Pak. J. Statist.
2015 Vol. 31(2), 211-218

USING SPLIT-QUESTIONNAIRE DESIGN: AN EMPIRICAL ANALYSIS

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ABSTRACT

Lengthy questionnaires have always been a problem for respondents, increasing the chances of delayed, hasty or slapdash responses. Splitting a long questionnaire into parts reduces the burden on the respondents as also increases the chances of getting prompt and responsible responses.

In this study, we have attempted to compare a new survey technique i.e. the Split-Questionnaire Design (SQD) and have compared it with the existing classical Full Questionnaire Design (FQD). Though developed recently, SQD has not yet been widely used in surveys. The present study employs both these designs to conduct a survey for measuring public's perception of corruption in the public sector of Pakistan and the results were subsequently compared. The Split Questionnaire Design has emerged as efficient as the classical design, however, there still are many unexplored aspects of this Design.

1. INTRODUCTION

Lengthy questionnaires not only are time consuming and costly but have also been a problem for respondents, increasing the chances of decreased, delayed, hasty or slapdash responses resulting in loss of information (Rässler et al., 2002; Rodrigues et al., 2005; Adiguzel and Wedel, 2008; Chipperfield, 2011). Split-Questionnaire Design (SQD) is one technique that might reduce respondents' burden as well as save loss of information. SQD is a relatively new survey technique and has not yet been widely used in surveys and there still are many unexplored aspects of this Design.

Since no study on SQD has ever been done in Pakistan, hence we have used both the SQD and the existing Full-Questionnaire Design (FQD) in a survey to find people's perception of corruption in the public sector and to calculate corruption perception index. The comparison of results of both the designs shows SQD and FQD as equally efficient.

2. SPLIT-QUESTIONNAIRE DESIGN (SQD)

Getting detailed and valuable information is the main concern of a researcher and such information is often collected through lengthy questionnaires. But lengthy questionnaires have seen to be affecting data quality (Johnson et al., 1974; Kraut et al, 1975; Herzog et al., 1981; Berdie, 1989). They not only are time consuming and costly

but also are fatiguing and burdensome for the respondents (Bradburn, 1977), increasing the chances of loss of information (Love and Turner, 1975; Heberline and Baumgartner, 1978; Adams and Darwin, 1982; Dillman et al., 1993; Rassler et al., 2002; Rodrigues et al., 2005 and Chipperfield, 2011). Splitting a lengthy questionnaire into parts is one option that might reduce respondents' burden and increase response rate (Raghunathan and Grizzle, 1995; Gonzalez, 2012; Gonzalez and Eltinge, 2007 and 2009; Goldenberg and Ryan, 2009). Reducing questionnaire length may lead to overcoming the loss of information, cost limitations/tight budget and increased non-response rates (Rässler, 2001; Rässler et al., 2002; Chipperfield et al., 2013).

Herzog et al., (1981) and Roszkowski et al., (1990) proposed to split a lengthy questionnaire into n parts of equal or unequal sizes with some common questions. Individual data from n parts are linked together to make it into a single data set. The linked data set is called synthetic data set. In recent years, some authors have studied the splitting of a long questionnaire using different techniques and derived results by pooling the responses. Rubin (1986, 1987 and 1996) and Rassler et al., (2002) employed various techniques for handling missing data using meta-analysis, matching approach and multiple imputation. Adams and Darwin (1982) and Dillman et al., (1993) found responses to be as if all the respondents, responded to all the parts. Raghunathan and Grizzle (1995) developed basic algebra to increase the precision of split questionnaires and in a simulated study, introduced a split questionnaire design based on the multiple matrix sampling design, wherein the original questionnaire was divided into several components containing approximately equal number of questions and found favorable results.

This split questionnaire approach is also being used in US educational achievement testing and program evaluation (Shoemaker, 1973; Holland Holland and Rubin, 1982; Munger and Lloyd, 1988). Chipperfield and Steel (2009) have shown SQD to have achieved 19% of more information as compared to multi-phase designs and suggest that this design can be used to reduce non-responses. There are quite a few other designs too, for splitting or dividing a questionnaire into parts. Adıgüzel et al., (2008) used 'between-block design' to split questionnaire for a massive survey which was more favored by the respondents and entailed lesser completion time, lesser fatigue, boredom and consequently significant decrease in information loss as compared to 'within-block design'. Rodrigues et al., (2005) applied the Split Questionnaire Design to Brazilian Census and not only achieved same inferences, but also reduced cost as well as the respondents' burden using matrix sampling design.

Särndal et al., (1992) have shown that information on some common parameters from a sampling on two occasions can be pooled together whereas SQD collects information on different parameters on the same occasion. Using real data sets, Rässler et al., (2002) have shown that splitting questions can reduce respondents' burden. But, the SQD has some disadvantages as well, such as a respondent does not get to have a full view of the problem as he/she has to answer a part of the questionnaire. Secondly, estimation of parameters is difficult and its efficiency has further to be improved by using optimal Split Questionnaire design.

The theoretical setting of the design for this study is illustrated below:

Let there be a number of questions divided into k groups, q_i, $i=1,2,...,k$. Suppose the questionnaire is divided into l number of parts, say $A_1...A_l$. Let A_1 and A_2 be two parts that are common for all respondents and $A_3, A_4...A_l$ parts are answered by $n_1, n_2...n_{l-3}$ i.e., $\sum n_i = n$ respondents respectively.

The scheme is as follows:

Table 2.1
Split Questionnaire Survey Scheme

Parts of Questionnaire	No. of Respondents	No. of question in each part
A_1	n	q_1
A_2		q_2
A_3	n_1	q_3
A_4	n_2	q_4
$\vdots$	$\vdots$	$\vdots$
A_l	n_{l-3}	q_l
	2_n	

2.1 Employing SQD in A Survey

To test the efficiency of the SQD, a survey on corruption perception was conducted, using the split as well as the full questionnaires design. We split the survey questionnaire into two sets of questions, i.e. A and B. The first set A contained 17 questions and B had 15 questions. The First 02 questions were common to the first and second sets. The two sets of questionnaires were administered to two different groups of respondents, with 250 respondents in each group. The third set C, the full questionnaire containing all the questions, was administered to another sample of 200 respondents.

The analysis is made on A, B and C and accuracy of SQD is checked on the basis of FQD. Fig. 2.1 shows the questions asked by the three groups.

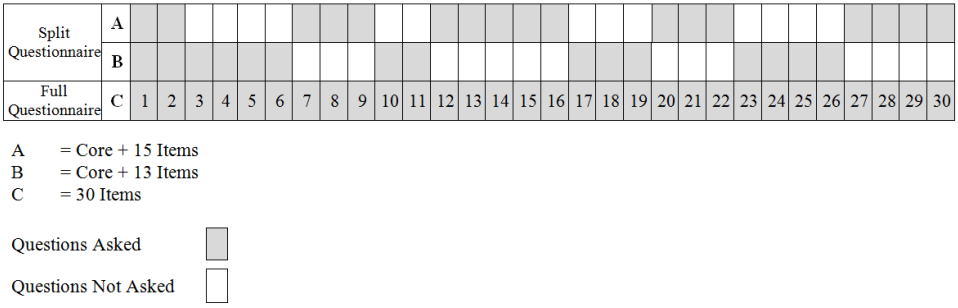

Fig. 2.1: Split Questionnaire Design by Questions

2.2 Analysis

The responses to Part A and Part B are 98.8% and 91.6%, whereas for full questionnaire, the responses are only 82.6%, showing that the responses to the shorter questionnaire are much higher than the full questionnaire.

We also computed means and standard deviations of SQD and FQD. Moreover, the comparison of the two systems of questionnaires by computing confidence intervals in both the cases, has also been made. The t-test too is applied on all the questions showing that split-questionnaire provides equally valid information as if full questionnaire design has been adopted.

This can be seen from Table 2.2 where Part A and Part B are pooled ($D = A \cup B$) and compared with Part C. For instance, the value of the estimation of parameter in C for Q.7 is 6.36 and for the same question, the estimation for $A \cup B = 6.25$. Both the values fall within the 95% confidence interval for the estimates, which is (6.12, 6.81). The responses, of persons in full-questionnaire survey and split-questionnaire surveys, on likert scale have been found to match closely. For example, in Q.6 regarding the 'Involvement in discussion', the mean score for $A \cup B$ is 1.84 and that of Part C is 1.80 (Table 2.2).

Similar results have been obtained for other estimators in Table 2.2.

Table 2.2 shows a comparison of other mean responses from both sources.

Table 2.2
Descriptive Statistics for $A \cup B$ and C

Q#	Variable	$D = A \cup B$			C			$\bar{D} \pm ts_D$
		N	**Mean**	**s.d.**	**n**	**Mean**	**s.d.**	
Q6	I have been involved in discussion about corruption	475	1.84	0.64	200	1.80	0.75	-
Q7	Corruption is widespread in our country	475	6.25	1.06	202	6.36	1.05	(6.12, 6.81)
Q8a	**FORMS OF CORRUPTION**- bribing a policeman to evade traffic fine	228	5.44	1.53	203	5.24	1.53	(5.10, 5.61)
Q8b	tax evasion	225	5.70	1.33	205	5.72	1.33	(5.62, 5.80)
Q8c	Paying bribe to pass an exam	226	5.56	1.47	203	5.58	1.47	(5.51, 5.10)
Q8d	Paying bribe to get college admission	228	5.22	1.12	204	5.26	1.12	(5.12, 5.35)
Q8e	Govt. servant is corrupt when he uses his influence to assign a govt. contract to a firm where his/her son is a Director	247	5.58	1.12	205	5.75	1.21	(5.23, 5.91)
Q8f	Bribing to get public service	244	5.45	1.31	203	5.53	1.18	(5.21, 5.63)

Q#	Variable	$D = A \cup B$			C			$\bar{D} \pm ts_D$
		N	**Mean**	**s.d.**	**n**	**Mean**	**s.d.**	
Q8g	Cheating public at large through fraudulent scheme	243	5.74	1.33	203	6.12	1.16	(5.35, 6.26)
Q9a	People achieve high standards of living through caworruption	227	5.75	1.21	205	5.49	1.42	(5.31, 6.02)
Q9b	People become non-religious when involved in corruption	228	5.53	1.18	204	5.21	1.51	(5.20, 5.82)
Q9c	People come close to each other through corruption	244	3.51	1.94	204	3.43	1.63	(3.25, 3.72)
Q9d	People lose trust when corruption prevails	247	5.72	1.49	203	5.60	1.4	(5.53, 5.91)
Q9e	People become poorer when they are involved in corruption	246	3.40	1.77	201	3.21	1.65	(3.20, 3.60)
Q10a	Corruption is need driven	475	4.87	1.58	201	3.62	1.66	(4.26, 5.31)
Q10b	Corruption is greed driven	469	5.25	1.58	201	5.78	1.44	(5.00,5.50)
Q11a	**CAUSES OF CORRUPTION** – Weak laws	229	5.21	1.51	205	5.95	1.36	(4.93, 5.91)
Q11b	Too much rules and regulations	227	3.43	1.63	205	3.98	2.14	(3.10, 3.78)
Q11c	Weak implementation of laws	225	5.60	1.40	205	5.62	1.31	(6.26, 6.11)
Q11d	Corrupt law enforcing agencies	246	5.51	1.31	202	5.44	1.27	(5.19, 5.93)
Q11e	People at the top are corrupt	246	5.67	1.27	204	5.55	1.33	(5.42, 5.89)
Q11f	Declining society standards with respect to honesty, integrity & credibility	247	5.64	1.22	205	5.35	1.29	(5.34, 5.98)
Q12a	**IMPACT OF CORRUPTION** - Reduction in economic growth and investment	223	3.21	1.65	202	4.83	1.25	(2.91, 4.10)
Q12b	Increase in poverty	226	3.62	1.66	203	5.18	1.31	(3.21, 4.12)
Q12c	Increasing gap between rich & poor	227	5.78	1.44	203	5.82	1.44	(5.23, 6.21)
Q12d	Concentration of wealth in a fewer hands	227	5.95	1.36	204	5.59	1.19	(5.45, 6.43)
Q12e	Weakens moral values & economy standard	244	5.38	1.22	204	5.3	1.16	(5.12, 5.59)
Q12f	Decrease in foreign investment	246	4.49	1.63	201	4.53	1.36	(4.34, 4.61)
Q12g	Impedes rule of merit	246	5.25	1.43	197	5.3	1.59	(5.10, 5.43)
Q13	Govt. is taking steps to curb the menace of corruption	226	3.98	2.14	205	2.94	1.82	(3.72, 4.16)

2.3 Discrepancy Measures

The discrepancy measures of full questionnaire and split-questionnaire are computed from, $Cov\left(\bar{X}\right)$ and $Cov\left(\bar{S}\right)$.

$$Cov\left(\bar{X}\right) = \frac{100}{\bar{X}}\left[\sum_{i=1}^{k} \frac{\left(\bar{X}_i - \bar{X}\right)^2}{k}\right]^{1/2},$$

$$Cov\left(\bar{S}\right) = \frac{100}{\bar{S}}\left[\sum_{i=1}^{k} \frac{\left(\bar{S}_i - \bar{S}\right)^2}{k}\right]^{1/2}$$

where

$\bar{X}$ is the average of all units,
$\bar{X}_i$ is the average of all units of the *i*th sub group,
$\bar{S}$ is the average of S.D. of all units,
$\bar{S}_i$ is the average of S.D. of all units of *i*th sub group, and
k is the number of equations.

The discrepancy measures for the complete and split-designs, as per calculations, for pooled data sets are $Cov_D\left(\bar{X}\right) = 21.41\%$ and $Cov_D\left(\bar{S}\right) = 20.46\%$, whereas for the full questionnaire, the covariances are $Cov_C\left(\bar{X}\right) = 21.06\%$ and $Cov_C\left(\bar{S}\right) = 18.64\%$, which are almost similar.

2.4 Correlation between the Two Groups of Respondents

If we look at the correlation coefficients of the two groups, for various questions, the opinion of the two groups is highly correlated, with value of the correlation coefficient $r_{AUB,C}$ is equal to 0.878, which is highly significant.

In addition to measuring discrepancies and correlation between complete design and split design, we have also tested the mean differences of each item, with the assumption of "equal variances". The mean difference $\left|A \cup B - C\right|$ is 0.066, the standard error is 0,096 and the t_{29} value is 0.694, showing that the difference is insignificant.

The results of SQD questions are similar to FQD questions showing that SQD provides as good results as FQD.

3. FUTURE WORK

The comparison of the new survey technique i.e., the Split-Questionnaire Design with that of the existing classical design, has confirmed its efficiency. However, there are still many aspects of Split-Questionnaire Design that need to be explored. One may build-in all the existing designs within SQD and come up with the most efficient Split Questionnaire Design for any survey, that can be used in social, economic, demographic, industrial, medical and biological sciences.

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