Survey attitude and nonresponse in a probability-based online panel

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1. Introduction

A high response of the sample units approached is one of the cornerstones of survey research (Groves, 1989) and the growing nonresponse has been a concern for survey statisticians for a long time (De Leeuw & De Heer, 2002). Several theories on the reasons of nonresponse have been developed over the years (Stoop, 2005). Survey climate and attitudes towards surveys are key concepts in these theories (Loosveldt and Storms, 2008). De Leeuw and colleagues (2010) proposed a brief nine-item scale to measure a subject's survey attitude. It consists of three sub-constructs: survey enjoyment, survey value, and survey burden. The present paper examines whether this survey attitude scale contributes to the explanation of unit nonresponse over and above the usual variables associated with unit nonresponse (e.g. age). Using panel data and longitudinal negative binomial regression, we find that the explanatory power of the survey attitude scale persists in presence of an extensive list of covariates. Furthermore, while the survey attitude scale explains 8.6% of the variance in the response patterns, the 13 covariates together explain merely 5%. The results indicate that a person's survey attitude is not a mere reflection of her socio- and psycho-demographic profile.

1.1. Data

The data used in this paper stem from the LISS (Longitudinal Internet Studies for the Social Sciences) panel, which started in 2007 and is ongoing[1]. The LISS panel is a probability based online household panel of the Dutch population, originally consisting of 5000 households comprising 8000 individuals (Scherpenzeel & Das, 2011). The households are recruited by means of a random 10% sample of the Dutch population drawn from the population register. A computer and/or internet connection is provided to those households that are not equipped with these. Ultimately, 48% of the sampled households have registered as panel members. The annual panel attrition is roughly 10%. Sample refreshments were conducted in 2009, 2011, and 2013. In contrast to other online panels, the LISS panel minimizes coverage error by not relying on households to register voluntarily and providing an internet connection to offline households. Panel members complete varying questionnaires every month and a core questionnaire every

[1] The LISS panel data were collected by CentERdata (Tilburg University, The Netherlands) through its MESS project funded by the Netherlands Organization for Scientific Research.

year to provide repeated measures of the same set of variables. Respondents are paid for each completed questionnaire. The wave response rates range from 50 to 80%.

Most variables used in this study are part of the core questionnaire and are consequently measured on an annual basis. We aggregated variables measured on a monthly basis by using the last value obtained per year[2]. Further, we consider the household level to be a nuisance parameter and therefore analyze individual panel members per year. Our analyses are limited to the period from 2008 to 2011 as the survey attitude scale is included in the core questionnaire only during this interval. We do not include the sample refreshments into our data-set. That way, the following sample sizes are obtained:

Wave	2008	2009	2010	2011
Individuals	8271	7909	7473	5959

As estimation problems arose due to the fraction of missing values, we make use of multiple imputation on the explanatory variables. The fraction of missing values per respondent before imputation is on average 20%. After imputing this number is reduced to 5%[3].

1.2. Operationalization

In order to investigate whether the survey attitude scale is effective in explaining unit nonresponse, the number of completed interviews of an individual panel member per year serves as our dependent variable. We use this dependent variable because we believe that the structural component of unit nonresponse is captured by the number of completed interviews per year better than by the sheer occurrence of unit (non)response per month. The occurrence of unit (non)response each month might comprise a considerable random component. Moreover, as most of our variables, the number of completed interviews is measured on an annual basis and therefore suits our unit of analysis. The average count is 31 with a standard deviation of 19. Per invitation, respondents completed on average 0.68 interviews (SD=0.34). The proportion of variance at the subject-level (intra-class correlation) is estimated as 0.60. Hence, about two-third of the variance is variance between individuals, and about one-third is variance within individuals across time. In what follows, the operationalization of our predictor of interest, the survey attitude scale, and the other covariates is described.

Survey attitude scale. Based on earlier work by multiple authors (Cialdini, 1991; Goyder, 1986; Singer, 1998; Stocke, 2006; Rogelberg et al., 2001), De Leeuw and colleagues (2010) developed a brief

[2] As these variables suffer from nonresponse attributable to respondents being unwilling to fill in the same information every month, we carry nonmissing values back- and forward if we expect little variation within one year (e.g. type of dwelling).

[3] Five imputed data-sets were created using STATA 13. The multiple imputation model contains all predictors and the dependent variable. The estimates of the separate data analyses are pooled using Rubin's rules (Rubin, 1987).

nine-item scale to measure the attitude of a respondent towards surveys. It consists of three sub-constructs: survey enjoyment, survey value, and survey burden. Each sub-construct is measured by three items using a seven-point Likert scale ranging from total disagreement to total agreement. The survey attitude scale is shown to be reliable and cross-culturally valid (De Leeuw et al., 2010). Bons, Hox and de Leeuw (2015), using latent trait-state models (see Kenny & Zautra, 2001), examine the stability of survey attitude over time. They conclude that two-third of the variance picked up by the survey attitude scale measures enduring aspects of a person's survey attitude while one-third relates to the situational aspect of survey attitude. To understand to which extent the trait-like and to which extent the state-like part of the survey attitude scale explains unit nonresponse, we create the person-mean of each sub-construct across waves and deviations from this person-mean at each wave as two separate variables. For the operationalization of the utilized covariates, please refer to Table 1 in the appendix.

1.3. Methodological strategy

To predict the number of completed interviews and determine the explanatory power of the survey attitude scale, longitudinal negative binomial regression is employed. Applying ordinary linear regression to count data can result in inefficient, inconsistent, and biased estimates (Hox, 2010). Negative binomial regression models a Poisson process, but compared to Poisson regression it contains an additional error term to accommodate overdispersion. We include the number of invitations to participate in a survey per year as offset parameter into the model because this differs across respondents and years. To account for dependences within households, robust standard errors with the household as cluster variable are estimated. Finally, we take a multilevel approach to longitudinal data analysis by using multilevel negative binomial regression nesting repeated measurements within individuals.

A grand theory of survey nonresponse is not available (cf. Hox & Leeuw, 1995; Stoop, 2005). For that reason, we rely on expert opinions on which covariates to include into the model. Prior to analyzing the data, we presented an extensive list of covariates to 31 experts in survey methodology and asked them to rate the relevance of each variable with respect to unit nonresponse. The 15 highest rated variables were included in the model.

2. Results

Table 1: Longitudinal negative binomial regression on five multiple imputed data-sets

Dependent variable: *Number of completed interviews p.a.*	Model 1: survey attitude scale		Model 2: + covariates	
	Exp(B)	SE	Exp(B)	SE
Intercept	0.210	0.024	0.201**	0.025
Wave	0.963**	0.001	0.964**	0.001
Survey attitude scale				
Enjoyment: mean	1.218**	0.017	1.201**	0.017
Enjoyment: deviation	1.021**	0.004	1.021**	0.004
Value: mean	1.084**	0.020	1.070**	0.019
Value: deviation	1.001	0.004	1.002	0.004
Burden: mean	0.883**	0.012	0.892**	0.012
Burden: deviation	0.992**	0.003	0.992**	0.003
Female (time-invariant)			1.031*	0.015
Age (time-invariant)			1.006**	0.001
Years of education			0.994**	0.002
Migrant (time-invariant)			0.924†	0.037
Dwelling: Self-owned^{S}			1.020	0.017
Household income			1.000	0.000
Urbanization			0.993	0.006
SimPC			0.959*	0.017
Household size			0.989*	0.005
Generalized trust			1.001	0.001
Voted			1.060†	0.032
Opportunity costs			0.994**	0.002
Agreeableness			0.974**	0.007
Dispersion parameter	-2.556	0.078	-2.562	0.078
Var(u)	0.634	0.022	0.599	0.021
Level-2 R^2	0.086		0.137	

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; ln(invited) = offset = 1 included in the model; ^{S} vs. rental or cost-free

Table 2 shows the results of the longitudinal negative binomial regression on five multiply imputed data-sets. The coefficients are exponentiated, and hence reflect the odds ratio. Hence, coefficients larger (smaller) than 1 indicate a positive (negative) relationship. Model 1 contains the survey attitude scale, a linear trend of time, and a random intercept. The *intercept* refers to the rate at the first wave and all other covariates being 0 and is estimated to be 0.21. There is considerable variation across individuals at this stage. The standard deviation is estimated as $\sqrt{0.634} = 0.796$. *Wave* discloses that, ceteris paribus, the expected count decreases by a factor of 0.963 (or 3.7%) per year. The *survey attitude scale* proves that the more enjoyable, the more valuable, and the less of a burden a survey is perceived to be, the more likely survey participation. The person-mean regression coefficients indicate that particularly the enduring aspects of a person's survey attitude are useful in explaining response patterns. A respondent perceiving a survey across waves on average one unit more enjoyable (on a scale from 1 to 7) is estimated to complete roughly 1.22 times as many or 22% more interviews per year than before. The same attitude change with

respect to the perceived survey value corresponds to 8% more interviews. This change in the perceived survey burden will cut down the number of completed interviews by 12%. Situational changes in survey attitude between waves have a much smaller impact to the number of completed interviews. The deviation from person-mean regression coefficients reveal effect sizes ranging from -0.8 to $+2.1$ percent per unit change across the sub-constructs. To conclude, the survey attitude scale does explain variance in unit nonresponse. It does so most successfully by its trait-like facet. Comparing the baseline model containing only intercept and wave (not shown) with Model 1, we estimate the ratio of explained to total variance between individuals as 8.6%[4]. This is quite substantial for one construct.

Model 2 adds an extensive list of covariates to the model in order to investigate whether the explanatory power of the survey attitude scale persists in presence of these covariates. It does. In fact, the regression coefficients remain almost constant. Hence, the survey attitude scale contributes to the explanation of unit nonresponse over and above the usual suspects. Most covariates are significant and the direction of the effect of all variables is as expected. A Wald test of all coefficients being 0 can be rejected ($F(13, 671.9) = 16.03$, p-value < 0.01). The level-2 R^2 rises to 13.7% showing once more the explanatory power of the survey attitude scale. While its three items explain 8.6% of the variance in the response patterns between respondents, the 13 covariates together explain merely 5%.

3. Discussion

The results of this study certify that survey attitude is a strong predictor of unit nonresponse, that is, over and above a person's socio- and psycho-demographic profile. In particular survey enjoyment and survey burden stand out in that respect. Survey methodologists are advised to make surveys as much fun and as little cumbersome as possible. This has to be taken more seriously if one wants to minimize unit nonresponse. All too often (scientific) surveys are advertised by their value~~,~~ which shows a relatively small effect on response, are too long, and not fun.

We plan to investigate whether the survey attitude scale proves useful in predicting future nonresponse. If that is the case, potential nonrespondents in panel studies could be identified early on and approached with a special treatment. At the workshop, we would like to discuss these results and welcome further ideas on how the survey attitude scale can be of use in official statistics and survey research.

[4] The level-1 R^2 cannot be estimated as negative binomial regression does not include a level-1 error term.

4. References

Bons, H., Hox, J. & De Leeuw, E. D. (2015). Stability Of The Survey Attitude Scale Over Time: A Latent State-Trait Analysis. Unpublished master's thesis, Statistics Netherlands, The Hague.

Cialdini, R. (1991). A new paradigm for experiments on the causes of survey nonresponse. In International workshop on household survey nonresponse. Washington D.C.

De Leeuw, E. D., & De Heer, W. (2002). Trends in household survey nonresponse: A longitudinal and international comparison. Survey nonresponse, 41-54.

De Leeuw, E. D., Hox, J. J., Lugtig, P., Scherpenzeel, C. V., Goritz, A., & Bartsch, S. (2010). Measuring and Comparing Survey Attitude Among New and Repeat Respondents Cross-Culturally. In Wapor annual conference. Chicago.

Goyder, J. (1986). Survey on surveys: limitations and potentialities. Public Opinion Quarterly, 50(1), 27–41.

Groves, R. M. (1989). Survey costs and survey errors. New York: Wiley.

Hox, J., De Leeuw, E. D., & Vorst, H. (1995). Survey Participation as Reasoned Action: A Behavioral Paradigm for Survey Nonresponse? Bulletin of Sociological Methodology, 48(1), 52–67.

Hox, J. (2010). Multilevel Analysis. Techniques and Applications. New York: Routledge.

Kenny, D., & Zautra, A. (2001). Trait-State models for longitudinal data. In L. Collins & A. Sayer (Eds.), New methods for the analysis of change. (pp. 241– 265). Washington: APA.

Loosveldt, G., & Storms, V. (2008). Measuring public opinions about surveys. International journal of public opinion research, 20(1), 74-89.

Rogelberg, S. (2001). Attitudes towards surveys: Development of a measure and its relationship to respondent behaviour. Organizational Research Methods, 4(1), 3–25.

Scherpenzeel, A., & Das, M. (2011). True longitudinal and probability-based Internet panels: Evidence from the Netherlands. In P. Ester & L. Kaczmirek (Eds.), Social and behavioral research and the internet (pp. 77–104). New York: Taylor & Francis Group.

Singer, E., van Hoewyk, J., & Maher, M. (1998). Does the payment of incentives create expectation effects? Public Opinion Quarterly, 62(2), 152–164.

Stocke, V. (2006). Attitudes towards surveys: attitude accessibility and the effect on respondents' susceptibility to nonresponse. Quality and Quantity, 40(2), 259–288.

Stoop, I. (2005). The hunt for the last respondent. Nonresponse in sample surveys. The Hague: SCP.

Appendix

Table 2: Operationalization and descriptive statistics of the used variables.

Variable	Operationalization	Mean	SD	Min	Max
Completed	Number of completed interviews per year	31	19	0	93
Invited	Number of invitations to participate in a survey per year	43	16	1	95
Wave	2008 = 0, 2015 = 7	2.92	2.25	0	7
Female	Female = 1, male = 0	0.533	0.499	0	1
Age	Age in years at first wave (i.e. 2008)	45.11	16.05	16	95
Education	School diplomas recoded into years spent in the educational system	12.72	3.38	6	18
Migrant	Non-Dutch = 1, Dutch = 0	0.118	0.322	0	1
Dwelling:self-owned	Self-owned = 1, rental or cost-free = 0	0.748	0.433	0	1
Household income	Net monthly income in Euro of all household members combined.	3098	5569	0	299660
Urbanization	Urban character of place of residence based on the surrounding address density (not urban = 1, extremely urban = 5)	2.98	1.27	1	5
SimPC	Computer and/or internet connection provided = 1, not = 0	0.055	0.228	0	1
Household size	Number of household members	2.81	1.37	1	9
Generalized trust	You can't be too careful = 0, most people can be trusted = 10	6.07	2.11	0	10
Voted	Respondent voted in at least one national election = 1, not = 0	0.889	0.314	0	1
Opportunity costs	Dissatisfaction with amount of available leisure time (entirely satisfied = 0, entirely dissatisfied = 10)	2.99	2.14	0	10
Agreeableness	Agreeableness score (very inaccurate = 1, very accurate = 5)	3.87	0.49	1	5
Survey attitude scale					
Enjoyment: mean	Person-mean of survey enjoyment across waves (tot. disagree = 1, tot. agree = 7)	4.67	0.72	1	7
Enjoyment: dev.	Deviation from the person-mean of survey enjoyment at each wave	-0.001	0.97	-5.20	5.10
Value: mean	Person-mean of survey value	5.58	0.57	1	7
Value: deviation	Deviation from the person-mean	-0.01	0.84	-5.51	3.74
Burden: mean	Person-mean of survey burden	3.06	0.62	1	7
Burden: deviation	Deviation from the person-mean	0.01	0.98	-3.85	5.18