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Effects of push-to-web in paper-and-pencil and online mixed mode surveys: Findings from three randomized experiments

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ABSTRACT

Encouraging survey completion digitally, as opposed to traditional paper-and-pencil methods, may influence response rates. Research has found that offering paper-and-pencil questionnaires with the first invitation and providing online questionnaires in reminders often leads to greater response rates than a 'push-to-web' method, where an online questionnaire is offered in the first invitation followed by a paper-and-pencil option. Given rising postage costs combined with improvements in digital literacy and internet access in recent years, reassessing the impacts of the potentially more cost-effective online-to-paper-and-pencil sequence is vital. This note presents findings from three randomized experiments administrated in mixed-mode surveys that aimed to evaluate two different strategies: one push-to-web approach where a link to an online questionnaire was provided in the first mailing and one no push-to-web approach where both a link to an online questionnaire and a paper-and-pencil questionnaire were provided simultaneously in the first mailing. Contrary to expectations, the results revealed that the push-to-web method did not decrease the overall response rate in any of the studies. Furthermore, nonresponse bias was reduced in the push-to-web approach in terms of sex, age, marital status, and immigrant status. This indicates that the online questionnaire first and paper-and-pencil questionnaires added in the reminders may be favored over the more expensive method of introducing the paper-and-pencil and online questionnaire already in the first invitation.

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INTRODUCTION

Surveys are facing a growing challenge with decreasing response rates, leading to a heightened risk of nonresponse bias (Groves, 2006). One possible factor influencing the response rate could be to encourage sample persons to fill out the questionnaire online rather than on a paper-and-pencil questionnaire (i.e., pushing-to-web compared to not pushing-to-web). Mixed-mode surveys, which allow respondents to fill out the questionnaire both online and by paper-and-pencil, have become increasingly common in research (de Leeuw, 2005; Couper, 2011; Sakshaug, Cernat, and Raghunathan, 2019). In contemporary survey research, initially inviting sample persons to respond via paper-and-pencil and later providing an online option has been found to increase response rates compared to offering only an online questionnaire first (i.e., push-to-web) (Sakshaug, Cernat, & Raghunathan, 2019, p. 3; see also Beebe, Locke, Barnes, Davern, & Anderson 2007; Converse, Wolfe, Huang, & Oswald 2008; Börkan 2010; Smyth, Dillman, Christian, & O'Neill 2010; Millar & Dillman 2011). Given the rapidly rising postage costs in Sweden, it is becoming crucial to reassess the effectiveness of the paper-and-pencil-to-online sequence in boosting response rates and the effect on nonresponse bias, especially when compared to the more cost-effective online-to-paper-and-pencil sequence. With the expansion of internet access, improvements in digital literacy, and more widespread smartphone use, the disparity between these two approaches may have diminished. This difference may be now minimal enough that it does not justify the higher expense of initially mailing a heavy paper-and-pencil questionnaire rather than starting with a lighter and less costly invitation to complete the questionnaire online.

This note presents the results from three randomized experiments conducted in 2020, 2021, and 2022 that all aimed to investigate the impact of pushing respondents towards completing the questionnaire online instead of by paper-and-pencil. The treatment group (push-to-web) was in the first invitation offered to complete the questionnaire by an online self-administrated questionnaire. The control group (no push-to-web) was in the first invitation offered to complete the questionnaire either through a self-administrated paper-and-pencil questionnaire or an online self-administrated questionnaire.

The first study was administered to one random sample of inhabitants in Sweden, and the second and third studies were administered to two random samples each: one random sample of inhabitants in Sweden and one random sample of inhabitants in the West Region of Sweden. Replicating the experiments three times in three separate years should provide a solid ground for drawing conclusions and reach reliable interpretation of the outcomes.

HYPOTHESIS

Four hypotheses were assessed:

RESPONSE RATES

H1: Sample persons who only received a link to an online questionnaire but no paper-and-pencil questionnaire in the first mailing (push-to-web) may be less likely to complete the questionnaire than sample persons who are sent a paper-and-pencil questionnaire and a link to the online questionnaire simultaneously in the first mailing (no push-to-web).

MODERATION OF THE PUSH-TO-WEB EFFECT ON RESPONSE RATE

H2: The negative effect that push-to-web has on the likelihood of submitting the survey is stronger the older the sample person is.

NONRESPONSE BIAS

H3: Sample persons who only receive a link to an online questionnaire but no paper-and-pencil questionnaire in the first mailing (push-to-web) may show less nonresponse bias than sample persons who are sent a paper-and-pencil questionnaire and a link to the online questionnaire simultaneously in the first mailing (no push-to-web).

DATA QUALITY

H4: Sample persons who only receive a link to an online questionnaire but no paper-and-pencil questionnaire in the first mailing (push-to-web) may produce worse data quality than sample persons who are sent a paper-and-pencil questionnaire and a link to the online questionnaire simultaneously in the first mailing (no push-to-web).

METHODS AND MATERIALS

PREREGISTRATION

The hypotheses, procedure, exclusion criteria, and analysis plan were preregistered before data collection had completed and prior to analyses. The preregistrations can be found at https://osf.io/29u48 and https://osf.io/kje8x and https://osf.io/d9u6c.

SAMPLE

In Study 1, a random sample of 22,500 individuals, 16-85 years old registered by the Swedish Tax Authority as residents in Sweden was drawn on August 26, 2020. In Study 2, two random sub-samples of individuals 16-85 years old, registered by the Swedish Tax Authority were drawn on August 26, 2021. The first sub-sample consisted of 24,500 individuals residing in Sweden, and the second sub-sample consisted of 6,000 individuals residing in the West Region of Sweden.[1] Lastly in Study 3, two random sub-samples of individuals 16-90 years, registered by the Swedish Tax Authority were drawn on August 9, 2022. The first sub-sample consisted of 26,250 individuals residing in Sweden and the second sub-sample of 6,000 individuals residing in the West Region of Sweden.[2]

The sub-samples in Study 2 and Study 3 were checked before administration to not contain the same individual twice. If that occurred, other randomly selected individuals replaced those individuals. In Study 2 and Study 3 analyses were conducted on the two-subsamples together as one main sample for each study. See Table 1 for an overview of the groups.

[1] In Study 2, one observation was dropped from the 24,500 sampled individuals residing in Sweden and one observation was dropped from the 6,000 sampled individuals in the West Region of Sweden due to lack of registry data.

[2] In Study 3, one observation was dropped from the 6,000 sampled individuals in the West Region of Sweden due to GDPR.

Table 1. *Overview of experimental groups in Study 1, Study 2, and Study 3.*

	The National SOM-survey	The West regional SOM-survey
Study 1		
Push-to-web	Group 1 *n* = 5,000	-
No push-to-web	Group 2 *n* = 17,500	-
Study 2		
Push-to-web	Group 1 *n* = 12,232	Group 1 *n* = 2,941
No push-to-web	Group 2 *n* = 12,267	Group 2 *n* = 3,058
Study 3		
Push-to-web	Group 1 *n* = 8,826	Group 1 *n* = 1,982
No push-to-web	Group 2 *n* = 17,424	Group 2 *n* = 4,017

PROCEDURE

Before being invited to complete the questionnaire, each sample person in each experiment was randomly assigned to one of two groups. Numbers for the randomizations of the samples were extracted from random.org.[3] One group was, in the first invitation, offered to complete the questionnaire only by an online self-administrated questionnaire, and one group was in the first invitation, offered to complete the questionnaire either through a self-administered paper-and-pencil questionnaire or by an online self-administered questionnaire. The probability of being assigned to the push-to-web group in Study 1 was two in nine, in Study 2 one in two, and in Study 3 one in three.

The procedure was similar across the three studies. Sample persons were first sent a pre-notification stating that they would soon be invited to complete a questionnaire. A week after the pre-notification, sample persons were sent a mailed invitation to complete the

[3] In Study 1, the randomization was conducted in Excel.

questionnaire. Nine days after the first invitation, all sample persons received a postcard with an envelope in which the person was thanked for their participation and reminded to participate if not yet done so. The postcard included instructions on how to respond to the online self-administered questionnaire. Sample persons who had not yet submitted their questionnaire or had refused 17 days after the first invitation received a text message on their cell phone, reminding them to participate.[4] Sample persons who had not submitted her or his questionnaire 28 days after the first invitation were sent a mailed reminder to complete the questionnaire either through the self-administrated paper-and-pencil questionnaire or by the online self-administrated questionnaire.[5] Sample persons who had not submitted their questionnaire or had not refused to participate received four mailed reminders with an offer to complete the questionnaire either through a paper-and-pencil questionnaire or by the online questionnaire, a postcard that included instructions on how to respond to the online self-administrated questionnaire, and four text messages including a link to the online questionnaire sent to their cell phone (i.e., nine reminders in total).

Some discrepancies in procedure existed between the studies. In Study 1, about half of the individuals in each group were sent a pre-notification by postcard a week before the first invitation, and the other half were not sent a pre-notification. Moreover, in Study 1, all sample persons received a URL address and a QR code that both redirected to the login page to the online questionnaire, and a passcode to log in. In Study 2 all sample persons received a QR code that redirected to the online questionnaire directly without a passcode. In Study 3, one-third of the sample received a QR-code that redirected to the online questionnaire directly without a passcode, one-third of the sample received a general QR-code that redirected to the login page for the online questionnaire to access it with a passcode and the remaining one-third of the sample received an URL-address to the login page to the online questionnaire and a passcode. In Study 1, the text messages included an URL-address to the login page to the online questionnaire and a passcode. In Study 2, the

[4] In Study 3, the first text was sent 28 days after the first invitation was sent.

[5] In Study 2, the reminder was sent 29 days after the first invitation was sent. The postal reminders included the questionnaire, an information letter, and a return envelope.

text messages included a link to the online questionnaire that redirected to the online questionnaire directly. In Study 3, for about three in five, the text messages included an URL-address to the login page to the online questionnaire and a passcode, for about one in five the text message included a general QR code that redirected to the login page for the online questionnaire to access it with a passcode, and for about one in five the text message included a link to the online questionnaire that redirected to the online questionnaire directly.

In regards to incentives, a lottery scratch ticket incentive (*Trisslott*) was offered to all respondents in Study 1. In Study 2, half of the sample persons aged 18-39 were offered a digital gift card worth 50 SEK, whereas the rest of the sample was offered a lottery scratch ticket. In Study 3, one-third of the sample persons aged 18-39 were offered a cinema gift card worth 150 SEK, one-third of the sample persons aged 18-39 were offered a grocery shop gift card worth 75 SEK, while the rest of the sample was offered the lottery scratch ticket.

MEASURES AND ANALYSIS PLAN

RESPONSE RATES

To evaluate the response rates, Response Rate 1 (RR1) was estimated according to the guidelines of the American Association for Public Opinion Research (AAPOR, 2023). To assess the response rates, the parameters of OLS regression equations predicting RR1 with the experimental groups were estimated.

To investigate the potential interaction effects of the push-to-web manipulation with age, the parameters for OLS regression equations predicting the response rate with the experimental group variable in each experiment, and the interaction between the experimental group variable and the continuous variable age (ranging from 16 to 85 in Study 1 and Study 2 and from 16 to 90 in Study 3) were estimated.

NONRESPONSE BIAS

To investigate the nonresponse bias, representativity indicators (R-indicators) were computed using the R-code provided on the web page of Representativity Indicators for Survey Quality project. The R-indicators were based on the standard deviation of probabilities of responses of units. In the models, nonresponse bias was estimated based on sex (female, male), age cohort (16-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80-85/90), marital status (married and not married), and immigrant status (born in Sweden, and not born in Sweden). The R-indicators were estimated for all sample persons in each experiment. If the confidence intervals of the two R-indicator values did not overlap, the R-indicator was considered statistically significantly different between the groups. The higher the value of the R-indicators, the less nonresponse bias.

DATA QUALITY

Data quality was assessed based on the share of *Breakoffs, Partials,* and *Completes.* Sample persons who answered at least one question were included in the estimations. The *Breakoffs/Partials/Completes* indicator measured the proportion of answers of a maximum of 50 percent of all questions included in each questionnaire *(Breakoffs)*, the proportion of answers between 50 and 79.9 percent of all questions included in each questionnaire *(Partials),* and the proportion of answers of 80 percent or more of all questions included in each questionnaire *(Completes)*. Multinomial logistic regressions with corresponding average marginal effects were estimated to evaluate if the probability of these shares was different between the experimental groups in each experiment.

RESULTS

RESPONSE RATES

In contrast to the expectations, pushing sample persons toward the web (i.e., only offering an online questionnaire in the first invitation) did not decrease the sample persons' response propensity compared to a simultaneous approach (i.e., offering the online and paper-and-pencil questionnaire simultaneously). In Study 1, 46.8% of the sample persons being pushed-to-web completed the questionnaire compared to 46.4% of those not pushed-to-

web. In study 2, the corresponding response rate among those pushed-to-web was 41.8%, versus 42.7% of those not-pushed-to-web. Finally, in Study 3, 43.1% of those pushed-to-web completed the questionnaire compared to 43.3% among those not-pushed-to-web (Study 1: Δ = 0.4, $b_{push\text{-}to\text{-}web}$ = 0.00, SE = 0.01, p = .58; Study 2: Δ = -0.9, $b_{push\text{-}to\text{-}web}$ = -0.01, SE = 0.01, p = .11; Study 3: Δ = -0.2, $b_{push\text{-}to\text{-}web}$ = -0.00, SE = 0.01, p = .78), see Table 2 and Table 3.

Table 2. ***Response Rate (RR1) in the experiments (standard error, confidence interval).***

	Response rate	*n*	Standard error	95% CI lower	95% CI higher
Study 1					
Push to web	46.8%	5,000	0,01	45.4%	48,2%
No push to web	46.4%	17,500	0,00	45,6%	47,1%
Study 2					
Push to web	41,8%	15,173	0,00	41,1%	42,6%
No push to web	42,7%	15,325	0,00	42,0%	43,5%
Study 3					
Push to web	43,1%	10,808	0,00	42.2%	44.1%
No push to web	43,3%	21,441	0,00	42.6%	43.9%

Note. **Response rates were calculated following the AAPOR 2023 standard (RR1).**

Moreover, the results indicated that pushing-to-web did not negatively affect the response rate the older the sample persons were as a statistically significant interaction effect between push-to-web and age was found only in one of the three studies (Study 1: $b_{push\text{-}to\text{-}web*age}$ = -0.00, SE = 0.00, p = .01 and when adding age into the OLS regression equation: $b_{push\text{-}to\text{-}web}$ = 0.05, SE = 0.02, p = .01). However in Study 2 and 3 the interaction effects on push-to-web and age were not statistically significant (Study 2: $b_{push\text{-}to\text{-}web*age}$ = -0.00, SE = 0.00, p = .13; Study 3: $b_{push\text{-}to\text{-}web*age}$ = -0.00, SE = 0.00, p = .13).

Table 3. ***Effects of Push to Web on Response Rate (RR1) (OLS regression coefficients).***

	Completed the questionnaire					
	Study 1		Study 2		Study 3	
	Baseline	Age	Baseline	Age	Baseline	Age
Push-to-web (reference: no push-to-web)	0.00 (0.01)	0.05* (0.02)	-0.01 (0.01)	0.02 (0.01)	-0.00 (0.01)	0.02 (0.01)
Age (16-85) [1]		0.01*** (0.00)		0.01*** (0.00)		0.01*** (0.00)
Push-to-web * Age		-0.00* (0.00)		-0.00 (0.00)		-0.00 (0.00)
Constant	0.46*** (0.00)	0.17*** (0.01)	0.43*** (0.00)	0.09*** (0.01)	0.43*** (0.00)	0.18*** (0.01)
Observations	22,500	22,500	30,498	30,498	32,249	32,249
R^2	0.00	0.05	0.01	0.07	0.00	0.04

Note. **Standard errors in parentheses. [1] In Study 3: 16-90.**

+p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

NONRESPONSE BIAS

Consistent with the predictions, the nonresponse bias was improved by offering only a link to the online questionnaire and no paper-and-pencil questionnaire in the first mailing, compared to offering a link to the online questionnaire and a paper-and-pencil questionnaire simultaneously in the first mailing. The three R-indicators in Study 1 and Study 2 were statistically significantly different with nonoverlapping confidence intervals. However, although the R-indicator was higher in Study 3 it was not statistically significantly different (see Table 4).

Table 4. *R-indicators and 95% CI for push-to-web vs. no push-to-web.*

	Push-to-web	No Push-to-web
Study 1		
R-indicator	0.71 (0.01)	0.68 (0.01)
Confidence interval	[0.70, 0.72]	[0.67, 0.68]
Study 2		
R-indicator	0.67 (0.01)	0.66 (0.01)
Confidence interval	[0.67, 0.68]	[0.65, 0.66]
Study 3		
R-indicator	0.71 (0.01)	0.69 (0.01)
Confidence interval	[0.70, 0.71]	[0.69, 0.70]

Note. **The R-indicators were estimated with a probit model predicting answering with sex, age, marital status, and immigrant status. Standard errors in parenthesis.**

DATA QUALITY

The push-to-web approach was linked to reduced data quality through an increased share of *Breakoffs*, and a decreased share of *Completes* in both Study 2 and Study 3, but not in Study 1. Three multinominal logistic regressions predicted that the proportion of *Breakoffs* was statistically significantly larger, and thus that the proportion of *Completes* was smaller among sample persons who received a link to the online questionnaire and no paper-and-pencil questionnaire in the first mailing than sample persons who received a link to the online questionnaire and a paper-and-pencil questionnaire simultaneously in the first mailing in Study 2 ($dyxy_{breakoffs}$= .03, SE = 0.00 p = .00) and in Study 3 ($dyxy_{breakoffs}$= .02, SE = 0.00 p = .00) but not in Study 1 ($dyxy_{breakoffs}$= .00, SE = 0.00 p = .23).

Table 5. *The share of breakoffs, partials, and completes in the experiments (multinominal logistic regression coefficients)*

	dy/dx	z-value	95% CI lower	95% CI higher
Study 1				
Breakoffs	.00 (.00)	1.20	-.00	.01
Partials	-.00 (.00)	-0.86	-.01	.01
Completes	.00 (.00)	0.03	-.01	.01
Study 2				
Breakoffs	.03*** (.00)	7.20	.02	.03
Partials	.00 (.00)	0.67	-.00	.01
Completes	-.03*** (.00)	-6.05	-.04	-.02
Study 3				
Breakoffs	.02*** (.00)	6.10	.01	.02
Partials	.00 (.00)	1.16	-.00	.01
Completes	-.02*** (.00)	-5.03	-.03	-.01

Note. **Average marginal effects of the treatment group on breakoffs, partials and completes with standard errors in parentheses. The main effects of the multinomial logistic regression breakoff, partial and complete variables were included in the regression but were dropped from the table for readability. The number of observations was 11,127 in Study 1, 14,136 in Study 2, and 15,113 in Study 3.**

$^{+}p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

CONCLUSION

The implementation of the three preregistered randomized experimental studies described in this note investigated the effects of pushing respondents toward completing

questionnaires online rather than by paper-and-pencil (a so-called push-to-web approach). The results showed that the push-to-web approach, contrary to expectations, did not decrease the response rates. This finding appeared very robust, showing up in three replications administered over three different years.

Further analysis indicated that age was not linked to reduced response propensity in the push-to-web approach compared to the no push-to-web approach as this was found in the first study but not evident in the other studies. The second and third studies showed that the push-to-web approach decreased nonresponse bias concerning sex, age, marital status, and immigrant status. This could imply that certain groups who are usually less responsive might be more inclined to participate in online surveys, whereas those who prefer traditional paper surveys might be discouraged by the web-only option.

Additionally, a higher proportion of sample persons answered only up to 50 percent of the questions with the push-to-web approach indicating a larger pool of potential respondents compared to the no push-to-web approach. These partial responses, not considered complete for response rate estimations, suggest a potential for increasing overall response rates. The extent of incomplete responses among those who began but did not return the paper-and-pencil questionnaire however remains unclear.

Thus, unlike prior research on the area, the three randomized experiments in this note provided strong support that the response rate was not affected in the sequence of offering a link to the online questionnaire and no paper-and-pencil questionnaire in the first invitation compared to the sequence of receiving a link to the online questionnaire and a paper-and-pencil questionnaire simultaneously. The results diverge from those of earlier studies, possibly due to Sweden's recent advances in internet access and enhanced digital literacy. This indicates that the more cost-effective push-to-web approach, which did not negatively affect response willingness, could be an effective method for survey practitioners to consider in a digital environment similar to Sweden. Further elaborating on the timing of introducing the paper-and-pencil questionnaire in the reminder mailings may be an area for future research.

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The SOM Institute is an academic organization located at the University of Gothenburg, Sweden. Since 1986 the SOM Institute conducts annual cross-sectional surveys among the Swedish population with a focus on Society, Opinion, and Media, as well as administering the web panel called the Swedish Citizen Panel. The annual surveys and the web panel both function as infrastructures, enabling researchers and public organizations to effectively collect research and opinion data in collaboration with researchers at the SOM Institute.

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