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# Estimation of the Current Occasion Parameters Using Successive Sampling Approach

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***Abstract: -*** In this study, successive sampling was used to determine the current estimate of the mean, minimum variance, estimate of change between the two successive occasions and estimate of average over the period of the two occasions. The Data used were based on the number of persons per school deployed by National Youth Service Corps scheme, Akwa Ibom State, Nigeria. The estimates of change and estimate of average over time give their optimum variance when $\rho = 0$ *and* $\mu = 1$ under varying values of $\rho$ and $\mu$ . Also the variance where found to be smaller in the second occasion as compared to the variance in the first occasion

***Keywords: -*** *Successive Sampling, Average overtime, Unmatched portion*

## I. INTRODUCTION

Successive Sampling is used extensively in applied sciences, sociology and economic researches. Many survey these days are repetitive in character. Government agencies like the National Bureau of Statistics and other research based institutes collect information regularly on the same population to estimate some population parameters for the current occasion . When the same population is sampled repeatedly, say that a first sample has been taken (on one occasion ) from a poplation of N units and a second sample is to be taken (on another occasion ) on the same population, there is thus an opportunity of making use of the information contained in the first sample. The problem is how best to learn from past experience and use it for improving precision of future estimates. Estimates can be made not only for the existing time period (current estimates ) but also of the change that has taken place since the previous occasion and of the average over a given period. This is what successive sampling entails. The theory of successive sampling appears to have started with the work of Jessen (1942). He utilized the entire information collected in the previous occasion and obtained two estimates, one was the sampling mean based on new sample only and the other was a regression estimate based on the sample units observed on both occasions by combining the two estimates . Yates (1949) extended jessen's scheme to the situation where the population of the variable is estimated on each one of the h≥ 2 occasions from a rotational sample design. Kullduf(1963) modified Jessen's scheme of the sampling by selecting the unmatched sample from the units not selected on the first occasion. He considered in details the optimum choice of the matching fraction under the most general form of cost function apart from fixed costs. Sen (1972) generalized Jessen's work by using a double sampling multivariate ratio estimate using P-auxilliary Variable (p>1) from the matched portion of the sample. Expressions for optimum matching fraction and the combined estimate and its error have also been derived. Okafor (1987) compared some estimators of the population total in two –stage successive sampling using auxiliary variable. Artes, Rueda and Arcos (2005) worked on successive sampling using a product estimate but they considered the case when the auxiliary variables are negatively correlated and double sampling product estimate from the matched sample was presented . Expressions for optimum estimator and its variance have been derived . Trivedi and Shukla (2008) looked into the efficient estimator in successive sampling using post stratification .They stated that it is often seen that the population having large number of elements remains unchanged in several occasions but the value of units change . In their work they introduced an estimator under successive survey , the estimator is unbiased and efficient over post stratification estimation. The intention of this paper is to estimate current mean ,the changes over time and the average over the periods of the number of 'corpers' deployed in Akwa Ibom State, Nigeria.

## II. DATA USED

The data used for this study is from the records of the number of persons posted by National Youth Service Corps Scheme to serve in different schools in Akwa Ibom State , Nigeria. The scheme is a one year compulsory scheme for graduates from Nigeria to serve in different part of the country after their graduation from a Bachelor Degree programme. Corper is the name given to those who participate in the scheme.

## III. METHODOLOGY

A population is sampled over two occasions for making current estimates and also for estimating changes in the population characteristics. On the first occasion a random sample of size n units is taken from a finite population of size N units. On the second occasion a random sub sample of size m =n$\boldsymbol{\lambda}$, ($0 \leq \boldsymbol{\lambda} \leq \mathbf{1}$) is retained from the first occasion sample and another independent random sample of size u(u =n-m), is selected from the population to supplement . A number of alternatives can be made about replacement policy on the structure of the sample on each occasion . For estimating change from one occasion to the next , it may be best to retain the sample on each occasion , a new sample on each occasion ( that is entire independent sample ) is drawn if average of change is our target and if it is desired to estimate the mean on each occasion and also the change from one occasion to the next, it may be best to retain part of the sample and draw the remainder of the sample afresh. It should be noted that high positive correlation always exist between observations made on the same unit at two occasions that are successive. For simplicity we shall denote by Y and X the measurement on the second and first occasions respectively.

## IV. RESULTS

From the data used, a random sample of 50 schools was selected from a population of 490 schools on each occasion ,this comprises of 30 unmatched schools and 20 matched schools.

i.e n=50; $\boldsymbol{\lambda}$=0.4; µ= 0.6; ${S^2}_x$ =4.79; ${S^2}_y$=3.58; b=0.95; $\rho$ =0.93

$\hat{\mu}_{2m=}$ $\bar{y}'$-b ($\bar{x}'$-$\bar{x}$) =5.67

The minimum variance unbiased estimator is used for the estimation because of the assumption of the equal variability at both occasions. We use the variance obtained by pooling the variances from the matched samples on the first and second occasions as an estimate of the population variance . The pooled variance is therefore

$\sigma^2$ = ( m-1) ${S^2}_y$ +(m-1) ${S^2}_x$ /2 (m-1) = 4.19

The variance for the matched portion is

V ($\hat{\mu}_{2m}$) = $\sigma^2$[1+ (1-$\boldsymbol{\lambda}$) 1-2$\rho$)/n = 0.04

Estimation of optimum variance is

V( $\hat{\mu}_2$) = $\sigma^2$/2n [1+$\sqrt{2(1-\rho)}$] =0.06

Mean at the second occasion is

$\widehat{M}_2$ = 1/1-$\mu^2\rho^2$ [$\lambda\mu\rho$ ($\bar{x}'' - \bar{x}'$) +$\boldsymbol{\lambda}\bar{y}'$+ µ (1-µ$\rho^2$) $\bar{y}''$]= 3.94

V ($\widehat{M}_2$) = (1-µ$\rho^2$ ) $\sigma^2$/ (1-$\mu^2\rho^2$ )n =0.059

The optimum variance of the mean at the second occasion is

V ($\widehat{M}_2$) = $\sigma^2$ [ 1+ $\sqrt{1-\rho^2}$] /2n =0.056

Mean at the first occasion is

$\widehat{M}_1$ = 1/1-$\mu^2\rho^2$ [$\lambda\mu\rho$ ($\bar{y}'' - \bar{y}'$) +$\boldsymbol{\lambda}\bar{x}'$+ µ (1-µ$\rho^2$) $\bar{x}''$]= 3.53

Estimate of change is

$\hat{\Delta}$ = $\widehat{M}_2 - \widehat{M}_1$ = 0.41

V ($\hat{\Delta}$ ) = 2$\sigma^2$ (1-$\rho$ )/ n(1-µ$\rho$) = 0.027

V ($\hat{\Delta}_1$ ) = 2( 1- $\rho\boldsymbol{\lambda}$ ) $\boldsymbol{\sigma^2}$ **/n** = 0.105

Thus gain in efficiency of using sampling on two successive occasions is

[ V ($\hat{\Delta}_1$ )/ V ($\widehat{M}_2$) -1 ] × 100%=77.9 %

Estimate for average over time is

$\hat{\Sigma}$/ 2 = $\widehat{M}_2 + \widehat{M}_1$ /2 =3.735

V ( $\hat{\Sigma}$ ) =0.104

V( $\hat{\Sigma}$/ 2) = 0.026

From table 1, minimum variance as well as maximum precision is achieved when $\rho$=1. This implies that there is a perfect positive relationship between the first and the second sampling occasions. From tables 2 and 3, variance estimates of change give the same values at $\rho = 0$ *and* $\mu = 1$. Therefore to enhance precision, $\mu$ should be considerable small and $\rho$ considerably high. From tables 4 and 5 , the variance estimates of the sum shows that the same estimate was obtained when ($\rho = 0$ *and* $\mu = 1.$), the said estimate happens to be the minimum value when compared to others at different values of $\rho$. To enhance precision therefore, independent samples should be taken on each occasion

## V. CONCLUSION

Based on the collected data utilized in the analysis of this study, we have been able to achieve the intention of this work which was to estimate the current mean and this was found to be 4 approximately with variance 0.059 and a standard error of 0.243. The minimum variance as well as maximum precision was achieved in table 1 when $\rho = 1$ because at this point the value was 0.052 which is minimum the values of $\rho$. The estimate of average of change overtime was 3.735 with variance of 0.026 and a standard error of 0.161. the relative efficiency or gain between the successive occasions was 77.9%.

## REFERENCES

[1] Artes E.,Rueda M. and Arcos (2005) Successive Sampling using Product Estimate When the auxiliary variables are negatively correlated; Applied Science and Environment
[2] Cochran W. G. (1977) Sampling Technique ( third edition ). John Wiley and Sons
[3] Jessen R. J. (1942) Statistical investiagation of a sample survey for farm facts. Iowa agricultural experiment statistical research bulletin.pg 304
[4] Kullduff. G, (1963). Some problem of optimum allocation for sampling on two occasion. Review international statistical institute vol.31,24-57
[5] Manish T. and Shukla D. (2008) Efficient Estimator in successive sampling using post stratification
[6] Okafor (1987) Comparison of estimators of population totals in two-stage successive sampling using auxiliary information survey method
[7] Sen (1972) Successive sampling P-auxilliary variables. Ann Mathematical Statistics

**Appendix**

Table 1. Table for variance of current estimate with different values of $\rho$

| $\rho$ | V ($\hat{M}_2$) |
|---|---|
| 0.0 | 0.0838 |
| 0.2 | 0.083 |
| 0.4 | 0.08 |
| 0.6 | 0.075 |
| 0.8 | 0.067 |
| 1.0 | 0.052 |

Table 2. Table for estimate of change with different values of µ

| µ | V ($\hat{\Delta}$) |
|---|---|
| 0.0 | 0.012 |
| 0.2 | 0.014 |
| 0.4 | 0.019 |
| 0.6 | 0.027 |
| 0.8 | 0.046 |
| 1.0 | 0.168 |
| | |
| | |

Table 3 Table for estimate of change with different values of $\rho$

| $\rho$ | V ($\hat{\Delta}$) |
|---|---|
| 0.0 | 0.168 |
| 0.2 | 0.152 |
| 0.4 | 0.132 |
| 0.6 | 0.105 |
| 0.8 | 0.064 |
| 1.0 | 0 |

Table 4 Table of average over time with varying µ

| $\mu$ | V ( $\hat{\sum}$ ) |
|---|---|
| 0.0 | 0.323 |
| 0.2 | 0.273 |
| 0.4 | 0.236 |
| 0.6 | 0.208 |
| 0.80 | 0.185 |
| 1.0 | 0.168 |

Table 5 Table of average over time with varying $\rho$

| $\rho$ | V ( $\hat{\sum}$ ) |
|---|---|
| 0.0 | 0.168 |
| 0.2 | 0.180 |
| 0.4 | 0.190 |
| 0.6 | 0.197 |
| 0.8 | 0.204 |
| 1.0 | 0.210 |