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Memory Type Estimator Of Population Mean Using Exponentially Weighted Moving Averages In Two-Phase Sampling

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Abstract

To propose a new memory type estimator of Population Mean in two phase simple random sampling with one auxiliary using EWMA for time scaled surveys and to compare the proposed estimator with related previous estimator. Using Two-Phase Sampling technique, a generalized difference-cum-ratio type estimator has been proposed for estimating the population mean. The expressions for bias and mean square error of proposed estimator have been obtained. The conditions under which proposed estimator is better than the regression estimator and mean per unit estimator have also been obtained. Simulation study has also been done to support the results by generating data. Exponentially weighted moving average (EWMA) statistic is a memory type statistic that used present and past information to estimate the population parameter. This study utilizes EWMA statistic to propose a ratio and product estimator for the surveys based on time scale. The usual ratio and product estimators consist of only current sample information, whereas the proposed estimators contains of current as well as past sample information. The mean square error expressions of the proposed estimators are derived and mathematical conditions are established to prove the efficiency of proposed estimators. It is revealed from the results of simulation study that utilization of the past samples information excels the performance of estimator in terms of efficiency.

Keywords: EWMA, Ratio Estimator, Product Estimator, Weighted Moving Averages, Memory Type Estimator.

Introduction

Chaudhary, Prajapati & Singh (2014), Developed the class of estimators of population mean using a benchmark variable with non-response. They carried out of comparative study in two-phase SRS scheme when the population mean of benchmark variable is not given. Then the results of relative efficiency of the optimum estimator is appreciated and ratio estimator W.R.T sample mean estimator is showed. They have observed that results of RE of the OE is more than the linear regression and ratio estimators.

Constructed the combination of exponential type estimators for estimating population mean using benchmark variable with double sampling. He has obtained the expressions for bias and MSE of suggested estimators for the optimum value of constant. So the developed estimator is more precise than the other estimators because that the proposed estimator gives better results in terms of MSE and bias (Hazra, 2015).

Singh, Pal and Mehta (2016) Developed a general class of ratio-cum-dual to ratio estimators of countable population mean with one benchmark variable that is correlated with the variable of interest. The bias and mean squared error expressions of the proposed class of estimators have been obtained to the first degree of approximation. We have compared the generalized ratio estimators of countable population mean to the classical unbiased estimator and different existing ratio, product and ratio-cum-product type estimators. It is found that the developed estimators are more efficient than the other some existing estimators.

Noor-ul-Amin (2019) Proposed ratio and product estimator that utilized the previous samples information along with the current sample information. The developed estimators based on auxiliary variables were using the information from the current sample only. Similarly, the derived MSE and Relatively efficiency expression for the proposed ratio and product estimator. The proposed estimators are capable to estimate population mean more efficiently as compare to usual ratio and product estimator on the basis of values of R.Es and MSE's.

The exponential weighted moving average (EWMA) statistic is utilized the past information along with the present to enhance the efficiency of the estimators used for estimating the population parameters. The exponential weighted moving average statistic is used for the estimation of population mean with suitable auxiliary information. The memory type ratio and product estimators are proposed under ranked-based sampling schemes including extreme ranked set sampling, median ranked set sampling, and quartile ranked set sampling. The expressions of mean square errors of the proposed estimators are derived. An extensive simulation study is conducted to evaluate the performance of the proposed estimators.

Noor-Ul-Amin, M. (2020), we utilized the past samples information along with the current sample information in the form of hybrid exponentially weighted moving averages to construct memory type ratio and product estimators for time-based surveys. The mean square error expressions of the proposed estimators are derived and mathematical conditions are established to prove the efficiency of proposed estimators. An extensive simulation study is conducted to examine the performance of the proposed estimators. It is revealed from the results that use of past sample information along with the current sample excels the performance of estimator in terms of efficiency. A real life example is given to demonstrate the use of proposed estimators.

Methodology

When the population mean $\bar{X}$ of the benchmark variable X is not given, first we select a countable population then select a first sample (S_1) of size n_1 as first phase or sub-population independently select from total population. Consider a subpopulation select from total population then we dependently select a second sample (S_2) of size n_2 as second phase or sub-sub-population from first phase or subpopulation.

In such situation, the selection of probability for the sub-sub-population as sample (S_2) is mostly expressing both the value of Y as study variable and X as benchmark variable obtained from the sub-population as first phase. As the sub-subpopulation as sample (S_2) selection probability depends on the observed value of the sub-population as sample(S_1), the sample inclusion probability for the sub-subpopulation as sample(S_2) does not same or change. Consider $\bar{y}$ and $\bar{x}$ denote the sample means are given as formulated are

$$\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i \quad \text{and} \quad \bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Then two-phase simple random sampling of the ratio $\bar{\mathbf{y}}_{\mathbf{dr}}$ estimator of population mean $\bar{\mathbf{y}}$ given by

$$\bar{y}_{dr} = \bar{y}\,\frac{\bar{x}'}{\bar{x}}$$

$\bar{y}$ and $\bar{x}$ are respective sample of the study and auxiliary variable

The MSE of the Ratio estimator is given below

$$\text{MSE}\ (\hat{\hat{\bar{Y}}}_{dr}) = \theta\bar{y}^2\left[c_y^2 + C_x^2 - 2\rho_{xy}C_yC_x\right]$$

It was showed the estimator $\bar{\mathbf{y}}_{\mathbf{dr}}$ is due to Sukhatme (1962).

The proposed memory type ratio estimator is formulated as:

$$\hat{\hat{\bar{\mathbf{y}}}}_{dmr} = \frac{Z_i}{Q_i}\bar{x}'$$

Respectively, where $\bar{x}'$ is population mean of benchmark variable and consider as to be known in advance and to be concluded, all these procedures derive MSE, Relative efficiency and conditions.

Proposed Memory Type Ratio Estimator

In this section we fine the MSE of the proposed ratio estimator. For this purpose, we make transformation following transformation.

$$e_y = \frac{Z_i - \bar{y}}{\bar{y}} \quad \text{and if} \quad e_x = \frac{Q_i - \bar{x}'}{\bar{x}'}$$

$$\therefore\ E\,(Z_i) = \bar{Y} \quad \text{and} \quad \therefore\ E\,(Q_i) = \bar{x}'$$

$$e_y = 0 \quad \text{and} \quad e_x = 0$$

$$E\,(e_{x^2}) = \frac{\theta}{\bar{x}'^2}\ \frac{\lambda}{2-\lambda}\ \frac{\sigma_{x^2}}{n}, \qquad E\,(e_{y^2}) = \frac{\theta}{\bar{y}^2}\ \frac{\lambda}{2-\lambda}\ \frac{\sigma_{y^2}}{n}$$

$$\text{and} \qquad E\,(e_y\, e_x) = \frac{\lambda\theta}{2-\lambda}\ 2\,\rho_{xy}C_xC_y$$

Then

$$\text{MSE}(\hat{\hat{\bar{\mathbf{Y}}}}_{dmr}) = \bar{Y}^2\,\frac{\lambda\theta}{2-\lambda}\ \left[C_y{}^2 + C_y{}^2\ -\ 2\,\rho_{xy}C_xC_y\right]$$

Results and Discussions

The MSE'S and RE'S of proposed estimator of the population mean using two-phase SRS with one benchmark variable are calculated of these are different steps of the following. Generate a population of size N= 2000 and sample size using the BVN distribution with estimators (Y, X) (2, 10, 1, 1, ρ). Utilize for all the values of lambda.

We have used 50000 samples of five distinct sizes of second phase or sub-samples such as10, 20, 30, 50, and 200. To calculate of each value of the estimator using the samples in step 3, the 50000 values. The computed results are presented in tables 1 – 6 for mean square errors and relative efficiencies. The evaluation of the mean square error of proposed memory type ratio estimators is computed in Tables 1, 2 and 3. The outputs of RE'S are calculated in the Tables 4,5 and 6. The results from simulation study are show that important of the performance of proposed memory type ratio estimator using two- phase SRS with one benchmark variable. The comparison of the developed estimator is showed with respect to usual ratio estimator using two-phase SRS with one benchmark variable. The MSE' S and RE'S are showed based on 50,000 replications for distinct two phase simple random sampling.

The MSE is find out by using the following formula

$$\text{MSE}\ (\hat{\hat{\bar{Y}}}_{rmi}) = \frac{1}{50000}\ \sum_{i=1}^{50000}\ E\,\langle \hat{\hat{\bar{Y}}}_{rmi} - \bar{Y}\rangle \quad (1)$$

The relative efficiencies (REs) are obtained by using the formula

$$\text{RE}\ \ (\hat{\hat{\bar{Y}}}_{dmr}) = \frac{\text{MSE}(\hat{\hat{\bar{Y}}}_{dr})}{\text{MSE}(\hat{\hat{\bar{Y}}}_{dmr})} \quad (2)$$

The following are the steps that have been used to compute the MSEs and REs of the proposed memory type ratio and product estimators under RBS:

i) Generate a population of size 5000 using the bivariate normal distribution using specified parameters i.e. (Y, X) (2, 10, 1, 1, ρ).

ii) Select 50,000 samples of different sizes such as n=10,20,30,50 and 200.

iii) Using the sample obtained in step iii), the 50,000 values of each SRS estimators are obtained.

iv) MSE for each sample size is computed using the formula given in 1

v) RE of each sample is obtained by using equation given in 2

Table No 1: MSE of Proposed $\widehat{\bar{y}}_{dmr}$ When N = 2000 and n_1 =1000

N = 2K	n_1 = 1000 λ=0.05, λ=0.1 λ=0.25 λ=0.5, λ=0.75 and λ=1						
ρ	n_2	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$
0.05	**10**	3.1881	0.0837	0.1562	0.394	0.9175	1.7256	3.1881
	20	1.4285	0.0596	0.0877	0.1991	0.4397	0.8233	1.4285
	30	0.9021	0.045	0.0691	0.1389	0.2957	0.5254	0.9021
	50	0.5146	0.0374	0.0479	0.0846	0.1708	0.3072	0.5146
	200	0.107	0.0266	0.0281	0.0313	0.0434	0.0666	0.107
0.25	**10**	3.2577	0.0929	0.0918	0.3809	0.9141	1.7451	3.2577
	20	1.4166	0.0593	0.0613	0.2006	0.4484	0.8107	1.4166
	30	0.8856	0.047	0.0478	0.1395	0.2987	0.5344	0.8856
	50	0.5276	0.0385	0.0383	0.0891	0.1773	0.3033	0.5276

	200	0.1073	0.0282	0.0286	0.0331	0.0441	0.0667	0.1073
0.5	**10**	3.1736	0.9241	0.1632	0.3994	0.9145	1.7439	3.1736
	20	1.4248	0.4538	0.0931	0.2083	0.4498	0.8341	1.4248
	30	0.9097	0.2981	0.0728	0.1391	0.3032	0.5249	0.9097
	50	0.5046	0.1805	0.0506	0.091	0.1773	0.3043	0.5046
	200	0.1078	0.0473	0.032	0.0346	0.0464	0.0684	0.1078
0.75	**10**	3.2323	0.0921	0.1729	0.4064	0.9257	1.7584	3.2323
	20	1.4124	0.0633	0.0965	0.2083	0.4514	0.8008	1.4124
	30	0.9104	0.052	0.0728	0.1458	0.2988	0.5276	0.9104
	50	0.5051	0.0428	0.0547	0.0926	0.1818	0.314	0.5051
	200	0.1068	0.0336	0.0342	0.0376	0.0475	0.0684	0.1068
0.95	**10**	3.3198	0.1016	0.1696	0.3978	0.9372	1.8022	3.3198
	20	1.4299	0.0654	0.0978	0.2104	0.4485	0.8151	1.4299
	30	0.9368	0.0545	0.0746	0.1448	0.2989	0.5237	0.9368
	50	0.5315	0.047	0.0576	0.0974	0.1843	0.3136	0.5315
	200	0.1081	0.0364	0.0359	0.0398	0.0491	0.0696	0.1081

Table No 2: MSE of Proposed $\widehat{\widehat{y}}_{dmr}$ When N = 20000 and n_1 =1500

N = 20K	n_1 = 1.5 k **λ=0.05, λ=0.1, λ=0.25, λ=0.5, λ=0.75 and λ= 1**							
ρ	**n_2**	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$
0.05	**10**	3.1514	0.0825	0.1502	0.3885	0.9289	1.7372	3.1514
	20	1.4267	0.0472	0.0837	0.1982	0.4521	0.8111	1.4267
	30	0.8933	0.0377	0.058	0.1371	0.2947	0.5313	0.8933
	50	0.525	0.028	0.0404	0.0847	0.1731	0.3111	0.525
	200	0.1125	0.0185	0.0203	0.0266	0.0429	0.0699	0.1125
0.25	**10**	3.2173	0.0827	0.1474	0.3939	0.9403	1.758	3.2173
	20	1.4182	0.0534	0.0836	0.2032	0.4355	0.8205	1.4182
	30	0.888	0.0388	0.0608	0.131	0.2937	0.54	0.888
	50	0.5186	0.0298	0.0405	0.0817	0.1766	0.3107	0.5186
	200	0.1159	0.0202	0.0216	0.0283	0.0444	0.0704	0.1159
0.5	**10**	3.1781	0.0864	0.1561	0.3873	0.9331	1.7572	3.1781
	20	1.3934	0.0528	0.086	0.206	0.446	0.8165	1.3934
	30	0.9085	0.0396	0.0631	0.138	0.2961	0.5305	0.9085
	50	0.5195	0.0318	0.0431	0.0853	0.1761	0.312	0.5195
	200	0.1151	0.0221	0.0235	0.0294	0.0452	0.0697	0.1151

0.75	**10**	3.2732	0.089	0.1729	0.3893	0.9257	1.7405	3.2732
	20	1.444	0.0518	0.0965	0.2091	0.4514	0.8188	1.444
	30	0.9107	0.042	0.0728	0.1395	0.2988	0.5337	0.9107
	50	0.5301	0.0332	0.0547	0.0879	0.1818	0.3078	0.5301
	200	0.1142	0.0233	0.0342	0.031	0.0475	0.0714	0.1142
0.95	**10**	3.3215	0.0859	0.1611	0.4045	0.9389	1.759	3.2125
	20	1.4205	0.0539	0.088	0.2022	0.4559	0.816	1.461
	30	0.8989	0.0444	0.0681	0.1402	0.3027	0.5393	0.8909
	50	0.5211	0.0351	0.0476	0.0877	0.1761	0.3148	0.5236
	200	0.1129	0.0249	0.0267	0.0323	0.0479	0.0727	0.1155

Table No 3: MSE of Proposed $\widehat{\bar{y}}_{dmr}$ When N = 25000 and n_1 =2000

N = 25K	**n_{1} = 2k λ=0.05, λ=0.1, λ=0.25, λ=0.5, λ=0.75 and λ=1**							
$\boldsymbol{\rho}$	**n_1**	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$
0.05	**10**	3.217	0.078	0.143	0.392	0.94	1.772	3.217
	20	1.427	0.044	0.082	0.194	0.466	0.827	1.427
	30	0.908	0.035	0.055	0.131	0.295	0.526	0.908
	50	0.522	0.026	0.037	0.082	0.175	0.311	0.522
	200	0.117	0.015	0.017	0.024	0.043	0.074	0.117

0.25	**10**	3.268	0.076	0.148	0.382	0.925	1.786	3.268
	20	1.429	0.045	0.079	0.198	0.452	0.821	1.429
	30	0.911	0.035	0.058	0.131	0.290	0.522	0.911
	50	0.527	0.026	0.038	0.083	0.173	0.317	0.527
	200	0.119	0.016	0.018	0.026	0.044	0.074	0.119
0.5	**10**	3.147	0.082	0.147	0.394	0.952	1.767	3.147
	20	1.424	0.046	0.081	0.197	0.448	0.833	1.424
	30	0.924	0.036	0.059	0.131	0.301	0.54	0.924
	50	0.532	0.028	0.041	0.085	0.177	0.316	0.532
	200	0.119	0.017	0.019	0.027	0.044	0.073	0.119
0.75	**10**	3.171	0.079	0.155	0.4	0.941	1.736	3.171
	20	1.429	0.048	0.081	0.196	0.462	0.818	1.429
	30	0.909	0.036	0.06	0.134	0.3	0.538	0.909
	50	0.524	0.028	0.041	0.085	0.179	0.307	0.524
	200	0.119	0.019	0.02	0.028	0.046	0.073	0.119
0.95	**10**	3.192	0.083	0.158	0.388	0.915	1.785	3.158
	20	1.449	0.051	0.084	0.198	0.452	0.821	1.428
	30	0.911	0.038	0.059	0.133	0.295	0.538	0.916
	50	0.531	0.029	0.044	0.085	0.177	0.318	0.54
	200	0.119	0.02	0.022	0.029	0.047	0.074	0.118

Table No 4: RE of proposed $\widehat{\bar{y}}_{dmr}$ when N = 2000 and n_1 = 1000

N = 2K	n_1 = 1k RE at λ=0.05, λ=0.1 λ=0.25 λ=0.5, λ=0.75 and λ=1							
ρ	n_1	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$	$\widehat{\bar{y}}_{dmr}$
0.05	**10**	0.0315	1.186	0.6434	0.2533	0.1088	0.0575	0.3015
	20	0.0348	0.8331	0.5669	0.2506	0.1134	0.0603	0.0348
	30	0.037	0.7453	0.4833	0.2369	0.1113	0.0639	0.037
	50	0.0391	0.5261	0.4196	0.2355	0.1166	0.0641	0.391
	200	0.0476	0.190	0.1812	0.1604	0.1158	0.0758	0.0476
0.25	**10**	0.0325	1.1404	1.1488	0.2783	0.1148	0.0602	0.0324
	20	0.0369	0.8942	0.866	0.2681	0.1187	0.0689	0.0369
	30	0.0404	0.0404	0.7422	0.7960	0.2529	0.0668	0.0404
	50	0.040	0.5478	0.5530	0.2390	0.1203	0.0697	0.04
	200	0.0493	0.1871	0.1847	0.1607	0.1219	0.0788	0.0493
0.5	**10**	0.0398	0.1345	0.7668	0.3104	0.1340	0.0722	0.0398

	20	0.0437	0.1370	0.6833	0.2974	0.1394	0.0744	0.0437
	30	0.0451	0.1416	0.5683	0.2939	0.1377	0.0799	0.451
	50	0.046	0.1385	0.4933	0.2790	0.1377	0.0818	0.0460
	200	0.0469	0.1323	0.1972	0.1818	0.1234	0.0920	0.0469
0.75	**10**	0.0477	1.7014	0.9054	0.3877	0.172	0.0896	0.0477
	20	0.0486	1.2614	0.806	0.3776	0.1718	0.098	0.0486
	30	0.0495	0.9975	0.7039	0.3484	0.1726	0.0983	0.0495
	50	0.0504	0.724	0.565	0.3392	0.1732	0.1008	0.0504
	200	0.0513	0.2323	0.2309	0.2104	0.1658	0.1131	0.0513
0.95	**10**	0.0522	1.8672	1.115	0.4824	0.203	0.1067	0.0522
	20	0.053	1.458	0.969	0.4553	0.2127	0.1151	0.0530
	30	0.5390	1.1745	0.852	0.4358	0.2118	0.122	0.0539
	50	0.0548	0.8203	0.6641	0.3926	0.2115	0.1211	0.0548
	200	0.0557	0.2624	0.2629	0.237	0.1965	0.1366	0.0557

Table No 5: RE of proposed $\widehat{\overline{y}}_{dmr}$ when N = 20000 and n_1 = 1500

N = 20K	n_1 = 1.5k λ=0.05, λ=0.1, λ=0.25, λ=0.5, λ=0.75 and λ=1							
ρ	n_1	$\widehat{\overline{y}}_{dmr}$	$\widehat{\overline{y}}_{dmr}$	$\widehat{\overline{y}}_{dmr}$	$\widehat{\overline{y}}_{dmr}$	$\widehat{\overline{y}}_{dmr}$	$\widehat{\overline{y}}_{dmr}$	$\widehat{\overline{y}}_{dmr}$
0.05	10	0.0319	1.2193	0.6639	0.2598	0.109	0.0584	0.0319
	20	0.0350	1.0544	0.6046	0.2509	0.1113	0.0621	0.035
	30	0.0377	0.8785	0.579	0.2473	0.113	0.0639	0.0377
	50	0.0384	0.7153	0.4987	0.2373	0.1156	0.0644	0.0384
	200	0.0439	0.2709	0.246	0.1885	0.1168	0.0721	0.0439
0.25	10	0.0327	1.2797	1.1488	0.3192	0.1123	0.0599	0.0327
	20	0.0372	1.0005	0.7292	0.3018	0.1221	0.0647	0.0372
	30	0.0403	0.9006	0.6354	0.3012	0.1205	0.0653	0.0403
	50	0.0408	0.7242	0.5909	0.2934	0.121	0.068	0.0408
	200	0.0461	0.2625	0.5205	0.217	0.1196	0.0751	0.0461
0.5	10	0.0398	1.438	0.7912	0.0457	0.1331	0.0698	0.0398
	20	0.045	1.1924	0.7365	0.2974	0.1406	0.0758	0.045
	30	0.0458	1.044	0.673	0.2939	0.1385	0.0783	0.0458
	50	0.0483	0.7854	0.5849	0.2729	0.1395	0.0805	0.0483
	200	0.0543	0.2872	0.2582	0.1818	0.1357	0.090	0.0543

0.75	**10**	0.0485	1.776	0.9707	0.3978	0.1686	0.0894	0.0485
	20	0.0536	1.4974	0.8852	0.3744	0.1704	0.0949	0.0536
	30	0.057	1.2512	0.821	0.3779	0.175	0.0982	0.057
	50	0.0582	0.9272	0.7028	0.3526	0.1757	0.1018	0.0582
	200	0.0681	0.3299	0.313	0.2520	0.1666	0.1094	0.0681
0.95	**10**	0.0579	2.226	1.1883	0.4730	0.2047	0.107	0.0579
	20	0.0669	1.7989	1.0885	0.4747	0.207	0.117	0.0669
	30	0.0699	1.4447	0.9446	0.4545	0.2107	0.1179	0.0699
	50	0.0721	1.0929	0.7937	0.4364	0.2164	0.1215	0.0721
	200	0.0834	0.3815	0.3642	0.2966	0.1997	0.1304	0.0834

Table No 6: RE of proposed $\widehat{\widehat{y}}_{dmr}$ when N = 25000 and n_1 = 2000

N = 20K	**n_1 = 1.5k λ=0.05, λ=0.1, λ=0.25, λ=0.5, λ=0.75 and λ=1**							
ρ	**n_1**	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$	$\widehat{\widehat{y}}_{dmr}$
0.05	**10**	0.0307	1.3108	0.7132	0.2525	0.1074	0.0565	0.0307
	20	0.0359	1.1408	0.6124	0.2573	0.1073	0.0611	0.0359
	30	0.0373	0.9531	0.6170	0.2557	0.1138	0.0631	0.0373
	50	0.0389	0.8011	0.5448	0.2432	0.1144	0.0644	0.0389
	200	0.0431	0.3403	0.2963	0.2045	0.117	0.0668	0.0431

0.25	**10**	0.0329	1.4098	0.7227	0.2745	0.1161	0.0601	0.0329
	20	0.0369	1.1758	0.6754	0.2618	0.1169	0.0647	0.0369
	30	0.0393	1.0156	0.6105	0.2692	0.1226	0.0678	0.0393
	50	0.0402	0.8197	0.5545	0.2548	0.123	0.0669	0.0402
	200	0.0444	0.3407	0.2932	0.2002	0.1218	0.0717	0.0444
0.5	**10**	0.040	1.5113	0.8374	0.3148	0.1305	0.0706	0.040
	20	0.0444	1.3499	0.7691	0.3151	0.1383	0.0747	0.0444
	30	0.045	1.1569	0.7091	0.3167	0.1392	0.0781	0.045
	50	0.0470	0.9036	0.6137	0.2944	0.1435	0.0792	0.0470
	200	0.0530	0.3665	0.3303	0.2309	0.1416	0.0862	0.053
0.75	**10**	0.0489	1.9748	1.0068	0.3849	0.166	0.0909	0.0489
	20	0.054	1.6172	0.9655	0.3951	0.1696	0.0962	0.054
	30	0.0578	1.4267	0.8731	0.3935	0.1739	0.0966	0.0578
	50	0.0602	1.1165	0.7745	0.3668	0.1752	0.1016	0.0602
	200	0.065	0.4214	0.3799	0.2797	0.1698	0.1081	0.065
0.95	**10**	0.0604	2.3048	1.2015	0.4933	0.2057	0.1059	0.0604
	20	0.0673	1.8498	1.1519	0.4842	0.2107	0.1154	0.0673
	30	0.0699	1.7117	1.0638	0.4815	0.2164	0.118	0.0694
	50	0.0706	1.33	0.8536	0.445	0.218	0.1184	0.0706

	200	0.0804	0.4804	0.4462	0.3282	0.2034	0.1266	0.0804

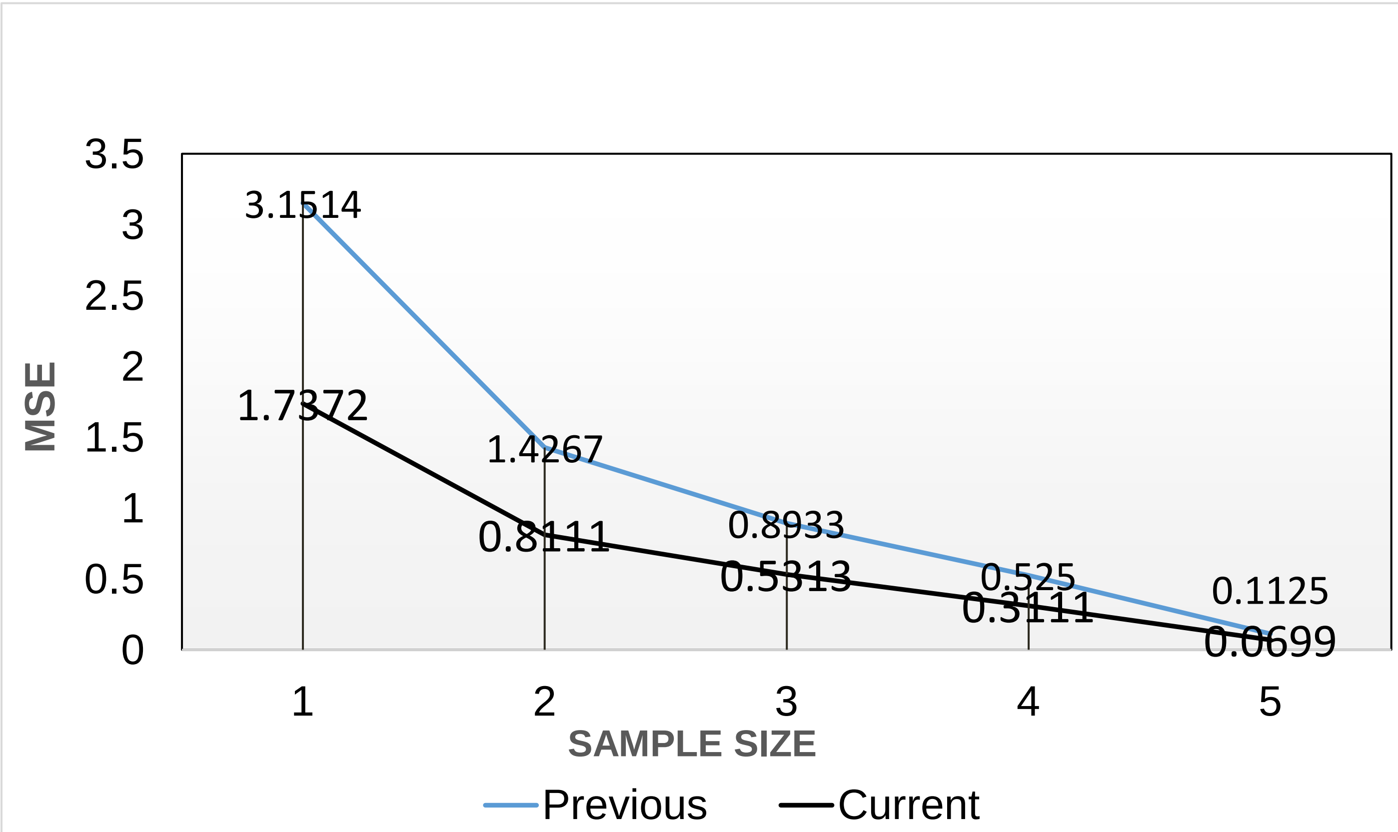

Figure 1: Graphical Representation of MSE at λ=0.75 and ρxy=0.05

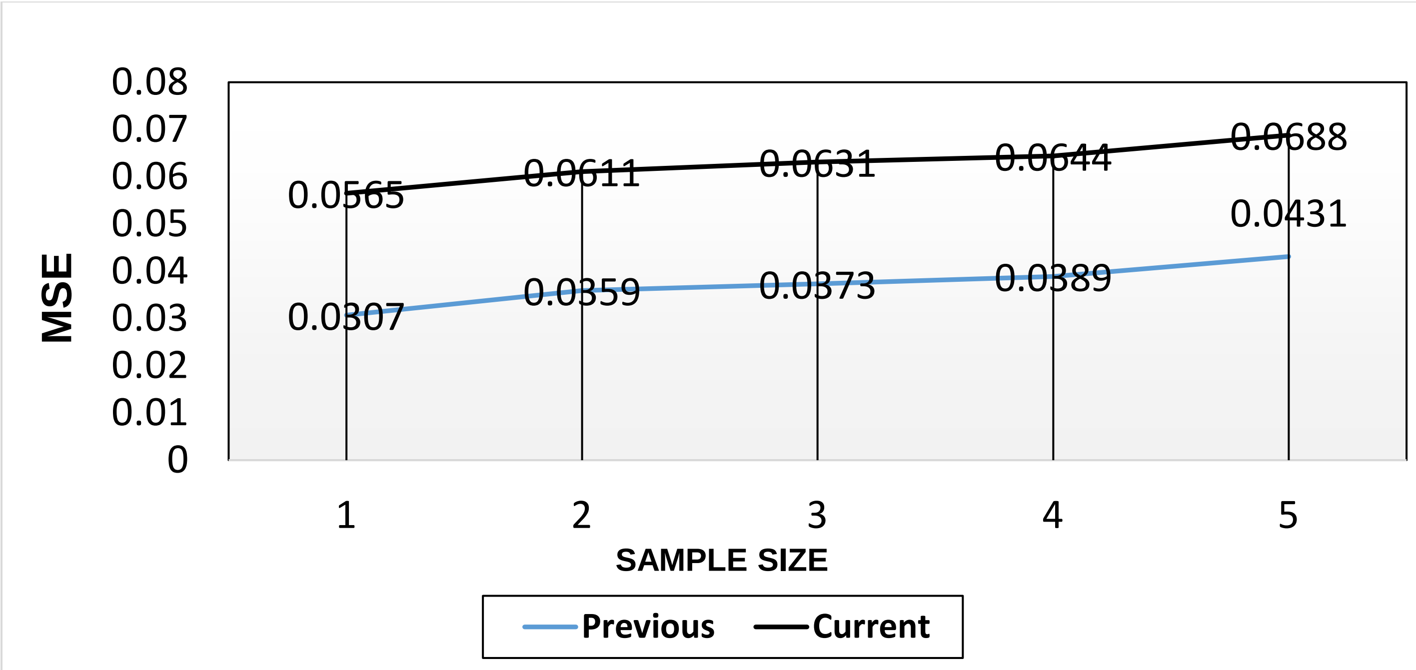

Figure 2: Graphical Representation of MSE at λ=0.1 and ρxy=0.05

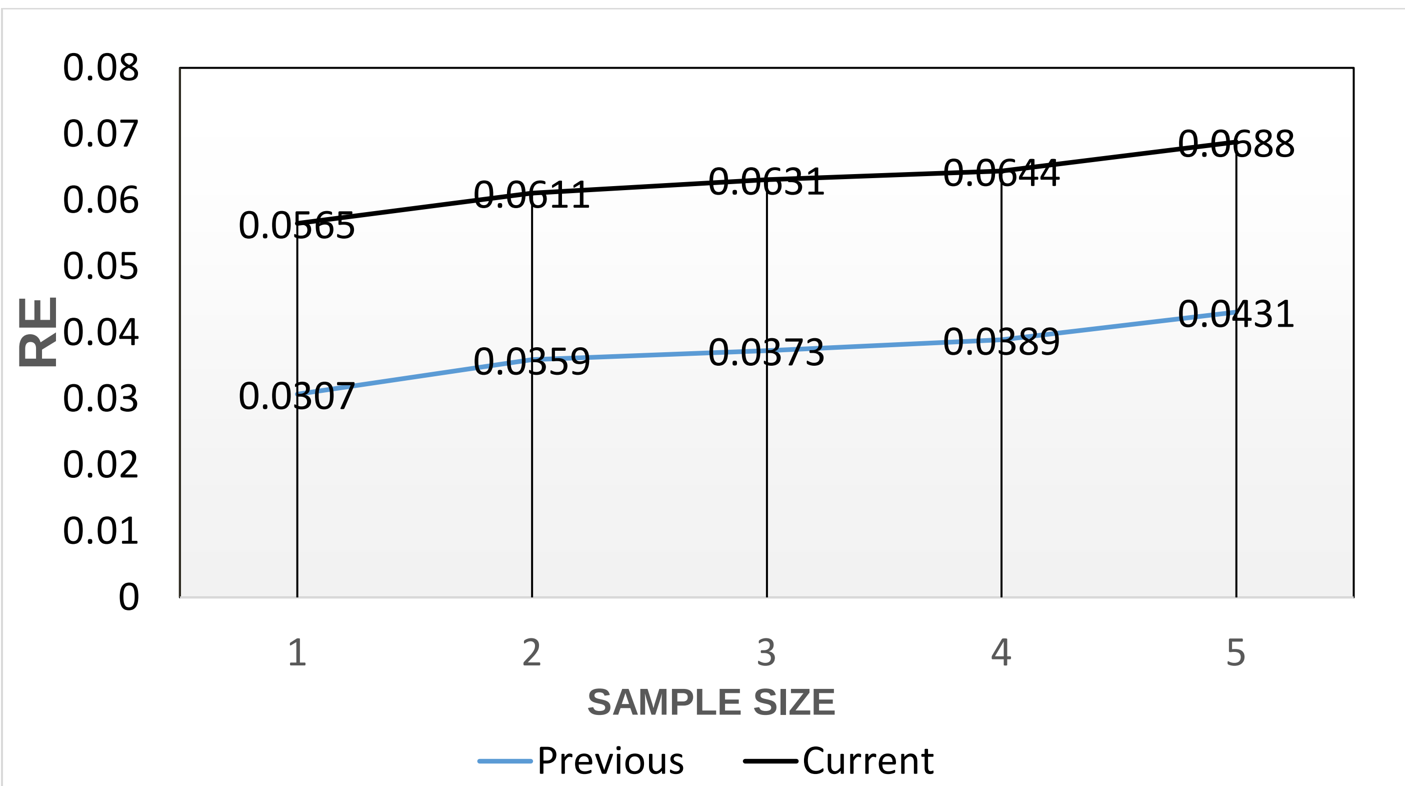

Figure 3: Graphical Representation of RE at λ=0.75 and ρxy=0.05

Conclusion

In this study, the proposed memory type ratio estimator in two phase simple random sampling with one auxiliary variable by using the past sample information and current sample information. The proposed estimator ($\widehat{\widehat{\mathbf{Y}}}_{\mathrm{dmr}}$) using the EWMA statistics is capable more efficiently as compared to the usual ratio estimator ($\widehat{\mathbf{Y}}_{\mathrm{dmr}}$). Because that the developed estimator of MSE's results are less than the usual estimator and RE's results are greater than the usual estimator by using the simulation study. Two phase simple random sampling is among the classical ways for new memory type estimator of population mean using EWMA for time scaled surveys. There is lack in research in the development two phase simple random sampling for this purpose yet. Hence, the proposed memory type ratio estimator ($\widehat{\widehat{\mathbf{Y}}}_{\mathrm{dmr}}$ are more reliable than the usual ratio estimator ($\widehat{\mathbf{Y}}_{\mathrm{dmr}}$).

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