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An Efficient Exponential Estimator of Population Mean in the Presence of Median of the Study Variable

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ABSTRACT

Survey sampling practitioners have been functioning on efficiency improvement and bias reduction in finite population parameter estimation. We proposed an exponential estimator of a population means in the presence of the median of the study variable. The bias and mean square error of the proposed estimator were obtained using the Taylor series method. The relative performance of the proposed estimators concerning conventional and some existing estimators was assessed using three (3) natural dataset information. The novel median-based estimator accomplishes better than the conventional, usual mean, ratio, regression and other existing estimators considered in the study have been established. The empirical result shows that the proposed estimator is more efficient than the conventional and some existing estimators considered in the study.

Keywords: Bias, Median, Efficiency, Mean Square Error, Percentage Relative Efficiency.

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INTRODUCTION

Background

Many authors have appeared in literature such as ratio, product, exponential ratio, and product, and regression estimators. These estimators are acquired in the presence of auxiliary variable information. In other, the estimator's are developed for improvement in the estimate of population mean of the study variable, using auxiliary information. In the absence of the auxiliary variable, the above estimators are not possible. However, one may think of getting additional information on the study variable and one can propose ratio and linear regression type estimators to improve the performance of the estimator. The idea of this paper is to use such variable, namely the median of the study variable, in the proposed ratio estimator. It is reasonable to assume that the median of the study variable is known since this parameter does not require complete information on the population units of the study variable unlike the other parameters like population the o estimated population mean is based on median information. In absence of the auxiliary variable we obtain a median of the samples of the study variable in our presented estimators and subsequently precision improved. We draw all possible samples of size from the population by using a simple random sampling without replacement (SRSWOR) scheme.

Objective

The objectives of this research is to propose an efficient exponential type estimator of population mean in the presence of median of the study variable. Derive the bias and mean square error of the proposed estimator. Assessed the efficiency of the proposed estimator over existing estimators considered in the study.

LITERATURE REVIEW

Background Theory

Consider a large population and draw a large sample of size N randomly, now consider it a complete population $U=\{\mu_1,\mu_2,.....,\mu_N\}$ of size N. Let y_i and x_i be characteristics of the study variable y and x the auxiliary variable respectively. We are interested to estimate population mean $\bar{Y}=\frac{1}{N}\sum_{i=1}^{N}y_i$ based on median information. Let $\bar{y}$ and $\bar{x}$ be the sample means; m be the sample median of the study variable; $\bar{M}$ be the average of sample medians; β be the population regression coefficient of y on x; and $\rho_{y,x}$ be the population correlation coefficient between y and x. In absence of the auxiliary variable we obtain median of the samples of the study variable y in our proposed estimators and subsequently precision improved. We draw all possible samples of size n from population U by using simple random sampling without replacement (SRSWOR) scheme.

Previous Studies

The sample mean ($\bar{y}$) of simple random sampling is given as:

$$\tau_0=\frac{1}{n}\sum_{i=1}^{n}y_i \qquad (1)$$

In absence of the auxiliary variable under simple random sampling without replacement (SRSWOR), the variance, is given by

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$$V(\tau_0) = \gamma \bar{Y}^2 C_y^2 \tag{2}$$

Cochran (1940) usual ratio estimator for the estimation of the finite population mean of the study variable and is widely used when the relationship between the study and the auxiliary variable is positive. It is given by:

$$\tau_1 = \bar{y}\left(\frac{\bar{X}}{\bar{x}}\right) \tag{3}$$

Where, $\bar{X}$ is the known population mean of x.
The bias and MSE, up to the first order of approximation, are given by

$$B(\tau_1) = \gamma \bar{Y}\left(C_x^2 - C_{yx}\right) \tag{4}$$

$$MSE(\tau_1) = \gamma \bar{Y}^2\left(C_y^2 + C_x^2 - 2C_{yx}\right) \tag{5}$$

where, $C_x^2 = \dfrac{V(\bar{x})}{\bar{X}^2}$ and $C_{yx} = \dfrac{Cov(\bar{y},\bar{x})}{\bar{Y}\bar{X}}$

Watson (1937) proposed the usual regression estimator, which is given as

$$\tau_2 = \bar{y} + b\left(\bar{X} - \bar{x}\right) \tag{6}$$

Where, the least square estimate of $\beta = \dfrac{S_{yx}}{S_x^2}$ the variance is given as

Tuteja (1991) introduces the following exponential-type ratio estimator

$$\tau_3 = \bar{y}\exp\left(\frac{\bar{X} - \bar{x}}{\bar{X} + \bar{x}}\right) \tag{8}$$

The bias and MSE of τ_3 to first order of approximation are given as

$$B(\tau_3) = \gamma \bar{Y}\left(\frac{3C_x^2}{8} - \frac{C_{yx}}{2}\right) \tag{9}$$

$$MSE(\tau_3) = \gamma \bar{Y}^2\left(C_y^2 + \frac{C_x^2}{4} - C_{yx}\right) \tag{10}$$

Rao (1991) signified the following estimator

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$$\tau_4 = K_1\bar{y} + K_2\left(\bar{X} - \bar{x}\right) \tag{11}$$

Where, K_1 and K_2 are constants.

The bias and MSE are given by

$$B\left(\tau_4\right) = \left(K_1 - 1\right)\bar{Y} \tag{12}$$

$$MSE\left(\tau_4\right) = \frac{\gamma\bar{Y}^2C_y^2\left(1-\rho_{yx}^2\right)}{1+C_y^2\left(1-\rho_{yx}^2\right)} \tag{13}$$

Grover and Kaur (2011) developed the following estimator

$$\tau_5 = \left[K_1\bar{y} + K_2\left(\bar{X} - \bar{x}\right)\right]\exp\left(\frac{\bar{X}-\bar{x}}{\bar{X}+\bar{x}}\right) \tag{14}$$

where K_1 and K_2 are constants. The bias and MSE of τ_5 are given below

$$B\left(\tau_5\right) = \bar{Y}\left[\left(K_1-1\right) + \gamma K_1\frac{C_x^2}{2}\left(\frac{3}{4}C_x - \rho_{yx}C_y\right)\right] + \gamma K_2\bar{X}\frac{C_x^2}{2} \tag{15}$$

$$MSE\left(\tau_5\right) = \frac{\gamma\bar{Y}^2C_y^2\left(1-\rho_{yx}^2\right)}{1+\gamma C_y^2\left(1-\rho_{yx}^2\right)} - \frac{\gamma^2\bar{Y}^2C_x^2\left(4C_y^2\left(1-\rho_{yx}^2\right)+\frac{C_x^2}{4}\right)}{16\left(1+\gamma C_y^2\left(1-\rho_{yx}^2\right)\right)} \tag{16}$$

Subramani (2016) developed a ratio-type estimator for the estimation of finite population mean given by:

$$\tau_6 = \bar{y}\left(\frac{M}{m}\right) \tag{17}$$

The bias and MSE of τ_6 are as follows

$$B\left(\tau_6\right) = \gamma\bar{Y}^2\left(C_m^2 - C_{ym}\frac{Bias\left(m\right)}{M}\right) \tag{18}$$

$$MSE\left(\tau_6\right) = \gamma\bar{Y}^2\left(C_y^2 + R^2C_m^2 - 2RC_{ym}\right) \tag{19}$$

where $R = \dfrac{\bar{Y}}{M}$

Muili and Audu (2022) presented the estimation of finite populations using power transformation. The estimator is given below:

$$\tau_7 = \bar{y}\log\left(\frac{M}{m}\right)^{\alpha} \tag{20}$$

The bias and MSE of τ_7 are given as follow

$$B(\tau_7) = \bar{Y}\left(\frac{\alpha(\alpha+1)}{2}\gamma C_m^2 - \alpha\frac{\bar{M}-M}{M} - \alpha\gamma C_{ym}\right) \tag{21}$$

$$MSE(\tau_7) = \gamma\bar{Y}^2\left(C_y^2 - \frac{C_{ym}^2}{C_m^2}\right) \tag{22}$$

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METHODOLOGY

Data

This section consists of an explanation of the data used in this study. For the empirical examples of the precision of proposed estimators, we use three (3) natural datasets to compare the proposed Mean Square Error (MSE) to those of some existing estimators considered in the study. The data is the sourced from Subramani (2016) and is presented in Table 1.

Table 1: Data used for empirical study

Parameter	Population 1	Population 2	Population 3
N	34	34	20
n	5	5	5
$^{N}C_{n}$	278256.0	278256.0	15504.0
$\bar{Y}$	856.412	856.412	41.50
$\bar{M}$	736.981	736.981	40.055
M	767.50	767.50	40.50
$\bar{X}$	208.882	199.441	441.950
R	1.1158	1.1158	1.0247
C_y	0.35357	0.35357	0.09132
C_x	0.29759	0.31108	0.08860
C_m	0.31754	0.31754	0.08130
C_{ym}	0.073140	0.073140	0.0053940
C_{yx}	0.04726	0.04898	0.00528
P_{yx}	0.449	0.445	0.652

Model Development

Having investigation pertinent literature and motivated work of Bahl and Tuteja (1991), Subramani (2016), and Muili and Audu (2022), we proposed an efficient exponential estimator for the estimation of the population mean of the study variable when the population median of the study variable is known as

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$$\tau_i^{(*)} = \bar{y}_r \left(\frac{M}{m}\right)\left(W_1 + W_2 \exp\left(\frac{M-m}{M+m}\right)\right) \tag{23}$$

To obtain the Bias and MSE we define the following error terms.

Let $\varepsilon_0 = \frac{\bar{y}-\bar{Y}}{\bar{Y}}$ and $\varepsilon_1 = \frac{m-M}{M}$ such that $\bar{y}_r = \bar{Y}(1+\varepsilon_0)$ and $m = M(1+\varepsilon_1)$

$$\left.\begin{array}{l}
E(\varepsilon_0)=0,\ E(\varepsilon_1)=\frac{\bar{M}-M}{M}=\frac{Bias(m)}{M},\ E(\varepsilon_0^2)=\frac{V(\bar{y})}{\bar{Y}^2}=\gamma C_y^2,\ E(\varepsilon_1^2)=\frac{V(m)}{M^2}=\gamma C_m^2, \\
E(\varepsilon_0\varepsilon_1)=\frac{Cov(\bar{y},m)}{\bar{Y}M}=\gamma C_{ym},\ S_y^2=\frac{1}{N}\sum_{i=1}^{N}(y_i-\bar{Y})^2,\ S_x^2=\frac{1}{N}\sum_{i=1}^{N}(x_i-\bar{X})^2,\ f=\frac{n}{N}, \\
V(m)=\frac{1}{\binom{N}{n}}\sum_{i=1}^{\binom{N}{n}}(m_i-\bar{M})^2,\ V(\bar{x})=\frac{1}{\binom{N}{n}}\sum_{i=1}^{\binom{N}{n}}(x_i-\bar{X})^2,\ \gamma=\frac{1-f}{n},\ C_{xx}^*=\frac{V(\bar{x})}{\bar{X}^2}, \\
Cov(\bar{y},\bar{x})=\frac{1-f}{n(N-1)}\sum_{i=1}^{\binom{N}{n}}(y_i-\bar{Y})(x_i-\bar{X}),\ Cov(\bar{y},m)=\frac{1}{\binom{N}{n}}\sum_{i=1}^{\binom{N}{n}}(y_i-\bar{Y})(m_i-\bar{M}), \\
C_{mm}^*=\frac{V(m)}{M^2},\ C_{ym}^*=\frac{Cov(\bar{y},m)}{\bar{Y}M},\ C_{yx}^*=\frac{Cov(\bar{y},\bar{x})}{\bar{Y}\bar{X}}
\end{array}\right\} \tag{24}$$

Bias and MSE of $\tau_i^{(*)}$

The estimator $\tau_i^{(*)}$ can be written in terms of ε_0 and ε_1 as

$$\tau_i^{(*)} = \bar{Y}(1+\varepsilon_0)(1+\varepsilon_1)^{-1}\left[W_1 + W_2 \exp\left(\frac{-\varepsilon_1}{2+\varepsilon_1}\right)\right] \tag{25}$$

$$\tau_i^{(*)} = \bar{Y}(1+\varepsilon_0)(1+\varepsilon_1)^{-1}\left[W_1 + W_2 \exp\left(\frac{-\varepsilon_1}{2}\left(1+\frac{\varepsilon_1}{2}\right)^{-1}\right)\right] \tag{26}$$

Simplifying (26) to get (27) as:

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$$\tau_i^{(*)} = \bar{Y}\left(1+\varepsilon_0\right)\left(1+\varepsilon_1\right)^{-1}\left[W_1 + W_2 \exp\left(\frac{-\varepsilon_1}{2} + \frac{\varepsilon_1^2}{4}\right)\right] \quad (27)$$

$$\tau_i^{(*)} = \bar{Y}\left(1+\varepsilon_0 - \varepsilon_1 + \varepsilon_1^2 - \varepsilon_0\varepsilon_1\right)\left[W_1 + W_2 \exp\left(1 - \frac{\varepsilon_1}{2} + \frac{3\varepsilon_1^2}{8}\right)\right] \quad (28)$$

Simplify (28) up to second-degree approximation, we have

$$\tau_i^{(*)} - \bar{Y} = \bar{Y}\left[W_1\left(1-\varepsilon_1+\varepsilon_0+\varepsilon_1^2-\varepsilon_0\varepsilon_1\right) + W_2\left(1+\frac{15}{8}\varepsilon_1^2 - \frac{3}{2}\varepsilon_0\varepsilon_1 - \frac{3}{2}\varepsilon_1\right) - 1\right] \quad (29)$$

Taking the expectation of (29) and applying the results of (24) to obtain the bias of the proposed estimators as

$$Bias\left(\tau_i^{(*)}\right) = \bar{Y}\left[W_1\left(1+\gamma\left(C_m^2 - C_{ym} + \left(\frac{\bar{M}-M}{M}\right)\right)\right) + W_2\left(1+\gamma\left(\frac{15}{8}C_m^2 - \frac{3}{2}C_{ym} - \frac{3}{2}\left(\frac{\bar{M}-M}{M}\right)\right) + \right) - 1\right] \quad (30)$$

Squaring and taking the expectation of (29), apply the results of (24) to obtain the MSE of the proposed estimator as

$$MSE\left(\tau_i^{(*)}\right) = \bar{Y}^2 E\left[W_1^2 A_1 + W_2^2 A_2 + 1 + 2W_1W_2A_3 - 2W_1A_4 - 2W_2A_5\right] \quad (31)$$

where,

$$A_1 = 1+\gamma\left(C_y^2 + 3C_m^2 - 4C_{ym}\right) - 2\left(\frac{\bar{M}-M}{M}\right)$$

$$A_2 = 1+\gamma\left(C_y^2 + 6C_m^2 - 6C_{ym}\right) - 3\left(\frac{\bar{M}-M}{M}\right), \quad A_3 = 1+\gamma\left(C_y^2 + \frac{35}{8}C_m^2 - 5C_{ym}\right) - \frac{5}{2}\left(\frac{\bar{M}-M}{M}\right)$$

$$A_4 = 1+\gamma\left(C_m^2 - C_{ym}\right) - \left(\frac{\bar{M}-M}{M}\right), \quad A_5 = 1+\gamma\left(C_y^2 + \frac{15}{8}C_m^2 - \frac{3}{2}C_{ym}\right) - \frac{3}{2}\left(\frac{\bar{M}-M}{M}\right)$$

Differentiating (31) partially concerning and o zero and solve for W_1 and W_2 simultaneously, we obtained $W_1 = \frac{\left(A_2A_4 - A_3A_5\right)}{\left(A_1A_2 - A_3^2\right)}$ and Substituting the results in (31), we obtained the minimum mean square error of $\tau_i^{(*)}$ denoted by $MSE\left(\tau_i^{(*)}\right)_{\min}$;

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$$MSE\left(\tau_i^{(*)}\right)_{\min} = \bar{Y}^2\left[1+\frac{A_2A_4^2 + A_3A_4^2 - 2A_3A_4A_5}{\left(A_1A_2 - A_3^2\right)}\right] \tag{32}$$

DATA ANALYSIS AND RESULTS

Results

This section consists of presentation of all the results in tables.

Table 2: The Mean Square Errors (MSEs) of the proposed and existing estimators

Estimators	Population 1	Population 2	Population 3
τ_0	15641.03	15641.03	2.154365
τ_1	14895.31	15492.24	1.45426
τ_2	12487.78	12543.72	1.238536
τ_3	12498.1	12539.73	1.297328
τ_4	12487.88	12543.82	1.24333
τ_6	10926.29	10926.29	1.170584
τ_7	9003.179	9003.179	1.017187
$\tau_i^{(*)}$	**7599.187**	**7599.187**	**0.8370249**

Table 3: The Percentage Relative Efficiencies (PREs) of the proposed and existing estimators

Estimators	Population 1	Population 2	Population 3
τ_0	100	100	100
τ_1	105.0064	100.9604	148.1417
τ_2	125.2507	124.6922	173.9445
τ_3	125.1473	124.7318	166.0617
τ_4	125.2497	124.6912	173.2738
τ_6	143.1505	143.1505	184.0419

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τ_7	173.7279	173.7279	211.7963
$\tau_i^{(*)}$	**205.8251**	**205.8251**	**257.3836**

Analysis
Table 2 shows the Mean Square Errors of the suggested and other existing estimators considered in the study using information from the three natural datasets 1, 2, and 3. Results obtained from each category indicated that proposed estimators under each category have minimum MSEs compared to conventional and some other competing existing estimators. This implies that the proposed estimators are more efficient than their peers and have higher chances to produce better estimates closer to the true values of means for any population of the Percentage Relative Efficiencies of the presented and some existing estimators using three natural datasets. The results revealed that the proposed estimator has the highest value of PRE compared to the conventional and some existing estimators considered in the study. This implies that the proposed estimator is more efficient and can produce better estimates of the population mean than conventional and some existing estimators considered in the study.

CONCLUSION AND RECOMMENDATIONS

Conclusion
In our research, we have proposed a new median-based ratio estimator for the estimation of the finite population mean. The conditions are derived for which proposed estimator is more efficient than the existing estimators. From the empirical study, the results showed that the proposed estimators were more efficient than their counterparts and have higher chances to produce estimates closer to the true values of the mean for any population of interest.

Recommendation
The proposed estimator is recommended for use in the estimation of the population mean of the study variable in the presence of the median of the study variable.

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REFERENCES

[1] Bahl, S., and Tuteja, R.K. (1991). Ratio and Product Type Exponential Estimator. *Information and Optimization Sciences*, XII (I): 59-163.

[2] Cochran, W.G. (1940). The Estimation of the Yields of the Cereal Experiments by Sampling for the Ratio of Grain to Total Produce. *The Journal of Agric. Science*, 30: 262-275.

[3] Grover, L.K., and Kaur, P. (2011). An improved estimator of the finite population mean in simple random sampling. *Model Assisted Statistics and Applications*; 6(1): 47–55.

[4] Kadilar, G.O. (2016). A New Exponential Type Estimator for the Population Mean in Simple Random Sampling. *Journal of Modern Applied Statistical Methods*, 15(2): 207-214.

[5] Kumar, R., Yadav, D.K., Misra, S., and Yadav, S.K. (2017). Estimating Population Mean Using Known Median of the Study Variable. *International Journal of Engineering Sciences and Research Technology*, 6(7): 15-21. Doi:10.5281/zenodo.822944

[6] Muili, J.O., and Audu, A. (2022). Estimation of finite population mean of median based using power transformation. *Oriental Journal of Physical Sciences*, 6(1-2): 26-31. DOI: http://dx.doi.org/10.13005/OJPS06.01-02.05

[7] Muili, J.O., Audu, A., Odeyale, A.B., and Olawoyin, I.O. (2019). Ratio Estimators for Estimating Population Mean Using Tri-mean, Median and Quartile Deviation of Auxiliary Variable. *Journal of Science and Technology Research*, 1(1): 91-102.

[8] Muili, J.O., Adebiyi, A., and Agwamba, E.N. (2020). Improved Ratio Estimators for Estimating Population Mean Using Auxiliary Information. *International Journal of Scientific and Research Publications*, 10(5).

[9] Rao, T. (1991). On certain methods of improving ratio and regression estimators. *Communications in Statistics-Theory and Methods*; 20(10): 3325–3340.

[10] Rashid, R., Noor-ul-Amin, M., and Hanif, M. (2015). Exponential Estimators for Population Using Transformed Auxiliary Variables. *International Journal of Applied Mathematics and Sciences,* 9(4): 2107-2112.

[11] Riaz, N., Noo-rul-Amin, M., and Hanif, M. (2014). Regression-Cum-Exponential Ratio-Type Estimators for the Population Mean. *Middle-East Journal of Scientific Research*, 19(12): 1716-1721.

[12] Subramani, J. (2016). A New Median Based Ratio Estimator for Estimation of the Finite Population Mean. *Statistics in Transition New Series*, 17(4): 1-14.

[13] Subramani, J., and Kumarapandiyan, G. (2012a). Estimation of Population Mean Using Coefficient of Variation and Median of an Auxiliary Variable. *International Journal of Probability and Statistics*, 1(4): 111–118.

[14] Subramani, J., and Kumarapandiyan, G. (2012b). Variance Estimation Using Median of the Auxiliary Variable. *International Journal of Probability and Statistics*, 1: 6-40.

[15] Subramani, J., and Kumarapandiyan, G. (2012c). Estimation of Population Mean Using Known Median and Coefficient of Skewness. *American Journal of Mathematics and Statistics*, 2(5): 101–107.

[16] Subramani, J., and Kumarapandiyan, G. (2013). A New Modified Ratio Estimator of Population Mean When Median of the Auxiliary Variable is Known. *Pakistan Journal of Statistics and Operation Research,* Vol. 9 (2): 137–145.

[17] Sanuallah, A., Khan, H., Ali, H.A., and Singh, R. (2012). Improved Exponential Ratio Type Estimator in Survey Sampling. *Journal of Reliability and Scientific Research*, 5(2): 119-132.

[18] Singh, R., Kumar, M., Chaudhary, M.K., and Kadilar, C. (2009). Improved Exponential Estimator in Stratified Random Sampling. *Pakistan Journal of Statistical Operational Research*, 5(2): 67-82.

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[19] Subzar, M., Maqbool, S., Raja, T.A., Surya, K.P., and Sharma, P. (2018). Efficient Estimators of Population Mean Using Auxiliary Information Under Simple Random Sampling. *Statistics in Transition new series*, 19(2): 1–20.

[20] Watson, D.J. (1937). The Estimation of Leaf Area in Field Crops. *The Journal of Agricultural Sciences*, 27(3): 474-483.

[21] Yadav, S.K., and Adewara, A.A. (2013). On Improved Estimation of Population Mean Using Qualitative Auxiliary Information. *International Journal of Mathematical Theory and Modelling*, 3(11): 42-50.

[22] Yadav, S.K., Mishra, S.S., and Shukla, A.K. (2014). Improved Ratio Estimators for Population Mean Based on Median Using Linear Combination of Population Mean and Median of an Auxiliary Variable. *American Journal of Operational Research*, 4(2): 21-27.

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LIST OF JOURNAL PUBLICATIONS

1. **Awwal Adejumobi**, Mojeed Abiodun Yunusa, Ahmed Audu (2022). Improved Modified classes of Regression Type Estimators of Finite Population Mean in the Presence of Auxiliary Attribute. *Oriental Journal of Physical Sciences*, 7(1): 41-47. https://dx.doi.org/10.13005/OJPS07.01.07
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3. **Awwal Adejumobi** and Mojeed A. Yunusa (2022). Some Improved Class of Ratio Estimators for Finite Population Variance with the Use of Known Parameters. *Logical Creation International Journal of Stem*, 3(3): 2708-7123. DOI: 10.5281/zenodo.7271392

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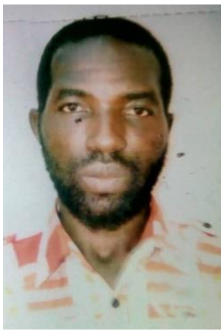

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LIST OF PUBLICATIONS

1. J. O. Muili, E. N. Agwamba, Y. A. Erinola, **M. A. Yunusa**, A. Audu and M. A. Hamzat (2020): Modified Ratio-cum-product Estimators of Finite Population Variance. International Journal of Advances in Engineering and Management, 2(4), 309-319. **DOI**: 10.35629/5252-0204309319
2. J. O. Muili1, E. N. Agwamba, Y. A. Erinola, **M. A. Yunusa**, A. Audu and M. A. Hamzat (2020): A Family of Ratio-Type Estimators of Population Mean using Two Auxiliary Variables. Asian Journal of Research in Computer Science. **DOI**: 10.9734/AJRCOS/2020/v6i130152
3. Awwal Adejumobi, **Mojeed Abiodun Yunusa** and Ahmed Audu (2022). Improved modified classes of regression type estimators of finite population mean in the presence of auxiliary attribute. *Oriental Journal of Physical Sciences*, 7(1): 41-47. **DOI:** https://dx.doi.org/10.13005/OJPS07.01.07
4. Adejumobi, A., Audu, A., **Yunusa, M. A.** and Singh, R.V.K. (2022). Efficiency of modified generalized imputation scheme for estimating population mean with known auxiliary information. *Bayero Journal of Pure and Applied Sciences*, 15(1): 105-113. **DOI:** https://dx.doi.org/10.4314/bajopas.v15i1.14
5. Adejumobi Awwal and **Mojeed A. Yunusa,** (2022, September). Some Improved Class of Ratio Estimators for Finite Population Variance with the Use of Known Parameters, *LC International Journal of Stem*, 3(3), 2708-7123. **DOI:** 10.5281/zenodo.7271392.