COMPARATIVE ANALYSIS OF STUDENT ENROLLMENT IN EKITI AND OGUN STATE USING SUCCESSIVE SAMPLING ON TWO OCCASIONS

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ABSTRACT

In a survey that is repetitive in nature, past values of the variable under investigation may be used as an auxiliary to improve on the precision of the estimate of current occasion. This paper explores the use of Successive Sampling on two occasions to determine the estimate of the mean, minimum variance, maximum precision, estimate of change in mean and estimate of the overall mean of student enrolment in Ekiti and Ogun state. In order to get a clear and complete overview of student enrolment in the states, successive sampling is used. The data is based on students' enrolment in Ekiti and Ogun State Public Secondary Schools, collected from Ekiti State Ministry of Education Teaching Service Commission and Ogun State Ministry of Education Oke-Mosan, Abeokuta. The current estimate for the student enrolments in Ekiti State Junior Secondary School is found to be 5542 students, compared to Ogun State Junior Secondary School which is found to be 7,557 students. The estimation for the current estimate is more precise when the correlation approaches unity. Also, from the results, minimum variance as well as maximum precision is achieved when correlation is unity. This implies that there is a perfect positive relationship between the first and the second sampling occasions. The results obtained show clearly that Ogun and Ekiti state government should monitor student's enrolment in every 3 years, so as to make adequate plans and implement competent infrastructure for universal basic education (UBE) and state universal primary education board (SUBEB) in public schools.

Keyword: - *Successive Sampling, Correlation, maximum precision, Variance, Enrolment.*

1. INTRODUCTION

Education is the most significant tool in eliminating poverty and unemployment. Moreover, it enhances the commercial scenario and benefits the country overall. However, the higher the level of education in a country, the better the chances of development are. This education benefits an individual in various ways because it helps a person make a better and more informed decision using their knowledge. This increases the success rate of a person's life. Subsequently, education is responsible for providing an enhanced lifestyle. It gives career opportunities that increase our quality of life. Basically, education history has witnessed tremendous growth in enrolment figures at all levels over the years. But this is not the case in Ogun and Ekiti state public schools, which Government owns. The population of students in Ogun and Ekiti state public schools, especially in both primary and post-primary education, has declined in recent years.

Nowadays, Successive sampling plays a very crucial role in sampling techniques that can be used in longitudinal surveys to estimate a population parameter and measure of difference or change in a study. Successive sampling is such kind of sampling scheme which consists of selecting sample units on different occasions such that some units are common with samples selected on previous occasions. Avadhani and Sukhatme (1972) discussed the method of sampling on several successive occasions with equal and unequal probabilities and without replacement. Where they have discussed the sampling on successive occasions for estimating terms and relationship in a time series involves a number of problems in theory and in practical survey design that need special attention. The problem arises because of the need for estimating several parameters from a sample thus estimates are often needed of aggregates or average at each period of time, such as for each month. Since it is not desirable that the estimate at each period require the

revision of the preceding estimates, the problem of estimation in times series raises question such as whether the sampling units should be identical at different point in time, if not, what proportion of units should be identical (i.e., matched) and how one should utilize the information from the past occasion to improve the estimates for the current occasion.

Successive sampling is used repeatedly to survey a population over time. It allows the first sample to be taken (on the first occasion) and a second sample is then taken (on the second occasion). Abraham et al. (1969) studied the problem of partial replacement of sample units according to some specific patterns. Yates (1949) was the first to follow up the work of Jessen and to develop the theory of partial replacement for more than two occasions. Following the work of Yates (1949), Avadhani and Sukhatme (1970) used the information on the study variable from the previous occasion through ratio method of estimation in successive (rotation) sampling. Jessen 1942 initially encountered the problem and suggested the method of estimation under the successive sampling with partial replacement of units utilizing the complete information at the previous occasion. Furthermore, Patterson 1950; Rao and Graham 1964. ; Feng and Zou 1997 studied the properties of different estimators under successive sampling. Biradar and Singh 2001, Singh and Vishwakarma, 2009; Singh and Pal, 2016; Sanahulla et al 2018. Javaid et al 2019. Pal et al 2019 used additional information for estimation under successive sampling. Repetitive or successive sampling is a variety of double sampling, commonly referred to as sampling over successive occasions, which is the basic study of this work. Thus, the desire to harness the plethora of information on successive sampling is worth studying, since successive sampling provides more serviceable and reliable information in decision making.

This research aims to carry out a comparative study of students' enrollment in Ekiti and Ogun State Public Secondary Schools, assess the enrollment rate, and compare the yearly admission quota and actual students' enrolment between Ekiti and Ogun State public schools. Also, obtain the current estimates including the minimum variance and maximum precisions, obtain the estimates of change between successive occasions and obtain the relative gain in precision between the first and second occasion samples. The data used are records of students' enrolment in Junior and Senior public Secondary Schools in 2015 and 2018 sessions. The sources of data are mainly secondary data from Planning Research and Statistics Unit, Ekiti State Ministry of Education and Ogun State Ministry of Education Oke-Mosan Abeokuta. This study will better understand Ekiti and Ogun state government by giving the necessary attention and providing funds to public secondary schools in Ekiti and Ogun state to procure the needed infrastructure and facilities.

2. METHODOLOGY

NOTATION

Let,

N be the number of units in the finite population

nbe the number of units randomly sampled from the finite population.

$\bar{y}_1 be$The estimate of the means on the first occasion based on initial sample of size n.

$\bar{y}_2 be$The estimate of the mean on the second occasion based on the current sample of size n.

$\bar{y}_1'$ bethe estimate of the mean on the first occasion based on the matched sample of size n

$\bar{y}_1'' be$The estimate of the mean on the first occasion based on the unmatched sample of size, n

$\bar{y}_2' be$The estimate of the mean on the second occasion based on the matchedsample size, n

$\bar{y}_2'' be$The estimate of the mean on the second occasion based on the unmatched sample size, n.

Estimation of the Population Mean

The estimator of the population mean on the second occasion based on the matched sample is given by

$$\bar{y}_{2m} = \bar{y}_2' - b(\bar{y}_1' - \bar{y}_1) \quad (1)$$

The estimator of the population mean on the second occasion is $\bar{y}_{2m}^* = \theta_1 \bar{y}_{2m} + \theta_2$ (2)

$$\theta_1 + \theta_2 = 1 \quad (3)$$

so that

$$\bar{y}_2^* = \theta_1 \bar{y}_{2m} + (1 + \theta_1)\bar{y}_2'' \quad (4)$$

θ_1 is a known constant chosen so that the variance of $\bar{y}_2^*$ is a minimum

The variance of $\bar{y}_2^*$ is

$$V(\bar{y}_2^*) = \theta_1^2(\bar{y}_{2m}) + (1 - \theta_1)V(\bar{y}_2'') + 2\theta_1(1 - \theta_1)cov(\bar{y}_{2m}, \bar{y}_2'') \quad (5)$$

$$\theta_{01} = \frac{V(\bar{y}_2'') - cov(\bar{y}_{2m}\bar{y}_2'')}{V(\bar{y}_2'') + V(\bar{y}_{2m}) - 2Cov(\bar{y}_{2m}\bar{y}_2'')} \quad (6)$$

The minimum variance of $\bar{y}_2^*$

$$V_0(\bar{y}_2^*) = \frac{V(\bar{y}_2'')V(\bar{y}_{2m}) - [cov(\bar{y}_{2m}\bar{y}_2'')]}{V(\bar{y}_2'') + V(\bar{y}_{2m}) - 2Cov(\bar{y}_{2m}\bar{y}_2'')} \quad (7)$$

$$\frac{V'(\bar{y}_2'')V'(\bar{y}_{2m})}{V'(\bar{y}_2'') + V'(\bar{y}_{2m})} + Cov(\bar{y}_{2m}, \bar{y}_2'') \quad (8)$$

Where

$V'(\bar{y}_2'') = V'(\bar{y}_2'') - Cov(\bar{y}_{2m}, \bar{y}_2'')$; $V'(\bar{y}_{2m}) = V(\bar{y}_{2m}) - COV(\bar{y}_{2m}, \bar{y}_2'')$

If μnunits are selected independently from the entire population N units or from an infinite population, then $Cov(\bar{y}_{2m}, \bar{y}_2'') = 0$ and

$$V_o(\bar{y}_2^*) = \frac{V(\bar{y}_{2m})V(\bar{y}_2'')}{\{V(\bar{y}_{2m}) + V(\bar{y}_2'')\}} \quad (9)$$

$$V(\bar{y}_{2m}) = \left(\frac{1}{n} + \frac{1}{N}\right)S^2 + \left(\frac{1}{\lambda n} - \frac{1}{n}\right)S^2(1 - \rho^2) \quad (10)$$

$$= \frac{s^2(1 - \mu\rho^2)}{\lambda n} - \frac{s^2}{N} \quad (11)$$

$$V(\bar{y}_2'') = \frac{S^2}{\mu n} - \frac{S^2}{N} \quad (12)$$

ρ is the correlation coefficient between the first and second occasion observations.

$$Cov(\bar{y}_{2m}, \bar{y}_2'') = -\frac{s^2}{N} \quad (13)$$

$$\emptyset_{01} = \lambda(1 - \mu^2\rho^2)^{-1} \quad (14)$$

$$V_o(\bar{y}_2^*) = \left(\frac{1 - \mu\rho^2}{1 - \mu^2\rho^2}\right)\frac{s^2}{n} - \frac{s^2}{N} \quad (15)$$

When the covariance is zero, the minimum variance reduces to

$$V_o(\bar{y}_2^*) = \left(\frac{1 - \mu\rho^2}{1 - \mu^2\rho^2}\right)\frac{s^2}{n} \quad (16)$$

$$\mu_o = \frac{\left(1 \pm \sqrt{1 - \rho^2}\right)}{\rho^2} \quad (17)$$

ESTIMATION OF THE CHANGE IN MEAN

The unbiased estimator of the change in mean, $\Delta = \bar{Y}_2 - \bar{Y}_1$, between the first and second occasion is

$$\hat{\Delta} = \emptyset(\bar{y}_2' - \bar{y}_1') + (1 - \emptyset)(\bar{y}_2'' - \bar{y}_1'' \quad (18)$$

$\emptyset$ is a constant chosen so as to make the variance of $\hat{\Delta}$ a minimum

$$\emptyset_o = \lambda(1 - \mu\rho)^{-1} \quad (19)$$

$$V_o(\hat{\Delta}) = cov(\hat{\Delta}, \bar{y}_2'' - \bar{y}_1'') = (1 - \emptyset_o)V(\bar{y}_2'', \bar{y}'') \quad (20)$$

$$= (1 - \emptyset_o)\frac{2s^2}{\mu n} = \frac{1-\rho}{1-\mu\rho}\frac{2s^2}{n} \quad (21)$$

Estimation of overall mean

The estimator of the overall population mean for the two occasions,

$$M = \frac{1}{2}(\bar{Y}_2 + \bar{Y}_1) \quad (22)$$

Is,

$$\hat{M} = \frac{1}{2}[\gamma(\bar{y}_1' + \bar{y}_2') + (1 - \gamma)(\bar{y}_1'' + \bar{y}_2'')] \quad (23)$$

γ is a known constant chosen so as to make the variance of $\hat{M}$ a minimum .

The optimum value of γ is

$$\gamma_o = (1 + \mu\rho)^{-1} \quad (24)$$

And the minimum variance of $\hat{M}, V_o(\hat{M})$ is derived as follows:

$$\text{Cov}(\hat{M}, \frac{1}{2}(\bar{y}_2'' + \bar{y}_1'') = \frac{1}{4}(1 - \gamma_o)V(\bar{y}_2'' + \bar{y}_1'') = V_o(\hat{M}) \quad (25)$$

The minimum variance of $\hat{M}$,

$$V_0\ (\hat{M}) = \frac{1}{2}(1 - \gamma_0)\frac{S^2}{\mu\rho} = \frac{1+\rho}{1+\mu\rho}\frac{S^2}{2n} \quad (26)$$

4. RESULT OF ANALYSIS

A random sample is selected on each occasion with the following characteristics

n = 24, nλ□= 17, nμ□= 8

So that, λ□= 0.68, μ□= 0.32

The unit of measurement is in thousands

Estimates with Junior Secondary School in Ekiti State as Study Variable

Thus, the minimum variance unbiased estimate, $\hat{M}2$ is as follows

n_u=24 n_m=126 n=150

Where n_m is the matched sample size, n_u is the unmatched sample size so that, λ□=0.84, μ□= 0.16

The unit of measurement is in thousands

$\hat{\rho} = 0.15042$ $\hat{\Delta} = 1.9572$

$\bar{\bar{Y}}_2 = 0.5542590$ $V_o(\hat{\Delta}) = 0.002793$

$V_o(\bar{\bar{Y}}_2) = 0.00165149$ $\widehat{M} = 0.8059$

$\hat{V}_o(\widehat{M}) = 0.000929907$

Table 1: Iterations of Estimated Variances for Junior Secondary Schools in Ekiti State in Category, Using Different Values Of ρ and μ

ρ	0.0	0.2	0.4	0.6	0.8	1.0
$V(\hat{\Delta})$	0.0033	0.0027	0.0021	0.0014	0.0075	0.0000
$V(\widehat{M})$	0.0008	0.0009	0.0010	0.0012	0.0013	0.0013
$V_o(\bar{\bar{Y}}_2)$	0.0016	0.0016	0.0016	0.0015	0.0015	0.0014
μ	0.0	0.2	0.4	0.6	0.8	1.0
$V(\hat{\Delta})$	0.0028	0.0029	0.0029	0.0030	0.0031	0.0033
$V(\widehat{M})$	0.0009	0.0015	0.0008	0.0008	0.0008	0.0008
$V_o(\bar{\bar{Y}}_2)$	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016

Estimates with Junior Secondary School in Ogun State as Study Variable

Thus, the minimum variance unbiased estimate, $\widehat{M}2$ is as follows

n_u=49 n_m=101 n=150

Where n_m is the matched sample size n_u is the unmatched sample size. so that, $\lambda = 0.6733$,

$\mu = 0.32667$. The unit of measurement is in thousands

$\hat{\rho} = 0.09182$ $V_o(\hat{\Delta}) = 0.0013057$

$s^2 = 0.10458$ $\widehat{M} = 0.339089$

$\bar{\bar{Y}}_2 = 0.755798$ $\hat{V}_o(\widehat{M}) = 0.000369526$

$V_o(\bar{\bar{Y}}_2) = 0.00069506$ $\hat{\Delta} = 0.032431$

Table 2: Iterations of Estimated Variances for Junior Category In Ogun State Using Different Values Of ρ and μ.

ρ	0.0	0.2	0.4	0.6	0.8	1.0
$V(\hat{\Delta})$	0.0013	0.0013	0.0013	0.0013	0.0012	0.0000
$V(\hat{M})$	0.0003	0.0003	0.0004	0.0004	0.0004	0.0005
$V_o(\hat{\bar{Y}}_2)$	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005
μ	0.0	0.2	0.4	0.6	0.8	1.0
$V(\hat{\Delta})$	0.0012	0.0012	0.0013	0.0013	0.0013	0.0013
$V(\hat{M})$	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
$V_o(\hat{\bar{Y}}_2)$	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006

Estimates with Senior Secondary School in Ekiti State as Study Variable

Thus, the minimum variance unbiased estimate, $\hat{M}2$ is as follows

n_u=26 n_m=124 n=150

Where n_m is the matched sample size n_u is the unmatched sample size. So that, λ=0.0.826, μ=0.1733. The unit of measurement is in thousands.

$\hat{\rho} = 0.250661$

$s^2 = 0.092898$

$\hat{\bar{Y}}_2 = 0.4434161389$

$V_o(\hat{\bar{Y}}_2) = 0.000613734$

$\hat{\Delta}$= 0.048681725

$V_o(\hat{\Delta}) = 0.000310479$

$\hat{M} = 0.588110551$

$\hat{V}_o(\hat{M}) = 0.000371154$

$V_o(\hat{\Delta}) = 0.000310479$

$\hat{M} = 0.588110551$

Table 3: Iterations of Estimated Variances for Senior Category in Ekiti State Using Different Values of $\rho and \mu$

ρ	0.0	0.2	0.4	0.6	0.8	1.0
$V(\hat{\Delta})$	0.0012	0.0010	0.0007	0.0005	0.0002	0.0000
$V(\hat{M})$	0.0003	0.0003	0.0004	0.0004	0.0004	0.0005
$V_o(\hat{\bar{Y}}_2)$	0.0006	0.0005	0.0006	0.0005	0.0005	0.0005
μ	**0.0**	**0.2**	**0.4**	**0.6**	**0.8**	**1.0**
$V(\hat{\Delta})$	0.0009	0.0009	0.0009	0.0010	0.0011	0.0012
$V(\hat{M})$	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
$V_o(\hat{\bar{Y}}_2)$	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006

Estimates with Senior Secondary School in Ogun State as Study Variable

n_u= 49 n_m=101 n=150

Where n_m is the matched sample size n_u is the unmatched sample size. So that, λ□=0.6733, μ□= 0.3266

The unit of measurement is in thousands.

$\hat{\rho} = 0.015578$ $\hat{\Delta}$= 0.1063

$s^2 = 0.055078$ $V_o(\hat{\Delta}) = 0.000726627$

$\hat{\bar{Y}}_2 = 0.65848$ $\hat{M} = 1.38369$

$V_o(\hat{\bar{Y}}_2) = 0.000367165$ $\hat{V}_o(\hat{M}) = 0.000185508$

Table 4: Iterations of Estimated Variances for Senior Secondary Ogun State Category Using Different Values of $\rho and \mu$.

ρ	0.0	0.2	0.4	0.6	0.8	1.0
$V(\hat{\Delta})$	0.0007	0.0006	0.0005	0.0003	0.0001	0.0000
$V(\hat{M})$	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
$V_o(\hat{\bar{Y}}_2)$	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
μ	**0.0**	**0.2**	**0.4**	**0.6**	**0.8**	**1.0**
$V(\hat{\Delta})$	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
$V(\hat{M})$	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
$V_o(\hat{\bar{Y}}_2)$	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

COMPARISM FOR THE ESTIMATE OF CHANGE BETWEEN EKITI AND OGUN STATE PUBLIC JUNIOR SECONDARY SCHOOLS.

μ AGAINST $V(\hat{\Delta})$

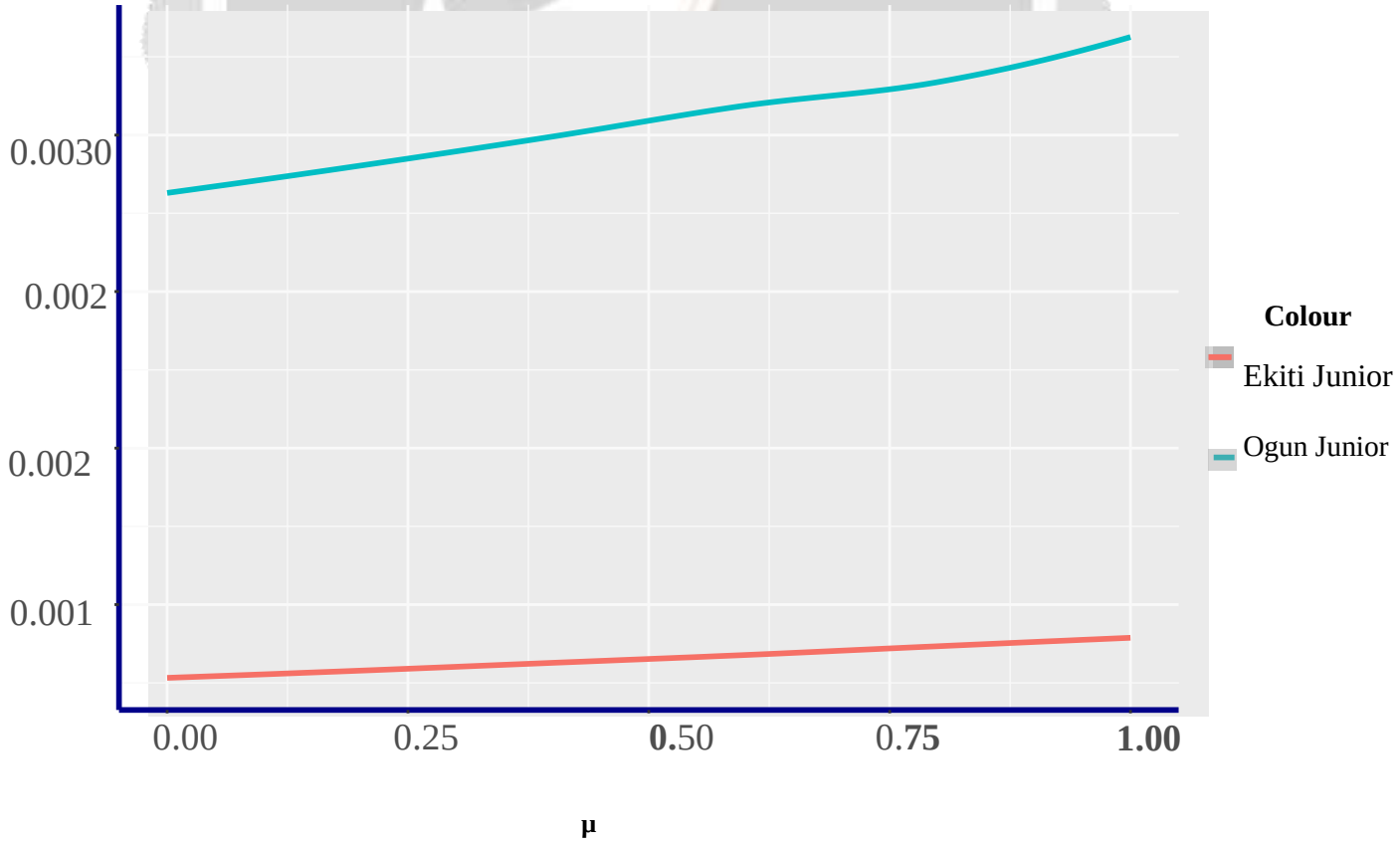

Figure 1

The Estimate of change between Ekiti Junior and Ogun junior increases as the mean increases. Both schools are independent of one another which imply that a change in mean of one school does not equal to the value of variance of the other.

COMPARISM FOR THE ESTIMATE OF CHANGE BETWEEN EKITI AND OGUN STATE JUNIOR PUBLIC SECONDARY SCHOOLS.

ρ AGAINST V$(\hat{\Delta})$

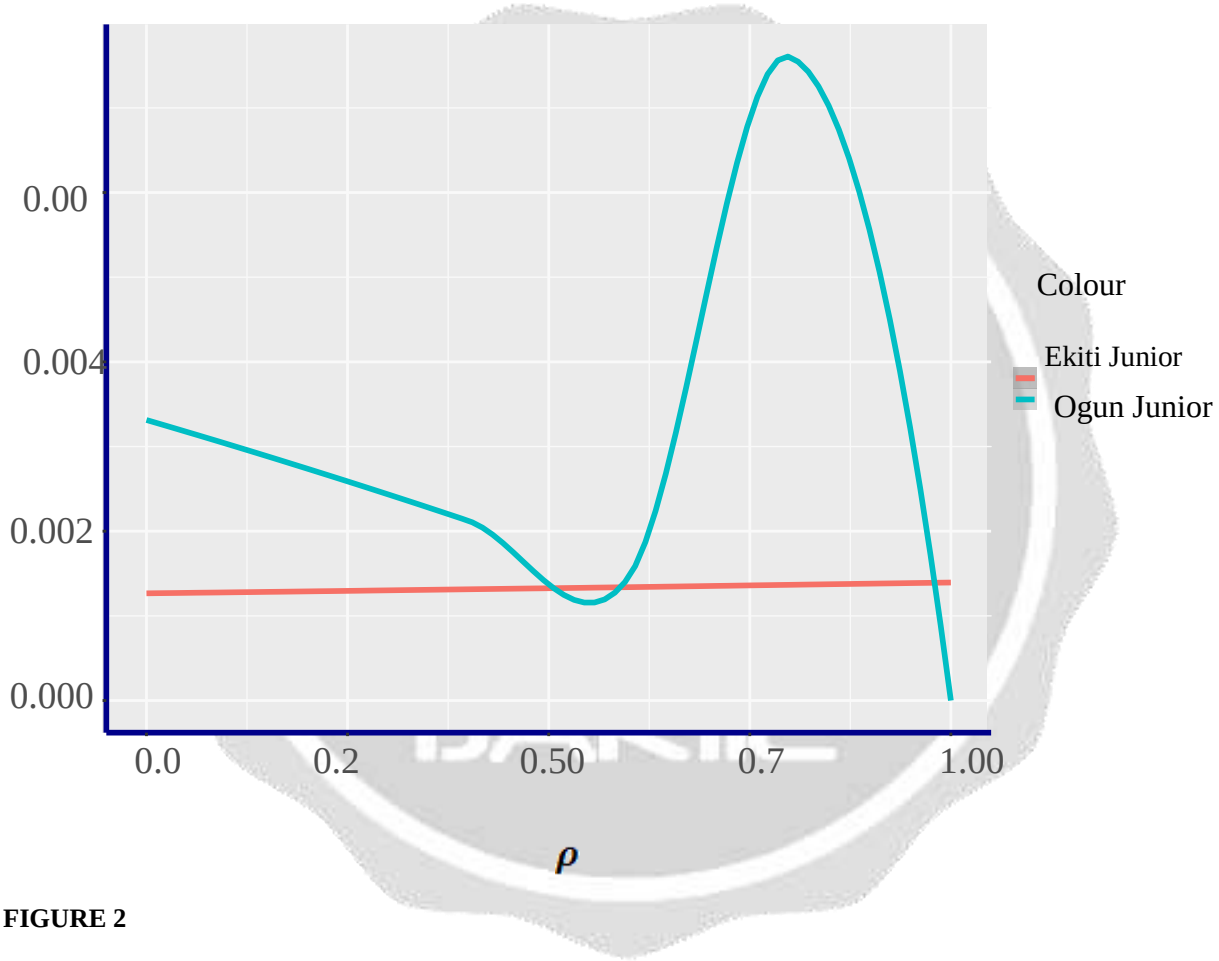

FIGURE 2

The law of the correlation coefficient states that the lower the variance, the lower the correlation. The figure above shows that Ekiti Junior obeys this law because it shows that as the variance increases steadily, the correlation increases steadily. Compared to Ogun Junior which also shows that, as the variance decreases, the correlation increases and vice versa.

COMPARISM FOR THE TEST OF CURRENT ESTIMATES WITH DIFFERENT VALUES OF ρ BETWEEN OGUN AND EKITI STATE PUBLIC JUNIOR SECONDARY SCHOOL.

ρ AGAINST $V_o\left(\bar{\bar{Y}}_2\right)$

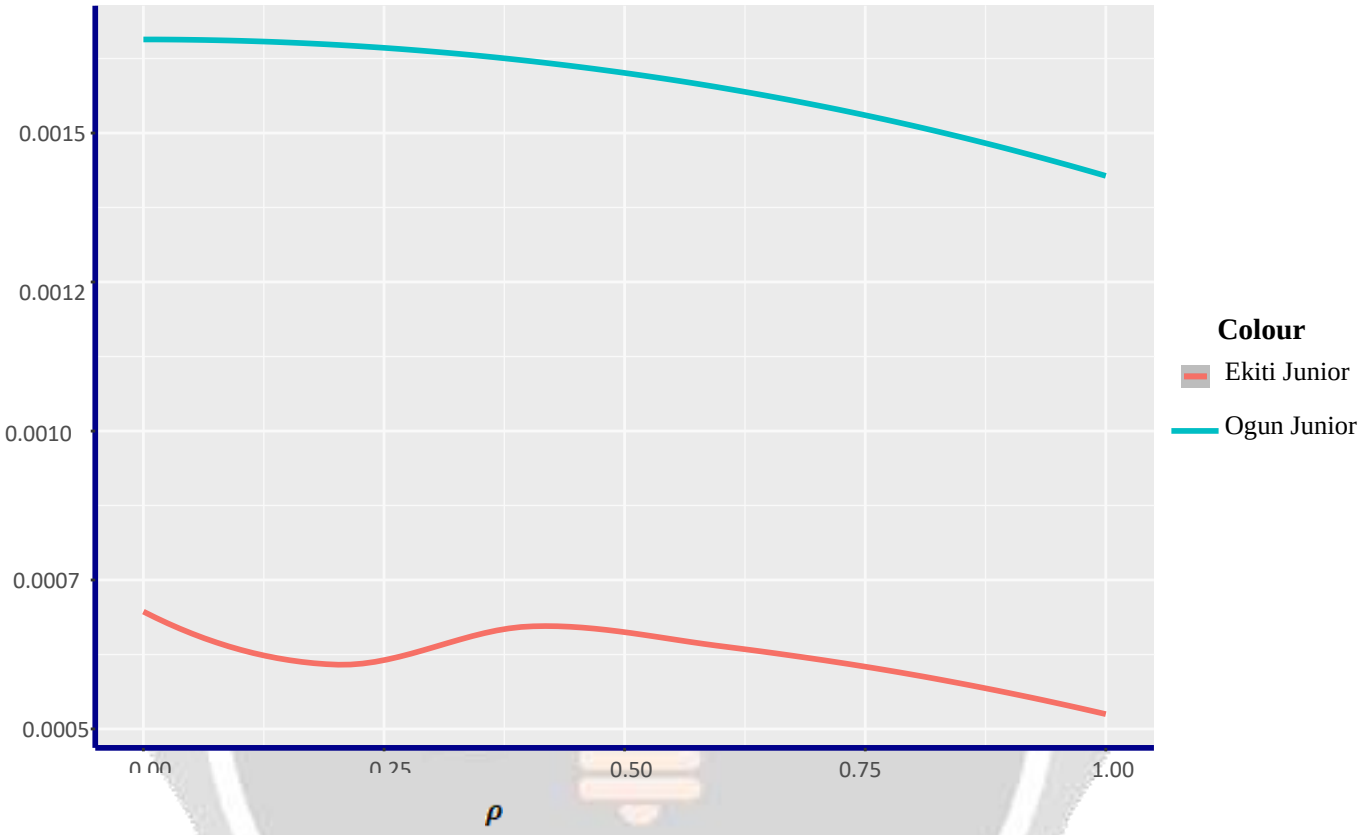

FIGURE 3

The figure above shows two distinction of graph of Ekiti junior and Ogun Junior, the graph shows that as the values of correlation changes, there is a decrease in the value of the variance for Ekiti Junior also we could deduce the same trend in the Ogun Junior in which the correlation value changes, the variance also changes.

COMPARISM FOR THE ESTIMATE OF OVERALL MEAN BETWEEN OGUN AND EKITI STATE PUBLIC JUNIOR SECONDARY SCHOOLS.

μ against $V(\widehat{M})$

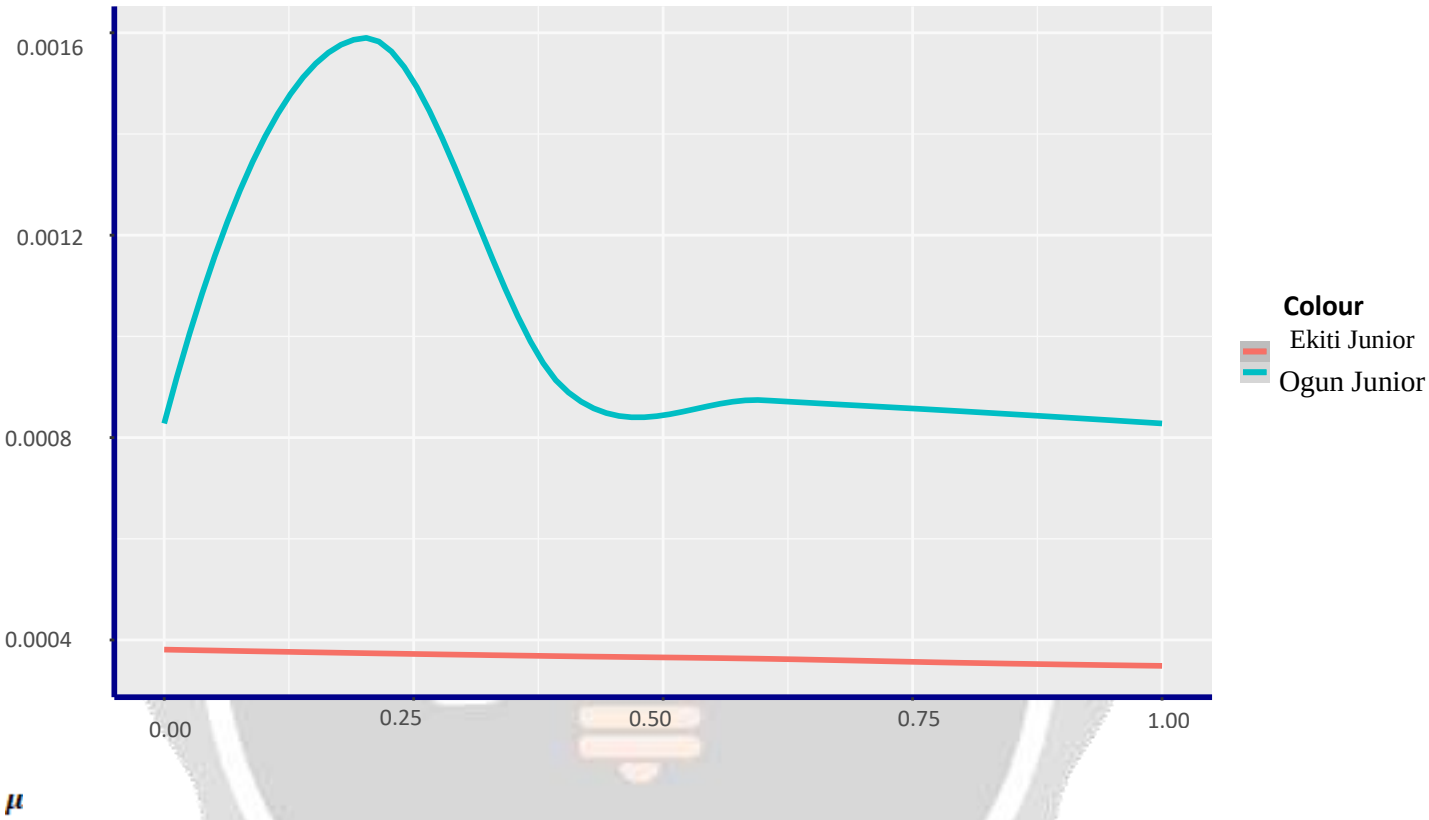

FIGURE 4

The mean estimate of Ekiti junior reduces slightly as the mean increases which show a mean effect compared to Ogun Junior which shows that as the mean by the value set increases, there is a decrease in its estimate.

COMPARISM FOR THE ESTIMATE OF OVERALL MEAN BETWEEN OGUN AND EKITI STATE PUBLIC JUNIOR SECONDARY SCHOOLS.

ρ AGAINST $V(\bar{M})$

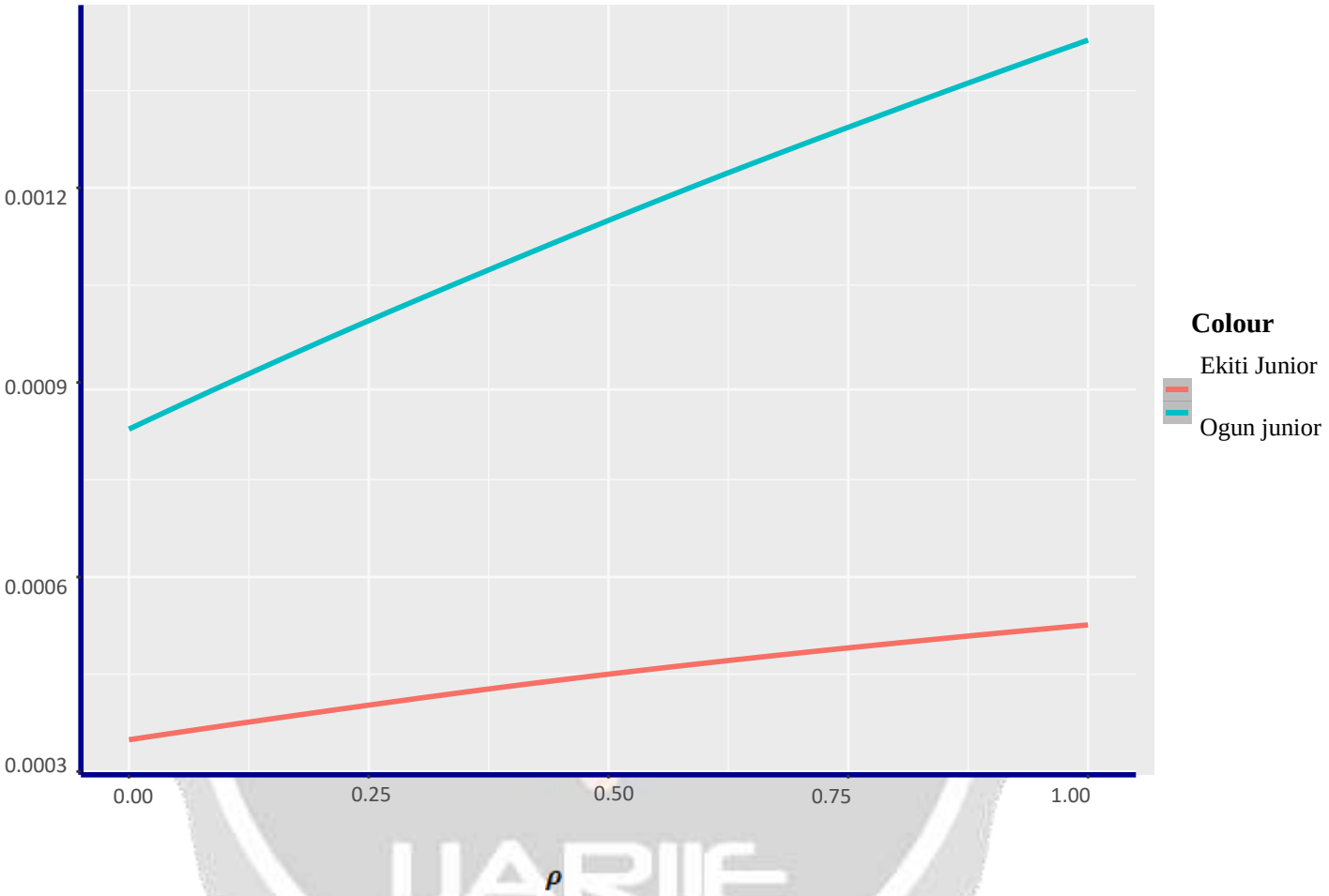

FIGURE 5

The plot shows a significant effect on the mean estimate which simply means that the mean estimate increases as the correlation coefficient for both Ekiti and Ogun Junior.

COMPARING THE ESTIMATE OF CHANGE BETWEEN EKITI STATE AND OGUN STATE PUBLIC SENIOR SECONDARY SCHOOLS.

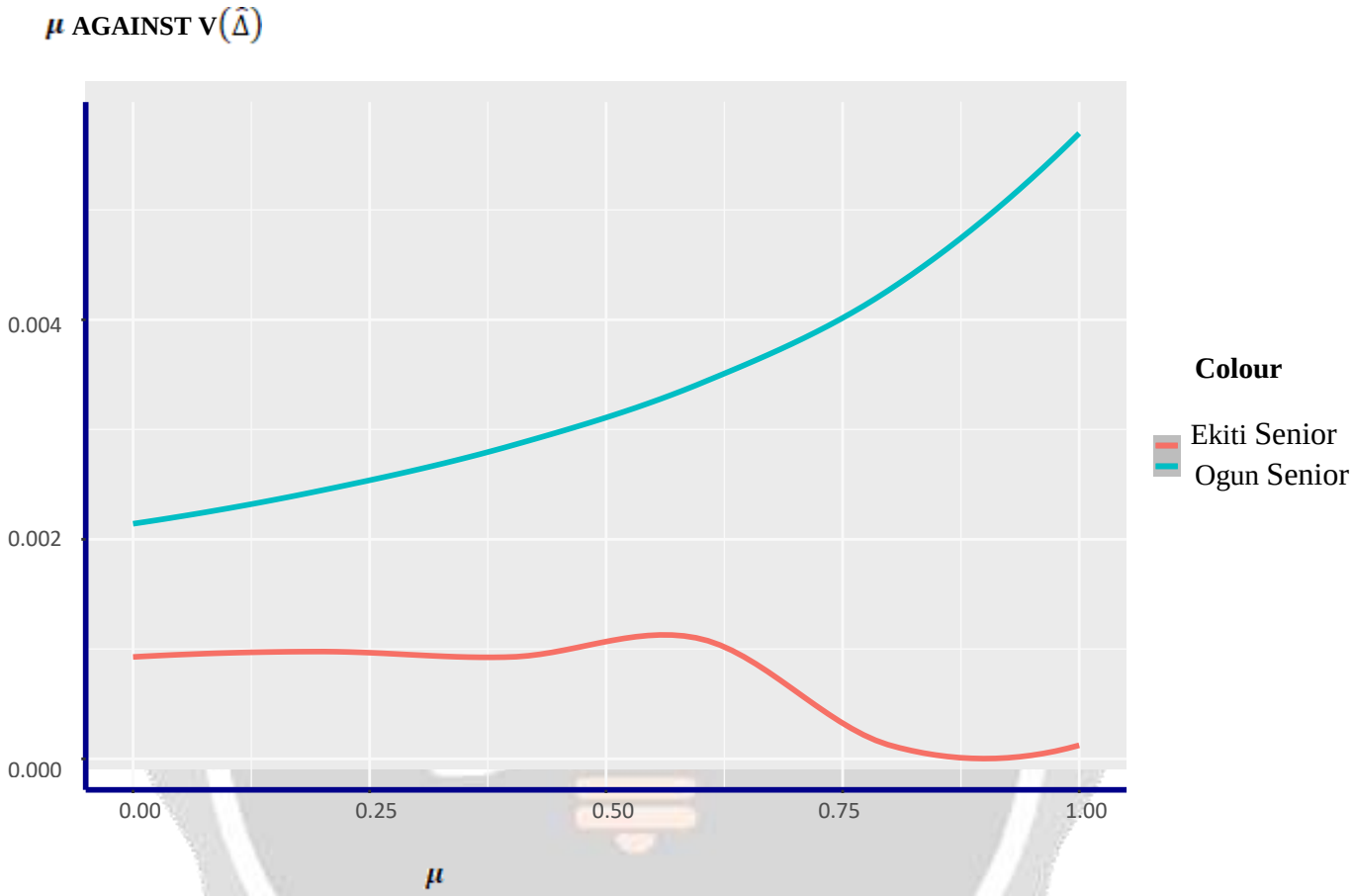

FIGURE 6

From the figure 6, the variance of estimate of change in Ogun State senior public secondary schools enrolment is increasing, compare to that of Ekiti State Senior public secondary schools enrolment in which the enrolment of student is not stable.

SHOWING THE COMPARISM FOR THE ESTIMATE OF CHANGE BETWEEN EKITI AND OGUN STATE PUBLIC SENIOR SECONDARY SCHOOLS.

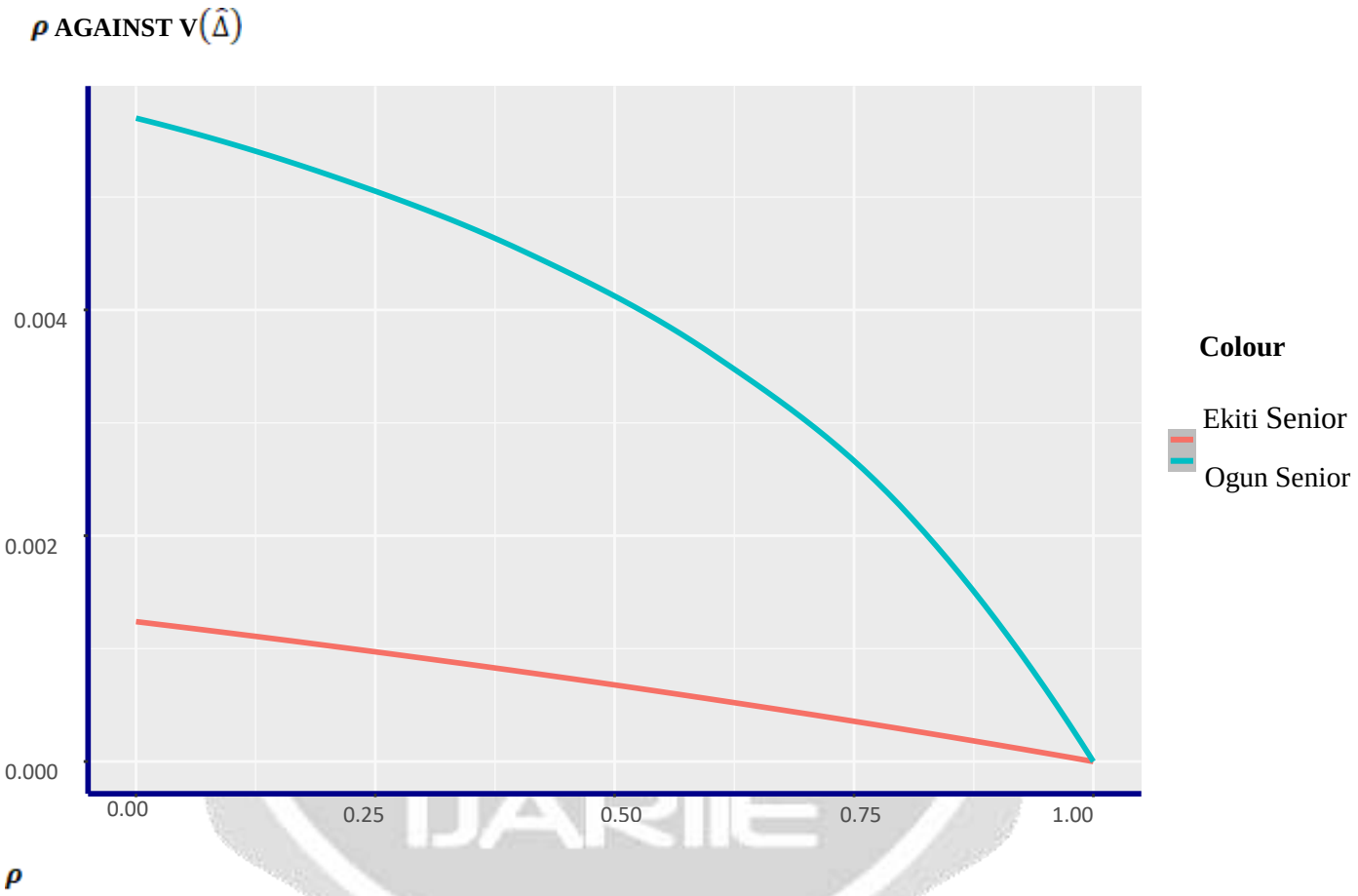

FIGURE 7

From figure 7, the variance of estimate of correlation shows a linear relationship between Ogun State and Ekiti State public senior secondary schools.

COMPARISM FOR THE TEST OF CURRENT ESTIMATES WITH DIFFERENT VALUES OF ρ BETWEEN OGUN AND EKITI STATE PUBLIC JUNIOR SECONDARY SCHOOL.

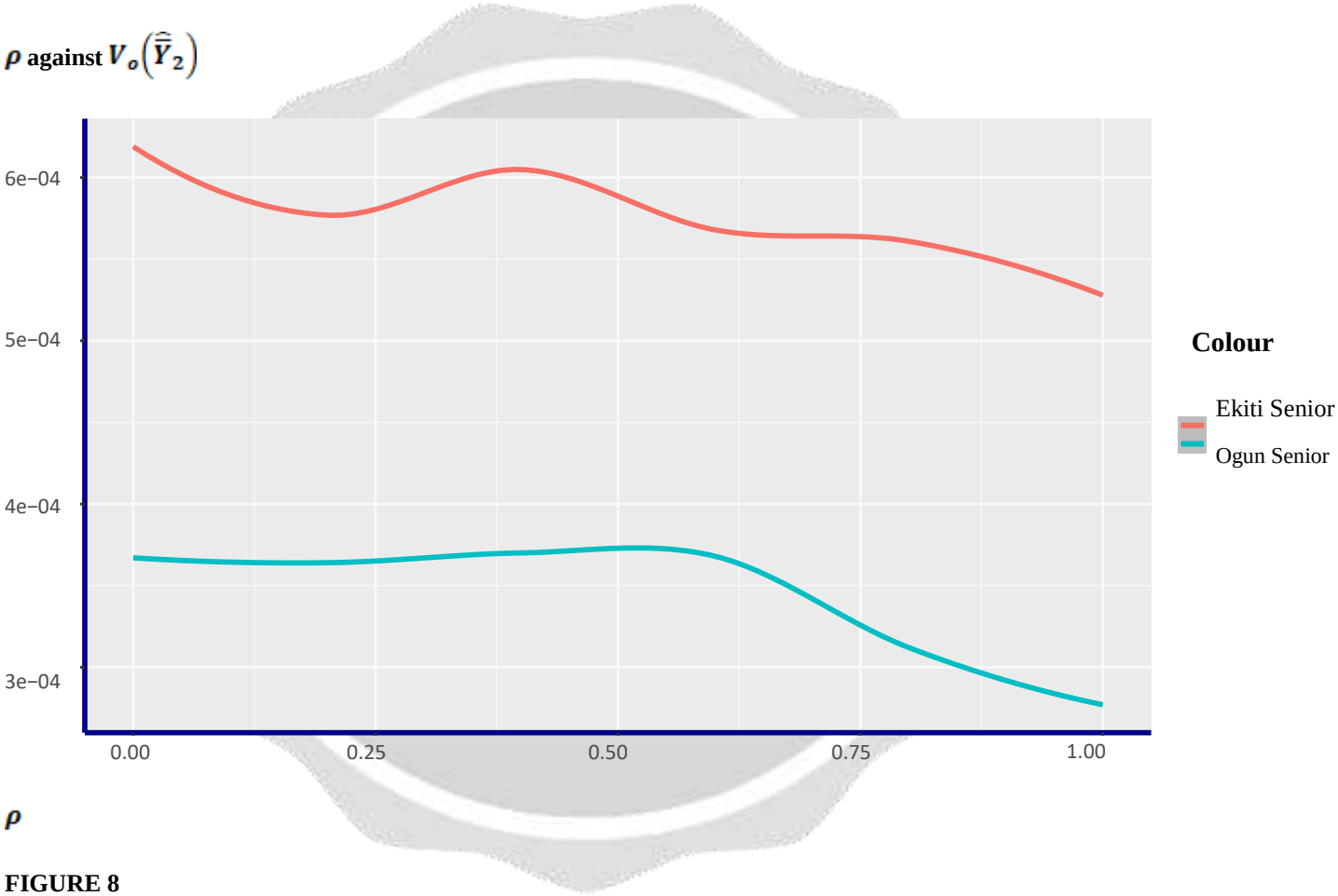

FIGURE 8

The figure shows that the correlation has no or little effect on the minimum since it does not obey the law of correlation in relation to variance as the value increases for Ekiti Junior while the Ogun State public schools, shows an effect at some point but become unstable without an effect at 0.50.

COMPARISM FOR THE ESTIMATE OF OVERALL MEAN BETWEEN OGUN AND EKITI STATE PUBLIC JUNIOR SECONDARY SCHOOL.

μ AGAINST $V(\widehat{M})$

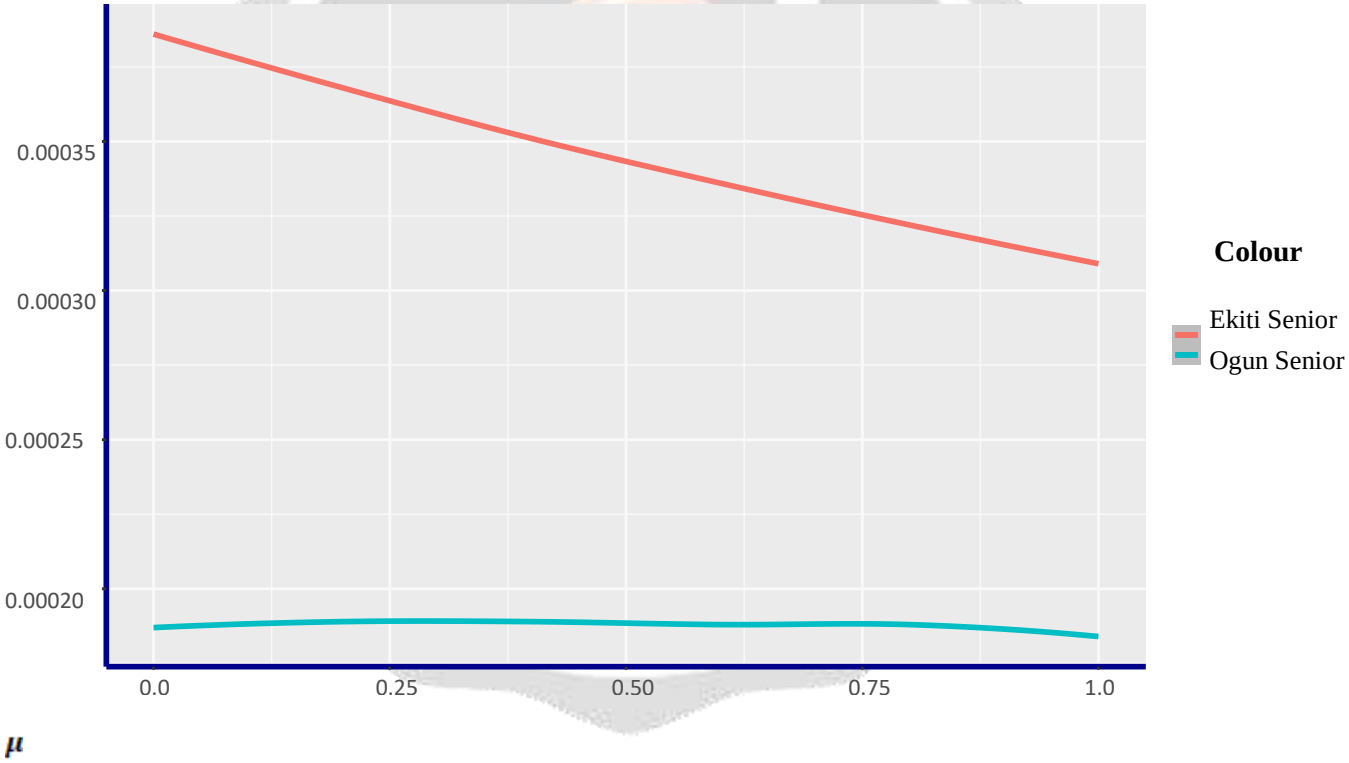

FIGURE 9

The mean of Ekiti Senior show a decreasing effect as the value increases while the Ogun Senior has no effect as the mean increases.

COMPARISM FOR THE ESTIMATE OF OVERALL MEAN BETWEEN OGUN AND EKITI STATE JUNIOR PUBLIC SECONDARY SCHOOL.

ρ AGAINST $V(\hat{M})$

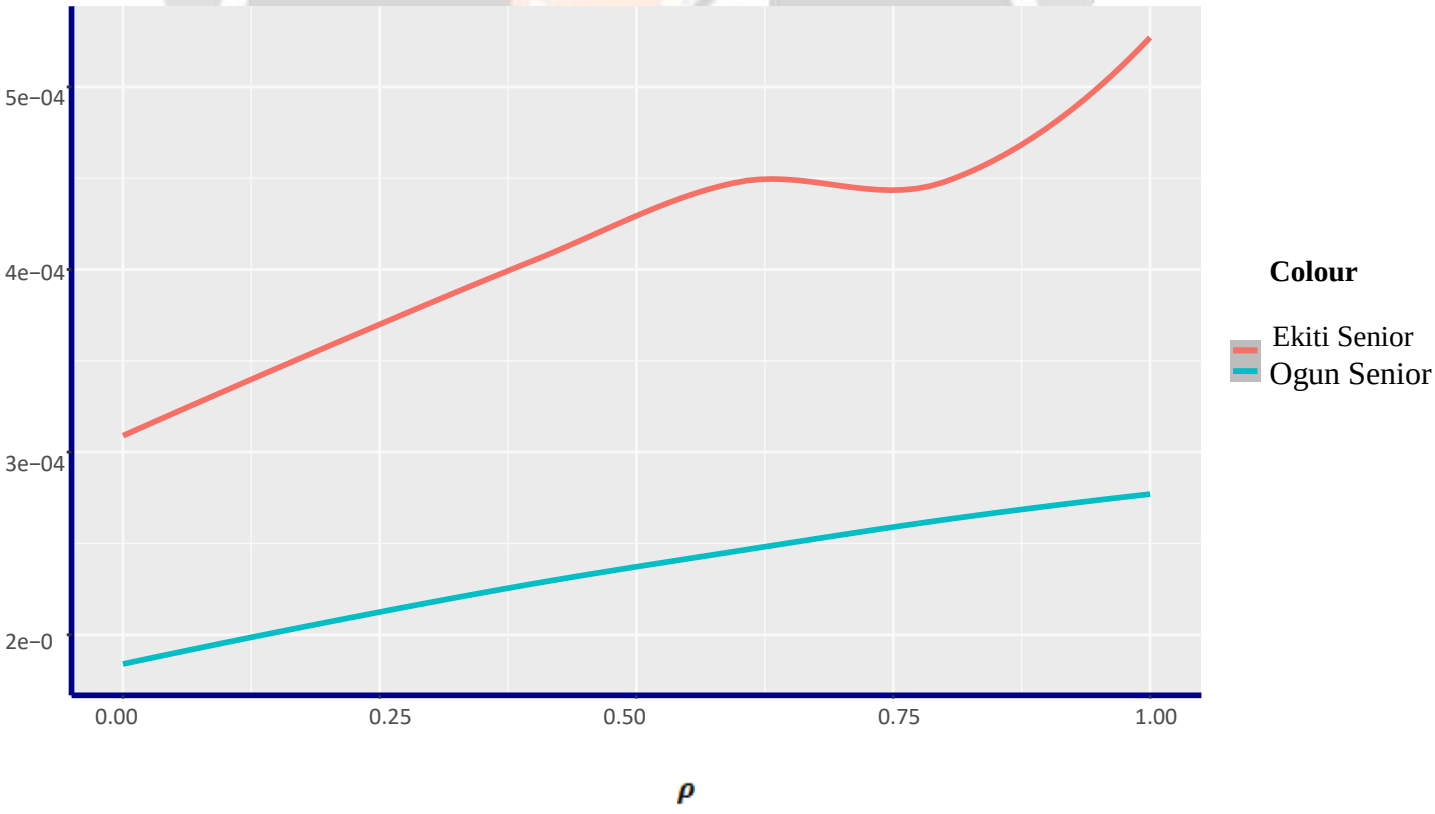

FIGURE 10

Ogun Senior clearly reveal that as the mean increases, there is an increase in its mean estimate at every single value while the Ekiti Senior shows an increase but become on steady at the end of the value which an unsteady state. Because of this, independent samples should be taken for precision and improvement on each occasion.

5. DISCUSSION OF RESULTS

From the above interpretation and discussion based on the available data used for analysis in this research, the successive sampling on two occasion technique has revealed values for the estimated parameters. The current estimate for the student enrolments in Ekiti and Ogun State Junior Secondary Schools were found to be 55425 and 75579 students respectively. Comparing the junior schools in Ekiti and Ogun state, the results revealed clearly that Ogun state has the highest number of estimated number of student enrolled in public Junior Secondary Schools every year. The variances for the current estimates in Tables 1 and 2 show sensitivity to various degrees of relationship that exist between the rates in the first and second occasion samples. As expected, in consonance with the theory, the variance tends to zero as ρ tends to one, and the estimate becomes more precise. Therefore, the variance for the current estimate is more precise when ρ tends to one.

The current estimate for the student enrolments in Ekiti and Ogun State Senior Secondary School were found to be 44341 and 75579 students respectively. Comparing the public senior secondary schools in Ekiti and Ogun state, the results revealed that Ogun state has the highest number of estimated number of senior secondary students enrolled in every year. Therefore, the variance for the current estimate is more precise when ρ tends to one.

The Minimum variance for Ekiti and Ogun state junior secondary school was achieved when ρ tends to one and μ tends to zero when compared to others at different values of ρ. This shows that, μ should be made as small as possible and ρ should be made as high as possible for estimating change.

Furthermore, The Minimum variance for Ekiti and Ogun State Senior Secondary School was achieved when ρ tends to one and μ tends to zero when compared to others at different values of ρ. This shows that, μ should be made as small as possible and ρ should be made as high as possible for estimating change. The estimate of overall mean for the students' enrollment in Ekiti and Ogun State Junior Secondary Schools were found to be 81 students and 34 students respectively. Comparing the overall mean between Ekiti and Ogun, it is evident that Ekiti has the highest overall mean for Junior Secondary Schools enrollment. The estimate overall mean happens to be the minimum value as ρ tends to zero and μ tends to one when compared to others at different values of ρ. The estimate of overall mean for the students' enrolment in Ekiti and Ogun State Senior Secondary School were found to be 59 and 137 students respectively. Comparing the estimate of overall mean, it is evident that Ogun state has the highest students' enrollments when compared with the previous year. The gain in information changing from one occasion to the next for Ekiti and Ogun State Junior Secondary School were found to be 20% and 31% respectively. Also, the gain in information changing from one occasion to the next for Ekiti State Senior Secondary School was found to be 91%. Compare to Ogun State junior school which does not gain information. It was further shown that reasonable gain in precision was achieved by using the estimator when ρ tends to unity. Also the value

of the ratio (λ□= m/n) in percentage showed that the ratio is 0.5 (as ρ increases) when maximum precision was achieved.

6. REFERENCES

[1] Abraham et al. (1969). Some investigations on the use of successive sampling in pest and diseases surveys, *Journal of the Indian Society of Agricultural Statistics*, 21, 43.

[2] Arnab R. (1998) Sampling on two occasions: Estimation of population total. *Survey Methodology* 24:185192.

[3] Avadhani M.S. and B.V. Sukhatme(1970) a comparison of two sampling procedure with an application to successive sampling, *Journal of the Royal Statistical Society*19(3C):251-259.

[4] Avadhani, M.S and Sukhatme, B.V. (1972). Sampling on several successive occasion with equal and unequal probabilities and without replacement, *Australian Journal of Statistics*, 14,109.

[5] Eckler, Albert R. (1955)-Rotation Sampling, *Annals of Mathematical Statistics*, 26,*664.*

[6] G.N. Singh and J.P. Karna, (2009). "Estimation of population mean on current occasion in two-occasion successive sampling", Metron **67**, 87-103.

[7] G.N. Singh and J.P. Karna, (2014). "Estimation of population mean under non- response in two-occasion rotation patterns," Communications in Statistics-Theory & Methods **43**, 3429-3442.

[8] G.N. Singh, (2005). "On the use of chain-type ratio estimator in successive sampling," Statistics in Transition **7**, 21-26.

[9] Hansen (1955) the redesign of census, current population survey, *Journal of the American Statistical Association* 50:701-719.

[10] Housila 2010: Estimation of Population variance in successive sampling.*cda.mrs.Umn.edu/ jongmink /research.*

[11] H.P. Singh and S. Kumar, (2008). "A regression approach to the estimation of finite population mean in the presence of non-response", Australian & New Zealand Journal of Statistics **50**, 395-408.

[12] Jessen R.J. (1942) Statistical Investigation of a Sample Survey for obtaining farm facts, *Iowa Agricultural Experiment Station Research Bulletin No. 304, Ames, Iowa,U. S. A.* 1-104.

[13] Kulldorff, G. (1963). Some problem of optimum allocation for sampling on two occasions. *Review International statistical institute*, 31, 24-57.

[14] M.H. Hansen and W.N. Hurwitz, (1946). "The problem of the non-response in sample surveys", J. Amer. Statist. Assoc. **41**, 517 – 529.

[15] R.J. Jessen, *Statistical investigation of a sample survey for obtaining farm facts*, (Iowa Agricultural Experiment Station Road Bulletin No. 304, Ames, USA, 1-104 1942).

[16] R.K. Choudhary, H.V.L. Bathal, and U.C. Sud, (2004). "On Non-response in Sampling on Two Occasions", J. Ind. Soc. Agril.Statist. **58**, 331-343.

[17] R.S.Biradar and H P Singh, (2001). "Successive sampling using auxiliary information on both occasions", Cal. Stat. Assoc. Bull. **51**, 243-25.

[18] Singh, G. N. (2005) on the use of chain-type ratio estimator in successive sampling, *Statistics in Transition*, 7, 1, 21-26.

[19] S. Feng and G. Zou, (1997). "Sample rotation method with auxiliary variable", Commun. Statist. Theo Meth. **26**, 1497-1509.\

[20] Singh, G. N. and Priyanka, K. (2006): On the use of chain-type ratio to difference estimator in successive sampling, *International Journal of Applied Mathematics and Statistics*, 5(S06), 41-49.

[21] Singh, G. N. and Priyanka, K. (2007): On the use of auxiliary information in search of good rotation patterns on successive occasions, *Bulletin of Statistics and Economics*, I(A07); 42-60.

[22] Singh, G.N. and Priyanka, K. (2008): On the use of auxiliary variables to improve the precision of estimates at current occasion. *Journal of the Indian Society of Agricultural Statistics*, 62(3), 253-265.

[23] Singh, G.N. and Priyanka, K. (2010): Estimation of population mean at current occasion in presence of several varying auxiliary variates in two – occasion successive sampling. *Statistics in Transition- new series*, 11(1), 105-126.

[24] Singh, G. N. and Prasad, S. (2013): Best linear unbiased estimators of population mean on current occasion in two-occasion Successive sampling, *Statistics in Transition-New Series*, 14(1), 57-74.

[25] Singh, H. P. And Vishwakarma, G. K. (2009): A general procedure for estimating population mean in successive sampling, *Communications in Statistics-Theory and Methods*, 38(2), 293-308.