Comparative Studies on Survey Sampling Bias in Cross-cultural Social Research

Yuejun Zheng
Faculty of Culture and Information Science, Doshisha University, Kyoto, Japan
e-mail: yzheng@mail.doshisha.ac.jp

Abstract

Social statistical studies have demonstrated that different sampling techniques can cause diverse biases toward the response results of cross-cultural survey. However, the unification to sampling methods in all countries is almost impossible because the sampling frame which includes all individuals of the target population does not necessarily exist in each country. This paper will discuss the intensity of impacts from the representative sampling approaches such as multi-stage sampling, stratified sampling, area sampling, quota sampling etc. which have been widely used in most cross-cultural surveys. Main statistical analyses have been carried out using the survey record data collected from two large-scale cross-cultural surveys. The important findings have shown that the non-probability sampling is a convenient approach in most situations, but it often causes a significant bias toward the sample unit drawing and an arbitrariness of individual selection for the face-to-face interview with the cross-cultural context. Sampling operations on decreasing the non-sampling error will also be demonstrated based on the real survey results.

Keywords: Cross-national comparison, Sampling error, Non-sampling error, Multi-stage sampling, Area sampling, Nonresponse, Statistical survey

1. Introduction

In the past decades, cross-cultural research with the comparative context has become into an essential approach to providing the necessary information for decision-making in all fields of social sciences. In particular, statistical cross-cultural research is applied widely in the sociology, psychology, economics, political science etc. There are two important principles that must be observed for conducting a statistical cross-cultural survey: comparability and equivalence. Comparability means that data organization methods and measurement scales must be with temporal and spatial constancy. On the other hand, equivalence requires that questionnaire must be accommodated to cultural diversity, and translated based on cultural context. Using the same questionnaire expressed in an equivalent manner in all relevant languages can provide a prerequisite for equivalence with cross-cultural surveys in the background of cultural diversity, but comparability can only be achieved through designing the reasonable sampling, precise instrument scale, and suitable conduction mode. In such a meaning, the establishment of a sampling technique in diverse societies, nations and cultures, is a fundamental and essential issue for statistical cross-cultural research, to guarantee the quality of survey data.

Several large-scale cross-national survey projects, such as International Social Survey Programme (ISSP) and the World Value Survey (WVS) are well known as the continuing surveys of cross-cultural collaboration on surveys covering topics important for social science research (Haller, 2010; Inglehart, 2010). Although the same questionnaire has primarily been adopted in all countries, the concrete sampling process was separately established for each country, depending on the access to population frame, such as multi-stage sampling, stratified sampling, area sampling, quota sampling etc.

The surveys on the Japanese national character is a statistical research project supported by Japanese governmental grant, and its aim is to capture the attitudes and

opinions of Japanese people, as well as their shifts over time (Nakamura, 2011). This survey project began in 1953, and since then a new installment has been introduced every 5 years, the 12th installment was conducted in 2008. These survey installments have been conducted with the same sampling methodology, using the same questionnaire items each time. The sampling technique in the in recent installments is as follow: After stratifying cities, towns and villages into 6 layers according to population scale, townships or streets blocks have been selected from each stratum with their probability of selection being proportionate to size. And then in consultation with the basic residents register from the selected township, street blocks, a number of individual samples assigned to that sampling point were selected through systematic sampling. This survey was one of the foundations of the public opinion survey system based on the statistical sampling theory in Japan. In other words, the public-opinion polls in Japan has begun based on a statistically ideal sampling using the resident register whereas the other countries have to use other methods such as quota sampling or random-route sampling.

Since 1970s, the survey on national character has been extended to a cross-national comparative study for more advanced understanding of Japanese national character (Hayashi, 1973). The focus of this project is the investigation of the statistical comparison of peoples' social values and their ways of thinking and feeling. More explicitly, our concern has been with cultural identities and people's attitudes toward economy, freedom of speech, interpersonal relationships, leadership, politics, public acceptance of science and technology, religion, social security, etc. These aspects may clarify certain similarities or dissimilarities that are represented by psychological distances between countries or races in certain statistical pattern analyses of responses (Yoshino, 1992).

This paper focuses on analyzing impacts from the representative sampling processes in cross-cultural researches. The survey record data collected from three large-scale cross-cultural surveys including the East Asia Value Survey (2002-2005), the Pacific-Rim Value Survey (2005-2008), the East Asia Environmental Consciousness Survey (2009-2011), and the Asia-Pacific Values Survey (2010-ongoing) are mainly used for making comparison on biases derived from the different sampling techniques.

2. Research methods

In large-scale cross-cultural researches, it is difficult to standardize the method for selecting individuals in all countries and cultural spheres. In most survey projects, different sampling techniques have been adopted in survey countries since the beginning of its history, and yet the sampling processes may differ according to the conduction year. The strict probability sampling such as simple random sampling, systematic sampling, multi-stage sampling, stratified sampling, or stratified multi-stage sampling has been employed only in small number of countries like England, German, and Japan. Multi-stage area sampling or quota sampling is widely employed in the most countries. In order to figure out the biases between different sampling techniques, this study concentrates on the two comparative analyses based on real surveys as follows.

2.1 Surveys based on random sampling and area sampling in Japan

In this research, two experimental surveys in which random sampling based on the basic resident register (Survey 1 hereafter) and area sampling based on the housing maps (Survey 2 hereafter) were conducted from December 2005 to January 2006 in Tokyo. In both of surveys, the population was defined as the adults (from 20 to 79 years old) living in 23 wards of Tokyo, and the data collection focusing on consciousness about daily life and culture, using a questionnaire that includes 44 question items and 9 demographic attributes, were conducted with a face-to-face interview (Zheng, 2007a, 2007b).

In Survey 1, a two-stage random sampling was employed as follows: As the primary sample units, 80 national census points (each point includes around 50 households) were drawn with probability proportional size (PPS) in proportion to the population scale in each ward. As the second sample units, 15 individuals were chosen from each primary sample unit using the basic resident register by a systematic sampling process.

On the other hand, a three-stage sampling based on street maps with scale from 1/3,000 to 1/1,500 was used in Survey 2. Although the method for drawing 80 national census points is the same as Survey 1, the second sample unit, household was chosen from the household list created based on the detailed housing map in which the resident name, building name, and address are clearly indicated. As the third sample unit, individuals were chosen by the birthday rule from the sample households selected from each survey point by an equi-interval sampling. The birthday rule means that the adult who celebrates a birthday early is selected as the individual sample in a sample household. Table 1 shows the basic information on sampling and completion rate in surveys.

Table 1 Sampling and completion rate of two experimental surveys in Tokyo

Individuals	Adults between 20-79 years old in Tokyo	
Survey type	Survey 1	Survey 2
Survey points	80	80
Sampling method	Two-stage random sampling	Three-stage area sampling
Sample size	1,200	560
Completed samples	525	539
Completion rate (%)	44	*32

*Since a regular completion rate is incalculable, it is a reference value.

2.2 Surveys based on area sampling and quota sampling in China

The social difference between urban districts and rural area is still significant in contemporary China, so the statistical surveys have been promoted mainly in the urban area. On the other hand, although there is a family registration system in China, it is difficult to access to the information in national wide, and consequently the development of sampling technique not relying on the resident information has become into an inevitable issue in the past decades. The first installment of East Asia Value Survey has been conducted in Beijing and Shanghai in 2002, a three-stage sampling was cautiously established by experimental survey (Zheng, 2003). As a country of the Pacific-Rim Value Survey and the Asia-Pacific Values Survey and the East Asia Environmental Consciousness Survey, the new installments were conducted in 2005 and 2011 in Beijing (Zheng,2007a; 2012). Because the success rate of home interview has abruptly dropped in recent years, we changed the sampling technique from area sampling to quota sampling in 2011. The biases regarding area sampling (Survey 3 hereafter) and quota sampling (Survey 4 hereafter) will be analyzed based on the data collected from the East Asia Environmental Consciousness Survey.

In Survey 3, the population was defined as the adults (over 18 years old) living in 8 central districts of Beijing. As the primary sample unit, 50 residents' communities were drawn using PPS in proportion to the population scale. The second sample unit is the household, and households were chosen by systematic sampling from each residents' community after drawing the housing map in the field. Finally, the interviewer has drawn the individual (the third sample units) from each sample household using Kish's random matrix. The substation of household samples was implemented by the next door rule in order to the completed sample size.

On the other hand, a two-stage sampling with quota sampling was adopted in Survey 4. The individuals in each residents' community were chosen by dividing population into male/female and five age classes (18-29, 30-39, 40-49, 50-59, 60- years old) after

drawing 100 residents' communities using PPS. The number of respondents from each category (e.g. male×18-29 years old) was calculated based on the proportions of population. The interviewer interviewed the quota of respondents directly from each specific category in field work. The information on sampling and completed samples is shown in Table 2.

Table 2 Sampling and completed samples of two surveys in Beijing

Individuals	Adults over 18 years old in districts of Beijing	
Survey type	Survey 3	Survey 4
Survey points	50	100
Sampling method	Three-stage sampling (Area sampling)	Two-stage sampling (Quota sampling)
Sample size	More than 1,000	More than 1,000
Completed samples	1,049	1,000

Questionnaire covers consciousness on daily life, culture and environmental issues. Both surveys were conducted by face-to-face interview. Data analysis focuses on clarifying the difference between Survey 1 and Survey 2 as well Survey 3 and Survey 4 from the viewpoints of sampling process.

3. Data analysis and results

Normally, the distribution of gender and age class in target population can be obtained from the census data, but there is no detailed information on other attributes. For that reason, comparing the distribution of education, occupation and household income in completed samples in these surveys is a mission in data analysis.

3.1 Comparison on random sampling and area sampling

From marginal distributions of demographic attributes such as gender, age class, education occupation, and household, it is possible to judge whether the characters of completed samples collected from different sampling techniques are the same. Figure 1 shows the marginal distributions of completed sample sets based on random sampling and area sampling.

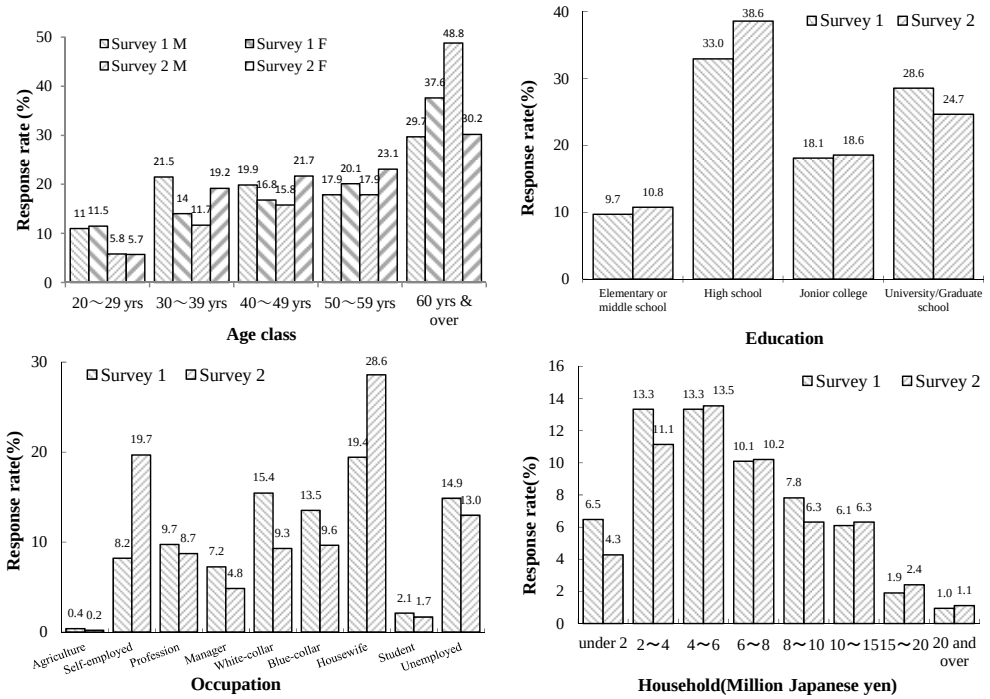

Figure 1 Distributions of demographic attributes on completed samples in Tokyo

Comparing with Survey 1, the following findings as for Survey 2 can be found from Figure 1: (1) Average age of respondents is higher and the younger people occupy less proportion; (2) More respondents with low education such as elementary, middle or high school; (3) Percentages of self-employed workers and housewives are quite higher; (4) few respondents with low household income less than 4 million yen.
The tendency in which the respondents in Survey 2 include more self-employed workers and housewives means the interviewer easily obtained their cooperation. In other words, the distribution of completed samples is sensitive to the at-home rate and implementation of a birthday rule. Since there is no record data for the operation process of choosing a sample individual by means of birthday rule, it is not easy to verify whether the interviewer used this rule to all household members eligible for population unit strictly.

3.2 Comparison on area sampling and quota sampling

Up to now, multi-stage area sampling is the best approach to social research in China, though it is not a perfect choice. This section concentrates on clarifying the distinction between area sampling and quota sampling. Figure 2 shows the distributions of five demographic attributes in tow completed sample sets collected by two surveys conducted in Beijing. Because Survey 3 and Survey 4 were conducted in 2005 and 2011, respectively, it is assumed that the social situation and economic conditions changed to some extents. This possibility implies that it is necessary to analyze the difference between both surveys cautiously.

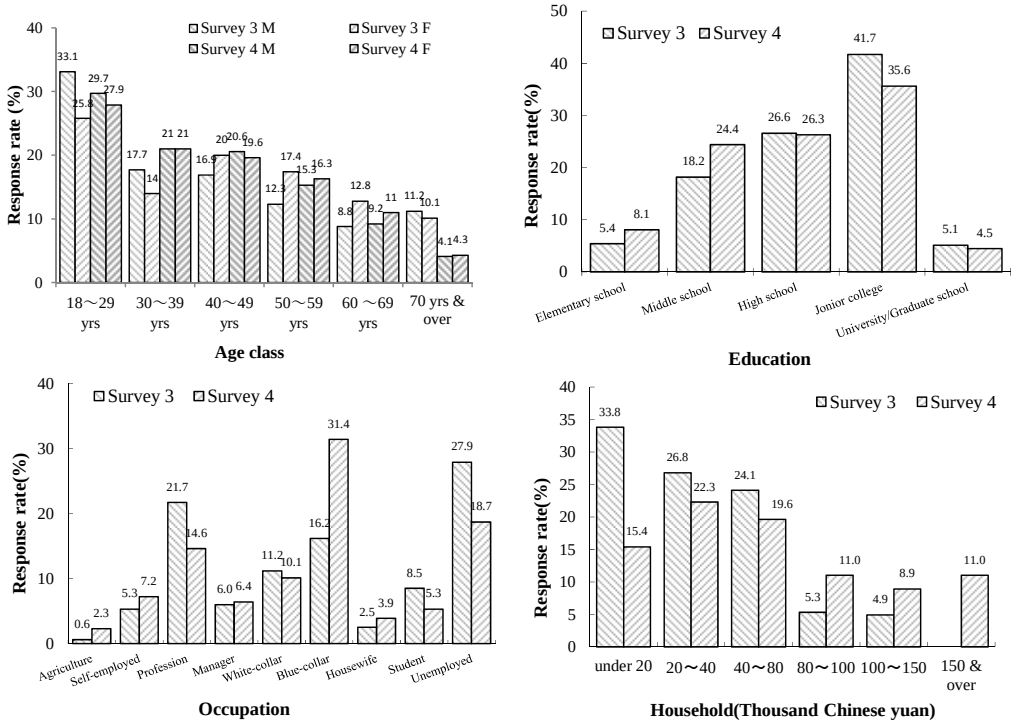

Figure 2 Distribution of demographic attributes on completed samples in Beijing

Comparing with Survey 3, the following facts as for Survey 4 can be read through comparing the distribution of demographic attributes of completed samples in two surveys: (1) As a matter of course, proportions of gender and age class are near the values in the population; (2) More respondents with low education such as elementary or middle school were contained; (3) Less professions and more blue-collar workers were chosen in respondents; (4) A really large number of people with high household income more than 80,000 RMB were selected.
Keeping watch on the above results, it is easy to find that the completed samples selected by quota sampling maintain the designed proportions of each category

belonging to gender and age class, but distribution of other demographic attributes shows a significant bias exactly because individuals in each category are not selected randomly. This is also the reason that quota sampling is not a reliable method to use for making inference about a population.

4. Conclusion remarks

In cross-cultural research for individuals, it is impossible to grasp how the demographic attributes affect the responses to a specific question beforehand. This is just a reason for using a probability sampling method in a social research. However, it is also a fact that statistical sampling cannot be used in many countries due to lacking of a sampling frame or other necessary information. This paper has compared the biases caused by sampling process in four real surveys, using the actual data regarding random sampling, area sampling, and quota sampling.

Results derived from tally did not show a remarkable difference in marginal distribution of question items between responses obtained from random sampling and area sampling, but area sampling decreased the number of completed interviews and led to a deviation in respondents' demographic attributes. Moreover, through comparing the distribution of demographic attributes obtained from area sampling with that one obtained from quota sampling, it is clear that quota sampling can bring a bias to distributions of respondents' demographic attributes which do not belong to stratified variables. As a conclusion, quota sampling is not suitable for cross-cultural research in spite of being used widely in the marketing research.

Although various non-probability sampling techniques have been proposed for cross-cultural research, it may say that the establishment of sampling approach in the framework of probability sampling is an important subject in order to obtain the responses with high reliability and validity. As one of unresolved issues, it is due to analyze how respondents' demographic attributes affect the responses to different types of question items.

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