Reliability and Validity of Statistical Survey Quality Evaluation

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Keywords: Statistical Survey; Investigation Statistical; Quality Evaluation

Abstract. The data obtained from statistical investigation mainly include various data, occurrence, and the relationship between each other, as well as the comprehensive conclusions and opinions of the investigators. The determining factor of whether the statistical analysis conclusion is correct is the quality of the statistical investigation. Based on this background, the main purpose of this paper is to study the quality evaluation of the main statistical survey, the relationship between the reliability and validity of the quality evaluation of statistical survey, and to grasp the correct method, so that the statistical survey work can play its own value and role. The research idea of this paper is to analyze and summarize the relevant data obtained from the statistical investigation of specific cases, so as to understand the thought and behavior habits of the respondents, and whether the respondents are consistent with the survey results. It is found that the relationship between reliability and validity is proportional. When the reliability evaluation value is 98.16% and the coincidence index is 94.72%, it means that the data survey results are consistent and both reliability and validity are valid. When the reliability evaluation value is only 47.17% and the coincidence index is only 53.82%, it indicates that the survey results are neither credible nor valid. In this paper, the results of the survey show that statistical investigation is the premise and basis of statistics and analysis, we in statistical investigation work to correctly grasp the good reliability and validity of statistical investigation data, the relationship between achieve a higher reliability and higher validity is a high quality, to ensure survey data accuracy, and make investigation statistical work to increase credibility and the development of science and health.

1. Introduction

Whether the data obtained from the statistical investigation are in line with the objective reality and to what extent they are in line with the reality directly indicate the quality of the statistical investigation, and the results of the statistical investigation also guide and determine people's attitudes and views on a certain research problem [1]. However, there are more and more lack of standard investigation methods, and those survey data and conclusions that seem to conform to the rules on the surface are hiding fatal fallacies [2]. Such findings not only mislead people's views on the research question, but also undermine the rigour of scientific research [3]. Therefore, how to improve the quality of statistical investigation is not only a performance of respecting facts and science, but also a quality that all researchers should have [4]. To improve the quality of research, it must involve the reliability and validity of quality evaluation.

In the evaluation of statistical survey results, the two most important concepts are reliability and validity [5]. To ensure the high standard of investigation quality, it is necessary to ensure the excellent reliability and validity of investigation results [6]. Previous scientific studies have made a lot of elaboration on the reliability and validity of survey quality evaluation. In literature [7], the author doubts whether the survey tool can accurately reflect the investigator's will, believing that when the survey time, place or object changes, the survey results will be affected by non-objective factors. In literature [8], the author emphasizes that the specific way of conducting the survey, the respondents and even the difference in the survey time will affect the reliability and validity of the questionnaire. In the literature [9], the author frankly says that reliability and validity are the most concerned questions for researchers when conducting questionnaires. In the literature [10], the

author believes that in order to effectively ensure the level of reliability and validity, the indicators selected in the survey, the scale score range and the scale content range should be described in detail.

In the existing literature, there is a general lack of description on whether the investigation method itself is defective, and there is no doubt on whether the investigation sample is representative and the rationality of the sample extraction method. Therefore, the reliability and validity of the questionnaire may be affected by the intervention of researchers' own level or subjective factors during the operation of the survey method. This study believes that the lack of criticism of existing studies is caused by the fact that each researcher gives a reasonable description of the investigation method he USES, but neglects the defects of his own investigation method.

Therefore, based on the classical measurement theory, this study discussed the advantages and disadvantages of the reliability and validity test methods of survey quality, as well as various matters needing attention during the test. This study also analyzes the factors affecting reliability and validity based on specific cases, discusses the conditions of reliability and validity test and the scope of reliability and validity test.

2. Overview of Reliability and Validity of Statistical Survey Quality Evaluation

2.1. Reliability and validity

The so-called reliability is often referred to as the credibility of statistical investigation results, which means that after many investigations and analyses, each result is close to the uniform standard. When the results of multiple surveys are basically similar, we can assume that the statistical survey has a high reliability. In other words, the smaller the difference between the results of multiple surveys, the better the credibility of the survey results. When the results of multiple surveys fluctuate greatly, the credibility of the survey results is low.

Validity refers to the extent to which survey tools or methods can accurately reflect the objective appearance of things. It refers to the judgment of whether the investigation result is consistent with the ideal result before the investigation. According to different evaluation criteria of validity, validity can be divided into three main parts: structure, criterion and content.

2.2. The relationship between reliability and validity of quality evaluation of statistical surveys

The purpose of reliability evaluation is to prove effectiveness, and validity is also one of the conditions for objectivity of reliability. Therefore, it can be considered that reliability and validity are closely related but fundamentally different in nature. The relationship between the two can be summarized as follows.

(1) Reliability is directly proportional to validity

The reliability and validity are directly proportional to the index. The results of the survey not only have high credibility degree, but also verify the ideal results. Reliability is proportional to validity and also includes cases where both reliability and validity lack validity. For example, in a survey, the total index of data evaluation is 1. The survey finds that the reliability evaluation value of the data investigation event is 98.16% and the coincidence index is 94.72%, which means that the results of the data investigation are consistent and both reliability and validity are valid. On the contrary, if the reliability evaluation value of the data investigation event is only 47.17% and the coincidence index is only 53.82%, it indicates that the investigation results neither lack credibility nor exist validity, so the investigation results are not objective. This is also the reason why we analyze both validity and reliability when conducting survey quality evaluation.

(2) Reliability and validity are interdependent

Assuming that the total index in the data survey is 100% and the reliability result of the data survey is 36.00%, we can preliminarily infer that the validity of this survey will not have ideal value based on the reliability result. Because the credibility of data evaluation is not enough, it will not only lead to the deviation between the investigation result and the evaluation result, but also lead to the decrease of the credibility. On the contrary, assuming that the reliability result of the data survey

is 98.50%, we can also make a judgment based on this and think that the credibility of the data survey is also relatively high.

3. Simulation Survey

3.1 Validity simulation survey

In the simulation survey, the study conducted a random sampling of the same population for 60 times, and simulated the survey for each sample, so as to achieve the direct real response to the simulated survey scene and calculate the results. In the simulated survey, the average level of the results of the direct real response simulated sampling survey was taken as the criterion. Chi-square test of composition distribution comparison between the results of the simulated sampling survey and the proportion of the criterion was conducted under 60 times of cluster sampling respectively. SPSS 23.0 was used to calculate and obtain the accurate P value.

3.2 Reliability simulation survey

The reliability evaluation index of this simulation survey refers to the reliability coefficient (r_{xx}). Generally, the variance of the error value (S_E^2) and the variance of the measured value (S_X^2) are expressed as:

$$r_{xx} = 1 - S_E^2 / S_X^2 \tag{1}$$

The parallel test model is the main theoretical basis for estimating the reliability coefficient. The ideal parallel measurement tool does not exist in practical work, so the application scenario of the formula is not all-purpose. When practical operability is not available, other methods can be used to indirectly evaluate reliability.

4. Results and Discussion

4.1 Simulation survey results

(1) Validity evaluation

The P values of 50 simulated cluster sampling survey results compared with the proportion of criteria are shown in Figure 1 and Table 1. Response information from the chart, simulation investigation results compared with norms of 60 time inspection in only 1 P value is less than 0.05, 59 of the inspection results of the samples can be thought of the proportions of the classification and standards classification, simulation research method in this study and its statistical formula can correctly estimate the overall level, has the very high validity.

Table 1. P values compared with the proportions of cluster sampling simulation survey results and criteria

Serial number	P values	Serial number	P values	Serial number	P values
1	0.0914	21	0.0589	41	0.0608
2	0.0728	22	0.0564	42	0.084
3	0.079	23	0.0607	43	0.0658
4	0.0982	24	0.0623	44	0.0868
5	0.0807	25	0.0575	45	0.0881
6	0.0606	26	0.0518	46	0.0896
7	0.0992	27	0.072	47	0.0783
8	0.0516	28	0.0943	48	0.0979
9	0.0971	29	0.0443	49	0.0503
10	0.0749	30	0.0551	50	0.0651
11	0.0672	31	0.0964	51	0.0557

Serial number	P values	Serial number	P values	Serial number	P values
12	0.0853	32	0.0949	52	0.0943
13	0.0792	33	0.0589	53	0.0952
14	0.0646	34	0.0723	54	0.0857
Serial number	P values	Serial number	P values	Serial number	P values
15	0.0758	35	0.0657	55	0.078
16	0.0937	36	0.0583	56	0.0511
17	0.0588	37	0.0745	57	0.0538
18	0.0515	38	0.0929	58	0.0721
19	0.0845	39	0.0813	59	0.0699
20	0.0932	40	0.057	60	0.0951

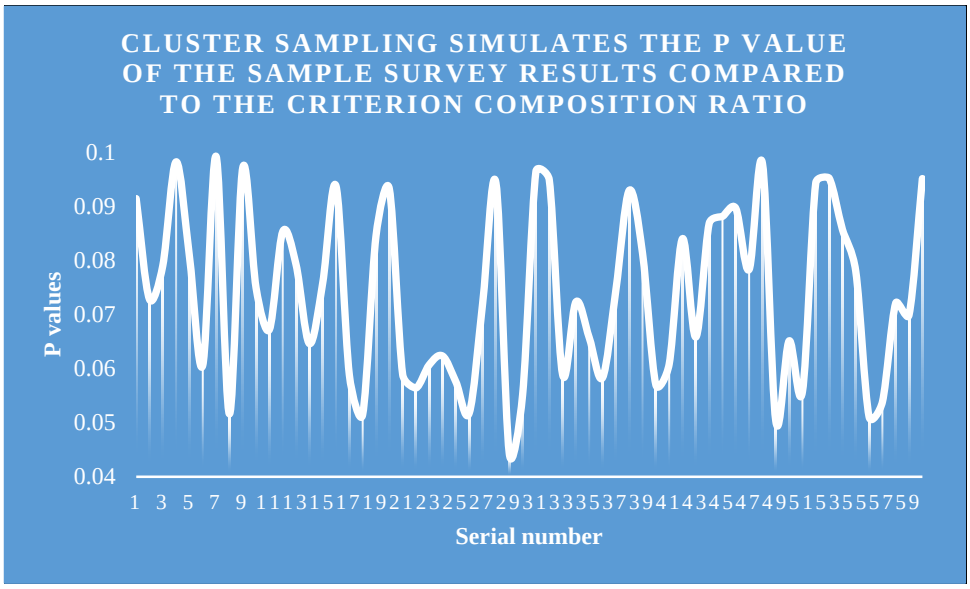

Figure 1. P value of cluster sampling simulation survey results compared with criterion composition ratio

(2) Reliability evaluation

From the evaluation results showed that the reliability and validity of simulation sampling survey results and standards of 60 time only 1 P values of hypothesis test is less than 0.05, 59 hypothesis testing results of the samples can be thought of rule of classification ratio and the difference is not significant, can be thought of 59 simulation investigation result is close to the same level, this study also simulate the investigation method and the results of the statistical formula is very stable, has the very high reliability.

4.2 Strategies to strengthen the reliability and validity of statistical survey quality evaluation

When conducting statistical analysis of quality evaluation, the validity and reliability of quality evaluation should be comprehended, which can also be summarized into the following two basic aspects.

(1) Positioning the survey quality evaluation standard

The positioning of survey quality evaluation standards means that in the process of statistical analysis, the analysis standards of the reliability and validity of the data survey must be clarified, and a normative and systematic data statistical system must be established. It is assumed that in the statistical processing of social survey data, the investigators will ensure the accurate grasp of the quarterly operating conditions of an enterprise and make the survey results reliable. Then the necessary steps must include: first, the survey data of enterprises in the region in recent years should be widely collected, and the collected data should have the value of index evaluation; Secondly, within the survey area, it is necessary to randomly select other relevant industries or

upstream and downstream enterprises and conduct a survey one by one to obtain the real business data of these enterprises. Finally, the statistical reliability and validity are evaluated according to the real data obtained. It is emphasized that before the acquisition of social survey data, the external environmental standards of survey data analysis should be established by fully combining relevant industries and fields, which lays a good foundation for the validity analysis of data survey. At the same time, it also emphasizes the acquisition of relevant enterprises' actual business data information, in order to conduct a logical induction of its practical operation. Only such investigation quality evaluation standard can meet the requirements of comprehensive analysis and exploration, and it can be used as the standard of reliability analysis of data investigation quality evaluation.

(2) Scientific reliability and validity analysis

To ensure the quality and accuracy of survey data, we need to rely on professional and scientific methods of reliability and validity of survey data. Suppose M city recent plan to carry out a social investigation on urban health quality evaluation, so during the actual survey, investigators in addition to avoid giving the respondents to cause the attention of the psychological feeling, also should be with the help of the professional data analysis system, bring the investigators themselves for what is in the process of investigation to their own subjective evaluation to give out. Virtual simulation and data analysis software can be used to evaluate the reliability and validity of the health survey data in this city to ensure that the statistical quality of data conforms to professional scientific standards.

Conclusion

In the process of statistical survey quality evaluation, the most important evaluation concepts are reliability and validity, which are the main points of statistical management and provide guarantee for real data restoration. The relationship between reliability and validity is interrelated but differentiated. To ensure the quality of statistical investigation results in line with objective facts, the evaluation results of reliability and validity must be highly consistent, which is also the fundamental principle of value theory to ensure that all investigation and statistical work can give full play to its due value. It can be said that investigation and statistics work is the premise of data collation and analysis, and the quality of investigation and statistics is directly related to the correctness and value of statistical analysis conclusions. Therefore, we must explore the reliability and validity of statistical survey quality evaluation in advance, correctly grasp the relationship between the reliability and validity of statistical survey data, achieve the unity of reliability and validity, and make the statistical work develop towards a healthy and scientific direction.

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