

<<*LRH: Baghal and Lynn*>>

<<*RRH: Motivation and Web Item Missing Rates*>>

**USING MOTIVATIONAL STATEMENTS IN WEB-INSTRUMENT DESIGN TO
REDUCE ITEM MISSING RATES IN A MIXED-MODE CONTEXT**

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Abstract Web questionnaires, including those used in mixed-mode surveys, generally produce higher levels of item nonresponse than interviewer-administered questionnaires. Item nonresponse is generally seen as having a detrimental impact on data quality. The current study examines using motivational statements to reduce item nonresponse in a web survey component of a mixed-mode design. The effects of alternative implementations are

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compared, both for web surveys and for mixed-mode surveys. In addition, the mixed-mode results are compared to a face-to-face survey. The current study adds to the literature on the use of motivational statements by using a unique large-scale randomized experiment to examine the impact of the timing of the motivational statement, and to compare with the same survey in an interviewer-administered context. Findings show that a motivational statement following immediately after an item is left unanswered greatly outperforms either the control or a motivational statement at a later point in the survey. Using this immediate reactive prompt reduces item nonresponse to levels equivalent to a face-to-face version. Conversely, the control (no statement) and later placed motivational statement lead to significantly greater item nonresponse. Point estimates for the tested variables are not affected by the additional responses obtained. The results suggest practical design implications to reduce item nonresponse when using a web design, specifically the use of a reactive motivational prompt in a planned way.

Introduction

Item nonresponse is an important and widely used indicator of data quality (Groves 1989; de Leeuw, Hox, and Huisman 2003), as those responding to an item may systematically differ from those who do not (Little and Rubin 1987). The causes of item nonresponse may include not knowing or inability to recall the answer, lack of respondent motivation, concerns about confidentiality, or inadvertent skipping (Beatty and Herrmann 2002). Web surveys produce significantly higher item-nonresponse rates than interviewer-administered surveys (Duffy, Smith and Terhanian 2005; Heerwegh 2009; Lesser, Newton, and Yang 2012; Jäckle, Lynn, and Burton 2015). This difference suggests that there may be scope to reduce item-nonresponse rates on web surveys if relevant aspects of the interviewer-administered context could be replicated. Attempts to reduce item-nonresponse rates are important for all web

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surveys but are particularly important in the context of mixed-mode surveys involving both web and interviewer-administered data collection, where it may be desirable to achieve similar data quality in each mode.

A potentially useful method to reduce item nonresponse is the use of motivational statements. From the perspective of the survey as a conversation, the web survey is the researcher's side of the conversation, and respondents are following a cooperative principle (Schwarz 1996). Motivational statements can inform respondents of the purposes of the study, and may increase effort by appealing to cooperative tendencies. This cooperative principle may be further increased in a longitudinal survey, where respondents have more of a connection to the study (Rose 2000).

In interviewer-administered surveys, motivational statements have been found to increase respondents' willingness to provide effort and answer the question (Miller and Cannell 1982). Based on this finding, some studies have implemented motivational statements in web surveys. Oudejans and Christian (2011) found that including a motivational statement about the importance of a question reduced the item-nonresponse rate for two out of four items tested. However, Smyth et al. (2009) found that a similar motivational statement actually increased item nonresponse for both of two items tested. Including a prompt immediately after an item was skipped has been found to reduce missingness (Derouvray and Couper 2002; Oudejans and Christian 2011). These previous studies have some limitations, however. Only one dealt with closed questions (Derouvray and Couper 2002). Because reasons for skipping a question could differ between closed and open questions, the effects of motivational statements and subsequent prompts could also differ. None of the studies tested prompts that did not come immediately after the attempt to skip a question. None of them provide any comparison with the interviewer-administered context.

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To address these limitations, an experiment was conducted in wave 6 of the Innovation Panel (IP), part of the United Kingdom Household Longitudinal Study (UKHLS). This experiment was in response to findings from wave 5, which found significantly higher item nonresponse with a mixed-mode (web and face-to-face) design than with a single-mode face-to-face design, due to greater item nonresponse in the web survey (Jäckle et al. 2015). The experiments at waves 5 and 6 were part of a research program aiming to identify mixed-mode designs that could deliver, among other things, similar data quality to single-mode face-to-face. A specific objective of the wave 6 experiment reported here was to identify design features that would deliver mixed-mode item-nonresponse rates similar to those in the single-mode face-to-face survey.

Data and Methods

The UKHLS-IP is a vehicle for experimentation regarding aspects of survey design in a longitudinal survey context. It is based on a stratified, multistage probability sample of persons and households in England, Scotland, and Wales. At wave 1, postcode sectors were selected using probability proportionate to size, with households selected within sectors with equal probability. All persons in the household became sample members. At each subsequent annual wave, interviews are attempted with all sample members 16 years of age and older plus any other members of their households (“temporary sample members”). Prior to wave 5, the survey was entirely interviewer administered.¹ Our analyses are based on the 2,149 respondents from wave 6. Of these, 2,025 were sample members, while 124 were temporary sample members; 1,351 of the sample members were being asked to participate for the sixth

¹ Entirely face-to-face at waves 1, 3 and 4; with a mix of face-to-face and telephone interviewing at wave 2.

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time (original sample), while 674 were being asked to participate for the third time (wave 4 refreshment sample). For the original sample, the wave 1 response rate was 51.7 percent and the wave 6 completion rate among wave 1 respondents was 52.4 percent, producing a net wave 6 response rate of 27.1 percent (AAPOR RR3). For the refreshment sample, the wave 4 response rate was 48.8 percent and the wave 6 completion rate among wave 4 respondents was 79.3 percent, producing a net wave 6 response rate of 38.7 percent (AAPOR RR3).

At wave 5, a random two-thirds of sample households were allocated to a mixed-mode web and face-to-face design, while the other third were administered the standard single-mode face-to-face design. In the mixed-mode treatment, if any household member did not respond to the web survey within two weeks, an interviewer was sent to attempt a face-to-face interview. The same sample allocation was maintained at wave 6, with data being collected from February through August 2013.

The experiment of interest in wave 6 compared three methods of asking questions in the web survey. It was implemented on questions identified as important items that may be prone to item nonresponse (based on analysis of wave 5 web data) and was limited to six questions unlikely to all be applicable to any respondent, in order to avoid repetitiveness and burden in the prompted questions.² These questions ask about gross pay at last payment, amount received in interest and dividends, net profit in the past year (for those self-

² Gross pay and hourly pay were asked only of those in paid employment; profit from earnings was asked only of those self-employed; only those born in the UK who had not answered the UK county of birth in prior waves were asked this question; and only those respondents who did not have the same cohabitating spouse/partner from the last wave were asked the marital-status-change question. Only the interest/dividends question was asked of all respondents.

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employed), UK county of birth, hourly pay, and whether marital status had changed since the last wave.³ In the face-to-face versions, these questions were asked without explicit “Don’t Know” (DK) or “Prefer Not to Say” (PNS) options, but these were accepted as answers if given. There were no item-specific instructions for interviewers on probing. Standard training was to probe once on questions requiring numeric amounts and on attitude/knowledge questions, but not for simple factual questions. Four of the items in our study require numeric amounts, and two are simple factual. The standard probe for numeric amounts is “Can you give me an approximate answer?”

In the web version, these six questions were asked using three experimental variations, allocated randomly in advance.⁴ Once assigned to a condition, each respondent received the same variation for all six of the questions. Initially, each question appeared without DK/PNS options available. The variation occurred if the respondent attempted to skip from this screen without selecting an option. The *control* condition repeated the approach from wave 5: The respondent was immediately presented the question again, with DK and PNS options now available. No additional follow-up statement was given. At this point, the respondent was not able to continue to the next screen until an option had been selected, though a nonsubstantive option was permitted. While some web surveys allow a question to be skipped without selection of an opt-out option, the design used here reduces the chances of inadvertent skipping of questions.

In the second variation, the *reactive motivational* condition, if the respondent skipped the initial screen, the question reappeared immediately but included the statement “If

³ Exact question wordings appear in appendix A.

⁴ As expected, given random assignment, there are no significant differences between conditions in terms of sex, age, or education.

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possible, please provide an answer to this question, as this is one of the key questions in this study. Please be assured that the information you give us will be treated confidentially.” If a respondent attempted to skip the question a second time, the DK/PNS options now became available. Again, respondents could not continue without selecting a response. In the third variation, the *follow-up motivational* condition, respondents proceeded exactly as in the control condition, with an attempted skip followed by DK/PNS options being available and a response being required. Then, at the end of the survey, the following statement was presented:

Thank you for taking part in “Understanding Society” this year. Earlier in the interview there were some questions that you did not answer. As you know, you do not have to answer any question you do not want to. However, X of these questions are important to researchers and we would be grateful if you could try your best to answer them.

(X was the number of the six questions for which they did not provide a substantive response.) The respondent was then asked the questions they did not answer with the same text as initially, with the DK/PNS options also offered. Again, a response was required at this screen.

The reason for testing two alternative motivational conditions was the idea that the supposed positive impact of the immediacy of the reactive motivational condition might be tempered by possible negative impacts of delaying the respondent’s progress and introducing repetition. The follow-up motivational condition does not introduce repetitious prompts or delay progress until the respondent is explicitly told they have reached the end of the questionnaire. It was therefore unclear in advance which of the two conditions was likely to be more effective. The conditions are summarized in figure 1 (screen shots are provided in the supplementary data online).

[FIGURE 1 HERE]

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There were 663 respondents in the single-mode face-to-face group and 1,320 respondents in the mixed-mode group, of whom 513 were interviewed face-to-face while 807 completed the web survey (260 in the control condition, 299 in the reactive motivational condition, and 248 in the follow-up motivational condition). To assess the effect for web surveys, we first compare item-nonresponse rates between conditions for web respondents. We then assess the effect for mixed-mode designs by combining the data from each of the web conditions in turn with the data provided by face-to-face respondents in the mixed-mode group. There are thus three mixed-mode estimates, representing the expected outcome for each web condition as part of a mixed-mode design. Since each web condition makes up only a fraction ($n/807$) of all web respondents, web respondents are weighted by the inverse of this fraction ($807/n$). Face-to-face respondents in the mixed-mode group received a weight of 1, so the weighted total for all three mixed-mode designs is 1,320. Generalized linear models using a logit-link and binomial distribution are used for all comparisons of item-nonresponse rates.

Results

Due to routing, respondents were administered between one and four of the six questions. Of the 1,983 respondents, 433 (21.8 percent) answered one question, 899 (45.3 percent) answered two, 475 (24.0 percent) answered three, and 176 (8.9 percent) answered four. These percentages are similar across modes and conditions. There is wide variation in the number of respondents administered each question; all respondents were asked the question about interest and dividends, while only 97 people who had not answered the question previously were asked the UK county of birth question. As no one failed to answer the UK county of birth question, this item is not considered further, but is included in analyses of total missingness.

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Item-nonresponse rates for each of the remaining five questions are presented for each condition in table 1. For each question, the first row presents the initial amount of missing data (reflecting DK and PNS responses) for each question prior to the experimental versions being administered. The second row presents the ultimate item missing rates for each experimental condition as well as significance test results across conditions. While some initial differences are detected, the final outcomes show the effects of the manipulations. For each of the questions and for the overall total, there is either more initial item nonresponse in the reactive condition than the control or no significant differences between the two. Yet, the final item nonresponse is always less for the reactive compared to the control condition (directionally if not always statistically significant). Conversely, the relative initial item missingness between the control and follow-up conditions does not change after the experimental versions were administered.

[TABLE 1 HERE]

Comparing the final outcomes, the follow-up motivational condition has reduced item-nonresponse rates for two items compared to the control, but these differences existed initially. Further, the follow-up did not significantly reduce the overall missing rate. The reactive motivational treatment, on the other hand, significantly reduced the overall rate as well as the rates for two individual items. For a third item, gross pay, item nonresponse was significantly lower with the reactive treatment than with the follow-up treatment, though neither differed significantly from the control. Additional analyses (not shown) suggest that there is no learning effect, with those prompted after a skip attempt on earlier questions being no more or less likely to be prompted in later questions regardless of condition.

The reduction in missingness comes from the reactive condition adding far more additional responses than either of the other conditions. These reductions are evident in table

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1, comparing initial and final missing data rates for each question.⁵ The reactive condition prompts reduced item nonresponse for all five items, and by 8.9 percent across all items. Conversely, the control condition prompts reduced the overall item-nonresponse rate by only 0.9 percent. The follow-up condition did not perform much better, garnering additional responses that reduced item nonresponse by 1.8 percent.

Weighted item missing rates for the three mixed-mode designs are presented in table 2, along with the rates from the single-mode face-to-face design. As the contribution from face-to-face respondents is the same in each mixed-mode design, all differences are attributable to the web treatments. The total proportion of missingness for the six questions in each condition is presented in the last row of the table. Significant differences in proportions between a mixed-mode and face-to-face design are denoted by a subscript.

[TABLE 2 HERE]

The reactive condition reduces overall item nonresponse in a mixed-mode design to levels comparable to the single-mode face-to-face design, outperforming the other mixed-mode conditions. None of the six item-nonresponse rates are significantly different from the single-mode face-to-face design. The mixed-mode control condition has significantly higher item nonresponse than single-mode face-to-face for two of the five questions as well as overall. The control is also the only condition that has any item nonresponse in the marital-status-change question.

The follow-up condition produced higher item-nonresponse rates than single-mode face-to-face for three individual items and overall. It produced lower item nonresponse for one item, net profit—the only instance where item nonresponse is significantly less in a

⁵ Also see online supplementary table 1.

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mixed-mode condition. Few people were asked this question, however (mixed-mode weighted $n = 72.3$, face-to-face $n = 52$). We also find no significant interactions between respondent characteristics and experimental conditions.⁶ The lack of interactions suggests that the differential effectiveness of the conditions in reducing item nonresponse does not vary between demographic subgroups.

Although less missingness may itself be considered an indicator of data quality, the question remains as to how the additional responses gained through different methods impact estimates. We analyzed (not shown) the central tendencies for the gross pay and interest and dividends questions, as well as the proportion of zero responses for interest and dividends. The additional responses do not appear to greatly affect the estimates. There are no significant differences between conditions in means, medians, or proportion of zero responses at $p < 0.05$.⁷

Discussion

Our results suggest that a reactive prompt, with a motivational statement presented immediately after a respondent attempts to skip a question without answering, may be effective in reducing item nonresponse in web surveys to levels comparable to that of face-to-face surveys. In our experiment, the reactive mixed-mode condition outperformed both the

⁶ The respondent demographics examined are sex, age (categorized), education (college/professional certification compared to all others), and race/ethnicity (British or Irish white compared to all others). The only significant main effect is for age: $F(3,742) = 4.19$, $p < 0.01$. The oldest respondents are estimated to have the most item nonresponse, whereas those in the 30–49 age category are estimated to have the least.

⁷ See online supplementary table 2.

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control and follow-up conditions. The percentage of additional responses garnered by the reactive condition is several times greater than those obtained in the other conditions. If the lower item nonresponse is due to the timing of the motivational statement, it suggests immediate rather than delayed action. It should be noted that the reactive condition also had a statement of confidentiality not present in the follow-up prompt, which may also have impacted results, increasing the impact as well as or instead of the timing.

The various conditions do not appear to affect item nonresponse differentially across respondent groups. This suggests that the same motivational messages can be used for a range of people. Our findings also suggest that the additional responses have a modest, if any, impact on estimates. However, this aspect warrants further investigation, as our findings are based on small numbers of cases and variables with large variances. Other research, albeit on open-ended questions, suggests the possibility that additionally obtained responses in a web survey can be of lower quality (Oudejans and Christian 2011).

The frequency with which a reactive motivational prompt can be used is a subject of concern. To prompt a respondent after every missed question likely adds to their burden, as well as diluting the effectiveness of the motivational statement. We suggest that reactive prompts should be used according to the researcher's needs and survey objectives, perhaps limiting prompts to items that are both substantively important and prone to item nonresponse. Further research could shed light on how often such a prompt could be used effectively.

Similarly, research should continue to examine the types of variables for which the reactive web prompt is best suited. The current study examined both numeric open-ended and categorical measures, with the greatest reductions in nonresponse being for the former. The reasons for this are unclear. Our categorical questions may have been particularly easy and nonintrusive, or the difference could have arisen because a categorical response is generally

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less difficult than a numeric one (Bradburn and Miles 1979). Further, our open-ended questions asked about monetary issues, which are generally seen as more intrusive and more prone to item nonresponse (Tourangeau, Rips, and Rasinski 2000).

Appendix A.

Gross Pay. The last time you were paid, what was your gross pay—that is, including any overtime, bonuses, commission, tips, or tax refund but before any deductions for tax, National Insurance or pension contributions, union dues, and so on?

Interest and Dividends. In the past 12 months, how much have you personally received in the way of dividends or interest from any saving and investments you may have?

Net Profit. What was the amount of (your share of) the profit or loss figure shown on these accounts for this period?

UK Birth County. In which UK county were you born?

Hourly Pay. What is your hourly rate of pay for your basic hours of work? Please enter both pounds and pence.

Marital-Status Change. Has your legal marital status changed at all since [last interview date]?

Control Condition:

If a respondent in the control condition attempted to skip one of these questions in the web version, it reappeared exactly as is with the additional radio button options, in a different hue.

- Don't Know
- Prefer Not to Say

Reactive Condition:

If a respondent in the reactive condition attempted to skip one of these questions in the web version, the following statement appeared above the question:

If possible, please provide an answer to this question, as this is one of the key questions in this study. Please be assured that the information you give us will be treated confidentially.

If a skip was attempted again, the same question appeared, with the DK/PNS radio button options.

Follow-Up Condition:

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If a respondent in the follow-up condition attempted to skip one of these questions in the web version, like the control condition, initially the question reappeared exactly as is with the additional DK/PNS radio button options, in a different hue. Then, at the end of the survey, the number of the six experimented questions that was unanswered was summed and the following statement was presented:

Thank you for taking part in “Understanding Society” this year. Earlier in the interview there were some questions that you did not answer. As you know, you do not have to answer any question you do not want to. However, X of these questions are important to researchers and we would be grateful if you could try your best to answer them.

(X is the number of unanswered questions out of six.) The questions were then presented once again, with the DK/PNS available.

Supplementary Data

Supplementary data are freely available online at <http://poq.oxfordjournals.org/>.

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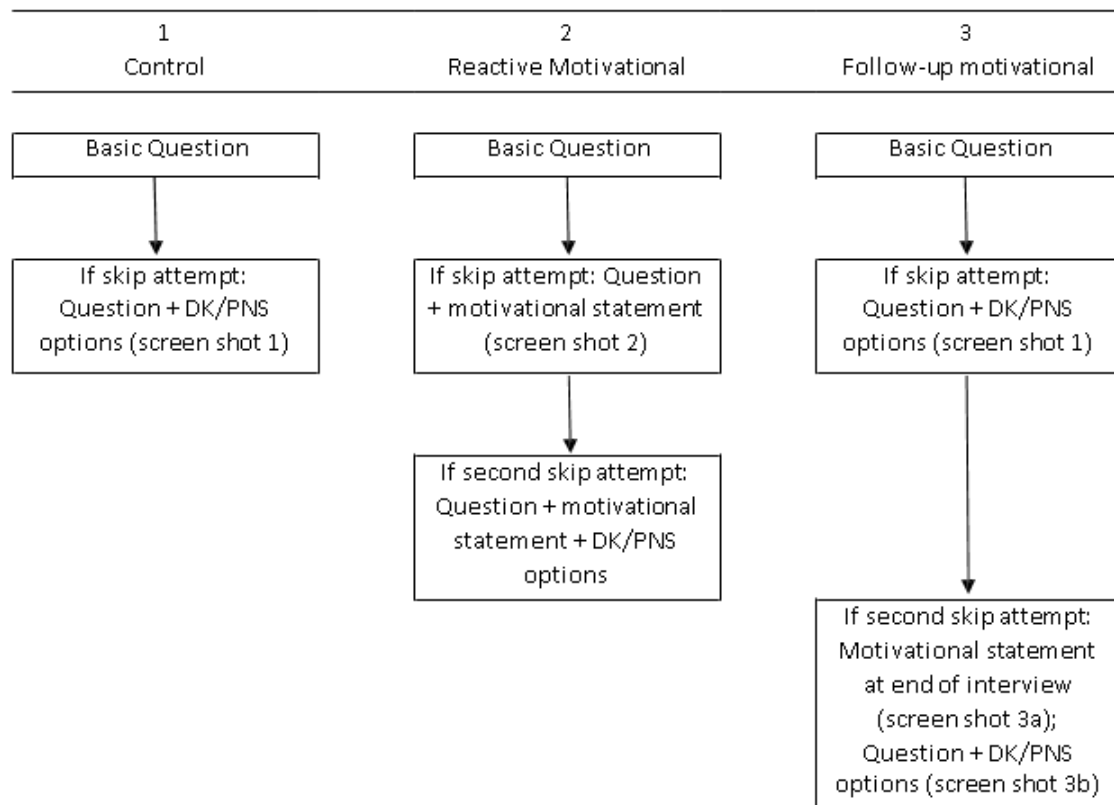
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Figure 1: Experimental treatments



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Table 1. Initial and Final Item Nonresponse Rates by Treatment (web respondents only)

		Control	Reactive	Follow-up
<i>Gross pay</i>	<i>Initial</i>	0.157	0.241	0.220
	<i>Final</i>	0.157 ^{a,b} (<i>n</i> = 134)	0.127 ^{a,b} (<i>n</i> = 166)	0.206 ^a (<i>n</i> = 141)
<i>Interest/Dividends</i>	<i>Initial</i>	0.273	0.251	0.250
	<i>Final</i>	0.254 ^a (<i>n</i> = 260)	0.151 ^{b,c} (<i>n</i> = 299)	0.226 ^{a,b} (<i>n</i> = 248)
<i>Net profit</i>	<i>Initial</i>	0.680	0.585	0.154
	<i>Final</i>	0.680 ^a (<i>n</i> = 25)	0.529 ^{a,b} (<i>n</i> = 17)	0.154 ^c (<i>n</i> = 13)
<i>Hourly pay</i>	<i>Initial</i>	0.119	0.208	0.245
	<i>Final</i>	0.119 ^{a,b} (<i>n</i> = 42)	0.039 ^b (<i>n</i> = 51)	0.204 ^a (<i>n</i> = 49)
<i>Marital-status change</i>	<i>Initial</i>	0.029	0.019	0
	<i>Final</i>	0.029 ^a (<i>n</i> = 105)	0 ^b (<i>n</i> = 107)	0 ^b (<i>n</i> = 95)
<i>Total</i>	<i>Initial</i>	0.224	0.217	0.195
	<i>Final</i>	0.215 ^a (<i>n</i> = 260)	0.128 ^b (<i>n</i> = 299)	0.177 ^a (<i>n</i> = 248)

NOTE.—Different superscripts i.e. a,b,c within row indicate significant difference at $p < 0.05$.

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Table 2. Weighted Item Nonresponse Rates by Treatment (mixed-mode and face-to-face designs)

	Mixed-mode outcomes			Face-to-face
	Control	Reactive	Follow-up	
Gross pay	0.150 (<i>n</i> = 607.92)	0.129 (<i>n</i> = 640.03)	0.185 ⁺ (<i>n</i> = 650.82)	0.118 (<i>n</i> = 332)
Interest/Dividends	0.209 ⁺ (<i>n</i> = 1,320)	0.146 (<i>n</i> = 1,320)	0.192 ⁺ (<i>n</i> = 1,320)	0.136 (<i>n</i> = 663)
Net profit	0.583 ⁺ (<i>n</i> = 107.60)	0.452 (<i>n</i> = 75.88)	0.228 ⁻ (<i>n</i> = 72.30)	0.404 (<i>n</i> = 52)
Hourly pay	0.108 (<i>n</i> = 209.36)	0.057 (<i>n</i> = 216.65)	0.166 ⁺ (<i>n</i> = 238.45)	0.061 (<i>n</i> = 98)
Marital-status change	0.016 (<i>n</i> = 601.90)	0 (<i>n</i> = 564.79)	0 (<i>n</i> = 585.13)	0 (<i>n</i> = 287)
Total	0.180 ⁺ (<i>n</i> = 1,320)	0.127 (<i>n</i> = 1,320)	0.156 ⁺ (<i>n</i> = 1,320)	0.120 (<i>n</i> = 663)

NOTE.—For mixed-mode conditions, weighted *n* reported; + indicates mixed-mode outcome significantly greater than face-to-face-only outcomes at $p < 0.05$; - indicates mixed-mode outcome significantly less than face-to-face-only outcomes at $p < 0.05$.