



## EXAMINE THE METHODS AND MEASURES USED IN TWO OCCASIONS SEQUENTIAL SAMPLING

**Hemant Kumari**

Research Scholar, Dept of Mathematics, Himalayan Garhwal University

**Dr. Sudhir Gupta**

Professor, Dept of Mathematics, Himalayan Garhwal University

**Abstract** – The suitability of the sample techniques used for the study has a big impact on how accurate the estimations are. Precision of closely similar sampling techniques may not match survey costs at their lowest. The goal of analysts is to use a specimen technique that can ensure maximum accuracy at the lowest possible cost. The main area of this training is to compare the accuracy of two sampling approaches that are closely related and have few procedural differences when the data has a known distribution. On behalf of a generally distributed inhabitant and slanted (Gamma) residents, consecutive double sampling with ratio focus, regression estimators, and sampling techniques were used. To determine the impact of example size continuously the accurateness of the tactics, the subsequent stage model was booked to be the corresponding pairs in selection on successive junctures, which stayed varied since 11% to 91%.

In relationships of accuracy crosswise the 3 relationship numbers aimed at Skewed distribution, the results showed that selection on sequential occasions is superior to both the proportion and deterioration estimators of binary sampling, whereas ratio estimator for binary sample has the least exactness. Underneath a usually distributed statistics situation with three association numbers, the reversion estimator aimed at double specimen outperforms its ratio foil for binary selection and specimen on following occasions while having the lowest performance.

**Keywords** – Sampling, Correlation Coefficient



## 1. Introduction:

Sampling is essential to almost all human undertakings because it offers a practical alternative to censuses in cases where they are either impractical or necessary. In the majority of real-life scenarios, the population's units cannot be reachable or accessible for inventory for motives outside the sampler's controller, leading to selection from the units that are now available. Later the main goal of sample surveys is to select a accidental sample after a inhabitants and then custom the gen from the taster to brand corollaries about certain inhabitants faces, sampler has thus become a very noteworthy and multipurpose facet of humanoid life that is anxious by the estimate of convinced statistic after the sample by the usage of apt estimators (s). Liable on the development and aptness of the sampling strategy used on behalf of the project, selection is proficient of providing the dicks per adequate, unswerving, and true information that possibly motivation be castoff as the root for oversimplification on the specified inhabitants. The precision based on performance metrics, such the variance, is what determines whether something is appropriate (Oshungade 2015). There are numerous sampling techniques with various applications and viabilities, particular of which might have identical selection techniques but use distinct estimators. When there are thoroughly similar sampling techniques, the sampler resolve undoubtedly pick on behalf of the ones that can provide the highest level of precision. Investigators or samplers must possess sufficient understanding of population coverage, sampling stages, and sampling techniques. When implementing any approach, it is also necessary to take into account variables such the inhabitants building, the supply of the variable(s) underneath deliberation, and the qualified accurateness and accuracy of the sampling way(s). According to Raj and Chandhok (1998), it is better to choose sampling designs that adhere to the managerial principle of providing the greatest precision on behalf of a specified cost or the lowest cost on behalf of a given near of precision. Throughout time, samplers have come to favors secondary variable-based sampling techniques. This may be because a good auxiliary variable, which is anticipated to be associated thru the variable of interest, will provide some information about the real variable of interest, increasing the accuracy of estimators of inhabitant's stricture together at the range and estimate stages. Raj (1989) noted that one advantage specimen theory has over other fields, such as statistical theory, is the use of an auxiliary variable to increase the correctness of the sample process. Some examples of sampling techniques that rely on auxiliary data



include double sampling and sampling on subsequent occasions, but the latter allows for parameter estimate on various times. The techniques can be used for many different things (Okafor 2000; Anieting 2013).

To repeatedly sample a population over time, sequential sampling and double sampling are employed. In both procedures, a first sample is busy (on the initial occasion), followed by a second taster (on the second juncture). The technique gives the researcher the chance to use the data from the initial sample in direction to increase the accuracy of subsequent estimates. Guesstimates of averages and full, however, depend on together events. In twin sampling, data on the inconstant of concentration, let's say  $y$ , is placid since a second sample that is reduced than the original model size using simple haphazard sampler without auxiliary (SRSWOR), while evidence on the supporting variable, let's say  $x$ , is placid as of a preliminary large sample using SRSWOR. In contrast to the aforementioned, a sample may be used on multiple occasions for sampling rather of having a new sample obtained each time. While the remaining portion of the sample may be drawn again, a portion may be kept. In order to estimate the means, additional units (unmatched units) must be chosen. Furthermore, according to Eze, Amahia, Olayiwola, and Adewara (2011), there is always a strong positive correlation amid observations finished on the identical unit on binary successive occasions.

The main goal of this learning is to evaluate the accuracy of the estimators of two meticulously related techniques when the sampler drinks a good understanding of the precise circulations that the adjustable of interest displays. While variables are obligated to exhibit a certain distribution, Oshungade (2014) focused only on the evaluation of sampling means wanting paying any consideration to the supply of the variables, which can affect the accuracy of sample estimators. Individual characteristics like income and height are typically known to have skewed distributions, although student test results may be evenly spread. In this study, regularly spread and skewed facts are taken into consideration, paying close courtesy to the gamma scenario. Raj (1976) contrasted the worsening and percentage estimators for duple sampling created by Neyman (1948), identifying several circumstances in which each method is superior to the other. Rao (1973) investigated stratification-related double specimen. Cochran (1977) reported the fundamental findings of two-phase sample, with the most basic regression estimators for this class of sample design, and proposed a number of both direct and indirect estimate strategies that use a double sampler thru deterioration technique to



minimise bias. Many writers have evaluated the double sampling method to determine the effectiveness of ratio and worsening estimators, including Sodipo (2007), and Kumar (2011). Jessen was the first to raise the issue of sampling twice in a row (1942). Using all the data gathered before with the intention of making two estimates, one based solely on new taster units and the extra a deterioration estimate grounded on taster units observed on together previous cases and an overall example mean strong-minded continuously the first (Singh 2001). Studies by Chaturvedi (1984) were all closely related to this concept (1983). Another option is a technique limited to unit stage simple random sampling and involving more than two occasions ( $h > 2$ ) (Yate, 1949). This creates a case for generalization (Patterson, 1950; Tikkiwal, 1967). The procedure has undergone evaluation over time (Biradar 2001) demonstrated various level spin specimen where it was determined that for one near rotation selection, only tasted values drawn as of the inhabitants of the current time can be other to the illustration form and that in this state of affairs, upper levels, both the prior sample ideals and the up-to-date values tin be added. Raj (1965) used PPSWR and basic casual sampling short of auxiliary to forerunner the use of shifting likelihood with auxiliary on behalf of sampling over binary subsequent events. On a second occasion, he estimated the population total founded on a line grouping of dual separate estimates from the matched and unmatched samples. Rodriguez (2001) suggested a sampling technique for approximating, through a linear guess, the populace proportion of two letterings beneath two-stage sampling done two junctures, while Pathak (1966) future a variation of the estimators of Raj (1965). (or sampling with partial replacement of units). Reuda, Arcos, Martinez-Miranda, and Roman (2004) conducted a parallel study that looked at the issue of estimating a finite populace mean on behalf of the present juncture using a sample chosen across dual occasions in the scenario where many auxiliary variables are linked with the foremost variable.

From the matched component, they accessible a binary sampling multivariate produce estimation, after which they deduced expressions for the best estimator and its error. It was calculated how much more efficient the combined estimate was compared to the direct estimate made without any data from the initial survey. Using a product estimate, Artes (2005) examined the situation in which the auxiliary variables remain negatively associated. The mien for the best estimator and its adjustment were generated, and the double selection product guess since the matched slice of the sample stayed shown. Also, examples of



auxiliary variables with positive and negative correlations were integrated in Singh (2018) work using exponential-type estimators. Additionally, several improved estimators and generalised estimates were proposed (Singh 2019; Singh 1998). In two separate studies, Housila (2007) investigated the estimation of a finite population quintile through consecutive sampling. By joining three double specimen estimators, namely ratio-type besides regression-type after the harmonized portion of the taster and a simple quintile grounded on an accidental sample since the unmatched share of the taster on the second time, the theory developed was intended to provide the best estimates. Their research revealed that, of all the discussed estimators, the regression-type estimator performed the best. In their 2010 study, Housila looked at the estimate of inhabitant's modification in succeeding sampling. On two occasions, they suggested and investigated a class of estimators of fixed population adjustment in succeeding sampling. When thinking about the issue of estimating finite population variation in survey sampling, this class of estimators can be applied. Contrasting analyses of the sampling methods' precision have, up until now, attracted little to no attention, despite the proximity and flexibility of double sampling and sampling on repeated occasions. In order to indorse the greatest and most effective sampling technique to use for a specific survey wherever the design of supply for the adjustable is identified, this research aims to identify the precision preferences between the two sampling techniques. According to Oshungade (2014), double selection aimed at regression outperformed its ratio matching part without taking into account the variable's dispersal.

## 2. METHODS

The simulation used to create the data for this study used two likely scenarios: normally distributed numbers and really skewed (gamma) distributed numbers. It has been noted that a variety of survey-related variables, including income, land ownership size, employment, and industrial establishment production, are likely to have skewed distributions. Since the focus of this study is on comparing the precision performance of two different sampling techniques, attention is given to the unbiased estimator of the alterations of the specimen techniques to establish the accuracy grading of the estimators under thought, where the higher the precision, the lower the variance, and vice versa.



### SELECTION PROCESS

An initial taster of size  $n' = 40$  d was collected by simple accidental sampling lacking extra as part of the double sampling selection procedure, and a subsample of extent  $n$  ( $21 \leq n \leq 38$ ) was then taken after the original taster. The subsample ranged since 51% to 91% of the original sample, with the lower limit ensuring that at least 50% matching was detected while the upper limit was limited to 90% to prevent a case of whole identical. Lower proportions of the lower bound, however, might be relevant for future research. The  $n$  subsample is known as the harmonized or reserved units "m" when sampling occurs twice. It suggests that  $n = m$ . Yet, sampling twice demands taking  $n'-m$  new elements independent of the early sample in command to estimate incomes and totals. On the another instance,  $n'-m$  units are denoted to as the matchless units.

Occupancy  $\lambda$  besides  $\lambda'$  be the measurement corresponding (subsample) and unrivaled (novel units) individually,

Then  $\lambda_n = \frac{m}{n}$  and  $\lambda_{n'} = \frac{n'-m}{n'}$  holds.

Seeing the altered variance estimators aimed at the change estimators of these specimen techniques by common rudiments (Oshungade 2014), The modifications of the estimators on behalf of double sample on behalf of regression then proportion are assumed in eq.1 & eq.2 correspondingly though eq. 3 is the estimator on behalf of the modification of specimen on successive junctures. This study is a postponement concentrating on the practical circumstances where the adjustable of interest is recognized or expected to exhibit a exact supply decoration.

$$V(y'/r) = \left(\frac{N-m}{Nm}\right)S_{ym}^2 + \left(\frac{n'-m}{n'm}\right)S_{my}^2(1-\rho_m^2) \quad (1)$$

$$V(\bar{y}'_r) = \left(\frac{N-m}{Nm}\right)S_{ym}^2 + \left(\frac{n'-m}{n'm}\right)R_m^2 S_{my}^2 - 2R_m S_{my} \quad (2)$$

$$V(\mu) = \frac{(1-\rho_m^2) S_m}{(1-\rho_m^2 \theta^2) m} \quad (3)$$

Including the languages for  $\lambda_m$  and  $\rho_m$  eqn. 1, eqn. 2 & eqn. 3 thus develops eqn 4, eqn. 5 and eqn. 6 correspondingly on the illness that the determinate population improvement factor



is tiny.

$$V(y'/r) = \frac{S_{ym}^2}{m} \{ 1 + (1 - [\lambda][\rho]) (1 - \rho_m^2) \} \quad (4)$$

$$V(\bar{y}'R) = \frac{1}{m} [S_{ym}^2 + (1 - [\lambda][\rho]) [R_m^2 S_{mx}^2 - 2R_m \rho_m S_{mx} S_{my}] \quad (5)$$

$$V([\lambda][\rho]) = \left\{ \frac{1 - \rho_m^2 (1 - [\lambda][\rho])}{1 - \rho_m^2 (1 - \lambda^2)} \right\} \frac{S_{xm}^2 + S_{ym}^2}{2m} \quad (6)$$

The estimators stated overhead clearly bare the familiarity of the specimen methods mutual citizens such as  $\rho_m$  and  $\lambda_m$  which play key characters in estimating actions of exactness. Aimed at the determination of this study  $\rho_m$  is immovable at 0.25, 0.5 and 0.75 to characterize cases wherever the connection is low, modest and high correspondingly.

### 3. Data Analysis

This piece grants the outcomes of subtractions carried out via using the adjustment estimators of the sampler methods consequent in the preceding section to attain the standard boo-boo of guesstimates. Having caused the data via simulation, trials are drawn at numerous values of  $\lambda$ . The example size depends continuously the worth of  $\lambda$ . Table I shows a the normal error of approximation at numerous  $\lambda_s$  ( $0.50 \leq [\lambda][\rho][\lambda][\rho][\lambda]$  0.090) through 0.05 interval among sequential  $\lambda_s$  aimed at the event of normally circulated facts while Table II demonstrations the ordinary error of evaluation aimed at a skewed statistics of the gamma delivery pattern. Too, three fixed associations  $\rho_m=0.25, 0.50, 0.75$  are selected. This is to detect the behaviors' of the sample approaches on behalf of the bags of distributions careful as the standards of  $\lambda$  and  $\rho$  change. Reversion and relation estimators were considered aimed at double sample. The three association constants were selected to represent the numerous potentials of low ( $\rho_m=0.25$ ), middle ( $\rho_m=0.5$ ) and great ( $\rho_m=0.75$ ) associations.

Additional so, it has remained recognized that ratio and reversion estimators determination be restored than a modest random specimen (SRS) after  $\rho_m=0.5$  (Cochran, 1977). In consecutive sampling by partial corresponding, the efficacy determination be contingent on the association between the coordinated units. As specified previous, the value of  $\lambda$  shows the proportion of matched taster " m". For instance,  $\lambda= 0.5$  earnings half of the first sample remained retained



or subsample. That is, if  $n' = 40$  and  $\lambda = 0.5$  such that 20 units of the first sample  $n'$  stood retained on another time.

4. Results:

On behalf of normally disseminated data cases, as publicized in table I, precision often rises as the values of and rise, but for  $\lambda = 0.90$  at all ideals of the connection coefficients taken into account, the correctness tends to fall. This might be seen from the rise in the estimate's standard fault when associated to the result immediately before it, or when  $\lambda = 0.85$ . In connection to the distribution decoration the adjustable of interest displays, there are precision preferences for the sampling techniques. From the table, it can be inferred that double sampling for regression, when all correlation coefficients are taken into account, has the maximum precision for a normally distributed dataset. Also, the competition for the second spot in the rating is strong in terms of values and fixed ideals of meant for skewed scattered figures.

Table 1: intended standard inaccuracy of approximation at numerous  $\rho_s$  and immovable values of  $\lambda_s$  for normal dispersed statistics

% Matched Sample	Sample Size $n$	$\rho_m$	Double Sampling		Sampling on Successive Occasion
			Regression	Ratio	
50	20	0.25	153.8568	244.1737	186.3850
		0.50	146.2170	218.6299	202.9332
		0.75	132.5204	187.7888	186.3703
55	22	0.25	142.6911	216.5267	171.0968
		0.50	136.3565	194.4195	166.7663
		0.75	125.0880	169.5409	158.3324
60	24	0.25	132.4803	207.2054	169.7448
		0.50	167.2829	187.8148	165.6141
		0.75	118.1136	165.1769	157.8490
65	26	0.25	130.7945	196.9045	167.7284
		0.50	126.3360	179.5781	163.9233
		0.75	118.5179	160.3906	156.9123





70	28	0.25	122.8869	177.3591	157.4218
		0.50	119.3126	162.8935	154.1552
		0.75	113.5049	147.0114	149.5429
75	30	0.25	116.9485	162.1147	127.1532
		0.50	113.9348	150.1321	148.0868
		0.75	109.0842	137.1062	145.2006
80	32	0.25	118.4738	152.2165	147.0536
		0.50	116.3006	142.3632	144.7797
		0.75	112.4000	131.7752	140.8281
85	34	0.25	113.6493	132.5977	139.9849
		0.25	116.6472	132.5977	140.3981
90	36				
		0.50	115.5415	127.4537	139.1996
		0.75	113.6748	122.0931	137.1822

It can be detected that for  $\lambda = 0.50-0.65$ , sampler on binary events drinks a well exactness than binary sampling aimed at ratio at altogether values of  $\rho$ . This ranges for  $\lambda = 0.75$  and  $\rho = 0.25$ . Then again on behalf of these similar values of  $\lambda$  at  $\rho=0.75$ , dual sampling aimed at ratio has advanced exactness than sampling on binary occasions. Too, table 2 demonstrations the consequence of examination aimed at a positively skewed delivery, it might be inferred that the exactness rating is sovereign of the standards of  $\lambda$  then  $\rho$ . Sampling on dual cases receipts the lead ended double sampling together aimed at deterioration then ratio estimators crossways completely values of  $\lambda$  and  $\rho$ , tailed through twofold sampling aimed at deterioration while twofold sampling aimed at proportion eats the slightest care.



**Table 2: Standard mistake of guesstimate at many  $\rho_s$  and fixed values of  $\lambda_s$  for tilted distributed statistics**

% Matched Sample	Sample Size $n$	$\rho_m$	Double Sampling		ng on Successive Occasion
			Regression	Ratio	
50	20	0.25	19.2148	21.6832	16.2985
		0.50	18.2615	19.4163	15.8723
		0.75	16.5509	16.8471	15.0252
55	22	0.25	20.5163	22.9600	17.4287
		0.50	19.6628	20.7687	16.9848
		0.75	18.0379	18.3172	16.1279
60	24	0.25	20.5137	22.6342	17.3558
		0.50	19.7089	20.6854	16.9332
		0.75	18.2890	18.5328	16.1393
65	26	0.25	20.2315	21.3617	17.1118
		0.50	19.5512	20.0108	16.2125
		0.75	17.2021	18.3685	15.6182
70	28	0.25	18.3839	19.8165	15.5191
		0.50	17.8492	18.4981	15.1973
		0.75	16.9206	17.0782	14.6184
75	30	0.25	17.5006	18.6407	14.7606
		0.50	17.0789	17.5911	14.4903
		0.75	16.3518	16.4748	14.0131
80	32	0.25	16.6387	17.5086	14.0237
		0.50	16.3198	16.7074	13.8068
		0.75	15.7738	15.8658	13.4299
		0.25	15.7479	16.3671	13.2655



85	34				
		0.50	15.5228	15.7964	13.1035
		0.75	15.1401	15.2042	12.8559
		0.25	15.5802	15.9898	13.1183
90	36				
		0.50	15.4325	15.6119	13.0081
		0.75	15.1831	15.2228	12.8161

### 5. Conclusion:

There is a bound at which the inkling of taking a sample styles sense, and it tin be seen that in general the meticulousness of the estimators grows when the figure of subsample units increases on a second instance. The subsample's size cannot, in this instance, be greater than 85% of the original sample. However, because double sampling for ratio estimators appears to have the lowest precision rating among the three types of distributions taken into consideration, samplers should avoid using them for analytical purposes due to computational difficulties. Also, double sampling for regression should be employed if the sampler is aware that the adjustable of notice is generally distributed, whereas sampling twice should enough for positively skewed (Gamma) distribution scenarios. This might apply to skewed distributions with a comparable skew.

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