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The impact of day of mailing on web survey response rate and response speed

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Non-technical summary

Researchers invest considerable efforts to encourage participation in surveys and to motivate respondents to take part in surveys promptly. Maximising survey participation is important, because if respondents not participating in surveys differ from those who are participating on some aspects which are relevant for the researcher, then population estimates might be biased.

Also, minimising the time which passes between the survey invitation and when respondents do actually take part is important: if respondents do not participate promptly in surveys, researchers may need to invest additional resources to persuade the respondent to take part – for example, an additional interviewer visit or additional reminder mailing.

In order to encourage participation in surveys and to motivate respondents to take part in surveys promptly, researchers are nowadays more and more often adopting techniques tailored to specific subgroups of the population. The rationale of varying the survey features across respondents relies on the idea that people respond to stimuli differently. In this research we experiment whether varying the day on which respondents receive an invitation to participate in the survey might help particular subgroups of the population to participate (and to participate promptly) to the survey.

The final aim of this work is identifying best practices for increasing survey participation and prompt response. The identified best practices might be used by survey practitioners and researchers to design effective data collection.

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Abstract: The day of the week on which sample members are invited to participate in a web survey might influence propensity to respond, or to respond promptly. This effect could differ between sample members with different characteristics. We explore such effects using a large-scale experiment implemented on the *Understanding Society* Innovation Panel, in which some people received an invitation on a Monday and some on a Friday. Specifically, we test whether any effect of the invitation day is moderated by economic activity status, previous participation in the panel, or whether the invitation was sent only by post or by post and email simultaneously.

Keywords: adaptive design, survey invitation, survey nonresponse, targeted survey design, web surveys.

JEL classifications: C81, C83

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1. Introduction

Survey researchers using online data collection methods continue to invest in efforts to identify ways of improving response rates (Jäckle, Gaia, and Benzeval 2017). Response speed is also of importance, particularly for surveys that use methods other than email to send reminders or to seek participation from initial nonrespondents (i.e. push-to-web mixed-mode surveys), due to the additional costs associated with slow response (Carpenter and Burton 2018). Meanwhile, the tools used to improve response rates and response speed have become more sophisticated, particularly various types of adaptive designs (Schouten, Peytchev, and Wagner 2017) have been introduced within this framework. Researchers no longer focus on the average effect of survey design features but are instead interested in the effect on subgroups of particular interest, namely those with otherwise low response rates or a propensity for slow response. This reflects a recognition that both outcomes of interest (response rate, response speed) and the effectiveness of design features that influence the outcomes may vary substantially over sample subgroups. In this respect, panel surveys provide a particularly rich environment for the application of this type of designs as the wealth of prior information available can be used to identify subgroups with (likely) variation in the outcomes of interest and to inform the choice of design features that might provide improved outcomes (Lynn 2017).

The design feature of interest in this article is the day of week on which an invitation to participate is mailed (i.e. day of mailing). We study this feature in the context of a web-first mixed-mode panel survey, where slow response leads to considerable cost as the follow-up data collection mode is face-to-face. We focus on the interaction between day of mailing and survey participation characteristics of sample members, namely

prior participation in the panel and previous provision of an email address. The former is related to co-operation of sample members while the latter allows invitations and remainders to be sent by email, thus affecting the frequency and volume of reminders that can be sent and could well therefore interact with mailing day. We also examine the role of socio-demographic characteristics of sample members. The socio-demographic characteristic in which we are interested is, specifically, economic activity status as we hypothesise ways in which the association between mailing day and outcomes might vary depending on economic activity status.

2. Literature review

Web surveys usually achieve lower response rates than surveys administered in other modes. The survey methodological literature has investigated the effectiveness of different strategies to boost web response, including, among other aspects, variations in the format, content, and length of survey invitations (Fan and Yan 2010; Kaplowitz et al. 2012; Mavletova, Deviatko, and Maloshonok 2014; Petrovčič, Petrič, and Lozar Manfreda 2016). Nevertheless research on the effect of invitation timings (time of the day or day of the week) on response rate and response speed is limited, and evidence is mixed. Indeed, while for interviewer administered surveys the best time for contacting respondents seem to be weekday afternoons (for face-to-face interviews), evenings (for telephone interviews) and weekends, a clear indication for timing the invitation to a web survey does not seem to exist (Callegaro, Lozar Manfreda, and Vehovar 2015).

As noted by Andreasson, Martinsson and Markstedt (2017), on one hand, defining optimal invitation timing in web surveys seems crucial as receiving an invitation at an inconvenient time may lead sample members to ignore the survey request and

eventually compromise participation altogether; on the other hand, invitation timing seems less relevant in web surveys compared to interviewer administer modes, like telephone and face-to-face surveys. Indeed, in web surveys, researchers have only control on when the invitation is dispatched (either by email or postal letter), while they can not fully control when the invitation reaches the sample member (e.g. when the postal letter arrives) nor when the sample member reads the invitation. Also, in web surveys sample members do not need to be immediately available to participate in the survey, as participation can be postponed to a more convenient time.

In this review, we focus on the day of the week on which the invitation was sent, given that the experiment tested this dimension (while the effect of time of the day was not tested). Evidence from the literature on this aspect is mixed. Lindgren et al (2020) test experimentally, using the Swedish Citizen Panel, the effect of sending invitation emails to a web survey on the seven different days of the week on net participation rates – these are calculated as responses (including partial responses) divided by the number of invitees in the initial sample, excluding e-mail bounce backs. The authors find that the highest prompt participation (within one day of fieldwork) is observed if invitations are sent on Wednesday and that prompt participation is significantly lower if respondents are invited on Fridays, Saturdays, and Sundays, as opposed to Wednesday. Nevertheless, the difference is eroded with time, with similar response rates after six days (even in absence of reminders). When analysing the effect separately for groups with different economic activity statuses, the authors find that both employed and not-employed sample members are less likely to respond within the first 24 hours if they receive the invitation on a Saturday or Sunday compared to Wednesday; however, the effects disappear after 6 days from the survey invitation. Furthermore, Lindgren et al

(2020), find indications that matching respondents' preferred day with the actual day for the survey invitation can increase participation rates, at least within a week.

Consistently with Lindgren et al (2020), Faught, Whitten and Green (2004) also conclude that Wednesday is the most effective day to send email invitations, while in a large scale study conducted on Federal employees, Lewis and Hesse (2017) found that invitations sent on Tuesday morning achieved the highest participation rates (as opposed to Wednesday and Thursday). Their experimental design however excluded Monday and Fridays, which are the two days of interest in our research design. The days of interest for our research were tested by Bennett-Harper et al (2007) who find that sending the survey invitation on a Friday increases response rates compared to an invitation sent on a Monday or on a Wednesday; however, Friday invitations required more reminders to achieve the final level of cooperation.

Shinn, Baker and Briers (2007) find no effect on response rates or response speed of varying the day on which the invitation is sent: the authors however conducted the survey on a very small sample size (N = 192) with five treatment groups, finding response rates that vary between 21% (Monday invite) to 44% (Wednesday invite) and response speed (i.e. number of working days elapsed from invitation to response) range from 3 (Monday invite) to 6 (Friday invite).

Observational, rather than experimental, studies include Zheng (2011), who analysed response rate from 100.000 surveys implemented through the platform Survey Monkey, focussing on customer surveys (i.e. surveys collecting customer feedback) and internal surveys (i.e. surveys run on employees of an organisation). The author finds the response rates were higher for survey invitations sent on Monday and lowest for invitations sent on Friday (all week days were tested). Similarly, Callegaro, Lozar Manfreda and Vehovar (2015) report results from other unpublished observational

research on data from 2007 from the Knowledge Networks online panel, which signals that prompt response (within one day) was highest on a Sunday and a Monday (compared to other days), but overall response rates were very similar after an email reminder (sent three days after the initial invitation, leaving no ultimate effect on the survey response rate).

Finally, using the same experimental data analysed in this paper, Culinane and Nicholaas (2013), comparing household outcomes, did not find any effect on response rate of the day (Monday *vs.* Friday) of invitation mailings (sent by post, and email whenever possible) on overall response. We extend the analysis of Culinane and Nicolaas (2013) in several respects, by considering individual-level response, by exploring interactions of the mailing day with economic activity status (which is expected to be associated with leisure time at week ends), with prior survey participation indicators, and email availability, and by including response speed as an additional outcome variable.

Research Questions

Previous research into the effects of mailing day on response rates is limited and has found mixed results. Further evidence of this effect is therefore valuable. Furthermore, it is of interest to know whether the effect, if any, differs between relatively co-operative and relatively reluctant sample members. If so, panel survey researchers would be able to vary the approach depending on prior wave participation of sample members. Similarly, mixed-mode panel surveys may have a valid email address for only a proportion of panel members, meaning that only some can be sent survey invitations and reminders by email while others must rely on postal mailings. But the effect of mailing day could depend on whether the survey invitation is received by email or letter

as the response mechanisms are different. In one case, the recipient is already online and just needs to click on the link to complete the survey, while, in the other case, he/she needs to open the invitation letter, then go online and type in the URL. Moreover, researchers have less control over the timing of arrival of postal letters than of emails. Also, the number of reminders could differ, as researchers may opt for sending email reminders (which are less costly and logistically easier to dispatch) in addition to postal mail reminders. To our knowledge, there is no empirical evidence to guide decisions about whether day of mailing should differ between postal mailings and emails. Our first set of research questions is:

RQ1a: Does propensity to participate in a web survey depend on whether the invitation is received on a Monday or on a Friday?

RQ1b: Does any effect of mailing day differ between previously cooperative sample members and previously less cooperative sample members?

RQ1c: Does any effect of mailing day depend on whether the invitation is sent by email in addition to postal letter or by postal letter only?

With respect to RQ1c, we acknowledge that respondents that provided an email address might have a higher willingness to cooperate and, thus, a higher response propensity than other respondents which may confound the invitation letter mode effect with the respondents' willingness. As discussed in the methodological section we attempted to minimise this confounding effect by fitting regression models that control for factors which are associated with respondents' cooperativeness (e.g. participation in earlier survey waves).

We hypothesise that mailing day might also affect the speed of participation. We introduce the notion of prompt response as participation within two days from the invitation. The rationale is that with web, if a person has time to complete the survey when he/she receives the invitation, then he/she would probably do it immediately.

Our second set of research questions is thus:

RQ2a: Does propensity to participate promptly in a web survey depend on whether the invitation is received on a Monday or on a Friday?

RQ2b: Does any effect of mailing day on prompt participation differ between previously cooperative sample members and previously less cooperative sample members?

RQ2c: Does any effect of mailing day on prompt participation depend on whether the invitation is sent by email or only by letter?

Further, we argue that individuals with different organization of time over the week might have different responding behaviours depending on the day they receive the invitation. Our hypothesis is that individuals with busy working weekdays and leisure time during the week-end may show higher response rates and/or higher response speed if the invitation arrives on a Friday, rather than on a Monday. This is expected to be particularly true for "employment-busy" people (these are defined here as people working more than a certain number of hours, see section "data" for details). Conversely, individuals with a less structured distinction between busy time and leisure time (e.g. retired persons) may not show any difference in response rates and response speed if invited on a Monday as opposed to a Friday. Thus, our third research question is:

RQ3: Does any effect of mailing day on propensity to participate or propensity to participate promptly depend on sample member's economic activity status?

3. Data

Survey Design

We use experimental data from Wave 5 of the Innovation Panel of *Understanding Society*: the UK Household Longitudinal Study. To our knowledge, this is the first time a study of mailing day effects on a web survey has been carried out on UK data. *Understanding Society* is a multidisciplinary panel study that addresses a wide range of topics such as living arrangements, fertility, housing, economic activity, income, health, and political attitudes (Buck and McFall 2012). The Innovation Panel (IP) is a separate sample from the main *Understanding Society* sample and is used to test methodological innovations applicable to *Understanding Society* and longitudinal surveys more generally (Uhrig 2011). The IP closely mirrors *Understanding Society* in its design. The target population is all persons living in Great Britain and a sample from this population was selected using a stratified, clustered, probability sampling design (Lynn 2009). Address-based sampling was used, with an initial sample of 2,760 addresses included from Wave 1 of the survey in 2008. A refreshment sample was added at Wave 4 in 2011 using the same design, including an additional 960 addresses. Each adult (aged 16+) initially resident at a sample address is defined as a sample person. The aim at the initial wave is to interview each sample person, while subsequent waves are carried out each 12 months and aim to interview both the sample persons (regardless of whether they still reside at the same address) and all other current members of the sample person's household. Sample persons are followed when they

move home, as long as they remain within Great Britain. The fieldwork for Wave 5 was conducted between May 11th and August 30th, 2012.

From Wave 5 onwards, experimentation with a sequential mixed-mode design (web and face-to-face) was introduced (Jäckle, Lynn, and Burton 2015; Bianchi, Biffignandi, and Lynn 2017). Specifically, at Wave 5, two thirds of the sample was randomly allocated to the mixed-mode design and one third was randomly allocated to a face-to-face-only design. The data used in this article are from an experiment mounted on the part of the sample allocated to the mixed-mode design. The analysis presented here is based on the 1,885 panel members that were eligible for interview at both Waves 4 and 5; newentrants at Wave 5 are excluded. This analysis base represented an estimated 30.8 percent of all eligible sample members (AAPOR RR1).[1]

The fieldwork procedures for the group of sample members allocated to the mixed-mode design at Wave 5 were as follows. Adult sample members (aged 16 or older) were sent by postal mail an invitation to participate in the survey online, along with an unconditional incentive. The incentive level varied experimentally. The invitation letter to the web survey included a URL and a unique user ID; respondents were invited to enter this user ID into the welcome screen of the web survey. Sample members who

[1] The sample issued at Wave 5 had two components: the original sample members who were participating for the fifth time, and the refreshment sample members who were participating for the second time. Estimated response rate to the Wave 1 enumeration was 60.9 percent (AAPOR RR1). The 1,331 panel members from the original sample included in the present analysis represent 46.9 percent of all persons aged 16 or over enumerated at Wave 1, the rest having been lost due to a failure to trace following a move, persistent non-contact, or refusal, or having been allocated to the face-to-face group in the mode experiment at Wave 5. Estimated response rate to the Wave 4 enumeration of the refreshment sample was 61.4 percent (AAPOR RR1), of whom 62.0 percent are included in the current analysis. The present study is therefore based on around 28.6 percent of original sample members and 38.0 percent of refreshment sample members, corresponding to 30.8 percent of all sample members.

had supplied a valid email address (a little over one third of the mixed-mode sample) also received a version of the invitation letter by email. Only sample members who signalled at previous survey waves that they do not use internet regularly for personal use, were informed in the letter of the possibility to do the survey through a face-to-face interview (26.9% of the sample). Sample members with a known email address were sent reminder emails after two days and four days if they had not yet responded. After around a week, all sample members who had not yet completed the web survey were sent a reminder by post (on Saturday 19th May, 2012). For those without a known email address, this was the first reminder. Starting from 24th May 2012, interviewers then started visiting sample members at their homes to attempt a CAPI interview. In this phase, the web survey remained open (Jäckle, Lynn and Burton 2015).

The survey consisted of a household grid (collecting information on who is living in the household and basic demographic indicators for each), a household questionnaire (collecting information about housing, payments for rent, mortgage and utility bills, and other household attributes) and a personal interview. The first person in the household logging in the web survey was asked to fill in the household grid. An item on this instrument queried who is responsible for paying the bills in the household. The household questionnaire was addressed to either this person or his/her spouse or partner (whichever logged in first). After the household questionnaire is completed, the survey carries on into the individual questionnaire (Jäckle, Lynn, and Burton 2015).

The Wave 5 questionnaire was not optimised for smartphone use: respondents attempting to complete the survey with a mobile device received a message asking them to log in to the survey using a computer (Jäckle, Lynn, and Burton 2015).

Experimental design

To test whether the timing of the invitation letters and emails has an effect on web survey response, a randomized experiment was implemented amongst the mixed-mode part of the IP Wave 5 sample. Individuals were randomly assigned to one of two treatment groups (all individuals in the same household were allocated to the same group). Half were sent the invitation mailing (by post, and email whenever possible) timed to arrive on a Monday (14th May 2012), and the other half on a Friday (11th May 2012). The randomisation to groups was orthogonal to the experimental groups for the incentives experiment mentioned earlier and independent of other experiments, so there is no confounding of experimental treatments (Lynn and Jäckle 2019). A summary of the experimental design with the dates of the mailings is presented in Table 4.1.

Table 4.1: Summary of experimental design

	Experimental group	
	Monday	Friday
Survey postal/mail invitation	Monday (14/05)	Friday (11/05)
First email reminder	Wednesday (16/05)	Sunday (13/05)
Second email reminder	Friday (18/05)	Tuesday (15/05)
Postal reminder*	Saturday (19/05)	Saturday (19/05)

Note: *refers to sending day, while all other days refers to date of arrive (for postal invitations, these were sent to arrive on the specified date).

Measures of interest

The two outcomes of interest in this study are participation in the web survey, and prompt participation. Both are indicated by dichotomous variables. The first is coded 1 if the web survey was completed at any point during the field work period; 0 otherwise. The second is coded 1 if the survey was completed within two days of the day that the

invitation should have arrived[2]. The first email reminder was sent after two days, so defining prompt response as response within two days avoids confounding the effect of the initial invitation with that of the reminder. Response to the CAPI follow-up phase is ignored as it is not the focus of this study.

Prior participation takes the value 1 if a personal interview was given at the previous wave; 0 otherwise (proxy or no interview at Wave 4). Whether or not an email address was previously supplied is similarly indicated by a binary variable.

Economic activity status is derived from the IP variable jbstat (job status), as reported at the most recent wave in which the sample member had previously participated, and has three categories[3]. People having a job are those who reported their main activity as being employed, self-employed, an unpaid worker in a family business, or in an apprenticeship; people not having a job are those who were unemployed, on maternity leave, looking after family or home, full-time student, long term sick or disabled, on a government training scheme, or doing something else; retired people are those who reported their status as "fully retired". Additionally, we define "employment-busy people" in the way introduced by Fumagalli, Laurie, and Lynn (2013): employed for at least 39 hours per week or employed for 30 to 38 hours with a commute of least 60 minutes each day.

The distribution of the issued sample of individuals across treatment groups is summarised in Table 4.2, both in total and by categories of each of the moderator variables, namely, previous wave participation, whether or not a valid email address

[2] In other words, by 24:00 on Wednesday 16 May for those whose invitation was scheduled to arrive on 14 May, and by 24:00 on Sunday 13 May for those whose invitation was scheduled to arrive on 11 May.

[3] This variable has 113 missing values corresponding to panel members that had never given a personal interview.

was supplied, economic activity status, and employment-busy people. The exact question wording of all survey questions used to derive the above mentioned measures are reported in the Appendix.

Table 4.2: Allocation of Individuals to Experimental Groups in Wave 5

	Experimental group		
	Monday	Friday	Total
Total sample	954	931	1885
Previous wave outcome			
Previous wave participants	697	697	1394
Previous wave non-participants	257	234	491
Valid email address supplied			
Yes	470	443	913
No	484	488	972
Economic activity status			
Has a job	479	489	968
No job	219	172	391
Retired	194	219	413
Employment-busy			
Yes	164	145	309
No	790	786	1576

4. Results

Table 5.1 reports response rates for web response and prompt web response by day of invitation, both overall and by each of the moderator variables under consideration. Overall, there is no evidence of any effect of day of invitation on web survey participation (RQ1a; p=0.71; Table 5.1).

In order to answer research questions 1b and 1c (i.e. whether any effect of mailing day depends on respondents' participation at the previous wave; whether any effect of mailing day depends on the respondent receiving an invitation by email, in addition to a postal invitation), we carried out a logistic regression, controlling for possible

differences among the groups identified by the moderator variables.[4] Table 5.2 reports the estimated coefficients from a logit model predicting web survey participation using the moderator variables and their interaction with treatment as predictors, controlling also for individual characteristics.

We find no statistically significant difference in the effect of mailing day on response between previously cooperative sample members and previously less cooperative sample members (RQ1b; p=0.096, Table 5.2). As for email availability, a significant interaction with mailing day is observed, with only the group that provided an email address having higher probability to participate when invited on a Monday (RQ1c; p = 0.012).

Moving to the second set of research questions regarding response speed, overall prompt response is more prevalent for Monday invitations, but the effect does not achieve significance (RQ2a; 9.3 vs 6.6, p = 0.08, Table 5.1). In order to investigate the effects of previous wave cooperation and email availability, we fitted a logistic regression model with prompt response as dependent variable and the moderator variables, their interaction with treatment and controls as independent variables (Table 5.3). The effect of mailing day on prompt participation does not appear to depend either on whether a respondent was previously cooperative (RQ2b; p = 0.759) or on whether or not an email address had been supplied (RQ2c; p = 0.960).

[4] We did not experiment with email *versus* postal invitation letter, rather we are comparing sample members who provided an email address (and thus received an email invitation in addition to a postal invitation letter) with sample members who did not provide any email address and thus received only an invitation by postal mail. As people who provided an email address are likely to have different characteristics from those who did not, we control for possible confounding variables.

Table 5.1: Response rates and prompt response rates, by day of invitation.

	Response (%)			Prompt response (%)		
	Monday invite	Friday invite	P	Monday invite	Friday invite	P
Total sample	33.5	32.4		9.3	6.6	
Previous wave participants	39.9	38.7		11.9	8.0	*
Previous wave non-participants	16.3	13.7		2.3	2.1	
With email address	51.5	46.3		14.9	10.8	
Without email address	16.1	19.9		3.9	2.7	
Has a job	40.1	41.1		10.0	8.8	
No job	26.9	23.3		8.2	4.1	
Retired	30.9	22.4		11.9	4.1	*
Employment-busy	40.9	31.0		12.8	6.9	

Note: P-values (corrected for the survey design, strata and clusters) from t-tests on the equality of means; *** indicates p<0.001, ** indicates p<0.01, * indicates p<0.05; prompt response defined as response within 2 days of the invitation day. "Employment busy" are sample members employed for 39+ hours/week or for 30-38 hours/week and commuting for 60+ minutes/day.

We turn now to examine our third research question (RQ3), regarding whether any of the possible effects of invitation day could be moderated by economic activity status. It turns out that the effect of mailing day on propensity to participate depends on sample member's economic activity status, with those not having a job and the retired being less likely to participate when invited on a Friday ($p = 0.056$ and $p = 0.006$, respectively; Table 5.2) compared to those having a job. Also, sample members who are "employment-busy" are less likely to participate when invited on a Friday ($p = 0.034$). For prompt response, the positive effect of Monday invitation is significant only for retired people ($p = 0.010$; Table 5.3).

Table 5.2. Logistic regression result for web survey participation.

Variable	Category	Coef.	S. E.	P
Intercept	-	-2.225	0.550	**0.000**
Mailing Day (MD)	Friday	0.173	0.413	0.678
(Ref. Monday)				
Previous wave participation	Yes	0.792	0.272	**0.005**
(Ref. No)				
Email given	Yes	1.493	0.220	**0.000**
(Ref. No)				
Economic activity status	No job	-0.163	0.212	0.444
(Ref. Has a job)	Retired	0.913	0.281	**0.002**
Emplyment-busy	Yes	0.294	0.241	0.227
(Ref. No)				
MD#Previous wave participation	Friday#Yes	0.641	0.379	0.096
MD#Email given	Friday#Yes	-0.615	0.238	**0.012**
MD#Economic activity status	Friday#No job	-0.533	0.274	**0.056**
	Friday#Retired	-0.943	0.328	**0.006**
MD#Employment-busy	Friday#Yes	-0.797	0.368	**0.034**
Gender	Female	0.107	0.103	0.304
(Ref. Male)				
Age	21-30	-1.075	0.348	**0.003**
(Ref. 16-20)	31-40	-0.652	0.408	0.115
	41-50	-0.551	0.400	0.173
	51-60	0.691	0.407	0.095
	61-70	-0.903	0.435	**0.042**
	71+	-2.107	0.486	**0.000**
Household type	Single, children	0.29	0.403	0.475
(Ref. Single)	Couple	0.41	0.343	0.237
	Couple, children	0.193	0.381	0.614
	2+ unrelated adults	0.407	0.313	0.199
	2+ unrelated adults, children	-0.263	0.323	0.419
Marital status	Married/civil partnership	0.440	0.303	0.151
(Ref. Single and never married/civil partn)	Separated/Divorced/Widowed	-0.400	0.265	0.137
Own children in household	Yes	-0.277	0.324	0.396
(Ref. No)				
Degree	Degree	0.467	0.136	**0.001**
(Ref. No degree)				
Urbanicity	Urban	0.199	0.200	0.325
(Ref. Rural)				

Notes: "S.E." stands for "standard error", "P" stands for "P-values". P-values adjusted for sampling design. Bold signals that P-values is <0.05. "Employment busy" are sample members employed for 39+ hours/week or for 30-38 hours/week and commuting for 60+ minutes/day. N = 1762.

Table 5.3 Logistic regression result for prompt response (within two days).

Variable	Category	Coeff.	S.E.	P
Intercept	-	-4.276	0.819	0.000
Mailing Day (MD)	Friday	-0.027	0.766	0.972
(Ref. Monday)				
Previous wave participation	Yes	1.056	0.488	**0.034**
(Ref. No)				
Email given	Yes	1.170	0.407	**0.006**
(Ref. No)				
Economic activity status	No job	0.232	0.346	0.505
(Ref. Has a job)	Retired	1.222	0.407	**0.004**
Employment-busy	Yes	0.644	0.286	**0.028**
(Ref. No)				
MD#Previous wave participation	Friday#Yes	0.224	0.725	0.759
MD#Email given	Friday#Yes	0.028	0.569	0.960
MD#Economic activity status	Friday#No job	-0.946	0.566	0.100
	Friday#Retired	-1.403	0.525	**0.010**
MD#Employment-busy	Friday#Yes	-0.875	0.523	0.100
Gender	Female	0.126	0.170	0.461
(Ref. Male)				
Age	21-30	-0.499	0.551	0.368
(Ref. 16-20)	31-40	-0.815	0.654	0.217
	41-50	-0.522	0.595	0.384
	51-60	-0.260	0.671	0.700
	61-70	-0.295	0.738	0.691
	71+	-1.474	0.785	0.065
Household type	Single, children	0.553	0.675	0.416
(Ref. Single)	Couple	-0.456	0.538	0.400
	Couple, children	0.335	0.766	0.664
	2+ unrelated adults	-0.456	0.614	0.461
	2+ unrelated adults, children	-0.179	0.616	0.773
Marital status	Married/civil partnership	0.899	0.531	0.096
(Ref. Single and never married/civil partn)	Separated/Divorced /Widowed	-0.123	0.581	0.833
Own children in household	Yes	-0.485	0.531	0.365
(Ref. No)				
Degree	Degree	0.112	0.180	0.538
(Ref. No degree)				
Urbanicity	Urban	0.199	0.292	0.325
(Ref. Rural)				

Note: "S.E." stands for "standard error", "P" stands for "P-values". P-values are adjusted for sampling design. "Employment busy" are sample members employed for 39+ hours/week or for 30-38 hours/week and commuting for 60+ minutes/day. N = 1762.

Discussion and conclusions

We have presented the results of an experiment implemented in a large scale probability-based survey, which tests the effect on response rates and response speed of varying the day of invitation to a web survey. Invitations were sent timed to arrive on Monday or Friday by postal mail to all sample members; in addition, sample members who at previous survey waves provided an email address also received an email invitation: this was also timed to arrive on Monday or Friday (on the same day as the postal invite). Overall, we do not find any difference either in survey participation or in prompt participation (defined as participation within two days from the invite) between respondents receiving the invite on Monday or Friday; however, group differences emerge.

Sample members who, at previous survey waves, provided an email address, and, thus, were contacted by email in addition to postal letter, are less likely to participate if invited on Friday (with email reminders on Sunday and Tuesday) as opposed to Monday (with email reminders on Wednesday and Friday). The effect seems to be due to the day of mailing of reminders, given that no difference between the two protocols is found for prompt response (i.e. after only the invitation is sent and reminders are not set yet). Indeed, we argue that is the receipt of reminders on weekdays (Wednesday and Friday) rather than during the week-end/at the beginning of the week (Sunday and Tuesday) that encouraged response. Given that we only find an effect in the "longer" term, i.e. only after reminders are sent, we speculate that the effect is not due to the timing of the survey invitation, but rather to the timing of reminders. Reminders were sent two and four days after the survey invitation, i.e. on Wednesday and Friday in the group of respondents who were invited on a Monday, and on Sunday and Tuesday in the group

of respondents who were invited on a Friday. Further research might usefully investigate this aspect.

In general sample members who are able and willing to share with the survey researchers/agency additional contact details (e.g. email, telephone number) tend to be more cooperative than those who do not share their contact details, and, thus, may respond differently than other sample members to variations in the survey design. In the analysis of these experimental data we control for previous wave cooperation and we also test the interaction between previous wave participation and variation in the survey invitation day: we do not find a significant difference (at standard statistical levels $p<0.05$) in participation or prompt participation between previously cooperative sample members and previously less cooperative sample members. We conclude that the effect found for the subgroups of respondents who provided email contact details is likely driven by the contact mode (which allows more precise timing of day of mailing) rather than by the supposed higher cooperation propensity of this subgroup of respondents.

Another important group difference which emerges from this study concerns the respondents' economic activity status. The rationale for this subgroup analysis is that sample members may have different organisation of time by day of the week depending on their economic activity status (i.e. whether they are employed, students/unemployed, or retired); this different organisation of time may result in different preferences for the timing of survey participation requests. Our study shows that employed respondents who work long hours (i.e. 39+ hours weekly or 30-38 hours/weekly with a 60 minutes commute) are less likely to participate if invited on a Friday; this finding contrasts with our hypothesis that respondents with a fixed organisation of time, with busy working

days and free time over the week end would be more likely to participate if invited just before the weekend, when they have more free time for survey participation. The opposite seems to be true, with busy respondents being less likely to participate if invited on Fridays. However, no effect is found for prompt participation.

Also contrary to our hypothesis, respondents who are retired are less likely to participate and to participate promptly (within two days) to the survey if they are invited on a Friday rather than on a Monday. Further analysis, not shown here, signals that the effect is persistent even after sample members receive further reminders (not timed to arrive on a specific day), leading to a lower response after two weeks of survey invitation for retired sample members who receive their first invitation on a Friday. This finding contrast with our expectation that survey participation would not vary by day of invitation for individuals that do not follow a Monday-Friday working routine. A possible explanation of this result is that retired respondents might be busier on weekends (when they may gather together with family and friends who work on week days) than on week days. If this proves to be the case, this finding would be consistent with the idea that survey contacts need to be timed in a way so that they are received by participants when they are not too busy (Callegaro, Lozar Manfreda, and Vehovar 2015). On this respect research on time use might provide useful insights for survey practice.

Overall, our findings confirm how survey design features that are not effective overall for a general population sample, might significantly improve response rates for population subgroups. This result emphasises the importance of implementing targeted survey design to meet the needs of different subgroups, which vary in their response

propensity and differ in how salient survey design features are in motivating sample members to participate in surveys (Groves, Singer, and Corning 2000).

One important characteristic of our study is its novelty, as, to the best of our knowledge, this is the first study on mailing day effects on response rates in a web survey conducted in the UK. Given the relatively limited research on the topic and the absence of other research on the UK context we encourage the replication of these findings to confirm their robustness.

This study has also important limitations. Indeed, while we expect these results to guide survey practitioners in choosing the optimal invitation timing, this is only possible under the assumption that researchers have some control over when respondents receive survey invitations. If survey invitations are sent by postal mail the date on when the invitation is received may differ depending on the reliability of the postal service adopted; this may vary by country and by the geographic proximity of respondents to major postal hubs. When invitations are sent by email, it is easier for researchers to control the time when the invitation reaches the respondent; however, the researcher has no control on when respondents check their email and read the content of the survey invitation; this latter consideration also applies to mail communication which may pile up for some time before respondents check them. This limitation needs to be considered when tailoring the invitation timings to web surveys.

Longitudinal surveys offer a favourable environment to time the survey invitation according to sample members' preferences. Indeed, information collected at previous survey waves may be used for tailoring the survey design: respondents may be asked at one survey wave to identify their preferred time to complete a survey request (e.g. week day or week end) and then be invited to participate on their preferred timing. Further

research might explore the feasibility of this approach and experimentally test its effectiveness.

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Appendix

Table A1: Question wording

Concept of interest	Variable name	Survey question	Operationalisation
Economic activity status	jbstat	"Which of these **best** describes your current employment situation? Self employed In paid employment (full or part-time) Unemployed Retired On maternity leave Looking after family or home Full-time student Long-term sick or disabled On a government training scheme Unpaid worker in family business Working in an apprenticeship Doing something else"	We recoded the variable as following: Employed = Self employed; In paid employment (full or part-time); Unpaid worker in family business; Working in an apprenticeship. Not employed = Unemployed; On maternity leave; Looking after family or home; Full-time student; Long-term sick or disabled; On a government training scheme; Doing something else" Retired=retired
Employment-busy,	jbhrs + jbttwt	"Thinking about your (main) job, how many hours, excluding overtime and meal breaks, are you expected to work in a normal week?" (jbhrs) "About how much time does it usually take for you to get to work each day, door to door (in minutes)?" (jbttwt)	Employment busy=1 if jbhrs≥39 or 30≤jbhrs≤38 and jbttwt≥60 Employment busy= 0 otherwise

Note: Other variables used in this analysis are: sex (sex), dvage (age), hhtype_dv (household type), mastat_dv (marital status), nchild_dv (own children in household), hiqual_dv (degree), urban_dv (urbanicity). These variables are all derived by the *Understanding Society* survey team; for more information see: https://www.understandingsociety.ac.uk/documentation/innovation-panel