	12129.32	10607.80	79.3013	71.9573
$\hat{\bar{Y}}_{BTst}$	14560.27	12773.83	102.810	92.7888
$\hat{\bar{Y}}_{Raost}$	10091.57	9015.665	72.6230	66.4143
$\hat{\bar{Y}}_{GKst}$	10080.51	9007.772	72.5420	66.3561
Using median of study variable.				
$\hat{\bar{Y}}_{BTst(m)}$	2569.088	1684.034	15.3356	10.9059
$\hat{\bar{Y}}_{dst(m)}$	2064.703	1298.339	9.0336	5.7984
$\hat{\bar{Y}}_{Raost(m)}$	1996.092	1270.870	8.9399	5.7597
$\hat{\bar{Y}}_{Pst(m)}$	1955.225	1242.277	8.7902	5.6532

Table 3: PRE of estimators with respect to $\bar{y}$ in stratified sampling.

Estimator	Population 1		Population 2	
	n=20	n=25	n=20	n=25
$\bar{y}_{st}$	100	100	100	100
Using auxiliary variable.				
$\hat{\bar{Y}}_{Rst}$	111.566	111.103	119.976	118.514
$\hat{\bar{Y}}_{regst}$	127.176	127.274	142.729	141.012
$\hat{\bar{Y}}_{BTst}$	105.943	105.692	110.082	109.354
$\hat{\bar{Y}}_{Raost}$	152.857	149.750	155.857	152.781
$\hat{\bar{Y}}_{GKst}$	153.025	149.881	156.029	152.915
Using median of study variable.				
$\hat{\bar{Y}}_{BTst(m)}$	600.432	801.702	738.060	930.396
$\hat{\bar{Y}}_{dst(m)}$	747.111	1039.86	1252.95	1749.93
$\hat{\bar{Y}}_{Raost(m)}$	772.792	1062.34	1266.07	1761.70
$\hat{\bar{Y}}_{Pst(m)}$	788.944	1086.79	1287.64	1794.88

5 Conclusion

On the lines of [2] and [4], we propose new median based estimators to estimate finite population mean under stratified random sampling. In this study it is conclude that in absence of the auxiliary variable median of the study variable can be used to get more precise estimates. The proposed estimator $\hat{\bar{Y}}_{Pst(m)}$ is more efficient than all other consider estimators for different sample sizes.

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