



Research article

Cost and performance tradeoffs between mail and internet survey modes in a nonmarket valuation study



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ARTICLE INFO

Article history:

Received 13 December 2016

Received in revised form

28 December 2017

Accepted 10 January 2018

Keywords:

Choice modeling

Cost effectiveness

Internet surveys

Survey mode

Willingness to pay

ABSTRACT

Using the results of a choice modeling survey, internet, mail-only and mixed internet and mail survey modes were examined with regards to their cost-effectiveness, representativeness, and willingness to pay (WTP). The topical focus of the study was biomass energy generation preferences of the residents of Montana, Colorado and Arizona, USA. Compared to the mail and mixed mode samples, the internet-only mode produced a sample of respondents that was younger, more likely to have a college degree, and more likely to have a household income of at least \$100,000 per year. However, observed differences in the characteristics of the collected sample did not result in significant differences in estimates of WTP. The internet survey mode was the most cost-effective method of collecting the target sample size of 400 responses. Sensitivity analysis showed that as the target number of responses increased the cost advantage of internet over the mail-only and mixed mode surveys increased because of the low marginal cost associated with extending additional invitations.

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1. Introduction

Stated preference nonmarket valuation studies rely on obtaining responses to surveys that present hypothetical markets for environmental goods and services that are not traded in actual markets. Contacting potential respondents and providing them with a survey has traditionally been performed using in-person interviews, telephone interviews, and mail contact. As internet use has increased rapidly in the United States, internet-based survey methods have emerged as a viable method for data collection (Pew Research Center, 2016). Internet-based surveys offer a number of advantages including reduced response time, the ability to provide large amounts of information to respondents, and low marginal cost per response relative to other survey modes (Berrens et al., 2003). However, as a relatively new method with generally lower response rates, questions still exist about the representativeness of samples collected by internet surveys and the effects of this mode on willingness to pay (WTP) estimates. Furthermore, there are high

fixed costs associated with setting up internet-based surveys that can offset the benefits of low marginal costs if a sufficient number of responses are not received.

The purpose of this paper is to evaluate whether an internet-based survey is an appropriate cost-effective alternative to mail-only and mixed mail and internet survey modes for nonmarket valuation, while also meeting the need to collect a representative sample and produce unbiased estimates of economic measures of interest, such as WTP. Data used in the evaluation was collected in an experiment conducted as part of a choice modeling exercise investigating public preferences for renewable woody biomass energy in three states in the western United States (Campbell, 2016; Campbell et al., 2016). The emphasis here is to provide a clear comparison of the cost and performance tradeoffs of mail and internet-based survey modes for a choice modeling survey, and also to provide new evidence regarding the representativeness of an internet sample and the quality of WTP estimates derived from it.

The paper proceeds by first reviewing the environmental valuation literature that has compared internet-based surveys to other methods. Then we provide a brief overview of the study that generated the data used in this analysis, which is described in detail elsewhere by Campbell (2016) and Campbell et al. (2016, 2018). Next, the methods and results of the comparison of the three

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survey modes are presented. Finally, the findings and their implications for practitioners are discussed.

2. Review of previous studies of survey modes

Dillman et al. (2014) described a high-quality survey as one that: a) provides a known opportunity for all members of the study population to be included in the sample, b) collects a sufficiently large sample of the population in a random fashion, c) encourages respondents to provide accurate information through well designed questions and information, and d) minimizes the probability that respondents to the survey differ systematically from people who choose not to respond. The degree to which these goals are met will determine the amount of error that is present in the data in the form of coverage error, sampling error, measurement error, and nonresponse error, respectively (Dillman et al., 2014). Coverage error occurs when the list from which sample is drawn does not accurately represent the population in ways that are important to the survey. Sampling error occurs as a result of surveying only some members of the sample frame. Nonresponse error occurs when nonrespondents differ from survey respondents in some way that influences estimates. Measurement error arises from unwillingness or inability of respondents to provide accurate answers. These potential sources of error can be difficult to disentangle from one another post hoc, and impossible to quantify individually without a study specifically design to do so. However, as they relate to this study, all sources of potential error have either been controlled for across survey modes or explored in the paper as outlined in Section 4.3.

The mode of a survey is defined as the method of administration used in data collection, and commonly includes in-person interviews, telephone interviews, or self-administration via mail or the internet. Survey modes may differ in their ability to minimize these sources of error as a result of differences in response rates, ability to collect a representative sample, effects on valuation estimates, and per-unit cost of obtaining usable responses. Previous research shows that internet-based surveys generally have been found to generate lower response rates than other contact methods, suggesting an internet sample may be more prone to nonresponse bias than other modes. Unsurprisingly, Marta-Pedroso et al. (2007) found higher response rates to in-person interviews (84%) than random internet contact (5.1%). Sinclair et al. (2012) found higher response rates for a random mail-survey contact (30.2% for personalized invitations and 10.5% for generic invitations) compared to a random contact internet survey (4.7% for personalized invitations and 2.2% for generic invitations).

Internet panels provide one potential solution to the problem to low internet response rates. Internet panels are groups of people that stand ready to participate in surveys, and consist of participants that are most often self-selected in response to some form of solicitation, or pre-recruited, sometimes based on a probability sampling design (e.g. Knowledge Networks, now known as GfK Knowledge Panel), and sometimes based on convenience samples¹. Both Lindhjem and Navrud (2011a) and MacDonald et al. (2010) found higher response rates for mail-contact than pre-recruited internet panels. The surprising result that an internet mode using panels of people who had already agreed to participate in surveys

failed to achieve higher response rates than a mail mode relying on random contact, speaks to the challenges of achieving high response rates with internet surveys. As outlined in Hays et al. (2015) it can be recruitment into the panels, rather than the response to an individual survey, that results in a lower effective response rate for panel-based internet surveys. However, panel methods can be improved. Olsen (2009) achieved a 63.6% response rate from a pre-recruited internet panel and 60.3% using a mail survey mode. Berrens et al. (2003), Schonlau et al. (2002), and Lindhjem and Navrud (2011b) provide detailed discussions of different types of internet panels and their relative attributes.

Although a large and growing proportion of households in the United States have access to the internet, the level of access differs between socioeconomic groups, with lower access amongst seniors, people with low educational attainment, and low household income (Perrin and Duggan, 2015). Also of concern is the ability to obtain responses from people who live in rural areas (Perrin and Duggan, 2015; Pew Research Center, 2015). This raises the concern that internet-based surveys may exacerbate the issues of coverage error that already exists with other survey modes in terms of collecting samples that are wealthier and better educated than the population as a whole. If the target population is the population as a whole and a representative sample cannot be collected, the preferences of the population may not be accurately estimated, and biased estimates of the economic values of interest may result. Published survey mode studies suggest that, on average, internet respondents tend to be younger, wealthier and better educated than mail and in-person interview respondents (Olsen, 2009; MacDonald et al., 2010; Windle and Rolfe, 2011). Mixed-mode sampling approaches (e.g. internet and mail sampling used together) have been suggested as a way to reach segments of the population that tend to have lower access to the internet (Champ, 2003). Mixed-mode surveys provide respondents with the option to respond via either internet, or mail, thus allowing respondents without internet-access or sufficient computer skills a means of participation. This is obviously only true if contact is made through the mail, not if contact is made only via an internet-based communication, such as email.

The purpose of nonmarket valuation surveys is to produce estimates of economic value for nonmarket goods and services. Like estimates of other parameters of interest, the magnitude and quality of results can be negatively impacted by the presence of nonresponse error from low response rates, coverage error from a non-representative sample, and measurement error associated with systematic variation in responses among survey modes. Research findings regarding the effect of survey mode on the magnitude and quality of valuation estimates are mixed. Some studies found no significant differences between internet and other survey modes (Covey et al., 2010; Fleming and Bowden, 2009; Lindhjem and Navrud, 2011a; Olsen, 2009). Bell et al. (2011) and Mjelde et al. (2016) on the other hand, both found that internet samples produce statistically significantly lower estimates of economic value than other survey modes. Olsen (2009) found lower estimation precision and lower certainty in choice (as measured through the variance of unobserved effects, and responses to debriefing questions for certainty) from an internet sample than one collected by mail. However, they also found a lower rate of protest responses (from zero bidders who were identified as protest responders in debriefing questions) than in the internet sample. Lindhjem and Navrud (2011a) found no evidence of difference in “don’t know” responses and protest responses between internet and face-to-face interviews. Based on their review of multiple studies that compared WTP estimates from internet surveys with other modes, Lindhjem and Navrud (2011b) concluded that there is little evidence to suggest that responses obtained from internet

¹ The internet survey mode in this study did not rely on internet panels. The stratified random sample was drawn from a sample frame of physical mail addresses and potential respondents were contacted via mail about participating in a single survey.

² According to the U.S. Environmental Protection Agency sensitive groups are defined as older adults and children, and persons with heart, lung or respiratory diseases (United States Environmental Protection Agency, 2017).

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