Course Name- B.A. (Hons.) Economics

Paper Name – Data Analysis

Paper No. : Skill Enhancement Course (SEC)

Module No. 4

Module Title
Population and Sample: Merits and Demerits

Academic Script

Hello dear students, welcome to the course Data Analysis. Topic for today's discussion is- 'Population and Sample: Merits and Demerits'.

Objectives of the Module:
The main objectives of the module are:

1. To outline the notion population and sample.
2. To delineate merits and demerits of population and sample.
3. To discuss the uses of sample.
4. To converse over phases of sampling project.

Introduction: One of the important requirements of data analysis or data science discipline is the accessibility of trustworthy information or data on various indicators related to research problem under study. Data may be used for developing the theories, for formulating the socio-economic policies and evaluation of these policy programmes on the targeted population. Therefore, it is imperative to gather the information in a more scientific way, which will ensure that the information obtained is reflexion of the necessary characteristics of the concerned group(s). Data can be obtained from either of the source i.e. primary or secondary. Sometimes, secondary data is not available on the particular research areas. For conducting research in such fields, researcher has to collect the information himself. Now, the problem crop up is - whether to choose census/population approach or sample approach to collect the information on the required variables. Under census approach of data collection, data is collected for entire population related to research problem, while under sampling approach, survey is conducted on few selected units or items with a perspective that they will represents the whole population. So, in this module, we will discuss on the two important methods of data collection i.e. population and sample along with their advantages and drawbacks.

Population Approach

Population method is also known as census method, universe approach and complete enumeration survey method. Under this approach, data is gathered for entire set of objects or items, here objects refers to either persons or households or schools or hospitals etc. depending on the subject of the study. In other words, under census approach, information is collected for each and every item under consideration of research problem. In statistical methods, the term universe or population simply implies the aggregate or whole from which

the sample has to drawn. Thus, the totality of elements which are under discussion and about which information is desired will be called the population. We can distinguish population from sample by taking an example. Suppose that 5000 employees are working in a steel mill, researcher is interested to compute the average wages of the workers. For this purpose, either he can resort to census method or sample method i.e. either he can collect the information from all the 5000 workers and then divide it by 5000 and he will get the average wages of the workers per month. Another option is to select some of the employees and find the average out of them. Former is subject matter of population approach, in which each and every item is studied, while later is part of sampling method, under which few selected items are studied. Another important example of population method is the data collected on population by every country.

Finite and Infinite Universe or Population

Population under study can be either finite or infinite depending on the situations. However, a finite population implies the fixed set of items or when number of items is determinable. In the examples discussed earlier population is found to be finite. On the other side, when the number of items or objects are not fixed or not determinable then it referred to as the infinite universe or population. Examples of infinite universe are number of stars in the sky, number of leaves on a tree etc.

Merits of Population Method

1. One of the major advantages of population method is that each and every item is studied under this approach.
2. Statistical results obtained from this data are found to be more precise and representative.
3. This method provides suitable grounds for conducting research in some specific areas like for measuring the exact area under particular crops and yield from it, for collecting data on population of country, segregation of population by gender, age, area (rural – urban) etc.
4. Data collected through this approach provides the basis for conducting the sample based studies. E.g. usually, researchers take help of the census data for selecting the sample, which will be more representative.

Demerits of Population Method

1. Population method is not so common in practice, as it requires huge amount of funds, time and efforts on the part of research conducting agency.
2. In case of underdeveloped or poor countries, there is shortage of money as well as skilled man power, thus this method is not useful for such nations.
3. If the universe under study is of infinite nature then definitely it will lead to distortions in the evaluation procedure and hence units of universe.

Sample Approach

Sample is actually a component of population or universe and sampling is a procedure through which, we learned about the features of population on the basis of sample. Therefore, under sampling method rather than investigating each and every element of universe, only a portion is considered and further results are computed for the whole population on the basis of this sample. In short, sample is a subset of population. Sampling technique is composed by three important steps i.e. selection of sample, gathering the data and finally deriving some important results or inferences for the universe or population. These components of sampling are inter-connected with each other. Selection of sample is undertaken under certain conditions and norms, which further describe the procedure of enumeration.

Sampling method is not a new technique; rather it is one of the popular methods among the common people. For instance, when rice are boiled, a few grains are taken to check whether they are fully cooked or not, similarly while selling the wheat or any other grain, quality is checked by taking handful of grains as a sample from the full lot, for checking the intelligence level of students of particular class a few students are selected by the teacher, for quality checks of the final product few items are selected at random by the businessman etc. So, these are some of the examples, which reflect the use of sampling method by layman without involving any complex statistical method for selection of sample. But for conducting formal research studies, researcher has to learn the procedure of sampling or various methods of random and non-random sampling (this will be discussed in the next modules).

The basic reason behind sampling is to make inferences about universe or population. So, sampling is an instrument, which assists us in capturing the features of population by exploring the subset or small portion taken out of population. Statistical results computed from sample about population are termed as statistics, while results obtained from population refers to the parameters.

Since sampling is perceived as a method of collecting data and interpreting it. In this context there are two objectives of sampling, which needs attention on the part of learners. First objective, which is considered as immediate objective in sampling is not to explain the sample but to employ it to compute the relevant characteristics of the population from which it comes. Second objective, which is ultimate objective of sampling is, help in providing the solution of problems occurring in applied areas of economic and business research.

Use of Samples: Method of sampling is most useful in economic and business research. Uses of sampling are –

1. **When only sampling is possible**: In case of industrial products, quality check is possible only through sampling process. Because it is not feasible and moreover not suggested to check each and every unit of production because products are destroyed in the quality check procedure. In such cases, a small portion of the output is scrutinized to check whether the process of production is under control or not. That is whether the quality of the product is within the accessible limits or not. Thus, whenever the universe seems to be of infinite nature, sampling is considered as the best way to know the characteristics of universe.

2. **Only Practical Method**: Although population is not always infinite, but many a times it consists of the thousands or millions of objects implying the large universe. Therefore, for large universe, sampling found to be more practical method of analysis as compared to the census method.
3. **Most Efficient Method**: Sometimes, it is physically and financially possible to collect the information for whole population, but there is no need to do so. Because the statistics drawn from sample are usually reliable, if the sample is selected properly. Thus, even smaller number of items selected under sample with greater level of accuracy will give the better statistical results as compared to the complete enumeration of population.

Essentials of Sampling: For deriving the useful results, sample must possess essential features like –

1. **Representativeness**: Items or objects under sample should be chosen in such a manner that it reflects all the characteristics of the population or universe; otherwise the statistics drawn from faulty samples will be faulty. Moreover, random sampling techniques should be used while choosing the items under sample.
2. **Adequacy**: Number of items constituting the sample should be sufficient enough that all the features of population are reflected by sample.
3. **Independence:** It means selection of one item does not affect the selection of other items in the sample. Otherwise, problem of correlation will crop up in the statistical results, which will reduce the reliability of the results. Best solution to avoid such situation is the use of random sampling technique.
4. **Homogeneity**: Here the term homogeneity refers to same items or units or items with same features. If two or more samples are drawn from the same set of population then they must produce similar results with little variations i.e. feature of homogeneity should hold.

Merits of Sample Method: Some of the positive points of sampling method over the census method are –

1. **Less time consumption**: As compared to population studies, sample based studies requires less time because sample is just part of the population. Thus, in case of sampling method time is saved in terms of data collection as well as data processing.
2. **Cost Saving**: Sample method is cost saving too, as the financial resources required for conducting sampling are lesser than those required for census. On the basis of this merit, it is usually suggested in under developed countries to carry out the sample based studies as these countries suffers from the paucity of the funds.
3. **Reliable Estimates**: If the sample is selected by following the proper formulas then it will provide us accurate and reliable estimates, which may be further employed in policy making process.
4. **Wider Information**: Since sampling method offers the advantage of saving of time and cost, thereby it is easy and viable to collect the vast information from the respondents. For instance, NSSO usually provides extensive information on the

various aspects like data collected on employment and unemployment constitutes the information on occupation status as well as on the consumption expenditure, assets owned by a person etc.

5. **Check of Accuracy and Reliability**: Sometimes sampling technique is used for verifying the accuracy and reliability of the information gathered by complete enumeration method.

Demerits of Sampling Method: Although sampling is easier than census method, still it suffers from certain drawbacks such as –

1. **Requires Expertise**: Sampling requires lots of efforts and expertise on the part of investigator. In absence of these aspects whole sampling procedure will result in misleading outcomes.
2. Probability of sampling errors is associated with sampling method.
3. In case of large samples, money, time and other resources are required to execute the sampling project, which is sometimes not feasible for individual researchers.

Phases of a Sampling Project

Now we will focus on the different phases of sampling project i.e. how the sample is selected, what are the different steps involved from sample selection to interpretation of results drawn from sample. Various phases of sampling project are –

1. **Rationale of Project:** First of all, we have to decide the justification behind the sampling project, then analysis of research problem, what will be carried out in other stages, which kind of data is required, sample design, statistical methods employed for computation of results etc. All these issues have to be addressed in first phase of the sampling project.
2. **Sampling Plan:** It is particularly related to the description of procedures by which the items or objects of sample will be chosen. If the research is undertaken on the basis of interview of the sampled persons then in that case, researcher has to prepare the questionnaire and instructions manual for collecting the required information. Thus, sampling plan includes the preparation of questionnaire and instructions, their pre-testing and training of the investigators.
3. **Operation of the Sampling Plan**: This phase is related to the execution of the sampling plan i.e. actual selection of the items from population and collection of data from them. Researcher must pay greater attention to this phase otherwise it will lead to faulty outcomes.
4. **Data Processing**: After the collection and data editing part, information has to be processed so that basic and useful results can be obtained. Data processing includes the simple arithmetic operations on the data, which will actually result in statistical description of the sample.
5. **Statistical Inference**: Under this phase, statistical results drawn from sample are compared with the features of population for checking the reliability of the estimates.

6. **Statistical Analysis**: In statistical analysis phase of sampling project, analysis of estimates is to be undertaken. In simple words, policy implications are drawn from these findings, which are relevant for the policy makers and development practitioners.

So these are different phases or steps of conducting the sampling project successfully.

Conclusion: To sum up, in this module, we have covered the basics of population and sampling methods. Population method is concerned with the study of each and every item or object of the universe, while sample is concerned with the study of part of universe. Population under study can be either finite or infinite depending on the purpose of the research problem. Finite population implies the case of fixed number of objects, while infinite refers to the situation when we can't count the number of objects under study like grains, leaves on tree etc. Each method has its own importance, like population method is used under census of population or vital statistics, whereas sample method is used almost in every field. Requirements for a sample to be considered as the best are representativeness, adequacy, homogeneity and independence. If these essentials are satisfied then sample will produce more accurate and reliable results.

So, this is all about today's lecture. Hope you have learned about this topic in an easiest way.

Thank you very much for listening us.