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An Examination of SMS-Related Nonresponse Bias

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AN EXAMINATION OF SMS-RELATED NONRESPONSE BIAS

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AN EXAMINATION OF SMS-RELATED NONRESPONSE BIAS

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With the proliferation of mobile information and communications technologies, researchers face new opportunities for data collection and challenges to data quality. Short message service (SMS) or "text messaging" is a flexible mobile data service that can be incorporated into survey designs in a variety of ways. Given the many uses of SMS, I provide a framework for the use of SMS in the survey process which outlines the temporal location of three types of SMS-related nonresponse: SMS nonconsent, SMS nondelivery, and SMS noncooperation.

To better understand when SMS-related nonresponse might pose a risk of producing bias in survey estimates, I create three conceptual models of the mechanisms for SMS-related nonresponse – one for each of the three types of SMS-related nonresponse. Two forms of SMS-related nonresponse bias are analyzed in this dissertation, namely SMS nonconsent and SMS noncooperation. I examine the relative impact of these two forms of SMS-related nonresponse bias on a series of national estimates. Additionally, I create nonresponse weighting adjustments and examine their effectiveness at reducing SMS-related nonresponse bias in survey estimates.

This dissertation uses data collected from a SMS experiment conducted by the Gallup Organization from a pool of respondents to Gallup Daily surveys from July 29, 2013 – October 14, 2013. This design provides a rich sampling frame from which to examine variables available for both respondents and nonrespondents to the SMS surveys. I develop two sets of response propensity models – one set predicting SMS consent and the other predicting SMS cooperation. Using the predicted probabilities from these models, I examine the relationships between response propensity and a group of survey variables of interest.

Results indicate the presence of SMS-related nonresponse bias for a series of national survey estimates. However, the magnitude of bias differs across nonresponse types and across the survey variables of interest. Total SMS-related nonresponse bias is largely driven by noncooperation with the SMS survey. Results of the weighting adjustments were mixed. They performed well at reducing SMS nonconsent bias, but were less effective for SMS noncooperation. For both SMS nonconsent and SMS noncooperation, the strongest mechanisms of nonresponse tend to be respondent characteristics.

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CHAPTER ONE

INTRODUCTION

With the proliferation of mobile information and communication technologies (ICTs), survey researchers face new opportunities for data collection and potential new challenges to data quality. Concerns about the widespread adoption of the mobile telephone, and its replacement of traditional landline technologies, have garnered significant interest from survey methodologists (AAPOR Cell Phone Task Force, 2010). Less attention has focused on the effects of mobile data services, including short message services (SMS) or "text messaging" on the quality of survey estimates.

Understanding the impact of SMS on the quality of survey estimates is challenging due to an inherently flexible nature that allows the service to be incorporated into survey designs in a number of different ways. For example, SMS can be used to send prenotifications or reminders (Bosnjak, Newbarth, Couper, Bandilla, & Kaczmirek, 2008; Brick et al., 2007; De Bruijne & Wijnant, 2014; Goldberg, Pearson, & Eyers, 2006; Mavletova & Couper, 2013, 2014; Virtanen, Sirkiä, & Jokiranta, 2007), deliver a survey invitation (Bosnjak et al., 2008; Crawford, McClain, O'Brien, & Nelson, 2013; De Bruijne & Wijnant, 2014; Mavletova & Couper, 2013, 2014; Marlar & McGeeney, 2014; Maxl, Haring, Tarkus, Altenstrasser, & Dolinar, 2010; Steeh, Buskirk, & Callegaro, 2007), transmit survey items directly to sample units for synchronous survey interviews (Conrad et al., 2013; Cooke, Nielsen, & Strong, 2003; Down & Duke, 2003; Goldberg et al., 2006; Marlar & McGeeney, 2014; Schober et al., 2013; Widman & Vogelius, 2002), obtain valuable paradata about the working status of a mobile telephone number (Buskirk, Callegaro, & Steeh, 2004; Steeh et al., 2007; Callegaro, 2002), and to collect diary and experiential data (Andrews, Russell-Bennett, & Drennan, 2011; Anhoj & Moldrup, 2004; Brenner & DeLamater, 2012; Kuntsche & Robert, 2009), to name a few.

In an era of declining survey response rates (Curtin, Presser, & Singer, 2005; de Leeuw & de Heer, 2002), the flexibility of mobile data services may be exploited in survey designs to mitigate the challenges associated with nonresponse, including a loss of sample size and statistical power, increased costs associated with the effort needed to gain additional responses, and the potential for nonresponse error in survey estimates. Yet nonresponse rates portend nonresponse bias on survey estimates only when the causes of nonresponse are associated with survey variables of interest (Groves, 2006). A better understanding of the causes of SMS-related nonresponse is necessary to assess the potential for bias (Groves, 2006; Groves & Peytcheva, 2008). No known research has examined the bias associated with SMS-related nonresponse.

In this dissertation, I aim to examine two different types of nonresponse associated with integrating SMS design features into survey protocols, and the degree of nonresponse bias attributed to each. In doing so, I offer a framework of SMS in the survey process as a tool for better understanding where and how SMS can be incorporated into survey designs. Additionally, for each type of SMS-related nonresponse, I offer a model of hypothesized mechanisms of nonresponse. Using data from a SMS experiment conducted by the Gallup Organization with respondents to months of Gallup Daily surveys, the research strategy employed for this evaluation of nonresponse bias utilizes information from a rich sampling frame to examine variables available for both respondents and nonrespondents (Groves, 2006).

Background and Significance

During the 1980s and 1990s landline telephone coverage in the U.S. grew, leading to a variety of gatekeeping technologies and services, such as the answering machine, caller ID, call blocking and call restriction registries. These gatekeeper devices raised questions about the quality of data from landline telephone surveys (Callegaro, McCutcheon, & Ludwig, 2010; Dutwin, Herrmann, Porath, & Sherr, 2011; Link, Mokdad, Kulp, & Hyon, 2006; Link & Oldendick, 1999; Oldendick & Link, 1994; Tuckel & O'Neill, 2002). With the growth in mobile telephone use, however, concerns about gatekeeper devices have largely been replaced. Today, mobile data services[1], such as internet and email, mobile applications, location services, Multimedia Messaging Services (MMS) and SMS are at the center of discussions about the impact of technology on data collection protocols and data quality (Link et al., 2014).

Between 2007 and 2016, the percentage of wireless-only households in the U.S. increased from 15.8% to 50.5% (Blumberg & Luke, 2007, 2017). The mobile phone is replacing traditional landline telephone service altogether in a phenomenon known as "wireless substitution" (Blumberg, Luke, & Cynamon, 2006). This circumstance has raised concerns about the potential for coverage errors in landline-only telephone surveys (Ehlen & Ehlen, 2007; Keeter, Kennedy, Clark, Tompson, & Mckazycki, 2007; Lee, Brick, Brown, & Grant, 2010; Peytchev, Carly-Baxter, & Black, 2008, 2010). Today, the

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[1] Mobile Data Services (MDS) are defined as an assortment of digital services that can be accessed by a mobile device over a wide geographic area (Hong & Tam, 2006).

rate of wireless substitution has grown such that mobile phone-only survey designs have been posited as both viable and, in some instances, a preferred strategy for conducting general population surveys (Peytchev & Neely, 2013). In fact, no legitimate survey of the general U.S. population is conducted today using a landline-only design (AAPOR Task Force on the Future of U.S. General Population Telephone Survey Research, 2017).

But data quality concerns resulting from wireless substitution are not just limited to coverage errors. Additionally, the mobile telephone, as a relatively new medium for survey administration, has raised anxieties about the quality of survey estimates obtained via this replacement technology, including sampling, measurement, and nonresponse errors (AAPOR Cell Phone Task Force, 2010).

Mobile Phone Technology Use in the U.S.

American use of the mobile phone is substantial. As of 2016, 95% of U.S. adults were estimated to own a mobile phone, with ownership among younger adults – those age 18-29 and 30-49 – almost universal at 100% and 99%, respectively (Pew Research Center, 2017). Nearly two-thirds of American adults report sleeping near their mobile phone to ensure the receipt of communications while asleep (Lenhart, 2010). Almost half of smartphone owners claim they could not live without their mobile phone (Smith, 2015). A smartphone is a special type of mobile telephone that incorporates traditional telephonic functionality with advanced computing features, such as: the ability to run an operating system and software applications, make use of location services, access the internet, and utilize an integrated camera. More than three-quarters (77%) of American adults own a smartphone (Pew Research Center, 2017).

While a large and growing array of mobile data services are available for ICTs, the vast majority of mobile phone owners in the U.S. (81%) use their device to send and receive text messages (Duggan, 2013). The first tests of SMS occurred in Europe in 1992 (Hillebrand, 2010). But by 2007, Americans were sending more text messages per month than making phone calls (Nielsen, 2008). Importantly, SMS functionality is available for both traditional mobile phones and more advanced smartphones.

What is SMS?

Short message service, commonly referred to as "text messaging," is a process for transmitting short, text-based messages between ICTs using a standardized communications protocol. Text messages are traditionally limited to 160 alphanumeric characters in length, although this varies across mobile service providers (Buskirk et al., 2004). Short message service works as a store-and-forward operation where a SMS transmission is not delivered directly from a sender to the intended recipient. Instead, SMS transmissions are sent to a SMS Center (SMSC) where the message is routed to the intended recipient through the SMS network via a series of associated infrastructures.

Acker (2014) provides an overview of the architecture and functionality of a SMS network (see also Enck, Traynor, McDaniel, & La Porta, 2005; Zerfos, Meng, Wong, Samanta, & Lu, 2006). Generally, two methods are used to transmit a SMS: (a) via a mobile telephone, or (b) through an External Short Messaging Entity (ESME) such as email, voicemail, web-based services, or some other software application. When a SMS originates from a mobile telephone, the message is sent to a SMSC that is part of a mobile network. When an ESME is used, instead the SMS is sent via the internet to a

SMSC. Once a SMS transmission has been received by the SMSC, however, these messages (mobile phone-originating or ESME-originating) are indistinguishable from one another (Enck et al., 2005).

The SMSC is responsible for routing the delivery of, and billing for, text messages. To do so, the SMSC queries the Home Location Register (HLR) to identify the intended recipient. The HLR is a database containing subscriber information, such as plan characteristics, billing information, target availability and location. In communication with additional network systems, the HLR responds with the location of the intended recipient or, if unavailable, a failure message. In the case of a failure, the SMSC will hold the message for a period of time and once the intended recipient has been located, the SMSC will again attempt delivery. If successful, the SMSC receives verification that the message was delivered and will cease repeated attempts to forward the message.

A Framework for SMS in the Survey Process

Due to the flexible nature of the service, there are many opportunities to integrate SMS into the survey process. To capture this, Figure 1, adapted from Groves and Couper's (1998) process of household survey participation, depicts a framework for SMS in the survey process which assumes contact and initial participation have already been established via some other mode (e.g., outbound telephone). This dissertation does not evaluate the mechanisms of nonresponse for initial contact/cooperation. That question has largely been addressed by previous authors (e.g., Groves & Couper, 1998). Rather, they are depicted in the framework to indicate that this portion of the survey process temporally precedes the integration of SMS design features.

The framework represents four distinct segments arranged in temporal order, each depicting where a unique type of SMS-related nonresponse might occur in the survey process: (a) initial participation depicting where traditional forms of noncontact and noncooperation nonresponse may arise, (b) consent to receive SMS where *nonconsent* nonresponse may arise, (c) delivery of a SMS transmission where *nondelivery* nonresponse can occur, and (d) cooperation with SMS where *noncooperation* nonresponse may result.

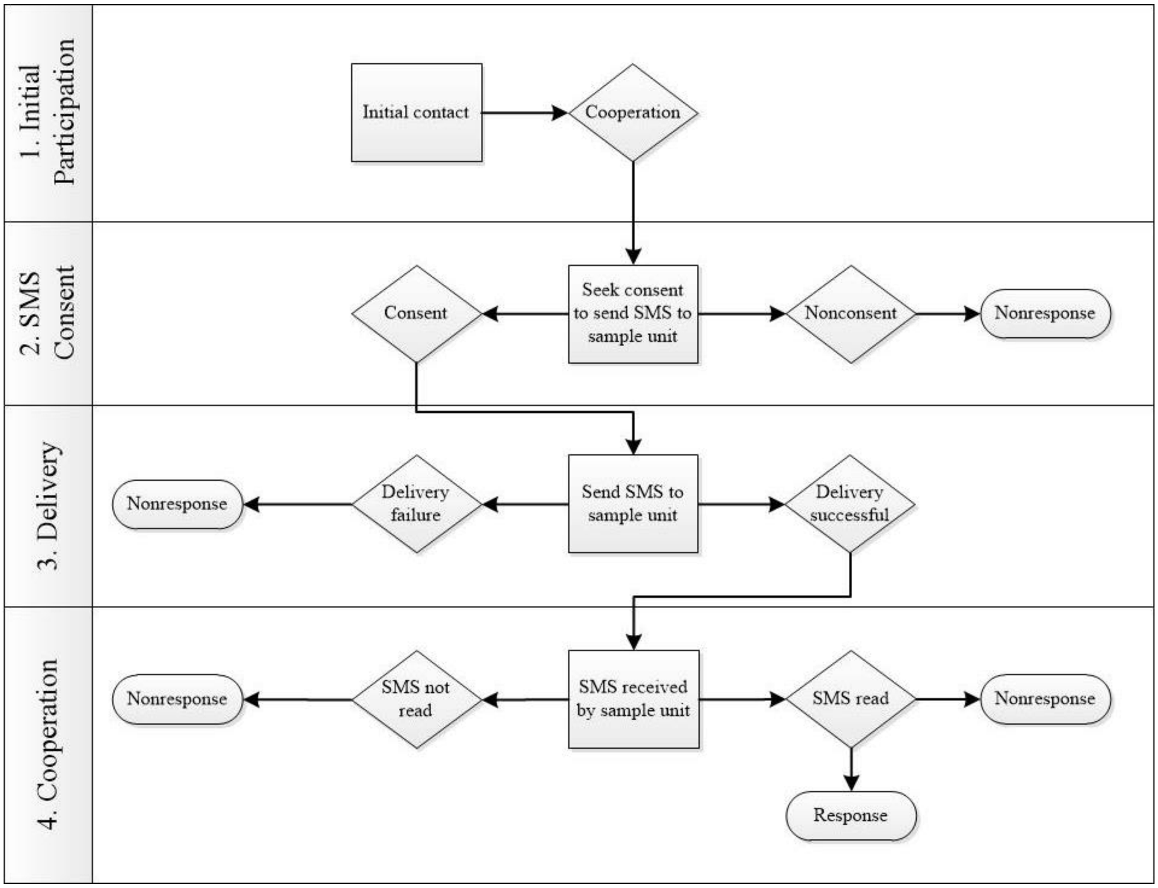

Figure 1. A framework for SMS in the survey process.

Initial Participation

The first segment, initial participation, represents the initial contact and cooperation phase of a survey. For example, a sample unit is contacted via an outbound telephone call from an RDD frame and the sample unit cooperates with the survey interview.

Consent

At some point during initial survey participation, the interviewer can seek consent from the sample unit to send a SMS. For example, this might take place upon completion of the initial survey interview where SMS design features could then be utilized as part of either a follow-up survey or an entirely new survey request (e.g., Marlar & McGeeny, 2014). Alternatively, a request for SMS consent may take place almost immediately upon establishing cooperation with the initial survey interview, in effect, providing an opportunity at the outset of the survey for a mode switch (e.g., Conrad et al., 2013; Schober et al., 2013). Or, the request could occur somewhere in between these two extremes. In practice, the interviewer may utilize different strategies as part of the respondent-interviewer interaction to determine when best to promulgate a SMS consent request, if at all.

Published rates of consent to SMS in the survey process are limited, but where available, they vary widely ranging from 19.9% (Crawford et al., 2013) to 87% (Brenner & DeLamater, 2012), both from samples of U.S. college students. For a SMS survey of the general U.S. population, consent has been reported between 54% and 59% (Marlar & McGeeney, 2014).

Delivery

Once a sample unit provides SMS consent a message can be sent. Failure to successfully deliver a SMS transmission to the sample unit's ICT will result in nondelivery nonresponse. Importantly, the delivery rate of SMS may be no better than traditional ICTs, such as email, Voice over IP (VoIP), and landline telephony. Estimates from a study of an Indian mobile phone service provider indicates an overall SMS delivery failure ratio of 5.1% compared to a 1.6% for email, 0.9% for VoIP, and 0.01% for landline telephony (Meng, Zerfos, Samanta, Wong, & Lu, 2007). In addition, these statistics likely underestimate the true failure rate as this study only looked at one portion (mobile terminating, i.e., the portion operating between the SMSC and the intended recipient) of the SMS mobile network.

There is limited published evidence of delivery rates from surveys that incorporate SMS design features into the survey process, and where it can be found rates are varied. These differences may be, at least in part, due to differences in the populations under investigation, the length of time between studies available for comparison, and differential survey design characteristics. In a study of one large mobile phone service provider in the U.S., Buskirk et al. (2004) report 40% of mobile numbers were identified as nonworking with an overall delivery rate of 57.9% for a SMS invitation. Alternatively, for a volunteer online panel survey conducted in Russia, Mavletova and Couper (2013) report SMS absorption rates[2] of 88.5% and 92.6%, respectively for a SMS invitation to a web survey.

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[2] Originally introduced by Lozar Manfreda & Vehovar (2002) and further defined by Callegaro and DiSogra (2008), the absorption rate represents the percent of delivery for a survey invitation.

Cooperation

Upon the successful delivery of a SMS, the sample unit may or may not actually read the message (Steeh et al., 2007). A failure to read the SMS can be the result of an explicit decision to not cooperate with the survey, but may also be caused by an inability to access the message due to a lack of technological acumen or a physical impediment/limitation. If the message is read, the sample unit can: (a) immediately cooperate, (b) provide a delayed response at a time more convenient, or (c) choose to ignore the message altogether resulting in noncooperation nonresponse.

Where SMS design features have been incorporated into the survey process, one finding seems consistent: responses are gained rapidly (Mavletova & Couper, 2014; Marlar & McGeeney, 2014; Widman & Vogelius, 2002), even by the majority of respondents within one hour (Cooke et al., 2003; Down & Duke, 2003; Maxl et al., 2010). And while some have reported that responses are gained either immediately or not at all (Maxl et al., 2010), other research indicates that responses may be gained over a period of a few hours (Mavletova & Couper, 2014; Marlar & McGeeney, 2014).

Conceptual Models of the Mechanisms of SMS-related Nonresponse

In the following section we further elucidate where three unique types of SMS-related nonresponse might occur in the survey process. We will discuss the potential mechanisms involved in producing nonresponse at each point in the process. This will allow for a better understanding of the statistics most likely to suffer from SMS-related nonresponse bias (Groves, 2006; Groves & Peytcheva, 2008).

Consent

The U.S. Federal Telephone Consumer Protection Act (TCPA) requires the hand-dialing of mobile numbers and prior consent to send SMS messages, unless sent for emergency purposes (Telephone Consumer Protection Act of 1991, 2015).[3] While the requirement for hand-dialing has been shown to produce increased costs for survey organizations (AAPOR Cell Phone Task Force, 2010; Keeter, Dimock, Kennedy, Best, & Horrigan, 2008; Steeh & Piekarski, 2008), it does not, necessarily, introduce a new mechanism of nonresponse into traditional conceptualizations of the survey process. The prior consent requirement does, however.

Nonresponse has traditionally been divided into three categories: noncontact nonresponse, noncooperation nonresponse, and nonresponse arising for other reasons (e.g., language or physical impediments to participation) with unique causes attributed to each (Groves & Couper, 1998). The TCPA's prior consent requirement introduces an additional mechanism of nonresponse to consider – nonresponse arising from nonconsent to receive SMS messages. To the extent that nonconsent is related to survey variables of interest, estimates may suffer from nonresponse bias.

A Conceptual Model for SMS Consent

Based largely on the traditional model of household survey participation (Groves & Couper, 1998), Figure 2 provides a conceptual model of the mechanisms of SMS consent. Hypothesized factors include those outside of researcher control, including: the

[3] The TCPA prior consent requirement applies even for telephone numbers not included in the national Do-Not-Call list.

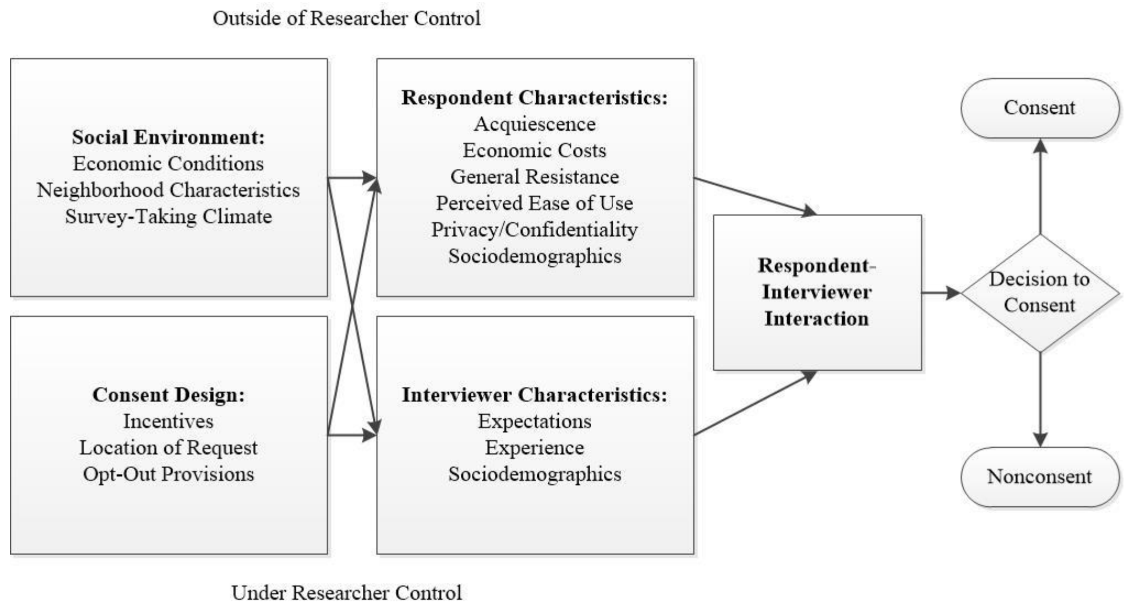

Figure 2. A conceptual model for SMS consent.

Social Environment and Respondent Characteristics. Also, it incorporates factors under researcher control, including: the Consent Design and Interviewer Characteristics. Together, these factors contribute to the interaction between the respondent and the interviewer which precedes the decision to consent. Where a sample unit fails to consent to receive a SMS, nonconsent nonresponse will arise.[4]

Social environment. Few published studies have examined SMS consent in the survey process. No known study has evaluated the social environmental influences on the SMS consent decision. However, the traditional model of household survey participation posits that surveys, being inherently social events, are influenced by social environmental factors (Groves & Couper, 1998). The SMS consent decision, as

[4] A summary of the anticipated relationships between the mechanisms and SMS consent and SMS consent propensities are provided in the Appendix (see Table 70).

presented in this model, occurs as part of an existing survey process. Likewise, the SMS consent decision too may be influenced by the broader societal context. Social environmental characteristics may not operate as direct mechanisms of SMS consent, but rather serve as correlates of the psychological predispositions of interviewers and sample units.

For surveys conducted using traditional modes, some relationships have been reported between social environmental characteristics and noncooperation. For example, urbanicity, explained in part by crime (Groves & Couper, 1998; House & Wolf, 1978), as well as age characteristics (Groves & Couper, 1998) have been linked to noncooperation. Similarly, we might expect lower SMS consent propensities in areas of higher urbanicity/crime and older age demographics to the degree that these factors covary with respondent characteristics, such as privacy/confidentiality concerns and the perceived ease of use of technology.

Respondent characteristics. Among respondent characteristics, sociodemographics are traditionally the most widely examined correlates of survey nonresponse (Groves & Couper, 1998) and, likewise, for the limited selection of studies that report on SMS consent in the survey process. Yet, similar to the situation for traditional survey modes, respondent sociodemographics are themselves not likely to be direct mechanisms of nonconsent, but instead serve as proxy measures for psychological predispositions that operate as the true causes of nonconsent (Groves & Couper, 1998). We account for these psychological predispositions in our model by including the notions: acquiescence, economic costs, the perceived ease of use of mobile technology, and the privacy/confidentiality concerns of sample units. Given the dearth of research examining the impact of respondent characteristics on SMS consent in the survey process, we look for evidence of these factors from the within-survey request and technology adoption literatures.

Providing consent to receive a SMS as part of the survey experience is similar to the decision-making process for within-survey requests. That is, sample units are asked to provide consent to an additional request above and beyond initial survey participation. Sakshaug (2013) provides an overview of data used to study within-survey nonresponse. This literature has dealt with consent to requests for biomarkers (Ofstedal, Guyer, Sakshaug, & Couper, 2010; Sakshaug, Couper, & Ofstedal, 2010; Sakshaug, Yan, & Tourangeau, 2010), leave-behind questionnaires (Health and Retirement Study, 2004), linking survey responses to administrative records (Dahlhamer & Cox, 2007; Jenkins, Cappellari, Lynn, Jackle, & Sala, 2006; Korbmacher & Schröder, 2013; Sakshaug, Couper, Ofstedal, & Weir, 2012; Sala, Burton, & Knies, 2012), and mode switches (Sakshaug & Kreuter, 2011). Providing SMS consent is not a one-time engagement, but will likely result in additional burden for the sample unit. That is, once a sample unit consents to SMS in the survey process, they are likely to receive an additional request(s) via SMS for survey participation requiring further action. This is different from, for example, the impact of providing consent for linking survey responses to administrative records where, once consent is provided, no additional action is required from the sample unit. Instead, SMS in the survey process more closely resembles the case of requests for biomarkers which may require producing a specimen sample, or leave-behind questionnaires which necessitate the return of a survey questionnaire.

The Technology Adoption Model (TAM) (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) has been employed to explain the adoption of mobile ICTs, including mobile data services (Hong & Tam. 2006; Phan & Daim, 2011) and to understand participation in mobile surveys (Bosnjak, Metzger, & Gräf, 2010). The TAM examines why organizations and individuals adopt the use of new technologies, suggesting that this decision is motivated by the perceived ease of use of technology, perceptions about its usefulness, and attitudes about technology. These factors, in turn, influence user intentions and behaviors. No known research has applied the TAM for understanding SMS consent in the survey process.

Acquiescence. Sample units may acquiesce to a SMS consent request if they find doing so to be the "easier" strategy. That is, rather than working to fully considering the implications of SMS consent, they may simply agree to receive future text messages from the survey organization. This mechanism is strongly related to the notion of satisficing which suggests that a sample unit may respond using strategies that require the least amount of cognitive demand (Krosnick, 1991, 1999). Marginal support for the acquiescence hypothesis has been provided for consent to within-survey record linkage requests (Sakshaug et al., 2012).

Economic costs. Sample units may refuse to consent to SMS due to the potential economic costs associated with sending and receiving text messages. Such costs vary across mobile phone service providers and plan types (Buskirk et al., 2004). Some observational evidence exists to suggest that the economic costs of SMS may be at play in the consent decision. In a study from a panel survey in the U.K., after receiving a 19% consent rate for a SMS survey, researchers modified the language of the consent request to emphasize that all costs associated with the SMS surveys would be covered, incentives for participation would be offered, and the surveys would be short and infrequent. The result was a 42% increase in the SMS consent rate, from 19% to 27% (Cooke et al., 2003). What is not clear from this finding is which of the emphasized features (i.e., economic costs, incentives, or survey length) motivated the increase in the SMS consent rate. Additionally, Marlar and McGeeney (2014) report on an experiment that presented sample units with two different SMS consent requests – one noting “free” text messages, the other simply stating “text message.” Results indicate 59% of respondents presented with the word “free” consented to receive a SMS compared to 54% of respondents to the generic text message language. No information as to the statistical significance of this difference was reported.

General resistance. Sample units may refuse to consent to SMS if they harbor a higher degree of general resistance to the survey. The notion of general resistance has long been posited as a potential respondent-based mechanisms of nonresponse (Groves & Couper, 1998). Related factors include a lack of interest in a survey topic (de Leeuw, 2004; Goyder, 1985; Groves, Presser, & Dipko, 2004; Heberlein & Baumgartner, 1978; McCarty, House, Harman, & Richards, 2006), mistrust or distrust of the survey sponsor (Everett & Everett, 1989; Heberlein & Baumgartner, 1978), and survey burden (Dillman, Sinclair, & Clark, 1993; Galesic & Bosnjak, 2009; Hansen, 2006; Tourangeau, Groves, Kennedy, & Yan, 2009). Proxy measures include, for example: the number of call attempts and the item missing rate. In addition to such traditional measures of these mechanisms, variables for political and social ideology may serve as proxies for mechanisms of nonresponse related to general resistance, especially those rooted in feelings of distrust or mistrust. Researchers have identified a relationship between social and political attitudes/beliefs and the physiological traits associated with threat (Ahn et al., 2014; Hibbing, Smith, & Alford, 2014; Oxley et al., 2008). These findings suggest a negativity bias amongst ideological conservatives (Hibbing et al., 2014). Additionally, Smith (1984) highlights a relationship between survey refusal and political conservatism (see Benson, Booman, & Clark, 1951; Brannon et al., 1973; Schuman & Gruendberg, 1970; Hawkins, 1975).

Evidence from the within-survey request literature finds that uncooperative respondents to a prior wave survey were less likely to consent to provide biomarkers in a subsequent wave (Sakshaug, Couper, et al., 2010). Additionally, results from an administrative record linkage study found support for the general resistance hypothesis where respondents more uncooperative during a prior wave survey were less likely to consent to linking records (Sakshaug et al., 2012). No known research has examined the effect of general resistance on SMS consent. Theory suggests such measures of general resistance might have a negative effect on SMS consent.

Perceived ease of use. Mobile ICTs present new tools for use in the design and administration of surveys and for executing other types of data collections (Link et al., 2014). But, for some sample units, the use of mobile ICTs can be cumbersome and confusing. The TAM posits that perceptions about the ease of use of technology may influence technological adoption (Davis, 1989; Davis et al., 1989). Similarly, sample units may be less likely to consent to a SMS request if they perceive the use of technology associated with text messaging to be challenging or burdensome. Some evidence exists to indicate that persons more familiar with a mobile phone, and thus conceivably more familiar with mobile data services like SMS, are more likely to provide consent to receive SMS (Crawford et al., 2013). That is, SMS consenters were more likely to check email on their smartphone (Crawford et al., 2013). However, this difference was not significant once accounting for mode preference (Crawford et al., 2013). Direct proxies for the perceived ease of use of technology are uncommon, however. Where not available, age and education may serve as proxy measures. Research indicates younger persons have adopted SMS technology at greater rates than older persons (Duggan, 2013). For surveys that incorporate SMS design features, higher cooperation has consistently been found among younger respondents (Goldberg et al., 2006; Marlar & McGeeney, 2014; Maxl et al., 2010). However, Virtanen et al. (2007) find that for two of three surveys higher response rates were identified across all age groups for a SMS reminder. Additional evidence to the age effect was presented by Widman and Vogelius (2002) who in a follow-up interview with nonresponders to a synchronous SMS survey identified that the reason for nonresponse differed across age groups. They find that older nonrespondents reported finding the survey difficult, while younger nonrespondents said they changed their mind about participation. To the degree that more educated sample units are exposed to more technology, they might find it easier to use, and thus be more likely to consent to receive SMS transmissions. Research indicates persons with higher levels of education utilize the internet (U.S. Department of Education, 2016), as well as own mobile phones and smartphones at greater rates than less educated persons (Pew Research Center, 2017).

Privacy/Confidentiality. Concerns about privacy/confidentiality have long been considered as a mechanism of nonresponse for traditional surveys (Jones, 1979; Singer, Van Hoewyk, & Neugebauer, 2003; Singer, Von Thurn, & Miller, 1995). Whether privacy/confidentiality concerns are at play for surveys that incorporate SMS design features is unexamined. However, some evidence exists to suggest that sample units with greater privacy/confidentiality concerns will have lower consent propensities. A study of panel survey participants in the U.K. found that SMS nonconsenters attributed their decision, at least in part, to confidentiality/privacy related concerns, such as: having a personal relationship with their mobile phone, the intrusiveness of SMS, and the potential for SPAM (Cooke et al., 2003). Also, privacy/confidentiality concerns were strongly related to the likelihood of consent to administrative records linkage where those with more privacy/confidentiality concern were less likely to agree to linking administrative records (Sakshaug et al., 2012).

Sociodemographics. Similar to findings for traditional survey modes (Groves & Couper, 1998), sociodemographics may serve as indirect mechanisms of SMS consent in the survey process. Often, such measures serve as proxies for the notions of social isolation (Goyder, 1987), social engagement (Abraham, Maitland, & Bianchi, 2006; Groves & Couper, 1998) or social participation (Brehm, 1993; Couper, Singer, & Kulka, 1998; Putnam, 2000). Resulting hypotheses suggest that persons more isolated or disenfranchised from society are less likely to participate in a survey request (Goyder, 1987; Groves & Couper. 1998). Specific sociodemographic measures accounted for in this dissertation include gender, marital status, race, and a series of religious measures. Accordingly, social isolation/engagement/participation hypotheses would expect racial minorities, men, and single persons to be less likely to consent to SMS. Additionally, those with greater involvement in, or attendance with, organized religious activities might be more likely to consent to SMS.

Published information as to the sociodemographic characteristics of SMS consenters is limited, but where research is available, results suggest SMS consenters tend to be younger, are more likely to be female, and are less educated (i.e., undergraduate versus graduate students) (Crawford et al., 2013). However, once accounting for mode preference, the effect of gender and education was not significant (Crawford et al., 2013). Evidence from the within-survey request literature shows that, for consent to link responses to administrative records, results are mixed across age, gender and income between consenting and nonconsenting respondents (Kho, Duffett, Willison, Cook, & Brouwers, 2009; Dunn, Jordan, Lacey, Shapley, & Jinks, 2004; Sakshaug et al., 2012). With respect to race and education, Sakshaug et al. (2012) found college graduates were more likely to consent to record linkage compared to those who did not complete high school, and noted a marginal race effect where black respondents were less likely to consent versus whites.

Consent design.

Incentive. As noted in our discussion of the respondent characteristics portion of the model, sample units may refuse to consent to SMS due to the potential economic costs associated with sending and receiving text messages. As such, consent design decisions such as offering an incentive to cover the costs associated with SMS may increase a respondent's propensity to consent to a SMS request. Limited evidence suggests that, in fact, incentives may be effective at improving SMS consent in the survey process (Cooke et al., 2003; Marlar & McGeeny, 2014).

Location of request. The conceptual model of SMS consent presented in this dissertation assumes that a SMS request occurs as part of an *existing* survey. As such, the temporal placement of where in the existing survey a SMS consent request is placed may have an influence on an individual's propensity to consent. For example, if placed at the end of the survey, the sample unit may be fatigued from already participating, resulting in a decreased consent propensity. Alternatively, placing the SMS consent request at the outset of a survey may not provide the interviewer with enough time to establish rapport with the sample unit and, thus, may come across as an affront to the respondent also resulting in decreased consent propensity. No known research has dealt with the temporal location of a SMS request within a survey questionnaire.

Opt-out provisions. Another SMS consent feature available to survey researchers relates to the design of the opt-out provision. The TCPA requires legitimately free methods for individuals to opt-out of receiving text messages. However, survey designers have some flexibility as to: (a) when the opt-out provision is presented to sample units, and (b) how the opt-out provision is worded. Regarding the first, for instance, upon seeking SMS consent an interviewer might simultaneously mention that individuals can opt-out of receiving future text messages at any time. Doing so may motivate consent for sample units concerned about receiving unwanted SMS transmissions by making salient the opt-out feature (Groves, Singer, & Corning, 2000). To the second, there is no standardized language required by the TCPA for use in a SMS opt-out message. As such, alternative wordings might be more or less effective at making the opt-out provision salient for sample units (Groves et al., 2000). However, no known research has evaluated the impact of opt-out designs on SMS consent in the survey process.

Interviewer characteristics. No known studies have examined the effect of interviewer characteristics on SMS consent in the survey process. So, again, we look to findings from traditional survey modes and the within-survey request literature to provide clues as to the mechanisms of SMS consent related to interviewer characteristics.

Expectations. The expectations of interviewers may be related to the likelihood of SMS consent. However, this may be an indirect relationship where interviewer expectations interact with respondent characteristics. For example, interviewer expectations may be recognizable to sample units through vocal characteristics (Charoenruk, 2015; Oksenberg & Cannell, 1988). If an interviewer sounds hesitant or unsure in requesting SMS consent, this hesitation may trigger psychological predispositions such as distrust or privacy/confidentiality concerns (Groves et al., 2000). On the other hand, an overly confident request for consent may seem abrasive and likewise promote distrust of the survey organization. Either way, interviewer expectations may interact with respondent characteristics to impact the SMS consent propensities of sample units. No known research has examined the effect of interviewer expectations on SMS consent in the survey process. However, interviewer personality traits and attitudes towards persuading respondents were found to be unrelated to consent for administrative record linkage (Sala et al., 2012).

Experience. SMS consent occurs as part of an *existing* survey process. As such, the SMS consent decision is conditional on initial survey cooperation. To the degree that more experienced interviewers are better at gaining initial cooperation, we expect them to be more likely to gain SMS consent. There are mixed findings for traditional survey modes as to the association between interviewer experience and survey cooperation. For example, some studies have found greater cooperation among more experienced interviewers (Couper, 1991; Groves & Fultz, 1985; Hansen, 2006), while others find no relationship (Singer, Frankel, & Glassman, 1983; Schyberger, 1967). Looking to the within-survey request literature, interviewer experience was negatively related to consent for linking survey responses to administrative records where interviewers who conducted more interviews during the current-wave yielded lower rates of consent (Sakshaug et al., 2012). Still, others find that interviewer experience does matter for linkage consent requests, although not the length of time one has been an interviewer, but rather current-wave and task-specific survey experience (Sala et al., 2012).

Sociodemographics. Similar to the case for respondent characteristics, to the degree that interviewer sociodemographics are related to other factors that may affect the consent decisions, sample units may be more or less inclined to consent. However, for traditional surveys, results are mixed as to the relationship between interviewer sociodemographic characteristics and nonresponse, including gender (Baruffol, Verger, & Rotily, 2001; Campanelli & O'Muircheartaigh, 1999; Hansen, 2006; Pickery & Loosveldt, 2002) and age (Norris & Hatcher, 1994; Singer et al., 1983). Generally, the within-survey request literature has found no association between interviewer sociodemographic characteristics and a respondent's likelihood to consent to administrative record linkage (Sala et al., 2012; Sakshaug et al., 2012).

Respondent-Interviewer interaction. Interviewers use a series of strategies in order to gain cooperation from sample units, including "tailoring" and efforts for "maintaining interaction" that can activate heuristics which motivate a participation decision (Groves, Cialdini, & Couper, 1992; Groves & Couper, 1998). If the SMS consent decision is made quickly, and thus likely heuristically, we would expect a similar influence to be at play in the respondent-interviewer interaction relative to SMS consent. However, no known study has examined such interviewer strategies for the SMS consent decision as part of the survey process.

Delivery

The factors involved in SMS delivery are largely related to the technical functionality involved in the transmission of a SMS, influences that generally lie outside of researcher control, including the Mobile Technical Environment and User-Device Characteristics. As such, in most cases, we may never know why a SMS fails to be delivered.

Conceptual Model for SMS Delivery

Figure 3 provides a conceptual model of the mechanisms for SMS delivery. In this model, both the Mobile Technical Environment and User-Device Characteristics fall

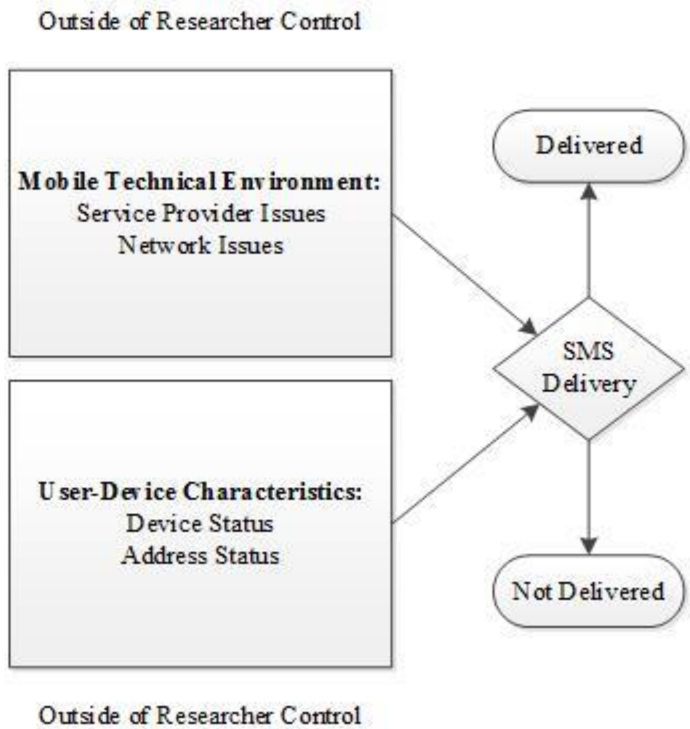

Figure 3. A conceptual model for SMS delivery.

outside of researcher control. Together, these factors precede SMS delivery where a SMS is either successfully delivered, or the message fails due to either the Mobile Technical Environment or User-Device Characteristics. When a SMS transmission is not successfully delivered, the second type of SMS-related nonresponse will arise – nondelivery nonresponse.

Mobile technical environment. The Mobile Technical Environment includes mechanisms of nondelivery nonresponse related to the mobile phone service provider and network functionality. Due to the complex technical influences at play, in many cases, why a SMS is not delivered may not always be clear.

Service provider issues. In the case of service provider issues, a mobile carrier may, for example, block SMS functionality or not support SMS resulting in delivery failure. Marlar and McGeeney (2014) report that in a SMS experiment from a sample of the general U.S. population, 6% of text messages were blocked by the carrier, although it is not clear whether or not these messages were blocked by the mobile provider independently or at request of the sample unit.

Network issues. Network issues such as not enough memory available to process a SMS may be present such that text messages fail. Because SMS operates as a store-and-forward service, a message that initially fails is temporarily stored for redelivery at a later time, and may be delivered successfully upon subsequent attempts (Zefros et al., 2006). Evidence suggests that the incidence of this mechanism of SMS failure is quite low, less than one-half of one percent, based on a study of one large mobile phone service provider in the India (Meng et al., 2007). Importantly, the likelihood of this mechanism of SMS-related nonresponse may differ across sample units. For example, due to greater volumes of SMS traffic, sample units located in urban areas may experience a higher prevalence of message failure due to network congestion issues (Meng et al., 2007).

User-Devise Characteristics. User-Device Characteristics represent mechanisms of nondelivery related to how the preferences of mobile phone users interact with mobile device features. Similar to the case with the Mobile Technical Environment, it may be challenging to understand the exact circumstances causing message delays or failure due to User-Device Characteristics. Researchers have proposed innovative methods that make use of mobile terminating messages from ESMEs provided by some mobile carriers to gain valuable information about the working status of mobile telephone numbers and the potential for nondelivery (Buskirk et al., 2004; Steeh et al., 2007).

Device status. A message may be postponed or not delivered for a number of reasons caused by the interaction of user preferences and mobile device features. For example, sample units may choose to disable SMS functionality on their mobile device. This is different from the mobile service provider blocking SMS functionality discussed in the previous section. Here, the sample unit disables the receipt of all SMS messages on their mobile device, but retains SMS functionality as a mobile data service. Other examples of this mechanism of nondelivery include where the destination is busy, the memory full, or the device is out of the service area. One study reported less than 1% of survey-related SMS messages failed because the device was unreachable (Marlar & McGeeney, 2014). But when SMS messages do fail, it seems the vast majority (about 87%) do so because of factors relating to device status (Meng et al., 2007).

Address status. Sample units may rescind or change their mobile telephone number before a SMS can be delivered. Doing so may result in delivery failure or inadvertently delivering a SMS to the wrong sample unit. Delivery failures due to destinations no longer at an address have been shown to account for about 13% of SMS failures (Meng et al., 2007).

Cooperation

Methodological research has examined SMS as a survey design feature with a variety of functions, such as prenotifications and reminders (Bosnjak et al., 2008; Brick et al. 2007; Goldberg et al., 2006; Mavletova & Couper, 2013, 2014; Virtanen et al., 2007), survey invitations (Bosnjak et al., 2008; Crawford et al., 2013; Mavletova & Couper, 2013, 2014; Marlar & McGeeney, 2014; Maxl et al., 2010; Steeh et al., 2007), and to deliver synchronous survey interviews (Conrad et al., 2013; Cooke et al., 2003; Down & Duke, 2003; Goldberg et al., 2006; Marlar & McGeeney, 2014; Schober et al., 2013; Widman & Vogelius, 2002). In the following section we describe the mechanisms involved in cooperation with a SMS survey.

A Conceptual Model for SMS Cooperation

The model for SMS cooperation presented in Figure 4 was developed based on the traditional model of household survey participation (Groves & Couper, 1998). Here, the Social Environment, Respondent Characteristics, and Device/Plan Characteristics all fall outside of the researcher's control. Only Survey Design features are under the researcher's control. These four factors influence the interaction between the sample unit and their device during the cooperation decision. If they decline to cooperate, the third form of SMS-related nonresponse will result – noncooperation nonresponse.[5]

Survey design.

Incentive. Mixed support exists for the impact of incentives where SMS is incorporated into survey designs. Brick et al. (2007) included a fully crossed SMS prenotice and incentive experiment into a 2004 nationwide survey in the U.S. finding that the difference in response rates across levels of incentive ($5 or $10) decreased with the use of a SMS prenotice. Goldberg et al. (2006) find that for a screener survey in the UK,

[5] A summary of the anticipated relationships between the mechanisms and SMS cooperation and SMS cooperation propensities are provided in the Appendix (see Table 70).

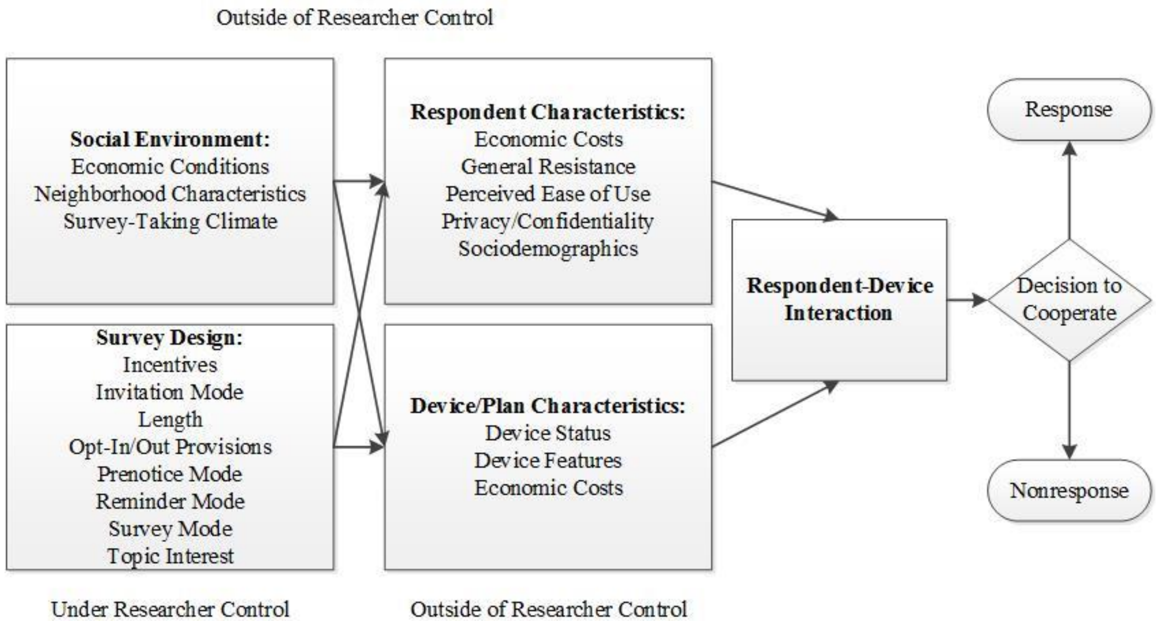

Figure 4. A conceptual model for SMS cooperation.

a 30 pence incentive produced a slightly higher response rate for a synchronous SMS interview, but no effect for a web survey where a SMS invite with an embedded URL was provided.

Invitation mode. Where SMS invitations are used, survey participation, measured as the rate of cooperation (Steeh et al., 2007), response (Bosnjak et al., 2008; Crawford et al., 2013; Marlar & McGeeney, 2014; Steeh et al., 2007), and completion (Mavletova & Couper, 2013) generally underperforms relative to other modes, such as email and telephone. Additionally, SMS invites have been shown to yield higher refusal (Steeh et al., 2007) and breakoff rates (Crawford et al., 2013; Mavletova & Couper, 2013, 2014) versus email. However, SMS invites produce higher cooperation among those responding with a mobile device (Mavletova & Couper, 2014) suggesting that the effect of a SMS invitation on survey cooperation may be dependent on the device used to complete the survey. No significant differences were identified between a SMS invite with an embedded URL for a web survey and a WAP-push[6] invitation for a sample of customers from a German bank (Maxl et al., 2010).

Length. There is limited evidence as to the effect of questionnaire length for surveys that incorporate SMS design features. Cooke et al. (2003) find completion rates decreased as the number of items increased from 3 questions (99%), to 4 questions (93%), and finally, 5 questions (92%). But Marlar and McGeeney (2014) found no difference in response rates (12%) between a 12 and 5 item for a synchronous SMS survey.

Opt-in/out provisions. For synchronous SMS surveys, survey designers may choose to utilize an opt-in message before transmitting survey items to sample units. For example, respondents may first receive a message from the survey organization asking them to activate a synchronous SMS survey by submitting a start message. In effect, this message indicates a sample unit's willingness to participate in a SMS survey. Once the opt-in message is received, survey items are delivered via SMS to the sample unit. Opt-out messages may also be used allowing respondents to discontinue receipt of SMS survey communications by, for example, replying with a stop message. While these design features have been used in studies including SMS (Marlar & McGeeny, 2014), no known research has experimentally evaluated the impact of such provisions on cooperation.

[6] A WAP-push alert is a special case of SMS formatted using XML-based Push Access Protocol (PAP). WAP-push messages provide users the option to link directly to a specified URL via a mobile web browser.

Prenotice mode. Evidence for the influence of a SMS prenotice on cooperation is mixed, but may be explained by differences in the mode of survey administration and/or populations under investigation. For a web survey of German college students, prenotification by SMS increased response rates relative to email (Bosnjak et al., 2008). Similarly, for an online panel survey conducted in the U.K., SMS prenotification yielded a significant increase in the response rate for a web survey compared to no prenotice (Goldberg et al., 2006). Alternatively, for a dual-frame landline and mobile telephone survey in the U.S., no differences in response rates were identified between a SMS prenotice and no prenotification (Brick et al., 2007).

Reminder mode. Findings for the effect of SMS reminders on survey participation are mixed, again perhaps due to differences in the survey mode and/or populations under investigation. Some evidence points to increased cooperation rates when a SMS reminder was used for a mail survey in Finland compared to the traditional postcard reminder (Virtanen et al., 2007), as well as increased response rates for a panel web survey in the U.K. compared to an email reminder (Goldberg et al., 2006). However, others find no clear pattern in participation rates across reminder modes (SMS or email) for a web survey in Russia (Mavletova & Couper, 2014).

Survey mode. SMS invitations can be designed to gain responses from different survey modes. The survey response mode may affect cooperation. For example, a SMS invitation may include a toll-free number asking respondents to complete via telephone (e.g., Steeh et al., 2007). Alternatively, the SMS invitation might include an embedded URL for a web survey. Generally, SMS invitations that include an embedded URL are most effective at yielding responses from mobile devices compared to PCs (Crawford et al., 2013; Marlar & McGeeny, 2014; Mavletova & Couper, 2014).

Topic interest. While research on this mechanism of nonresponse is limited where SMS-related design features are incorporated into the survey process, what does exist suggests that synchronous SMS surveys yield consistently high response rates across sensitive (i.e., those dealing with religion, work absenteeism, and voting) and nonsensitive question topics (Cooke et al., 2003). This may provide evidence that, due to the personal and private nature of SMS as a communication mode, respondents feel comfortable to provide responses to sensitive items and nonsensitive items alike.

Social environment. Similar to the situation for the conceptual model of SMS consent, no known research has examined social environmental conditions, such as economic and neighborhood characteristics, or survey-taking climate, as they relate to cooperation with a survey that integrates SMS features. Again, however, understanding surveys as inherently social events (Groves & Couper, 1998), we hypothesize that social environmental mechanisms are at play in causing noncooperation. Although such mechanisms are unlikely to be direct influences on cooperation, but rather serve as context for the psychological predispositions of respondents.

Respondent characteristics. Of the limited research related to SMS in the survey process, respondent characteristics are perhaps the most widely examined correlates of survey nonresponse. Specific factors incorporated into our model of SMS cooperation include: economic costs, general resistance, the perceived ease of use of technology, privacy/confidentiality concerns, and sociodemographics.

Economic costs. In our conceptual model for SMS consent (see Figure 4, p. 31), we identified economic costs as one potential mechanism of nonconsent. Similarly, in the model for SMS cooperation discussed in this section, we again identify economic costs as a mechanism of nonresponse. In this case, however, sample units are actually sending and receiving SMS transmissions (as opposed to agreeing to the prospect of SMS-related costs) and thus incurring a realized economic cost. The capacity or willingness of individuals to incur the economic costs associated with text messages may differ across sample units. No known research has examined the impact of economic costs on cooperation with a SMS survey.

General resistance. The notion of general resistance to surveys typically includes factors such as: a lack of interest in a survey topic (de Leeuw, 2004; Goyder, 1985; Groves et al., 2004; Heberlein & Baumgartner, 1978; McCarty et al., 2006), survey burden (Dillman et al., 1993; Galesic & Bosnjak, 2009; Hansen, 2006; Tourangeau et al., 2009) and mistrust or distrust of the survey sponsor (Everett & Everett, 1989; Heberlein & Baumgartner, 1978). Proxy measures include, for example, the number of missed calls and the item missing rate. A growing body of literature has documented the relationship between social and political attitudes/beliefs and the physiological traits associated with threat (Ahn et al., 2014; Hibbing et al., 2014; Oxley et al., 2008). These findings suggest a negativity bias amongst ideological conservatives – even if subconscious (Hibbing et al., 2014). In addition, Smith (1984) highlights a relationship between survey refusal and political conservatism (see Benson et al., 1951; Brannon et al., 1973; Hawkins, 1975; Schuman & Gruendberg, 1970). In turn, measures of political and social ideology may serve as proxies for mechanisms of nonresponse related to general resistance, especially those rooted in feelings of distrust or mistrust. No known research has examined the effect of general resistance on cooperation for surveys that incorporate SMS functionality, but the act of cooperation is similar for both. As such, we expect such measures of general resistance to have a negative effect on cooperation, as it is with traditional or non-SMS surveys.

Perceived ease of use. No known research has evaluated the perceived ease of use of technology as a mechanism of noncooperation for surveys that incorporate SMS design features. However, one study finds that the likelihood of completing a survey, once controlling for prior contact, is higher for those who consent to receive the survey via SMS (Crawford et al., 2013). This may suggest that individuals more adept at using SMS, and conceivably find such technology easier to use, will be more likely to cooperate with a SMS survey. Where a direct measure of this mechanism is not available, age may serve as a proxy. Younger persons have adopted SMS technology at greater rates than older persons (Duggan, 2013). For surveys that incorporate SMS design features, higher cooperation has consistently been found among younger respondents (Goldberg et al., 2006; Marlar & McGeeney, 2014; Maxl et al., 2010). However, Virtanen et al. (2007) find that for two of three surveys higher response rates were identified across all age groups for a SMS reminder. Additional evidence to the age effect was presented by Widman and Vogelius (2002) who in a follow-up interview with nonresponders to a synchronous SMS survey identified that the reason for nonresponse differed across age groups. They find that older nonrespondents reported finding the survey difficult, while younger nonrespondents said they changed their mind about participation. Likewise, education may serve as a proxy for the perceived ease of use of technology. To the degree that more educated sample units are exposed to more technology, they might find it easier to use, and thus be more likely to cooperate with a SMS survey request. Research indicates persons with higher levels of education tend to make use of the internet at greater rates (U.S. Department of Education, 2016). Additionally, mobile phone and smartphone ownership is higher for college graduates compared to less educated persons (Pew Research Center, 2017).

Privacy/Confidentiality. No known research has evaluated privacy/confidentiality concerns as an influence on cooperation for SMS-related surveys. However, for a mobile web survey that did not include a SMS component, trust considerations like anonymity and data security were found to be positively related to survey participation (Bosniak et al., 2012). We anticipate that privacy/confidentiality concerns may have a similar effect on cooperation for surveys with SMS functionality.

Sociodemographics. As was the case with the model of SMS consent, sociodemographics are themselves not likely to be causes of SMS noncooperation, but instead serve as indirect measures of the underlying causes (Groves & Couper, 1998). Sociodemographic measures are often used as proxies for social isolation (Goyder, 1987), social engagement (Abraham et al., 2006; Groves & Couper, 1998) or social participation (Brehm, 1993; Couper et al., 1998; Putnam, 2000). Generally, these notions suggest that persons more isolated or disenfranchised from society are less likely to participate in a survey request (Goyder, 1987; Groves & Couper, 1998). In this dissertation, measures for gender, marital status, race, and a series of religious measures are considered. Related hypotheses would expect racial minorities, men, and single persons to be less likely to cooperate with the SMS survey. Sample units with greater involvement in, or attendance with, organized religious activities would be more likely to cooperate with SMS.

Evidence for a relationship between the aforementioned sociodemographics (i.e., gender, marital status, race, and religious measures) and cooperation with SMS surveys is limited. Where available, results typically address gender for which the findings are mixed. Some studies find no gender effect (Bosnjak et al., 2008; Goldberg et al., 2006). However, others show greater gains in response rates among males (Goldberg et al., 2006), and more male responses compared to the population of interest (Maxl et al., 2010). Alternatively, others find significantly higher response rates for women (Virtanen et al., 2007).

Device/Plan characteristics.

Economic costs. The economic costs for sending and receiving SMS transmissions vary across mobile phone service providers (Buskirk et al., 2004). In some cases, sample units are allowed an unlimited number of text messages as part of their mobile plan. In other cases, SMS transmissions (incoming and outgoing) are charged on a per message basis. The specifics of a sample unit's mobile plan, including the economic costs involved with sending and receiving SMS, may impact cooperation propensities. However, no known research has examined the economic costs of mobile plans as an influence on cooperation for surveys that incorporate SMS design features.

Device status. The model for SMS in the survey process (see Figure 1, p. 8) shows that, in order for a sample unit to cooperate with a survey request, they must first read the message. The device status may impact the probability of a sample unit reading a SMS and, thus, cooperation propensities. For example, most mobile phones allow for the ringer to be disabled, quieted, or placed on vibrate. In such cases, a sample unit may not be aware that they have received a text message. No known research has examined device status as an influence on cooperation for surveys that incorporate SMS design features.

Device features. Mobile phones come in all shapes and sizes, each with unique features and functionalities, such as screen type (e.g., touch screen or view-only), screen size, and keypad size and style. Certain device features may make the process of consuming and producing text messages more or less challenging. To the degree that the features of mobile ICTs are correlated with the ease of use for SMS may affect cooperation propensities. There is no known research that examines the impact of mobile phone device features on cooperation to surveys that incorporate SMS design features.

Respondent-devise interaction. While the traditional model of survey participation considers the respondent-interviewer interaction as an influence on cooperation (Groves & Couper, 1998), our model replaces this with a respondent-device interaction. In the case of a SMS survey, the mobile phone, in effect, serves as a proxy for the interviewer. As such, strategies to gain cooperation from sample units such as “tailoring” and “maintaining interaction” operate behind this technological buffer which may serve to enhance or mute the effectiveness of these strategies.

Nonresponse Bias

The difference between a survey estimate from the full sample and those not consenting to SMS, nondelivered SMS communications, and sample units not cooperating with a SMS survey represents the SMS-related nonresponse bias in the survey estimate. As detailed by Groves et al. (2009), statistically, nonresponse bias for a mean can be expressed as $Bias(\bar{y}_r) = \bar{y}_r - \bar{y}_s = \frac{m_s}{n_s}(\bar{y}_r - \bar{y}_m)$ where:

$\bar{y}_s$= Mean of the entire specific sample as selected

$\bar{y}_r$= Mean of the respondents within the *s*th sample

$\bar{y}_m$= Mean of the nonrespondents within the *s*th sample

n_s= Total number of sample members in the *s*th sample

m_s= Total number of nonrespondents in the *s*th sample

From this expression, we see that bias is represented as the difference between respondents and the entire sample $(\bar{y}_r - \bar{y}_s)$ for a variable of interest, or, as the estimate specific product of the response rate $\left(\frac{m_s}{n_s}\right)$ and the difference between respondents and nonrespondents $(\bar{y}_r - \bar{y}_m)$. For our analyses, nonrespondents will be operationalized as those not consenting to receive SMS communications, or as sample units who do not cooperate with a SMS survey.

More recently, a stochastic understanding of nonresponse has been embraced by survey methodologists. From this view, nonresponse bias is understood as the correlation between individual i's response propensity and variable y divided by the average response propensity of the target population (Bethlehem, 2002). Statistically, this conceptualization of nonresponse bias can be expressed as $Bias(\bar{y}_r) \approx \frac{\sigma_{yp}}{\bar{p}}$ where:

σ_{yp} = covariance between survey variable y and response propensity p, and

$\bar{p}$ = mean response propensity for the target population.

While these formulas showcase, statistically, how nonresponse bias is calculated, they do not provide a model for the causes of nonresponse bias – that is, they do not explain the nature of the covariance between y and p. The "common cause" model suggests that nonresponse bias will occur when response propensity (p) and survey variables of interest (y) share a "common cause" (z) (Groves, 2006). In this case, the covariate z is the cause of both a sample unit's response propensity and their response on a survey variable of interest. For example, a sample unit's response to a survey question about monthly household income (y), as well as their propensity to respond to (p) altogether, may be simultaneously associated with a common cause relating to privacy concerns (z). In this dissertation, the common cause model, detailed in Figure 5, is used to anticipate the relationships between y and p that are associated with SMS-related nonresponse bias. Covariates from our data set that serve as proxy measures for the mechanisms of SMS related nonresponse bias (the zs) represent the common causes of SMS-related nonresponse bias. [7]

[7] The variables of interest examined in this dissertation are categorical. As such, percentages are calculated rather than means. To avoid confusing the notation for our variables of interest (p) with response propensities ($\hat{p}$), throughout the dissertation we adopt (y) as the notation for our survey variables of interest.

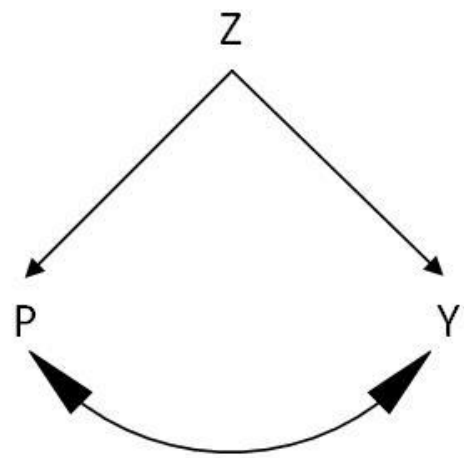

Figure 5. Common cause model of response propensity.

Implications for Survey Research

There is a great deal we do not know about how SMS affects survey estimates. To date, many of the studies examining SMS as a survey design feature have been conducted with target populations outside of the U.S. (e.g., Andrews et al., 2011; Anhoj & Moldrup, 2004; Bosnjak et al., 2008; Callegaro, 2002; Cooke et al., 2003; De Bruijne & Wijnant, 2014; Down & Duke, 2003; Goldber et al., 2006; Mavletova & Couper, 2013, 2014; Maxl et al., 2010; Virtanen et al., 2007; Widman & Vogelius, 2002). Given the prior consent requirement of the TCPA, studies utilizing SMS in the U.S. are more easily conducted as experimental designs with convenient populations such as college students (e.g., Brenner & DeLamater, 2012; Crawford et al., 2013). As such, research on the impact of SMS in the survey process is needed in context of the general U.S. population.

Additionally, mobile ICTs and their related data services are continuously evolving. In turn, so are the survey design options available to researchers.

Communication functionalities like SMS are generating new forms of traditional survey errors. SMS nonconsent and SMS nondelivery nonresponse, in particular, are uniquely the byproduct of integrating new technologies and services into survey designs and adhering to regulations governing their use. As survey designs become more flexible, traditional survey errors become more nuanced. This phenomenon can make understanding when survey errors may occur more complex, and quantifying survey errors more challenging. In order to gain a better understanding of these new forms of nonresponse necessitates the adoption of standard survey outcomes that are more applicable to new survey contexts, such as surveys that utilize SMS communications.

Standardized SMS Consent Rates

The TCPA requires prior consent in order to send SMS messages to sample units (Telephone Consumer Protection Act of 1991, 2015). We propose the following as a SMS consent rate calculation. As depicted below, the SMS consent rate (SMSCR) represents the prior consent rate to a SMS request. It is similar to the recruitment rate (RECR) for probability-based internet panels defined in the AAPOR guidelines (AAPOR Standard Definitions, 2015), but placed in the context of SMS consent. The SMS consent rate represents the proportion of sample units who consent to receive SMS transmissions divided by all sampled units asked to consent.

SMS Consent Rate:

$$SMSCR = PC/[PC+(R+BO+NC+O)+e(UO)]$$

Where:

PC = Prior Consent to SMS (i.e., TCPA requirement)

R = Refusal to Consent to Questions

BO =	Break-off Prior to Consent Question
NC =	Noncontact [Assumed to be zero in surveys where respondents are asked consent directly; may be non-zero if consent requested outside initial survey]
O =	Other [language, cognitive, physical, or other barriers preclude consent]
e =	estimated proportion of cases of unknown eligibility that are eligible
UO =	Unknown other [Unknown if consent request ever reached target sample member; assumed to be zero in surveys were respondents are asked consent directly; may be non-zero if consent requested outside initial survey]
NE =	Not eligible [No mobile phone; mobile phone does not accept text messages; duplicate listing; quota filled]

Standardized SMS Delivery Rates

The precise reason as to why SMS transmissions fail to be delivered may never be fully known to the researcher. However, the technical functionality of SMS transmissions as a store and forward process produces a delivery confirmation message for all SMS communications. That is, in order to suspend efforts by the SMSC at forwarding a SMS transmission, a delivery confirmation is generated. As such, when these delivery confirmation messages are collected, researchers can use these delivery confirmation messages to calculate standardized delivery rates.

Importantly, depending on the specifics of how SMS is incorporated into a survey design, the SMS delivery rate (SMSDR) may be presented as either an item-/question-level outcome measures or as a survey-level outcome. For synchronous SMS surveys, each SMS transmission contains a new survey question or response. As such, one question may be successfully transmitted while the next is not delivered. In this case, it may be possible to have different delivery rates for each survey question delivered via SMS. Alternatively, where SMS is used to deliver an embedded URL for accessing a mobile web survey, generally, the successful transmission of only one SMS communication is required – the SMS transmission containing the URL. In other words, the SMS delivery rate may be calculated for *T* items included in the survey design. The SMS delivery rate below is for a particular item *t*.

SMS Delivery Rate:

$$\mathrm{SMSDR}_t = \mathrm{D}_t/(\mathrm{D}_t + \mathrm{F}_t + \mathrm{UO}_t)$$

Where:

D_t = SMS Delivered for item *t*

F_t = SMS Delivery Failure for item *t*

UO_t = SMS Delivery Unknown for item *t*

Standardized SMS Cooperation Rates

Generally, calculation of standardized cooperation rates for SMS-related surveys can adopt measures similar to the AAPOR cooperation rates (AAPOR Standard Definitions, 2015), but considering a few important additions relevant to the SMS context such as the potential use of a start message and for SMS delivery failures. Five standardized SMS cooperation rates are presented below. The first, the SMS opt-in rate (SMSOIR) is for use where survey designs implement opt-in provisions, such as start messages. This rate reflects the proportion of sample units who opt-in (such as providing a start message to initiate a synchronous SMS survey) over all sample units to which the SMS transmission was sent. The second, the SMS cooperation rate one (SMSCOR1), represents the rate of complete SMS surveys, i.e., where all survey items are completed, out of those to whom the message was sent, regardless of delivery. The third, the SMS cooperation rate two (SMSCOR2), depicts the partial response rate for a SMS survey. Similar to guidance provided for traditional surveys, the threshold for determining partial response should be determined by the researcher (AAPOR Standard Definitions, 2015). The fourth (SMSCOR3) and fifth (SMSCOR4) rates examines only the cooperation rate among sampled cases with known successful delivery. This information may be available to researchers from paradata files about each sent SMS.

SMS Cooperation Rates:

SMSOIR = OI/[OI+(R+F+UO)]

SMSCOR1 = I/[(I+P)+(R+F+UO)]

SMSCOR2 = (I+P)/[(I+P)+(R+F+UO)]

SMSCOR3 = I/[(I+P)+(R)]

SMSCOR4 = (I+P)/[(I+P)+(R)]

Where:

OI = Opt-In, Start or Initial Cooperation

I = Completed minimum number of items

P = Partial Complete

R = Broke off while Completing Items, but not sufficient for partial or Refuse to answer any items

F = SMS Delivery Failure

UO = SMS Delivery Unknown

Practical Implications for Survey Implementation

Integrating SMS into the survey process is inherently a multi-mode endeavor. The TCPA requires that sample units be contacted using some mode other than SMS in order to gain prior consent to transmit SMS communications. As with any mixed-mode survey, researchers who aim to field a synchronous SMS survey or use SMS as a survey design feature (e.g., prenotifications, reminders, or delivering a SMS invitation including a URL to access a web survey) should give careful consideration to the impact of multiple mode survey designs on total survey error (Dillman, Smyth, & Christian, 2009). The conceptual models of SMS-related nonresponse presented above can provide insight into nonresponse considerations when seeking to incorporate SMS into the survey process.

CHAPTER TWO

DATA AND METHODS

Data

This dissertation uses data collected from a SMS experiment conducted by the Gallup Organization from Gallup Daily tracking polls taken from July 29, 2013 – October 14, 2013. The Gallup U.S. Daily is a Computer Assisted Telephone Interview (CATI) of the U.S. population age 18 and older. The survey utilizes a dual-frame sample with list-assisted Random-Digit-Dial (RDD) sampling of landline and mobile telephone numbers stratified by U.S. Census region. The survey employs a 50/50 completion allocation from landline and mobile telephone frames. Surveys are conducted in both English and Spanish. One thousand interviews are completed daily, with half of respondents randomly assigned to one of two survey tracks, the Wellbeing track or the Politics and Economy track. A core set of questions, consistent across both tracks, are asked of all respondents. Response rates (AAPOR RR3) averaged 7% for the Wellbeing track and 10% for the Politics and Economy track (Gallup, 2013).

The total respondent pool for these 78 surveys was 79,605, with about 48% coming from the landline frame and nearly 52% from the mobile frame. Ultimately, 60,527 (79.5%) sampled units agreed to be recontacted by the Gallup Organization, including 29,069 (48%) from the landline frame and 31,271 (52%) from the mobile frame. SMS consent was sought from mobile frame respondents to the Gallup Daily who agreed to be recontacted. Specifically, respondents were asked "Will you consent to receiving future survey questions from Gallup by text message?" A subset of the consenters were selected for a SMS experiment. Figure 6 displays sample allocation for this experimental design.

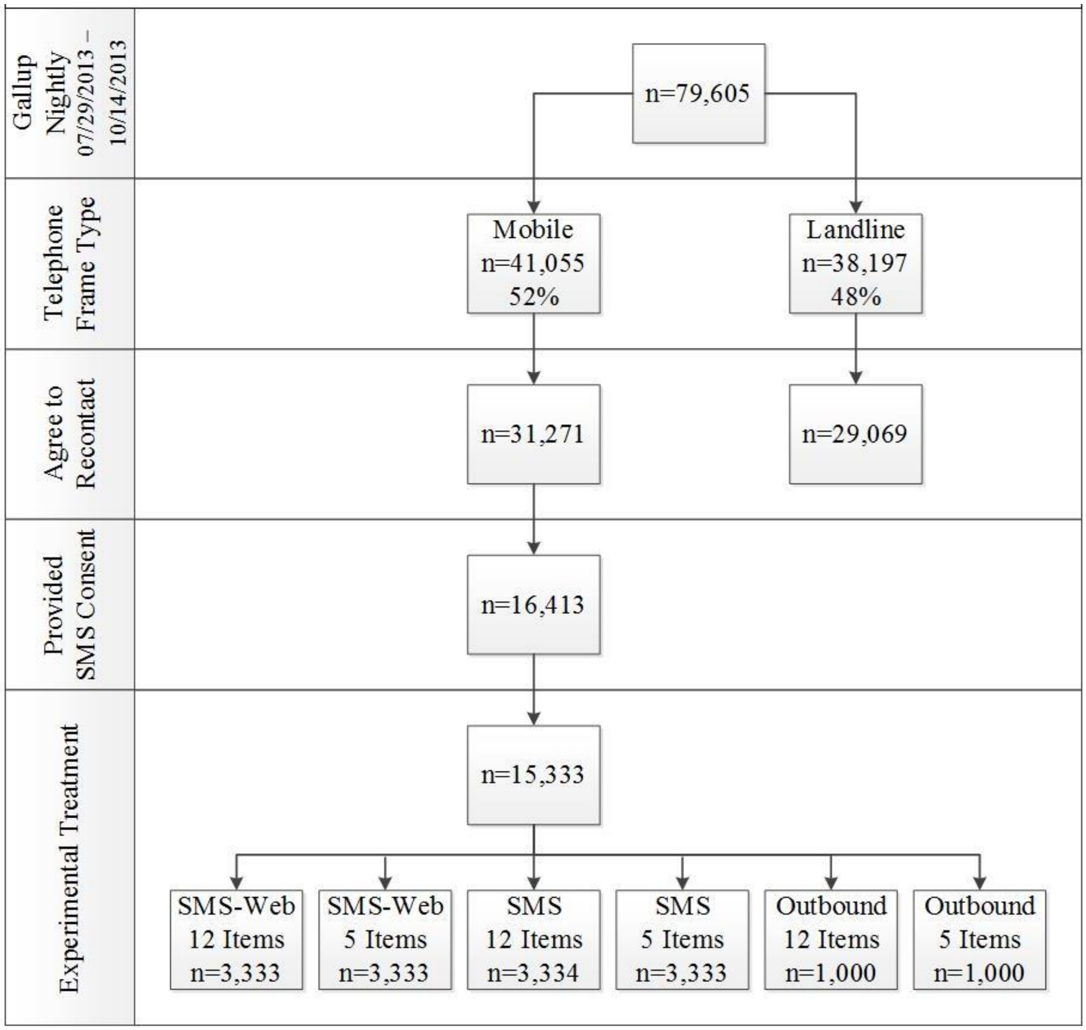

Figure 6. Respondent pool, sample size and experimental design.

Experimental Design

Of the 16,413 sample units consenting to occasionally receive SMS survey messages from Gallup, 15,333 were randomly selected to participate in the SMS experiment with sampled units randomly assigned to one of six experimental conditions creating a fully crossed 2x3 factorial design. Factor one represents the number of items included in the experimental survey (5 or 12) and factor two represents the survey response mode (outbound telephone, synchronous SMS, or SMS Web) (see Table 1).

Table 1

Experimental Design: A Fully Crossed 2x3 Factorial Design

	Response Mode		
# of Questions	Outbound Phone	Synchronous SMS	SMS Web
5 Questions	1	2	3
12 Questions	4	5	6

This sample of consenting respondents was subsequently invited to participate in an experimental survey about banking utilizing SMS. A third party commercial vendor, StrongView, was used to deliver the SMS messages. The sample was randomly assigned to one of the six experimental conditions depicted in Figure 6 (p. 49) and in Table 1 above. These conditions include: (1) a five question outbound telephone survey, (2) a 12 question outbound telephone survey, (3) a five question synchronous SMS survey, (4) a 12 question synchronous SMS survey, (5) a five question SMS invite with embedded URL to access a web survey, and (6) a 12 question SMS invite with embedded URL to access a web survey. All conditions were provided advance notice by mode corresponding to invite (SMS or telephone). The synchronous SMS and SMS Web conditions were invited to begin the survey via SMS while the outbound phone condition was invited by voice via telephone. No incentives were provided, nor were participants reimbursed for any costs.

Unfortunately, we only have SMS delivery information (as well as opt-in data) for the synchronous SMS treatments (experimental groups 2 and 5). Of the 6,667 sample units assigned to these two treatments, 5,814 were successfully delivered (87% SMSDR) and 886 start messages were provided (13% SMSOIR). As such, for purposes of this dissertation, we restrict our investigation of SMS-related nonresponse bias to SMS consent and SMS cooperation only. Our analysis of SMS consent originates from the 29,780 respondents to the initial Gallup Daily tracking polls who were asked to consent to receive SMS messages. For SMS cooperation, our analysis is restricted to the 13,333 sample units from the synchronous SMS and SMS Web conditions (experimental groups 2, 3, 5, and 6).

Dependent Variables

In Table 2, we present the dependent variables under investigation in this dissertation – outcome rates of SMS consent (SMSCR) and SMS cooperation (SMSCOR1 and SMSCOR2). As mentioned in Chapter One, a standardized calculation of SMS consent is not included in the AAPOR Standard Definitions. As such, we operationalize the SMS consent rate (SMSCR) using the formula provided in Chapter One, i.e., the ratio of the number of individuals who consent to receive SMS communications over the total number of sample units asked to provide SMS consent. Likewise, AAPOR Standard Definitions do not include standardized calculations of SMS cooperation.

Table 2

Dependent Variables: Outcome Rates of SMS Consent and SMS Cooperation

	SMS Consent (SMSCR)	SMS Cooperation (SMSCOR1)	SMS Cooperation (SMSCOR2)
Numerator	16,413	1,355	1,502
Denominator	29,780	13,333	13,333
Rate	55.11%	10.16%	11.27%

As such, we use the SMS cooperation rates (SMSCOR1 and SMSCOR2) provided in Chapter One. The first (SMCOR1) represents the percentage of sample units who provided a response to *all* survey items (5 or 12 depending on the assigned treatment group). The second (SMSCOR2) indicates the percentage of sample units who provided a partial response – *at least one* response – to a survey item, regardless of the number of items contained in the survey. All subsequent analyses and discussions of SMS cooperation provided in the main text of this dissertation are restricted to SMS cooperation operationalized as responding to *at least one* item (SMSCOR2). However, we provide footnotes in the text highlighting where results differ when SMS cooperation is operationalized as responding to *all* survey items (SMSCOR1) and provide full analyses for this outcome in the Appendix.

Approximately 55% (SMSCR) of respondents who were asked to occasionally receive survey items via text message from the Gallup Organization actually provided consent. For the combined synchronous SMS and SMS Web treatments (experimental groups 2, 3, 5, and 6), complete and partial response rates were about 10% (SMSCOR1) and 11% (SMSCOR2), respectively.

Independent Variables

In the following paragraphs we present the independent variables used to predict SMS-related nonresponse. First, we present the *z* covariates (i.e., the anticipated correlates of both response propensity (*p*) and the survey variables of interest (*y*s)) followed by the *y* survey variables of interest under investigation in this dissertation (Groves, 2006). All tables of independent variables contain both unweighted and weighted estimates. Weighted estimates utilize the national weights developed by the Gallup Organization.

Missing data was multiply imputed using chained equations (Ragunathan, Lepkowski, Van Hoewyk, & Solenberger, 2001) via Stata 14 with the user-developed *ice* command (Royston, 2005a, 2005b, 2007, 2009). Five imputations were created. The imputation model included all analytic variables for this dissertation, including survey variables of interest (*y*s), proxy variables for the hypothesized mechanisms of nonresponse (*z*s), and the outcome rates under investigation in this dissertation. Additionally, survey design variables used for sample stratification, survey weights, and a series of additional variables correlated with those included in the analytic models were included in the imputation model. Estimation using imputed data follow Rubin's rules (Rubin, 1987, 1996) and were conducted using the *mi estimate* command as part of Stata 14. Item missing percentages and descriptive statistics for the imputed data are presented in the Appendix.

Proxies for Mechanisms of SMS Consent

To begin, we present descriptive statistics for those variables corresponding to the mechanisms of SMS consent outlined in Figure 2 from Chapter One (p. 13). These variables represent *z* covariates as depicted by Groves (2006) and serve proxies for the hypothesized causes of SMS nonconsent nonresponse. Descriptive statistics are restricted to sample units from the mobile telephone frame.

Respondent Characteristics

Table 3 provides descriptive statistics for the independent variables related to respondent characteristics. Overall, the majority of respondents are white (78%), older (60% age 50 and older), have obtained at least a high school diploma (87%), and are employed in a full time capacity (74%). Politically, respondents tend to identify as "Independent" or "Other" (38%) and tend to be "Moderate" (36%) or more ideologically conservative (41% conservative/very conservative). A majority of respondents report themselves as married (53%), believe religion to be important (66%), and attend religious services at least once per month (55%). The average item missing rate was about 7%, where the item nonresponse rate represents the mean ratio of missed items (i.e., the number of missing items over the total number of a subset of survey items asked of all respondents unique to each survey track (Politics and Economy or Wellbeing)) multiplied by 100. The mean number of call attempts for the Gallup Daily survey was just over two.

Table 3

Independent Variables: Unweighted and Weighted Descriptive Statistics for Respondent Characteristics

	Unweighted			Weighted	
Respondent Characteristics	Freq.	Percent/Mean	S.E.	Percent/Mean	S.E.
Economic Costs					
Household Income					
Under $999	2,836	9.05%	0.16	13.73%	0.28
$1,000 to $1,999	3,950	12.61%	0.19	16.92%	0.29
$2,000 to $2,999	4,086	13.04%	0.19	14.98%	0.27
$3,000 to $3,999	3,488	11.14%	0.18	11.00%	0.22
$4,000 to $4,999	3,237	10.33%	0.17	9.37%	0.20
$5,000 to $7,499	5,757	18.38%	0.22	15.07%	0.23
$7,500 to $9,999	2,582	8.24%	0.16	6.43%	0.15
$10,000 to $14,999	2,936	9.37%	0.16	6.75%	0.15
$15,000 and over	2,451	7.82%	0.15	5.74%	0.14
Employment Status					
Employed Full Time (Employer)	20,823	67.79%	0.27	66.02%	0.35
Employed Full Time (Self)	2,673	8.70%	0.16	7.26%	0.18
Employed Part Time (Do Not Want Full Time)	2,722	8.86%	0.16	7.78%	0.19
Employed Part Time (Want Full Time)	2,462	8.02%	0.15	10.09%	0.24
Unemployed	2,035	6.63%	0.14	8.85%	0.23
General Resistance					
Item Missing Rate	41,055	6.97%	0.04	7.23%	0.15
Call Attempts	41,055	2.16	0.01	2.22	0.02
Party Identification					
Republican	6,863	27.57%	0.28	23.78%	0.33
Democrat	7,929	31.85%	0.30	32.47%	0.38
Independent and Other	10,105	40.59%	0.31	43.75%	0.40

Table 3 continues

Respondent Characteristics	Unweighted			Weighted	
	Freq.	Percent/Mean	S.E.	Percent/Mean	S.E.
Political Views					
Very Conservative	1,900	9.14%	0.20	8.42%	0.24
Conservative	6,210	29.89%	0.32	28.46%	0.40
Moderate	7,474	35.97%	0.33	36.40%	0.42
Liberal	4,051	19.50%	0.27	20.88%	0.37
Very Liberal	1,144	5.51%	0.16	5.84%	0.21
Perceived Ease of Use					
Age					
15-24	5,770	14.24%	0.17	21.81%	0.29
25-34	7,454	18.40%	0.19	23.32%	0.28
35-49	9,750	24.07%	0.21	27.63%	0.29
50-64	11,297	27.89%	0.22	19.30%	0.22
65+	6,237	15.40%	0.18	7.93%	0.13
Education					
Less than high school diploma	2,153	5.35%	0.11	13.05%	0.27
High school degree or diploma	7,551	18.78%	0.19	30.76%	0.32
Technical/Vocational school	2,765	6.88%	0.13	5.56%	0.12
Some college	10,400	25.87%	0.22	23.30%	0.25
College graduate	10,038	24.97%	0.22	16.52%	0.19
Post graduate work or degree	7,300	18.16%	0.19	10.81%	0.15
Sociodemographics					
Gender					
Male	23,407	57.01%	0.24	54.01%	0.32
Female	17,648	42.99%	0.24	45.99%	0.32
Marital Status					
Single/Never been married	10,850	26.71%	0.22	35.17%	0.31
Married	20,648	50.82%	0.25	42.04%	0.31
Separated/Divorced	5,193	12.78%	0.17	12.48%	0.21
Widowed	1,842	4.53%	0.10	3.23%	0.10

Table 3 continues

Respondent Characteristics	Unweighted			Weighted	
	Freq.	Percent/Mean	S.E.	Percent/Mean	S.E.
Domestic partnerships/Living with partner (not legally married)	2,094	5.15%	0.11	7.07%	0.18
Religious Preference					
Protestant	9,727	24.49%	0.22	16.78%	0.21
Roman Catholic	8,797	22.15%	0.21	23.41%	0.28
Other Christian Religion	10,679	26.88%	0.22	31.62%	0.30
Other Non-Christian Religion	2,470	6.22%	0.12	5.84%	0.15
No Religion/Atheist/Agnostic	8,049	20.26%	0.20	22.35%	0.27
Religion Important					
Yes	14,043	62.52%	0.32	61.85%	0.41
No	8,420	37.48%	0.32	38.15%	0.41
Religious Attendance					
At least once a week	7,002	31.46%	0.31	29.81%	0.39
Almost every week	1,969	8.85%	0.19	8.41%	0.24
About once a month	2,857	12.84%	0.22	13.84%	0.30
Seldom	5,477	24.61%	0.29	24.26%	0.36
Never	4,951	22.25%	0.28	23.68%	0.36
Race					
White	28,645	71.93%	0.23	61.68%	0.32
Black	1,967	4.94%	0.11	4.03%	0.11
Other	4,199	10.54%	0.15	14.31%	0.24
Hispanic	5,015	12.59%	0.17	19.98%	0.29

Notes. "Freq." represents frequency, "S.E." represents standard error. Standard errors for unweighted estimates are calculated using the asymptotically derived sqrt(P(1-P)/n). Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Social Environment

Variables related to social environmental mechanisms of nonresponse are presented in Table 4. Again, descriptive statistics are restricted to the mobile telephone frame. Generally, respondents report their employers to be either "hiring new people and

Table 4

Independent Variables: Unweighted and Weighted Descriptive Statistics for Social Environment

	Unweighted			Weighted	
Social Environment	Freq.	Percent	S.E.	Percent	S.E.
Economic Conditions					
Your Company: Hire/Reduce					
Hiring new people and expanding the size	10,695	39.70%	0.30	43.33%	0.38
Not changing the size of its workforce	11,818	43.87%	0.30	41.06%	0.37
Letting people go and the size	4,427	16.43%	0.23	15.50%	0.27
Direction of the National Economy					
Getting better	8,213	40.63%	0.35	42.05%	0.45
The same	662	3.28%	0.13	3.22%	0.16
Getting worse	11,337	56.09%	0.35	54.74%	0.45
Neighborhood Characteristics					
Census Region					
Northeast	7,478	18.21%	0.19	18.16%	0.20
Midwest	9,170	22.34%	0.21	21.18%	0.21
South	14,882	36.25%	0.24	37.31%	0.25
West	9,525	23.20%	0.21	23.35%	0.22

Notes. "Freq." represents frequency, "S.E." represents standard error. Standard errors for unweighted estimates are calculated using the asymptotically derived sqrt(P(1-P)/n). Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

expanding the size" (36%) or "not changing the size of its workforce" (46%). Yet, a majority perceive the national economy to be "getting worse" (59%). A plurality of respondents reside in the South Census Region (36%).

Interviewer Characteristics

Table 5 provides descriptive statistics from the mobile telephone frame for the *z* covariates related to Interviewer Characteristics. Interviewers averaged more than 26 months of experience upon conducting the Gallup Daily CATI survey. A slight majority of interviewers are female (52%) and overwhelmingly report their race as “white” (84%).

Table 5

Independent Variables: Unweighted and Weighted Descriptive Statistics for Interviewer Characteristics

	Unweighted			Weighted	
Interviewer Characteristics	Freq.	Percent/Mean	S.E.	Percent	S.E.
Experience					
Tenure (Months)	41,034	26.67	0.23	25.92%	0.29
Sociodemographics					
Interviewer Gender					
Male	19,508	47.52%	0.25	46.90%	0.31
Female	21,547	52.48%	0.25	53.10%	0.31
Interviewer Race					
White	34,287	83.51%	0.18	82.24%	0.25
African American/Black	3,703	9.02%	0.14	8.6%	0.17
Other	3,065	7.47%	0.13	9.16%	0.20

Notes. “Freq.” represents frequency, “S.E.” represents standard error. Standard errors for unweighted estimates are calculated using the asymptotically derived sqrt(P(1-P)/n). Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Proxies for Mechanisms of SMS Cooperation

Finally, we examine descriptive statistics for the independent variables that serve as proxies for mechanisms of SMS cooperation presented in Figure 4 from Chapter One (p. 31). In some cases, the hypothesized causes for this mechanism are identical to those reviewed in the proxies for mechanisms of SMS consent section above. As such, we will only review *z* covariates that are unique to this mechanism of nonresponse and have yet to be discussed in the previous sections. These statistics are restricted to the 13,333 sample units from the synchronous SMS and SMS Web treatments.

Survey Design

Consistent with the experimental design information provided in previous sections, nearly equal proportions of respondents were assigned to either the 5 or 12 question experimental groups. Likewise, 50% of the sample was assigned to each of the SMS experimental design conditions (see Table 6).

Survey Variables of Interest

Next, we provide descriptive statistics for the survey variables of interest, or the *y* variables as described by Groves (2006) for the mobile frame. Six separate *y* variables are under investigation in this dissertation on topics ranging from politics, to the economy and personal health measures. Table 7 details that a strong majority of respondents are nonsmokers (83%) with health insurance coverage (87%), and rate their own health as at least "good" (81% good/very good/excellent). Just over half (54%) of respondents disapprove of the way the President is handling his job. Additionally, most are registered to vote (86%) and report the national economy as "poor" (38%) or "only fair" (45%).

Table 6

Independent Variables: Unweighted and Weighted Descriptive Statistics for Survey Design

	Unweighted			Weighted	
Survey Design	Freq.	Percent	S.E.	Percent	S.E.
Length					
Number of Items					
5 Items	6,666	50.00%	0.40	50.18%	0.51
12 Items	6,667	50.00%	0.40	49.82%	0.51
Survey Mode					
Experimental Design					
Synchronous SMS	6,667	50.00%	0.43	50.00%	0.54
SMS with Embedded URL	6,66	50.00%	0.43	50.00%	0.54

Notes. “Freq.” represents frequency, “S.E.” represents standard error. Standard errors for unweighted estimates are calculated using the asymptotically derived sqrt(P(1-P)/n). Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Table 7

Independent Variables: Survey Variables of Interest

	Unweighted			Weighted	
Survey Variables of Interest	Freq.	Percent	S.E.	Percent	S.E.
Registered to Vote					
Yes, Registered	12,385	81.19%	0.32	71.86%	0.50
No, Not Registered/Plan to/ Don't' Need to Register	2,869	18.81%	0.32	28.14%	0.50
Obama Job Approval					
Approve	9,109	47.74%	0.36	51.75%	0.46
Disapprove	9,973	52.26%	0.36	48.25%	0.46
Economic Conditions					
Poor	7,201	35.30%	0.33	34.33%	0.42
Only Fair	9,368	45.92%	0.35	46.58%	0.45
Good/Excellent	3,833	18.79%	0.27	19.09%	0.35
Own Health Rating					
Excellent	4,465	21.84%	0.29	19.55%	0.34
Very Good	6,599	32.28%	0.33	29.68%	0.40
Good	5,957	29.14%	0.32	30.86%	0.42
Fair	2,598	12.71%	0.23	15.58%	0.35
Poor	825	4.04%	0.14	4.33%	0.19
Do you smoke?					
Yes	3,811	18.63%	0.27	20.58%	0.28
No	16,649	81.3%	0.27	79.42%	0.28
Health Insurance Coverage?					
Yes	17,025	83.38%	0.26	76.56%	0.41
No	3,393	16.62%	0.26	23.44%	0.41

Notes. "Freq." represents frequency, "S.E." represents standard error. Standard errors for unweighted estimates are calculated using the asymptotically derived sqrt(P(1-P)/n). Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Methods

Research Design

This dissertation utilizes data from a rich frame to examine differences in survey variables and predictor variables for both respondents and nonrespondents (Groves, 2006). A particular strength of the dataset employed here is that information exists for both respondents and nonrespondents for a series of variables gained during the original Gallup Daily surveys. Additionally, for each sample unit we have outcome information as to the different types of SMS-related nonresponse under investigation in this dissertation: SMS nonconsent and SMS noncooperation. However, one drawback to this design is that we do not know about those sample units who did not respond to the original Gallup Daily survey. Additionally, SMS delivery information was not collected for some treatment groups. As noted previously, paradata denoting the successful delivery of a SMS transmission and initial cooperation or "start" message was only collected for the synchronous SMS treatments (experimental groups 2 and 5).

Analysis Methods

As an analytic plan, this dissertation will follow the same general five-step process for examining SMS-related nonresponse bias due to SMS nonconsent (Chapter Three) and SMS noncooperation (Chapter Four). These steps are as follows:

1. Estimate a series of response propensity models using logistic regression informed by the conceptual model for SMS consent/cooperation;
2. Estimate the correlation between the response propensities estimated in step one and a set of survey variables of interest, $Corr(y, p)$;

3. Estimate the empirical bias for a set of survey variables of interest, $Bias(\bar{y}_r)$;
4. Develop nonresponse adjustment weights as the inverse of the estimated response propensities $\left(\frac{1}{\hat{p}}\right)$ using the propensity models created in step one; and
5. Examine the effectiveness of the propensity models created in step one at addressing SMS-related nonresponse bias by applying the nonresponse adjustment weights created in step four and assessing the reduction in bias characterized by estimates that are closer to those of the base-weighted full sample, $\bar{y}_{Full,bw}$.

Next, we evaluate the relative contribution of SMS nonconsent and SMS noncooperation to the overall estimate of SMS-related nonresponse bias (Chapter Five) using the following analytic steps:

1. Estimate the difference between consenters and nonconsent, those selected and not selected into the SMS experimental design, and cooperators and noncooperation with the SMS survey for a set of variables of interest (*y*s);
2. Estimate nonconsent (SMSCR) and noncooperation rates (SMSCOR1 and SMSCOR2);
3. Estimate SMS nonconsent bias, SMS experimental selection bias, SMS noncooperation bias, and total SMS-related nonresponse bias for a set of variables of interest (*y*s);
4. Evaluate the relative contribution of the parameters estimated in Step One and Step Two above towards the total SMS-related nonresponse bias estimated in Step Three for a set of survey variables of interest (*y*s);

5. Develop nonresponse adjustment weights as the product of the nonconsent weights created in Chapter Three, the noncooperation weights created in Chapter Four, and the base weights; and
6. Examine the effectiveness of the propensity models created in Chapter Three and Four at addressing total SMS-related nonresponse bias by applying the combined SMS-related nonresponse adjustment weights created in Step Five above assessing the reduction in bias characterized by estimates that are closer to those of the full sample, $\bar{y}_{Full,bw}$.

Response Propensity Models

Response propensity models can be estimated using logistic regression to predict survey participation (Little, 1986). For this dissertation, we develop two sets of propensity models, one set predicting SMS consent and the other predicting cooperation with a SMS survey. The first set of models presented in Chapter Three predict SMS consent from a series of covariates guided by the conceptual model of SMS consent presented in Chapter One. More specifically, five propensity models are estimated for this section – one for each portion of the conceptual model of SMS consent presented in Chapter One for which we have available proxy measures (Respondent Characteristics, Social Environment, and Interviewer & Consent Design) (Models 1, 2, and 3), a full model including all covariates (Model 4), and a final, parsimonious model (Model 5) including covariates that were statistically significant ($p < 0.05$) from the full model (Model 4).

Table 8 depicts the five propensity models for SMS consent we estimate in Chapter Three, including the corresponding nonresponse mechanisms to be included as model predictors. The grayed out cells depict mechanisms that will *not* be included in the corresponding propensity model. Alternatively, the empty cells identify the nonresponse mechanisms that *will* be included in the corresponding propensity model. The cells for the final model contain question marks denoting that the exact covariates to be included will be dependent of on which variables form the full model are statistically significant in predicting SMS consent. Significant covariates are brought forward to create the final, parsimonious model.

Table 8

Propensity Model Parameterization: Predicting SMS Consent

	Model 1	Model 2	Model 3	Model 4	Model 5
Respondent Characteristics					?
Social Environment					?
Interviewer Characteristics					?

In Chapter Four we develop a second set of propensity models predicting SMS cooperation. Six models are estimated – one for each of the mechanisms of SMS cooperation for which we have available proxy measures (Respondent Characteristics, Social Environment, and Survey Design Characteristics), a fourth model that contains the interaction of experimental covariates from the Survey Design model (Model 4), a full model with all covariates (Model 5), and a final, parsimonious model (Model 6) including only the statistically significant ($p < 0.05$) covariates from the full model (Model 5). Similar to those presented for SMS consent, Table 9 identifies the mechanisms to be included as predictors for each of the six propensity models predicting SMS cooperation.

Table 9

Propensity Model Parameterization: Predicting SMS Cooperation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Respondent Characteristics						?
Social Environment Characteristics						?
Social Environment Characteristics (Interaction)						?
Survey Design Characteristics						?

Correlation between *y* and *p*

Using the predicted probabilities from the propensity models created using logistic regression, we next calculate the correlation between response propensities (p) and the survey variable of interest (y). Predicted probabilities are obtained by first estimating the linear prediction of each imputation and combined using the *mi predict* command in Stata 14 to accommodate Rubin's rules. Subsequently, the linear predictions are transformed using the inverse logit function to produce predicted probabilities.

Specifically, we are interested in the direction and strength of these correlations as an indicator of nonresponse bias. For each type of SMS-related nonresponse, we examine the correlation of y and p across propensity models. In doing so, we will evaluate the effect each mechanism of SMS-related nonresponse on nonresponse bias. Where the correlations are in competing directions across SMS-related nonresponse types, we will examine if the total SMS-related nonresponse bias is effectively mitigated.

Estimating Empirical Bias

Due to the rich sampling frame employed in this dissertation, we have information about both respondents and nonrespondents. As such, we are able to calculate the empirical bias for variables of interest as the difference between the respondent mean and that of the full sample where $Bias(\overline{y_r}) = \bar{y}_r - \bar{y}_s$. We will examine the respondent mean, the nonrespondents mean, and the full sample mean, as well as the difference between respondents and the full sample and the difference between respondents and nonrespondents.

Nonresponse Weighting Adjustments

Next, using the predicted propensities from the logistic models discussed above, we calculate nonresponse weighting adjustments as the inverse of the predicted response propensity $(1/\hat{p})$. Weights are created for the final, parsimonious models developed for each type of SMS-related nonresponse.

Evaluating Reductions in Nonresponse Bias

Applying the nonresponse weighting adjustments noted in the previous section, next we examine the effectiveness of the weighting adjustments at reducing nonresponse bias in survey estimates. The degree to which nonresponse weighting adjustments result in estimates that are closer to the unadjusted, base-weighted full sample estimates will indicate the effectiveness of the response propensity models at reducing SMS-related nonresponse bias.

Summary of Research Objectives

This dissertation offers a first look into bias associated with two different types of SMS-related nonresponse: (a) a failure to provide consent to receive SMS communications, and (b) noncooperation with a SMS survey.

The research objectives for this study are as follows:

1. Examine SMS nonconsent nonresponse bias by evaluating responses to the Gallup Daily from SMS consenting and nonconsenting sample units. (Chapter Three)
2. Examine SMS noncooperation nonresponse bias by evaluating responses to the Gallup Daily from SMS cooperating and noncooperating respondents. (Chapter Four)
3. Understand the relative bias attributable to each form of SMS-related nonresponse (identified in objectives 1 and 2 above). (Chapter Five)

We conclude in Chapter Six by summarizing the results and their implications, the limitations of this work, and recommendations for future research.

CHAPTER THREE

NONCONSENT NONRESPONSE BIAS

Introduction

Nonresponse has traditionally been divided into three categories: noncontact nonresponse, noncooperation nonresponse, and nonresponse arising for other reasons (e.g., language or physical impediments to participation) with unique causes attributed to each (Groves & Couper, 1998). For survey designs that incorporate SMS-related functionality, the prior consent requirement of the U.S. Federal Telephone Consumer Protection Act (TCPA) introduces an additional mechanism of nonresponse to consider – nonresponse arising from nonconsent to receive SMS messages. To the extent that nonconsent is related to survey variables of interest, estimates may suffer from nonresponse bias. This chapter provides an examination of nonresponse bias resulting from nonconsent to receiving SMS transmissions.

Background Review

There are many ways to incorporate SMS into the survey process. In Chapter One, we adapted the Groves and Couper (1998) framework of nonresponse to SMS requests, assuming that contact and initial participation have already been established via some other mode (e.g., outbound telephone). The framework depicts four unique types of nonresponse that might occur (sequentially) in the survey process: (a) initial participation where traditional forms of noncontact and noncooperation nonresponse may arise, (b) consent to receive SMS where *nonconsent* nonresponse may arise, (c) delivery of a SMS transmission where *nondelivery* nonresponse can occur, and (d) cooperation with SMS where *noncooperation* nonresponse may result. This chapter focuses on one of these segments – consent. Figure 7 shows SMS in the survey process, highlighting the particular segment under investigation in this chapter.

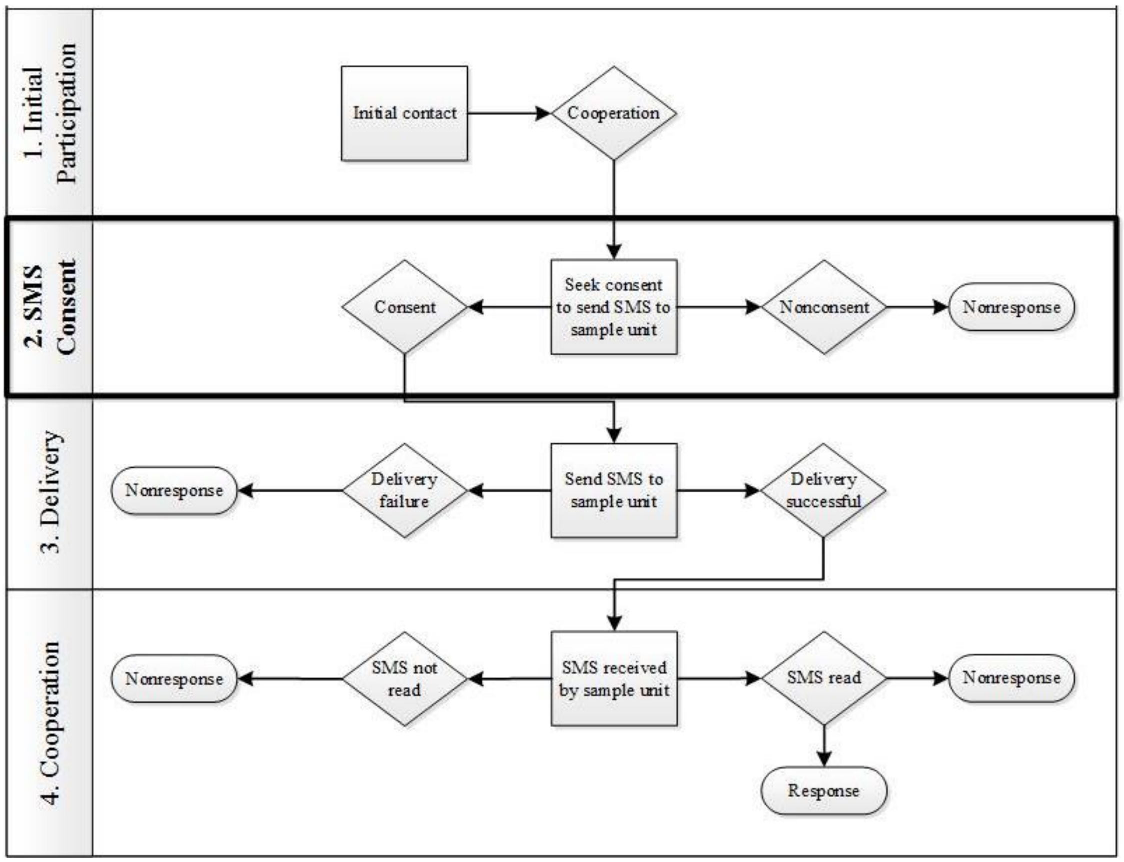

Figure 7. Framework for SMS in the survey process.

As the framework depicts, a sample unit is contacted via a different mode and cooperates with a survey interview. At some point during initial survey participation, the interviewer can seek consent from the sample unit to send a SMS. As noted in Chapter One, the U.S. Federal Telephone Consumer Protection Act (TCPA) requires the hand-dialing of mobile numbers *and* prior consent to send SMS messages, unless sent for emergency purposes (Telephone Consumer Protection Act, 2015). Published rates of consent to SMS in the survey process are limited, but where available, they vary widely ranging from 19.9% (Crawford et al., 2013) to 87% (Brenner & DeLamater, 2012), both from samples of U.S. college students. For a SMS survey of the general U.S. population, consent has been reported between 54% and 59% (Marlar & McGeeney, 2014).

To guide our analysis of nonresponse bias resulting from the SMS consent decision, we utilize the conceptual model for SMS consent presented in Chapter One. This model was developed from the traditional model of household survey participation (Groves & Couper, 1998). Hypothesized factors include those outside of researcher control, including the *Social Environment* and *Respondent Characteristics*, and factors under researcher control, including the *Consent Design* and *Interviewer Characteristics* (see Figure 8). These factors contribute to the *Interaction between the Respondent and the Interviewer* which precedes the decision to consent.

Data

The data used to examine the bias attributed to SMS consent comes from an experiment conducted by the Gallup Organization using Gallup Daily tracking polls taken from July 29, 2013 – October 14, 2013. The total pooled sample size for these 78 surveys was 79,605, with about 48% coming from the landline frame and nearly 52% from the mobile frame. Ultimately, 60,527 (79.5%) sampled units agreed to be recontacted by the Gallup Organization, including 29,069 (48%) from the landline frame

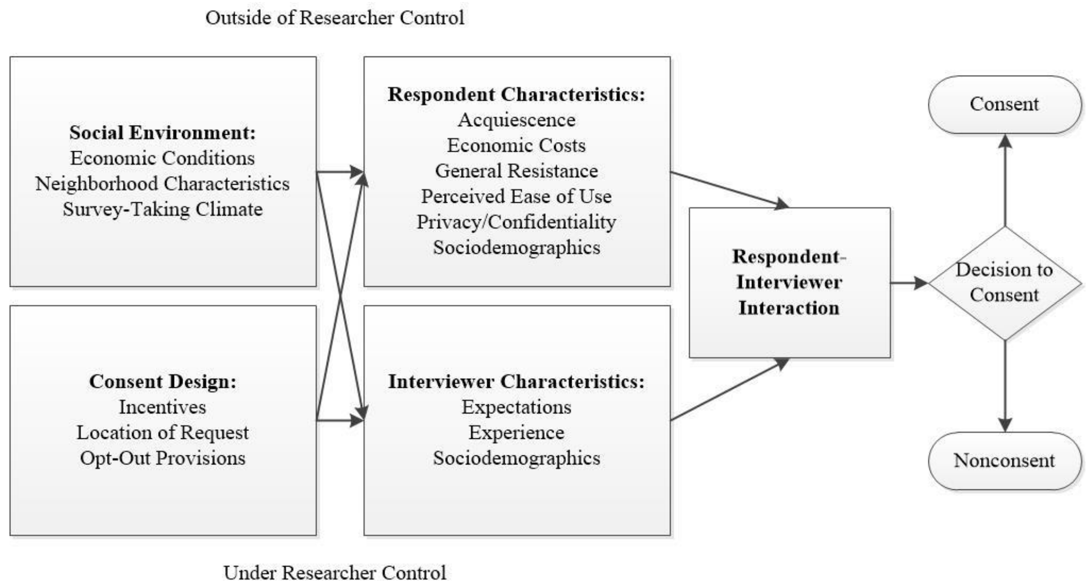

Figure 8. Conceptual model for SMS consent.

and 31,271 (52%) from the mobile frame. SMS consent was sought from mobile frame respondents to the Gallup Daily who agreed to be recontacted. Ultimately, 29,780 mobile frame respondents were asked for consent with the question, “Will you consent to receiving future survey questions from Gallup by text message?,” and 16,413 respondents consented to receiving future text messages from Gallup, yielding a SMS consent rate (SMSCR) of 55.11%.

Analytic Approach

To evaluate nonconsent bias, the analytic plan for this chapter follows a five-step process, as discussed in Chapter Two:

1. Estimate a series of response propensity models using logistic regression informed by the conceptual model for SMS consent;

2. Estimate the correlation between the response propensities estimated in step one and a set of survey variables of interest, $Corr(y, p)$;
3. Estimate the empirical bias for a set of survey variables of interest, $Bias(\bar{y}_r)$;
4. Develop nonresponse adjustment weights as the inverse of the estimated response propensities $\left(\frac{1}{\hat{p}}\right)$ using the propensity models created in step one; and
5. Examine the effectiveness of the propensity models created in step one at addressing SMS-related nonresponse bias by applying the nonresponse adjustment weights created in step four and assessing the reduction in bias characterized by estimates that are closer to those of the base-weighted full sample, $\bar{y}_{Full,bw}$.

Response propensity models use logistic regression models to predict a survey participation outcome of interest (Little, 1986). These models predict SMS consent from a series of covariates guided by the conceptual model of SMS consent presented in Chapter One for which we have adequate measures. More specifically, five propensity models are estimated for this chapter – one for each portion of the conceptual model of SMS consent for which we have measures (*Respondent Characteristics*, *Social Environment*, *and Interviewer Characteristics*), a combined model including covariates from all three groups of consent mechanism proxies, and a final, parsimonious model which retains only significant predictors from the full model.

Results of the propensity models for SMS consent are presented in Table 10. Model parameterization is as follows: Model 1 includes covariates measuring *Respondent Characteristics*, Model 2 includes measures of the *Social Environment*, Model 3 includes

Interviewer Characteristics, Model 4 is the full model, and Model 5 is a final, parsimonious model. A design based approach was used to account for the clustering of sample units within interviewers.

Results

Step One: Response Propensity Models

To begin, we examine five consent propensity models predicting consent to receive SMS transmissions.

Respondent Characteristics

Model 1 from Table 10 provides results for the *Respondent Characteristics* mechanism.

Economic Costs

As discussed in Chapter One, we hypothesize that sample units may refuse to consent to SMS due to the economic costs associated with sending and receiving text messages. Of the two variables used to examine *Economic Costs*, only employment status was a significant predictor of SMS consent, $F(4, 283.0) = 4.69$, $p < 0.01$ and in the opposite direction anticipated. Relative to those employed full-time for an employer, the unemployed and those employed part-time but wanting full-time work had higher odds of consenting to SMS (OR = 1.21, $p < 0.01$ and OR = 1.16, $p < 0.05$). Conversely, the odds of consenting to SMS are lower for those employed part-time but not looking for full-time work compared to those employed full-time for an employer (OR = 0.87, $p < .05$). This finding runs contrary to our expectation where employed sample units may have more discretionary income available to incur the potential costs associated with sending

Table 10

Response Propensity Models for SMS Consent

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
Respondent Characteristics										
Economic Costs										
Monthly Household Income										
Under $999	1.00						1.01			
$1,000 to $1,999	1.01						1.02			
$2,000 to $2,999	0.96						0.97			
$3,000 to $3,999	0.87	†					0.88	†		
$4,000 to $4,999	0.89						0.90			
$5,000 to $7,499	0.90						0.91			
$7,500 to $9,999	0.88	†					0.88	†		
$10,000 to $14,999	1.01						1.01			
$15,000 and over (Reference)	-						-			
Employment Status		**						***		***
Employed Full Time for Employer (Reference)	-						-		-	
Employed Full Time for Self	0.98						0.98		0.99	
Employed Part Time - Do Not Want Full Time	0.87	*					0.87	*	0.89	†
Employed Part Time - Want Full Time	1.16	*					1.16	*	1.19	**
Unemployed	1.21	**					1.24	**	1.25	**
General Resistance										
Item Missing Rate	0.98	***					0.98	***	0.98	***
Call Attempts	1.03	*					1.03	*	1.03	*

Table 10 continues

	Model 1		Model 2	Model 3	Model 4		Model 5	
	Odds Ratio		Odds Ratio	Odds Ratio	Odds Ratio		Odds Ratio	
General Resistance (cont'd)								
Party Identification		**				*		**
Republican (Reference)	-				-		-	
Lean Republican	1.09				1.09		1.07	
Independent	0.91				0.91		0.88	†
Lean Democrat	1.09				1.07		1.05	
Democrat	1.17	*			1.14	*	1.14	*
Refuse	1.00				1.04		0.98	
Political Ideology								
Very Conservative (Reference)	-				-			
Conservative	0.94				0.94			
Moderate	0.98				0.97			
Liberal	1.09				1.09			
Very Liberal	1.15				1.15			
Perceived Ease of Use								
Age		***				***		***
18-24 (Reference)	-				-		-	
25-34	1.04				1.04		1.05	
35-49	1.13	*			1.14	*	1.15	*
50-64	0.84	**			0.85	**	0.87	*
65+	0.60	***			0.62	***	0.63	***
Education		***				***		***
Less than high school diploma	1.42	***			1.41	***	1.44	***
High school degree or diploma (Reference)	-				-		-	
Technical/Vocational school	0.86	*			0.86	*	0.86	*

Table 10 continues

	Model 1		Model 2	Model 3	Model 4		Model 5	
	Odds Ratio		Odds Ratio	Odds Ratio	Odds Ratio		Odds Ratio	
Perceived Ease of Use (cont'd)								
Education (cont'd)		***				***		***
Some college	0.89	**			0.88	**	0.88	**
College graduate	0.72	***			0.71	***	0.71	***
Post graduate work or degree	0.76	***			0.74	***	0.76	***
Sociodemographics								
Gender								
Male (Reference)	-				-		-	
Female	1.13	***			1.14	***	1.15	***
Marital Status		***				***		***
Single/Never been married (Reference)	1.00				1.01		1.01	
Married (Reference)	-				-		-	
Separated/Divorced	1.25	***			1.25	***	1.25	***
Widowed	1.02				1.02		1.03	
Domestic partnerships/Living with partner…	1.21	**			1.21	**	1.20	*
Religious Preference								
Protestant	1.05				1.04			
Roman Catholic	1.01				1.02			
Other Christian Religion	0.95				0.95			
Other Non-Christian Religion	0.90				0.91			
No Religion/Atheist/ Agnostic (Reference)	-				-			
Religion Important								
No (Reference)	-				-			
Yes	1.06				1.06			

Table 10 continues

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
Sociodemographics (cont'd)										
Religious Attendance										
At least once a week	1.18	*					1.17	*		
Almost every week	1.17	*					1.16	†		
About once a month	1.07						1.06			
Seldom	1.07						1.07			
Never (Reference)	-						-			
Race		***						***		***
White (Reference)	-						-		-	
Black	0.94						0.94		0.94	
Other	1.69	***					1.64	***	1.67	***
Hispanic	1.49	***					1.45	***	1.53	***
Social Environment										
Economic Conditions										
Your Company: Hire/Reduce										
Hiring new people and expanding the size			1.05				0.97			
Not changing the size of its workforce (Reference)			-				-			
Letting people go and the size			1.07				1.05			
Direction of the National Economy				***				**		**
Getting better			1.25	***			1.17	***	1.16	***
The same			1.10				1.08		1.07	
Getting worse (Reference)			-				-		-	
Neighborhood Characteristics										
Census Region				***				***		***
Northeast			0.80	***			0.84	***	0.83	***

Table 10 continues

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
Neighborhood Characteristics (cont'd)										
Census Region (cont'd)										
Midwest			0.81	***			0.90	*	0.89	**
South (Reference)			-				-		-	
West			0.86	**			0.89	**	0.88	**
Interviewer Characteristics										
Experience										
Tenure (Months)					1.00		1.00			
Sociodemographics										
Interviewer Gender										
Female (Reference)					-		-			
Male					0.94	†	0.96			
Interviewer Race						**				
White (Reference)					-		-			
African American or Black					1.04		1.08			
Other					1.27	***	1.04			
Questionnaire										
Survey Version										
Politics and Economy					0.89	**	1.10	†		
Wellbeing (Reference)					-		-			
Constant	1.22	†	1.46	***	1.58	***	1.22		1.28	**

Table 10 continues

	Model 1	Model 2	Model 3	Model 4	Model 5
	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Model Statistics					
N	29,780	29,780	29,780	29,780	29,780
Average RVI	0.148	0.191	0.001	0.146	0.064
Largest FMI	0.465	0.408	0.003	0.422	0.407
Complete DF	3,088	3,088	3,088	3,088	3,088
Model F Test	(49, 2405.1) 14.84 ***	(7, 564.1) 9.14 ***	(5, 3085.8) 5.80 ***	(61, 2532.4) 12.47 ***	(33, 2821.1) 22.79 ***
Prob.>F	0.000	0.000	0.001	0.000	0.000

Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10

and receiving SMS relative to unemployed/underemployed persons. Alternatively, this finding may instead be a reflection of the "busyness" of sample units where employed persons have less discretionary time relative to the unemployed and those employed part-time but seeking full-time work (Couper, 1997). The covariate for monthly household income was not a significant predictor of SMS consent, $F(8, 2096.6) = 1.63$, $p > 0.10$.

General Resistance

Additionally, we surmised that sample units may refuse to consent to SMS if they harbor a higher degree of general resistance to the survey. Looking to the measures of *General Resistance*, findings are mixed. While both the item missing rate and number of call attempts are statistically significant, they move in opposite directions. One is consistent with the notion of general resistance. As expected, an increase in the item missing rate is associated with decreased levels of consent (OR = 0.98, $p < 0.001$). Yet conversely, an increase in the number of call attempts is associated with a greater probability of consent (OR = 1.03, $p < 0.05$). The exact reason for this mixed finding is unclear. However, sample units requiring more call attempts may not be necessarily *resistant* to survey participation, just busy or hard-to-contact. As such, they may be more willing to provide consent to SMS if doing so means allowing for survey participation via, potentially, a more convenient mode (i.e., SMS).

Looking to other measures of *General Resistance*, as noted in Chapter One, a growing body of literature has documented the relationship between social and political attitudes/beliefs and the physiological traits associated with threat (Ahn, 2014; Hibbing et al., 2014; Oxley et al., 2008). These findings suggest a negativity bias amongst ideological conservatives – even if subconscious (Hibbing et al., 2014). In turn, measures of political ideology may serve as proxies for mechanisms of nonresponse related to general resistance, especially those rooted in feelings of distrust or mistrust. Results from measures of political party identification and ideology were mixed. Party identification was, overall, found to be significant, $F(5, 2483.5) = 3.85$, $p < 0.01$. Consistent with our expectations, relative to Republicans, Democrats were more likely to consent to receive SMS messages (OR = 1.17, $p = 0.01$). However, overall political ideology was not associated with consent, $F(4, 56.6) = 1.87$, $p > 0.10$.

Perceived Ease of Use

Mobile ICTs present new tools for use in the design and administration of surveys and for executing other types of data collections (Link et al., 2014). But, for some sample units, the use of mobile ICTs can be cumbersome and confusing. As reviewed in Chapter One, the Technological Adoption Model posits that perceptions about the ease of use of technology may influence technological adoption (Davis, 1989; Davis et al.. 1989). Similarly, we hypothesized that sample units may be less likely to consent to a SMS request if they perceive the use of technology associated with text messaging to be challenging or burdensome. Results indicate that both measures of the *Perceived Ease of Use* – age $F(4, 2242.3) = 31.36$, $p < 0.001$ and education $F(5, 3006.7) = 22.14$, $p < 0.001$ – were overall significant predictors of consent.

Relative to the youngest age category (18-25 year olds) middle-aged respondents between the ages of 25-34 (OR = 1.04, $p > 0.10$) and 35-49 (OR = 1.13, $p < 0.05$) were more likely to consent while older respondents aged 50-64 (OR = 0.84, $p < 0.01$) and 65+

(OR = 0.60, $p < 0.001$) were less likely to consent. This finding is generally consistent with our expectation that older respondents may be less accustomed to mobile technology and, in turn, are less likely to provide consent to receive SMS transmissions.

Looking to education, results ran opposite our expectation that more educated sample units might be exposed to more technology, find it easier to use, and thus be more likely to consent. Compared to those having earned a high school diploma, those with less than a high school degree were more likely to consent (OR = 1.42, $p < 0.001$). Conversely, relative to those with a high school diploma, those with higher levels of education were less likely to consent – technical/vocational school (OR = 0.86, $p < 0.05$), some college (OR = 0.89, $p < 0.01$), college graduate (OR = 0.72, $p < 0.001$) and post graduate work or degree (OR = 0.76, $p < 0.001$). As such, it may be that education is not a good proxy for the perceived ease of use concept. It could be that mobile technology has proliferated to such a degree that one's level of education does not accurately proxy access to technology (and thus perceived ease of use). Alternatively, more educated sample units may feel too busy (Couper, 1997) or hold greater concerns for privacy/anonymity of their responses (Madden & Rainie, 2015) compared to those with less education.

Sociodemographics

Similar to findings for traditional survey modes (Groves & Couper, 1998), we hypothesized that *Sociodemographics* may serve as indirect mechanisms of SMS consent in the survey process. These measures are proxies for the notions of social isolation (Goyder, 1987; Groves & Couper, 1998), social engagement (Abraham et al., 2006;

Groves & Couper, 1998) or social participation (Brehm, 1993; Couper et al., 1998; Putnam, 2000). Consistent with our expectations, females were more likely than males to consent (OR = 1.13, $p < 0.001$). Marital status was also found to be an overall significant predictor of consent, $F(4, 2854.9) = 7.27$, $p < 0.001$. Relative to married sample units, those who are separated or divorced (OR = 1.25, $p < 0.001$) and those in a domestic partnership (OR = 1.21, $p < 0.01$) were more likely to consent to receive SMS transmissions.

Overall, none of the three measures of religion were found to be significant, including measures of religious preference, the importance of religion, and frequency of religious service attendance.

Finally, race was found to be an overall significant predictor of SMS consent, $F(3, 2708.1) = 46.74$, $p < 0.001$. Relative to whites, Hispanics and those self-identified as "other race" were found to be significantly more likely to consent (Hispanic OR = 1.49, $p < 0.001$; other race OR = 1.69, $p < 0.001$). This finding runs counter to what might be expected under the social isolation theory of survey participation where racial minorities may feel disenfranchised from society and thus be less likely to cooperate with survey requests (Goyder, 1987; Groves & Couper, 1998). It is hard to know exactly what is causing this finding, but an alternative explanation may invoke the social exchange theory of survey participation (Dillman, 1978; Goyder, 1987) where Hispanic and "other race" sample units feel some sense of indebtedness to the survey sponsor and in exchange provide SMS consent. The Gallup Daily was available in Spanish language. As such, higher levels of SMS consent among Hispanics may be related to Spanish speaking respondents providing SMS consent in exchange for the survey organization's effort to offer the survey in Spanish language.

Social Environment

Understanding surveys as inherently social events (Groves & Couper, 1998), we hypothesized that social environmental mechanisms are at play in causing nonconsent. Although such mechanisms are unlikely to be direct influences, but rather serve as context for the psychological predispositions of respondents. Model 2 presents results for the *Social Environment* mechanism.

Economic Conditions

One of the two measures of *Economic Conditions* was, overall, a significant predictor of SMS consent. The first, a measure of whether or not one's company was hiring or reducing staff, was non-significant, $F(2, 45.5) = 1.23$, $p > 0.05$. However, the measure for the direction of the national economy was related to SMS consent, $F(2, 38.0) = 17.51$, $p < 0.001$. In many cases, sending or receiving SMS transmissions may come at a cost to individuals. Consistent with our expectation that positive economic conditions might serve as an advantageous context for an affirmative SMS consent decision, relative to those who thought the economy was getting worse, those who felt it was improving were more likely to consent to receive SMS transmissions (OR = 1.25, $p < 0.001$).

Neighborhood Characteristics

Neighborhood Characteristics were measured via census region which was significant overall, $F(3, 3075.5) = 9.71$, $p < 0.001$. Relative to the South, all other

Census regions were less likely to consent to receive a SMS transmission (Northeast OR = 0.80, $p < 0.001$; Midwest OR = 0.81, $p < 0.001$; West OR = 0.86, $p < 0.01$). This finding is interesting and is not easily explained. However, the results may be indicative of the "Southern distinctiveness" phenomenon documented for political and social norms of the region (Black & Black, 1987, 2002; Hillygus & Shields, 2008; Key, 2006 [1949]; Kousser, 2010). Alternatively, there may be other factors associated with the geographic region otherwise unaccounted for in this model driving these results.

Interviewer Characteristics

Model 3 from Table 10 provides results for the *Interviewer Characteristics* mechanism.

Interviewer Experience

SMS consent occurs as part of an existing survey process. As such, the SMS consent decision is conditional on initial survey cooperation. To the degree that more experienced interviewers are better at gaining initial cooperation, we expected them to be more likely to gain SMS consent. Results indicate that our measure of *Interviewer Experience*, tenure, was unassociated with the consent decision (OR = 1.00, $p > 0.10$).

Interviewer Sociodemographics

Similar to the case for *Respondent Characteristics*, to the degree that *Interviewer Sociodemographics* are related to other factors that may affect the consent decisions, sample units may be more or less inclined to consent. While the measure for interviewer gender was not found to be associated with SMS consent (OR = 0.94, $p > 0.05$), overall interviewer race was associated with SMS consent $F(2, 3086.0) = 6.21$, $p < 0.01$. More specifically, relative to white interviewers, those identified as “other race” interviewers were more likely to gain consent (OR = 1.27, $p < 0.001$). This finding is interesting and may be explained by “other race” interviewers gaining a greater percentage of consent among Hispanic sample units. Consent rates for “other race” interviewers were 70% for Hispanic respondents, compared to 51% for whites, 56% for blacks, and 67% for “other” race respondents ($X^2(3)70.1$, $p < 0.001$).

Questionnaire

In addition to the interviewer-related measures, we included in Model 3 a measure of the questionnaire version employed during the initial Gallup Daily survey. The decision to include the questionnaire type variable was motivated by the fact that, in Chapter Four, the model predicting cooperation via *Social Environmental* mechanisms (e.g., Model 2 from Chapter Four) failed to properly fit. The model F test for the model without the questionnaire variable was not significant. Upon including the variable for questionnaire, the model achieved an overall significant model F test. Given its inclusion in the model was not directly motivated by the conceptual model of SMS cooperation, but rather due to model estimation challenges, it was also included in our analyses here in Chapter Three to ensure that any effect the questionnaire variable might have on SMS cooperation was also considered in our analysis of SMS consent. As part of the experimental design, sample units were randomly assigned to receive one of two survey versions with questions related to either politics and the economy or wellbeing.

Results indicate that, relative to the wellbeing version, those receiving the questionnaire with items related to politics and the economy were less likely to consent to the SMS request (OR = 0.89, $p < 0.01$). This finding indicates that there is something about the politics and economy version of the survey itself that, relative to the wellbeing version, is decreasing SMS consent. It is hard to know from our analyses what exactly is causing this result, but we surmise this may be a function of topic interest. Sample units who have an interest in the subject matter of a survey cooperate with survey requests at a higher rate when that subject matter is made salient (de Leeuw, 2004; Groves et al., 2006; Groves et al., 2004). Where respondents are less interested in politics and the economy or find the subject stressful or burdensome, completing an interview on the topic would make the undesirable subject matter more salient, decreasing a respondent's willingness to consent to SMS.

Full Model

In the full model (Model 4), all measures of *Respondent Characteristics*, *Social Environment* and *Interviewer Characteristics* were included. For this combined model, all of the predictors that were significant in the models for each individual mechanism of consent were also significant and presented in the same direction of association as in the full model but for the following exceptions. Looking at the *Social Environment* measure of whether one's company is hiring, the direction of association for the "hiring new people and expanding the size" category flipped (Model 2 OR = 1.05, $p > 0.10$; Model 4 OR = 0.97, $p > 0.10$). However, both odds ratios are not statistically different from 1.00. For the *Interviewer Characteristics* measure for interviewer race, while the direction of association remained the same, this variable lost statistical significance in the full model (Model 3 $F(2, 3086.0) = 6.21$, $p < 0.01$; Model 4 $F(2, 3079.1) = 1.19$, $p > 0.10$). In addition, the questionnaire covariate for survey version (politics vs. wellbeing) changed direction of association and lost statistical significance (Model 3 OR = 0.89, $p < 0.01$; Model 4 OR = 1.10, $p > 0.05$).

Parsimonious Model

Our final, parsimonious model (Model 5) was parameterized by retaining all predictors achieving at least a $p < 0.05$ level of statistical significance from the full model (Model 4). Results from this final model reveal that, compared to the full model, all variables retained their statistical significance and presented in the direction of association identified in the full model described previously. Due to the limitations of statistical analysis software, at this time traditional measures of model fit (e.g., likelihood ratio tests, AIC, BIC) cannot be calculated for logistic regression models using multiply imputed data that involve a complex survey design. As such, to evaluate model fit we rely on the individual model F test for each propensity model given relative model fit comparisons cannot be computed.

Step Two: Correlation between Consent Propensity and Survey Variables

Next, we examine the correlations between the consent propensity (p) and survey variable of interest (y). Specifically, we examine the direction and strength of associations as an indicator of potential nonconsent bias. Correlations range from $r = 0.02$ between the survey variable measuring Smoking Status and consent propensity from the *Interviewer Characteristics* model to $r = 0.36$ for the survey variable measuring Economic Conditions and consent propensity from the *Social Environment* model (see Table 11.

Table 11

Correlations of Survey Variables of Interest (y) and Response Propensity (p) for SMS Consent

	Respondent Characteristics Model	Social Environment Model	Interviewer Characteristics Model	Full Model	Parsimonious Model
Registered to Vote	-0.2278***	-0.0304	-0.0743***	-0.2207***	-0.2248***
Obama Job Approval	0.2764***	0.1343*	0.0221	0.2661***	0.2738***
Economic Conditions	0.0833***	0.3595***	0.0529*	0.1392***	0.1377***
Own Health Rating	0.1534***	-0.0370†	-0.0746**	0.1467***	0.1437***
Do you Smoke?	0.1188***	-0.0398**	0.0186	0.1084***	0.1204***
Health Insurance Coverage?	-0.2576***	-0.0670***	-0.0353†	-0.2628***	-0.2645***

Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10

Looking across the correlations for each propensity model, we see that the direction and strength of the correlation between *p* and *y* changes. Propensities calculated via the *Respondent Characteristics* model (Model 1) yield the strongest correlations with the survey items registered to vote, presidential approval, and health insurance coverage. These correlations are lower for the other economic and health-related variables of interest. Conversely, the *Social Environmental* model (Model 2) produces propensities that yield relatively strong correlations with the economic conditions variable, but lower correlations for the other *y* variables. Consent propensities estimated via the *Interviewer Characteristics* model (Model 3) yield relatively weak correlations across all *y* variables.

Some of the proxies for each of the mechanisms are more strongly related to one's propensity to consent and to these six survey variables of interest than others. This gives us some indication as to the relative impact of each portion of the conceptual model on consent to receive SMS messages. What is clear is that the *Respondent Characteristics* model produces propensities most strongly related to the survey variables of interest overall, but it does so differently for each *y* variable. In other words, as for other types of survey nonresponse, the correlates of consent that produce nonresponse bias are item-specific. These respondent characteristic correlates have the largest effects for estimates from the political and health insurance items.

Step Three: Estimating Empirical Nonconsent Bias

The empirical bias for survey variables of interest (the *y*s) was investigated by examining the difference in base-weighted estimates for SMS consenters and the full sample:

$$\text{Nonconsent Bias}\left(\bar{y}_{Full,original}\right) = \bar{y}_{Consent,bw} - \bar{y}_{Full,bw}$$

Additionally, we look at the difference between base-weighted SMS consenters and nonconsenters:

$$\text{Difference}\left(\bar{y}_{Full}\right) = \bar{y}_{Consent,bw} - \bar{y}_{Nonconsent,bw}$$

Results presented in Table 12 indicate that nonconsent bias ranges from about zero to four percentage points. For example, 69% of consenters answered that they have health insurance, and 78% of nonconsenters responded that they have health insurance, resulting in an estimate of about 73% for the full sample, i.e., the combined estimate from those consenting and not consenting to receive SMS transmissions. This yields a nonconsent bias in the estimate of about four percentage points (i.e., 69% - 73%). The difference between SMS consenting and nonconsenting sample units exceeds nine percentage points for the same item (i.e., 69% - 78%).

Table 12

Base-Weighted Percentages and Standard Errors for SMS Consenters, SMS Nonconsenters, Full Sample Percentage Distribution, Empirical Nonconsent Bias and Difference between Consenters and Nonconsenters

Survey Variables of Interest	Consent %	S.E.	Nonconsent %	S.E.	Full Sample %	S.E.	Nonconsent Bias	Consent - Nonconsent
Registered to Vote								
Yes, Registered	70.13%	1.31%	76.74%	1.05%	72.81%	1.11%	-2.68%	-6.61%
No, Not Registered…	29.87%	1.31%	23.26%	1.05%	27.19%	1.11%	2.68%	6.61%
Obama Job Approval								
Approve	53.12%	1.17%	46.54%	0.94%	50.46%	1.00%	2.67%	6.58%
Disapprove	46.88%	1.17%	53.46%	0.94%	49.54%	1.00%	-2.67%	-6.58%
Economic Conditions								
Poor	33.93%	1.22%	38.03%	1.84%	35.59%	1.38%	-1.66%	-4.10%
Only Fair	46.40%	0.69%	44.39%	1.38%	45.59%	0.84%	0.81%	2.00%
Good/Excellent	19.67%	1.01%	17.58%	0.76%	18.82%	0.82%	0.85%	2.09%
Own Health Rating								
Excellent	14.12%	0.50%	16.13%	0.46%	14.93%	0.38%	-0.81%	-2.01%
Very Good	24.77%	0.63%	27.29%	1.06%	25.79%	0.66%	-1.02%	-2.52%
Good	31.44%	0.48%	31.59%	0.75%	31.50%	0.40%	-0.06%	-0.15%
Fair	21.00%	0.64%	17.97%	0.98%	19.77%	0.68%	1.23%	3.03%
Poor	8.67%	0.44%	7.02%	0.39%	8.00%	0.35%	0.67%	1.65%
Do you Smoke?								
Yes	24.63%	1.18%	19.54%	1.13%	22.57%	1.11%	2.06%	5.09%
No	75.37%	1.18%	80.46%	1.13%	77.43%	1.11%	-2.06%	-5.09%
Health Insurance Coverage?								
Yes	68.91%	1.03%	78.00%	0.82%	72.59%	0.88%	-3.68%	-9.10%
No	31.09%	1.03%	22.00%	0.82%	27.41%	0.88%	3.68%	9.10%

Looking to the question about economic conditions, almost 20% of SMS-consenting respondents indicated that economic conditions are “good” or “excellent,” nearly 18% of nonconsenting sample units responded the same, resulting in an estimate of about 19% for the full sample. This yields a nonconsent bias estimate of about one percentage point. Here again, the difference between consenters and nonconsenters was wider at just over two percentage points. As expected, the survey variables of interest with the greatest nonresponse bias are consistent with those who have the strongest correlations with consent propensities from the parsimonious model reviewed in the *Step Two: Correlation between Response Propensity and Survey Variables* section (p. 90).

Step Four: Nonconsent Weighting Adjustments

Using the parsimonious consent propensity model reviewed above, next we create SMS nonconsent weighting adjustments as the inverse of the consent propensity (1/*p*). The product of this nonconsent weight and the base weight ((1/*p*) * base weight) was created and applied to examine the impact of the parsimonious model at reducing nonconsent bias in the survey variables of interest (*y*s). Descriptive statistics for the newly created nonconsent weights derived from the parsimonious propensity model and the combined weight created as the product of the parsimonious model weight and original base weights are displayed in Table 13.

Results indicate the nonconsent weights average 1.90 (0.39) and range from 1.14 to 4.80 for the full sample, i.e., SMS consenters plus SMS nonconsenters. The mean weight for the consenters only is 1.84 (0.37) ranging from 1.15 to 4.16 while for nonconsenters, weights averaged 1.98 (0.40) with a range of 1.14 to 4.80.

Table 13

Descriptive Statistics for SMS Nonconsent Adjustment Weights

	N	Mean	S.D.	Min.	Max.
Nonconsent Weights					
Consent	16,413	1.84	0.37	1.15	4.16
Nonconsent	13,367	1.98	0.40	1.14	4.80
Sample	29,780	1.90	0.39	1.14	4.80
*Nonconsent Weights * Base Weights*					
Consent	16,413	1.76	1.19	0.29	7.60
Nonconsent	13,367	1.59	1.10	0.31	7.08
Sample	29,780	1.68	1.15	0.29	7.60

Figures 9 and 10 display the kernel density plots of the distribution of the nonconsent weights and combined weights for both consenters and nonconsenters.

Step Five: Evaluating Reductions in Bias

I applied the combined nonconsent weighting adjustments (nonconsent weight * base weight) to the survey variables of interest (*y*s) and re-estimated in order to evaluate their effectiveness at reducing nonconsent bias:

$$\text{Remaining Nonconsent Bias}\left(\bar{y}_{Full,adjusted}\right) = \bar{y}_{Consent,fw} - \bar{y}_{Full,bw}$$

Table 14 displays the re-estimated percentages for consenters using the nonconsent weighting adjustments ($\bar{y}_{Consent,fw}$) and the base-weighted full sample percentages ($\bar{y}_{Full,bw}$) along with their standard errors. Results indicate the new weights were successful at reducing nonconsent bias. For example, the variable with the largest magnitude of nonconsent bias – the measure of whether or not one has health insurance – was reduced from 3.7 percentage points to about one percentage point.

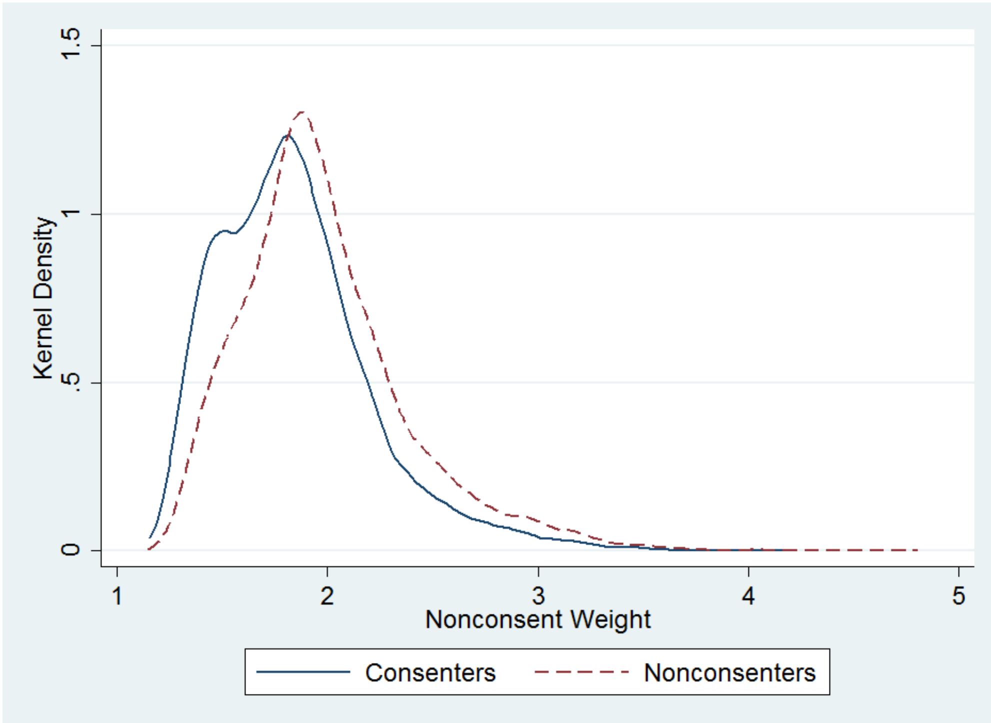

Figure 9. Kernel density plot of SMS nonconsent adjustment weights (1/p).

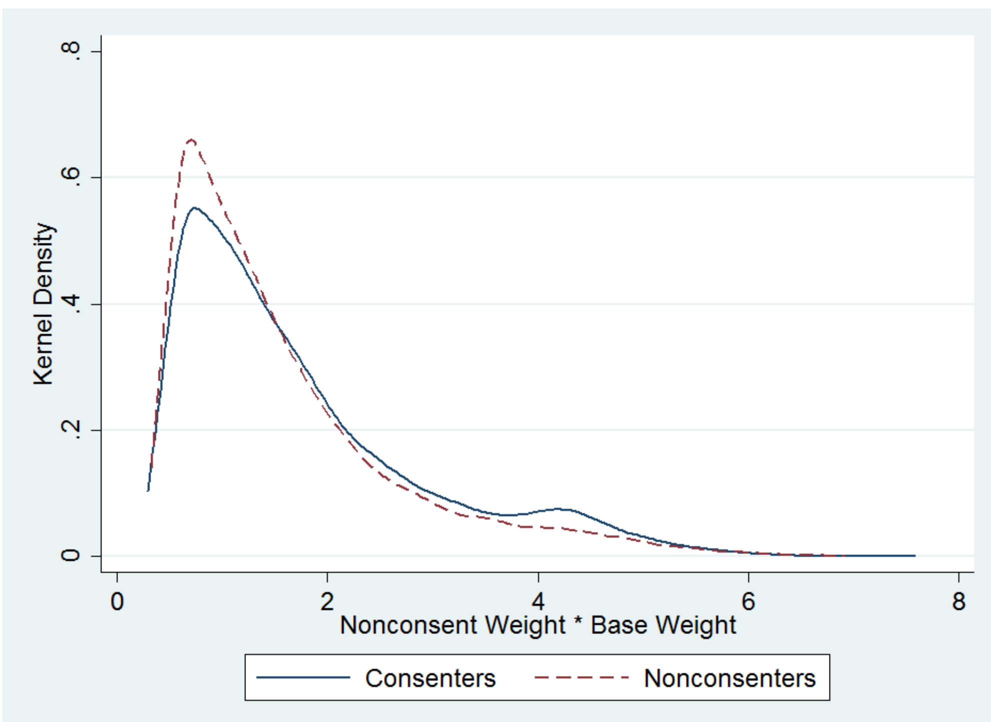

Figure 10. Kernel density plot of SMS nonconsent adjustment weights (1/p * base weight).

Table 14

Nonconsent Weighting Adjusted Percentages, Standard Errors, and Lower and Upper 95% Confidence Intervals for Consenters to SMS Request, Base-Weighted Full Sample Percentages and Standard Errors, and Remaining Nonconsent Bias

Survey Variables of Interest	Consent %	S.E.	95% CI LB	95% CI UB	Full Sample %	S.E.	Remaining Nonconsent Bias
Registered to Vote							
Yes, Registered	72.21%	1.21%	69.57%	74.85%	72.81%	1.11%	-0.60%
No, Not Registered…	27.79%	1.21%	25.15%	30.43%	27.19%	1.11%	0.60%
Obama Job Approval							
Approve	50.69%	1.14%	48.03%	53.36%	50.46%	1.00%	0.24%
Disapprove	49.31%	1.14%	46.64%	51.97%	49.54%	1.00%	-0.24%
Economic Conditions							
Poor	35.06%	1.27%	31.87%	38.25%	35.59%	1.38%	-0.53%
Only Fair	45.86%	0.67%	44.46%	47.27%	45.59%	0.84%	0.28%
Good/Excellent	19.08%	1.01%	16.54%	21.62%	18.82%	0.82%	0.25%
Own Health Rating							
Excellent	14.59%	0.53%	13.45%	15.72%	14.93%	0.38%	-0.35%
Very Good	25.53%	0.62%	24.25%	26.81%	25.79%	0.66%	-0.26%
Good	31.32%	0.45%	30.42%	32.21%	31.50%	0.40%	-0.18%
Fair	20.14%	0.64%	18.80%	21.48%	19.77%	0.68%	0.37%
Poor	8.43%	0.41%	7.60%	9.26%	8.00%	0.35%	0.43%

Table 14 continues

Survey Variables of Interest	Consent %	S.E.	95% CI LB	95% CI UB	Full Sample %	S.E.	Remaining Nonconsent Bias
Do you smoke?							
Yes	23.58%	1.21%	20.50%	26.66%	22.57%	1.11%	1.01%
No	76.42%	1.21%	73.34%	79.50%	77.43%	1.11%	-1.01%
Health Insurance Coverage?							
Yes	71.29%	0.97%	69.28%	73.30%	72.59%	0.88%	-1.30%
No	28.71%	0.97%	26.70%	30.72%	27.41%	0.88%	1.30%

Looking at the variable measuring the President's job approval rating, the nonresponse weighting adjustments reduced nonconsent bias to about one-quarter-of-one percentage point from nearly three percentage points. For the measure of Economic Conditions, nonconsent bias was reduced to about 0.25 percentage points for two of the three proportions ("good/excellent" and "only fair") and to about 0.5 percentage points for the remaining proportion ("poor"). The weighting adjustments resulted in a nonconsent bias estimates of less than 0.5 percentage points for all proportions included in the Health Rating measure. However, the bias for one proportion ("good") increased, but by a miniscule amount – about 0.1 percentage points. For the item asking if a sample unit is a smoker, bias was reduced by about one percentage point. As shown in Table 14, in each case the confidence intervals for the nonconsent weighting adjusted percentages contain the full sample percentages indicating that the weighting adjustments have, essentially, removed nonconsent bias.

To further illustrate the effectiveness of the nonconsent weighting adjustments, Figure 11 depicts graphically the reduction in bias by plotting the remaining empirical bias estimates detailed in Table 14 relative to the original empirical bias obtained using only base weights provided in Table 12. Each bar represents the degree (percentage points) of empirical bias present in the estimated proportion above or below the true estimate (that of the full sample ($\bar{y}_{Full,bw}$)). The closer the bar is to the midline (0% or no bias), the less bias is present in the estimate. As such, by applying the nonconsent weighting adjustments we aim to reduce nonconsent bias, thereby making the

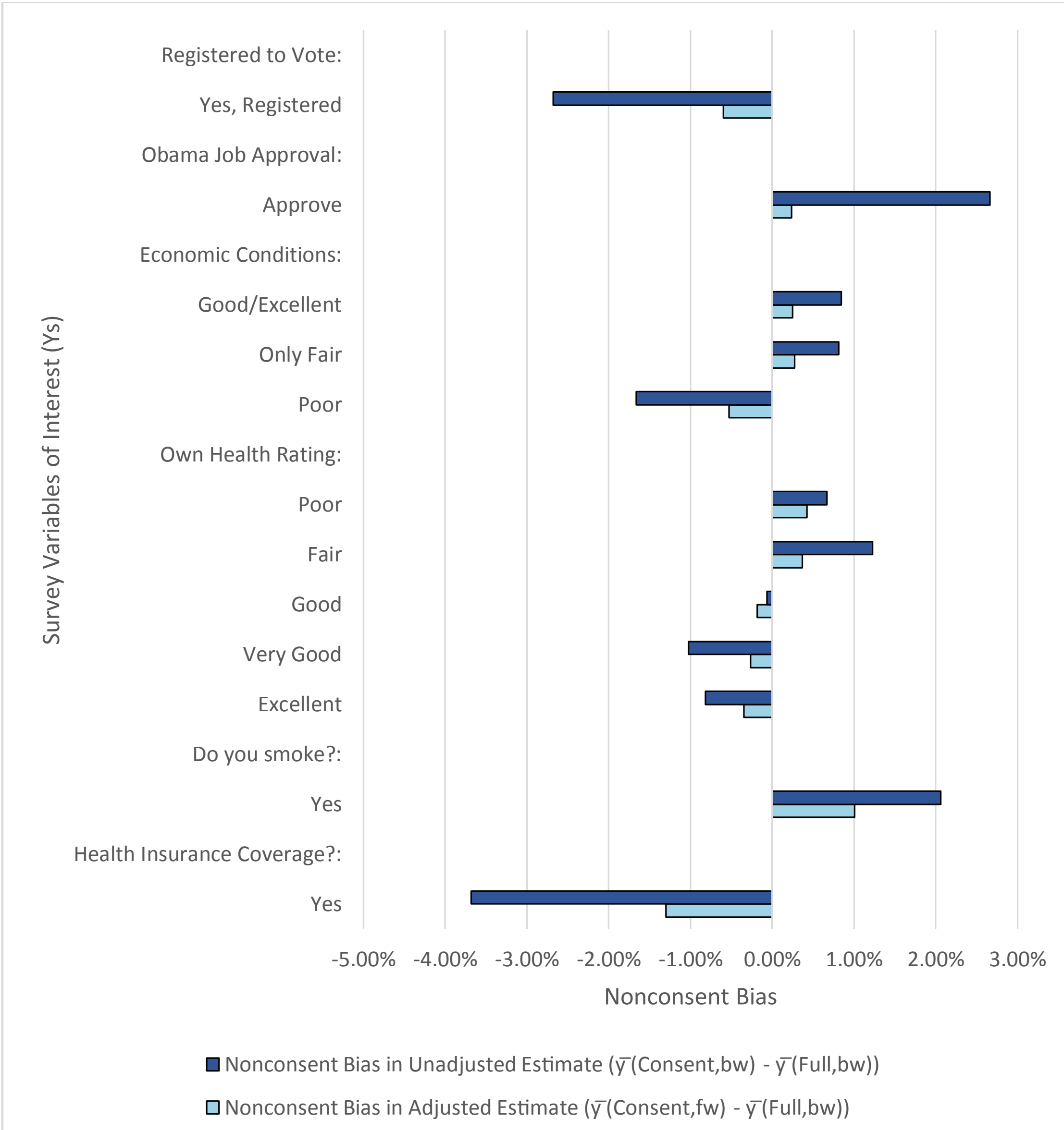

Figure 11. Difference in nonconsent bias for survey variables of interest (*y*s) estimated using base weight and nonconsent weight * base weight adjustments.

bars appear as close as possible to the midline. The darkest bar represents the bias present in the original estimates calculated with base weights only $(\bar{y}_{Full,original}) = \bar{y}_{Consent,bw} - \bar{y}_{Full,bw}$. The lighter bar represent the nonconsent bias remaining after applying the nonconsent weighting adjustments $(\bar{y}_{Full,adjusted}) = \bar{y}_{Consent,fw} - \bar{y}_{Full,bw}$. This figure again makes clear that the weighting adjustments were effective at reducing nonconsent bias across all survey variables of interest.

Summary

This chapter offers a first look at nonresponse bias resulting from nonconsent to receive SMS transmissions. Results highlight the presence, though small, of SMS nonconsent bias for all survey variables of interest (*y*s) examined in this chapter. Nonresponse weighting adjustments, designed using the conceptual model of SMS consent presented in Chapter One (Figure 2, p. 13), were effective at reducing nonconsent bias in survey estimates.

Model Results

We began our examination of SMS-related nonconsent bias by developing a series of logistic regression models designed to predict consent to receiving SMS transmissions using the conceptual model of SMS consent developed in Chapter One. Three factors affecting consent outlined in the conceptual model for which we had available measures were examined, including: *Respondent Characteristics*, *Social Environment*, and *Interviewer Characteristics*. A review of the final, parsimonious model results shows that it included covariates from all three mechanisms of SMS consent for which we had available measures (i.e., *Respondent Characteristics*, *Social Environment*, and *Interviewer Characteristics*).

Reviewing Correlations – Corr(y, p)

The correlations between survey variables of interest (*y*s) and consent propensities (*p*s) provide an indication of the degree of nonconsent bias. Results indicate that the *y*-*p* correlations are differential across items and across the three mechanisms of nonconsent modeled in this chapter. In sum, correlations ranged from $r = 0.02$ to $r = 0.36$.

Among the three mechanisms hypothesized to cause SMS nonconsent, the *Respondent Characteristics* model consistently produced the largest *y*-*p* correlations – especially for political measures and the health insurance item. However, the *Social Environment* model produced the strongest correlation with the survey variable of interest measuring economic conditions. The *Interviewer Characteristics* model produced the weakest *y*-*p* correlations overall, but were largest for political and health insurance items. What is clear is that different consent mechanisms were more or less at play in contributing to the *y*-*p* correlations across the six survey variables of interest (*y*s).

Empirical Nonconsent Bias

While generally small, ranging from -0.06% to 3.68%, empirical nonconsent bias was present in survey estimates. This finding provides, to our knowledge, the first evidence of this type of nonresponse bias resulting from the use of SMS functionality in survey designs. Further, the magnitude of empirical nonconsent bias was differential across survey items (*y*s), consistent with the *y*-*p* correlations reviewed previously. Bias was largest for political and economic items – those variables for which we identified the largest *y*-*p* correlations.

Effectiveness of Weighting Adjustments

Where we identified a stronger relationship between *p* and *y*, we would expect to be able to adjust most effectively for nonconsent bias through the use of nonconsent weighting adjustments. The weighting adjustments created from the parsimonious consent propensity model performed well at reducing nonconsent bias. As detailed above, the 95% confidence intervals for the nonconsent weighting adjusted estimates contain the full sample percentages. As such, we conclude that the weighting adjustments performed well – they were effective at removing nonconsent bias. However, it should be noted that, to begin, the amount of nonconsent bias in the base-weighted, unadjusted estimates was relatively small.

Implications for Understanding SMS Consent

What do these findings mean for survey research? The conceptual model presented in Chapter One posits that SMS nonconsent may result from a series of mechanisms. When these mechanisms (*z*s) are both the cause of nonconsent propensity (*p*) and the survey variables of interest (*y*s), nonconsent bias will arise. In this chapter, we find SMS nonconsent to be nonignorable for a number of *Respondent Characteristics* and one *Social Environment* measure – variables that are the cause of both *p* and *y*. With these findings in mind, as an example, were a SMS survey used to measures layoff rates, if employment status is the common cause of both layoff and SMS consent, the resulting estimates would be at risk of nonconsent bias. Similarly, where SMS surveys are employed to measure sociodemographics or some other constructs associated with them, again nonconsent bias may result. Still, as discussed previously, sociodemographics themselves are likely not the direct cause of nonconsent, but rather only proxies for some other spurious psychological factors that are the true causes of SMS nonconsent (Groves & Couper, 1998). As such, this model has been useful in understanding and anticipating the SMS consent mechanisms for which there may be a common cause between *p* and *y*.

Implications for Survey Practice

What do these findings suggest for survey practice? Using SMS in survey designs is not without risks. In this chapter, we present empirical evidence indicating that SMS nonconsent nonresponse introduces biases into survey estimates related here to matters ranging from politics, to the economy, and personal health matters. We look to the *z* variables (i.e., the covariates included in our propensity models) that are most strongly related to consent propensity (*p*) – to the degree that consent propensity is also related to our survey variables of interest (*y*s) – in order to identify the best candidates for monitoring during data collection in order to reduce the risk of SMS nonconsent bias.

Overall, our results suggest the best candidates for variables to monitor during data collection come from the *Respondent Characteristics* mechanism of SMS nonconsent. The *Respondent Characteristics* model exhibited, overall, the strongest *y-p* correlations. In addition, it contains a series of significant covariates with a, relatively, strong effect on estimated consent propensity (*p*). In particular, we would point survey researchers to variables that might proxy for the *Perceived Ease of Use* of technology – variables such as age and education as used in this study. Our findings indicate that older, more educated sample units are less likely to consent to SMS relative to younger, less educated persons. Survey practitioners may perhaps incentivize sample units with these characteristics into the SMS consent pool – especially if the survey variables of interest deal with matters of politics such as presidential approval and voter registration, as well as personal health insurance coverage.

Where one's survey variables of interest deal with economic conditions, survey practitioners might pay special attention to measures of the *Social Environmental* mechanism of SMS consent. The *Social Environment* model produced the strongest *y-p* correlation in our study for the survey variable measuring one's perception of the economic condition of the nation. Results from the parsimonious propensity model indicate *Neighborhood Characteristics*, in particular U.S. Census region, as a significant predictor of consent propensity. This finding suggests survey practitioners might benefit from encouraging more SMS consenters from outside the Southern region (i.e., Northeast, Midwest, and West). Here again, incentives for persons with such neighborhood characteristics may be warranted to mitigate the potential for nonconsent bias.

As described earlier, the nonconsent weighting adjustments created here as the inverse of the consent propensity performed well at reducing nonconsent bias. While nonconsent bias was generally small – generally less than three percentage points – given the relative ease with which such weighting adjustments are constructed, we recommend implementing nonconsent weighting adjustments to mitigate nonconsent bias. As such, where indicators of *Respondent Characteristics*, especially, are not available on the sampling frame, survey practitioners should seek to include them in their survey. Additionally, they should include other measures of the mechanism(s) of nonconsent that might be related to both consent propensity (p) and their survey variables of interest (y) for use in the development of nonconsent weighting adjustments. The results presented here suggest that the conceptual model of SMS consent may be useful to survey researchers in making these decisions.

Limitations

This analysis is not without limitations. In making use of secondary data, our ability to measure the hypothesized mechanisms of SMS consent noted in the conceptual model (Figure 8, p. 73) were dependent on a series of pre-existing proxies to adequately represent these constructs. As such, we did not have the ability to examine all the mechanisms included in the conceptual model of SMS consent, especially those otherwise under researcher control such as the *Consent Design* properties. Future research might look especially to those mechanisms that can be manipulated by survey designers to determine the impact on nonconsent rates and nonconsent bias.

Also, to the degree that we did not have access to ideal proxies, or that they were poorly measured for our purposes, the analyses may be limited. In some cases, proxy variables employed here could have been used to represent different portions of our theoretical model. For example, we utilized education as a proxy for the perceived ease of use of technology. However, as discussed in the model results section, education may be better suited as a proxy for some other mechanism of nonconsent, namely discretionary time. Our results indicated that, relative to those with a high school degree, those with higher levels of education (technical vocational school, some college, college graduate, and post graduate work or degree) were less likely to consent to SMS while those with less than a high school degree were more likely to consent. This finding is more consistent with expectations related to the discretionary time of sample units.

The questionnaire version (Politics and Economy or Wellbeing) was randomly assigned to initial survey respondents. As such, for our six variables of interest (*y*s) anywhere from 50% to 63% of information was missing from respondents. For our *z* variables, rates of missing data ranged from 0% to about 52%. The fraction of missing data is presented for each of our analytic variables in the Appendix. To address this challenge, we utilized multiple imputation to fill in missing data. Results from the imputation reveal that for each of the 5 imputations, the distribution of imputed variables closely resembles that of the original, non-imputed dataset (+/- 2 percentage points), with one exception. The variable with the largest deviation between the distribution of unimputed and imputed variables was the survey variables of interest (*y*) measuring one's own health rating. In this case, there were more responses imputed in the lower ratings (poor 4.6% and fair 4.7%) and fewer responses imputed into the higher ratings (very good +4.6% and excellent +5.2%) relative to the unimputed distribution. Being a *y* variable, there is no concern about the impact of the imputation for this variable on results for the propensity models – the propensity models were designed to predict *p* from our *z* covariates only, not the *y*'s. Instead, the potential for error here lies with the correlations between *p* and *y*. Reviewing the correlations for the unimputed and imputed data separately revealed a difference in the correlation between *p* and *y* of about -0.06

points (r = 0.14 imputed versus r = 0.20 unimputed) for the parsimonious model. As such, the effect here is underestimating the strength of the *y-p* correlation. As a general rule, future research would benefit from less reliance on the specification of imputation models or the creation of more imputations.

The conceptual model proposed in Chapter One (Figure 2, p. 13) and re-presented at the outset of this Chapter (Figure 8, p. 73) adapted a model of traditional, household survey participation (Groves & Couper, 1998) to the SMS context in order to anticipate and make sense of the *y-p* relationship. Future work should continue to test and refine this new model and expand by considering, perhaps, other causal relationships between consent propensity (*p*) and survey variables of interest (*y*s) beyond the common cause model (Groves, 2006).

Conclusions

Chapter Three provides a first look at SMS nonconsent bias and included the following key findings. First, the conceptual and analytic models of SMS consent performed well for their intended purposes. The conceptual model for SMS consent suggests that there are different mechanisms at play in causing SMS nonconsent. Indeed there were, and they are differential across survey variables of interest (*y*s) highlighting that nonconsent bias is item-specific. Second, nonconsent bias is present in estimates for the survey variables of interest reviewed here. As such, the use of SMS in the survey process may not come without a risk given the prior consent requirements of the TCPA. That said, nonconsent bias was generally small – less than three percentage points.

Finally, the nonconsent adjustment weights were successful at essentially eliminating nonconsent bias.

CHAPTER FOUR

NONCOOPERATION NONRESPONSE BIAS

Introduction

In an era of declining survey response rates (Curtin et al., 2005; de Leeuw & de Heer, 2002), the flexibility of mobile data services such as SMS can be an attractive tool for survey designers seeking to mitigate nonresponse. As nonresponse rates portend nonresponse bias when the causes of nonresponse are associated with survey variables of interest (Groves, 2006), a better understanding of the causes of SMS-related nonresponse is necessary to assess the potential of bias when using this tool. No known research has examined the bias associated with SMS-related nonresponse. This chapter provides an examination of nonresponse bias resulting from noncooperation with a SMS survey.

Background Review

Given the flexibility of SMS as a survey design tool, there are many ways it can be incorporated into the survey process. In Chapter One we presented a framework for SMS in the survey process adapted from Groves and Couper's (1998) process of household survey participation. It contains four distinct segments arranged in temporal order, each depicting where a unique type of SMS-related nonresponse might occur in the survey process. This chapter focuses on the segment related to SMS survey cooperation. We re-present the framework for SMS in the survey process below, highlighting the particular segment under investigation in this chapter (see Figure 12).

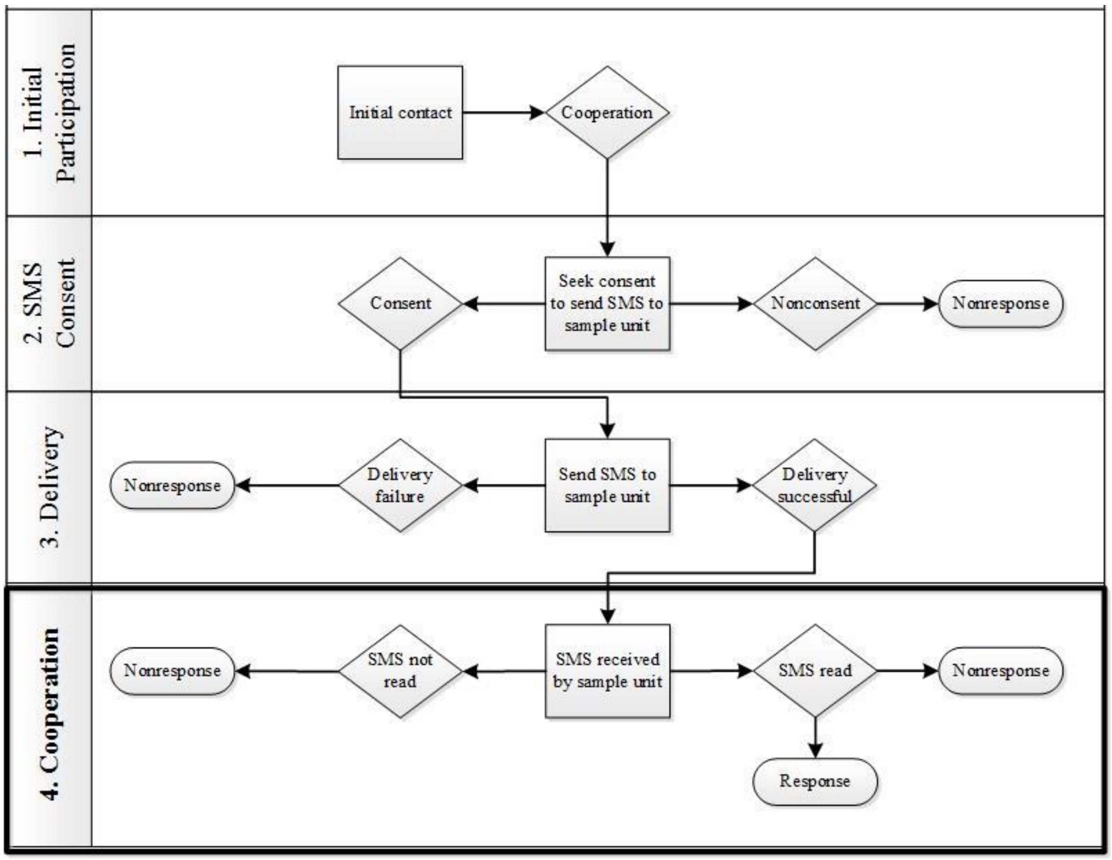

Figure 12. Framework for SMS in the survey process.

As the framework depicts, a sample unit is contacted and cooperates with a survey interview. At some point during initial survey participation, the interviewer can seek consent from the sample unit to send a SMS, after which a SMS message can be sent. Upon the successful delivery of a SMS, the sample unit may or may not actually read the message (Steeh et al., 2007). If the message is read, the sample unit can: (a) immediately cooperate, (b) provide a delayed response at a time more convenient, or (c) choose to ignore the message altogether resulting in noncooperation nonresponse.

To guide our analysis of nonresponse bias resulting from the SMS cooperation decision, we utilize the conceptual model for SMS cooperation also presented in

Chapter One. Hypothesized factors include those outside of researcher control, including the *Social Environment*, *Respondent Characteristics* and *Device/Plan Characteristics*. Also, it incorporates factors under researcher control, including the *Survey Design*. These four factors influence the interaction between the respondent and their device during the cooperation decision. If they decline to cooperate, the third form of SMS-related nonresponse will result – noncooperation nonresponse (see Figure 13).

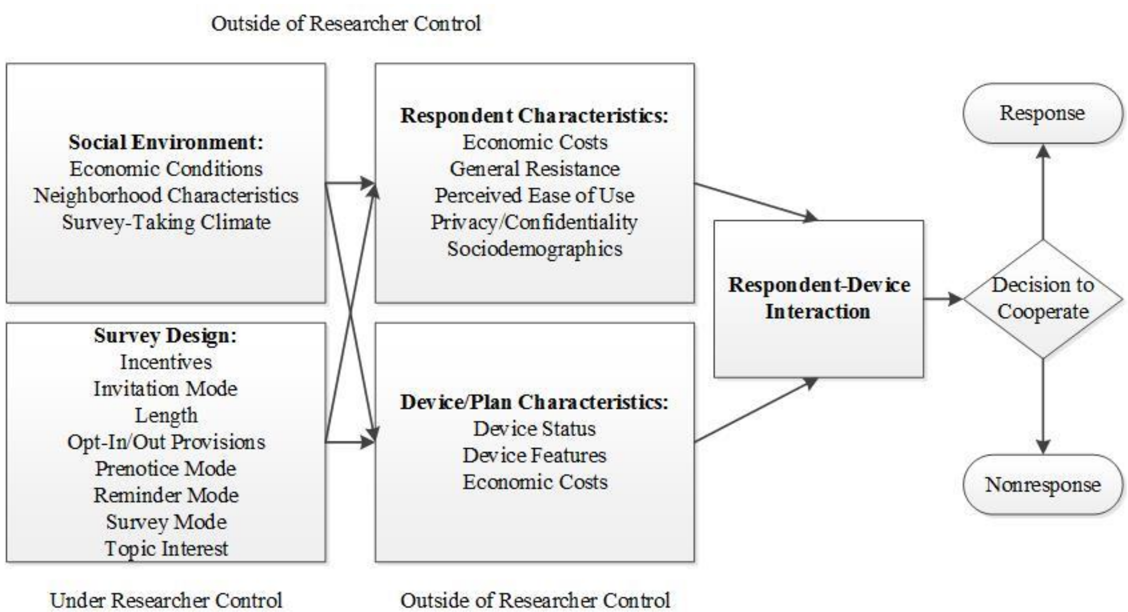

Figure 13. Conceptual model for SMS cooperation.

Data

To examine the bias attributed to SMS cooperation, we utilize data from an experiment conducted by the Gallup Organization using Gallup Daily tracking polls taken from July 29, 2013 – October 14, 2013. A full description of the dataset is presented in Chapter Two of this dissertation. In summary, 78 surveys were conducted during this time period yielding a total pooled sample size of 79,605, with about 48% coming from the landline frame and nearly 52% from the mobile frame. Ultimately, 60,527 (79.5%) sampled units agreed to be recontacted by the Gallup Organization. SMS consent was sought from 29,780 mobile frame respondents to the Gallup Daily who agreed to be recontacted. Of the 16,413 sample units consenting to occasionally receive SMS survey messages from Gallup, 15,333 were randomly selected to participate in a SMS experiment with sample units randomly assigned to one of six experimental conditions creating a fully crossed 2x3 factorial design. Factor one represents the number of items included in the experimental survey (5 or 12) and factor two represents the survey response mode (outbound phone, synchronous SMS, or SMS Web). The analysis provided in this chapter is restricted to only the 13,333 sample units assigned to the synchronous SMS and SMS Web response modes. Unfortunately, we only have SMS delivery information (as well as opt-in data) for the synchronous SMS treatments (experimental groups 2 and 5). However, of the 6,667 sample units assigned to the synchronous SMS treatment, 5,814 SMS transmissions were successfully delivered (about 87% SMSDR) with complete and partial cooperation rates of about 10% (SMSCOR1) and 11% (SMSCOR2), respectively. We will ignore this distinction between delivered and nondelivered SMS for this chapter because we do not have the information available in all experimental treatments.

Analytic Approach

To evaluate noncooperation bias, the analytic plan for this chapter follows a five-step process, as detailed in Chapter Two:

1. Estimate a series of response propensity models using logistic regression informed by the conceptual model for SMS cooperation;
2. Estimate the correlation between the response propensities estimated in step one and a set of survey variables of interest, $Corr(y,p)$;
3. Estimate the empirical bias for a set of survey variables of interest, $Bias(\overline{y_r})$;
4. Develop nonresponse adjustment weights as the inverse of the estimated response propensities $\left(\frac{1}{\hat{p}}\right)$ using the propensity models created in step one; and
5. Examine the effectiveness of the propensity models created in step one at addressing SMS-related nonresponse bias by applying the nonresponse adjustment weights created in step four and assessing the reduction in bias characterized by estimates that are closer to those of the consenting sample, $\bar{y}_{ConsentSam,bw}$.

Results

Step One: Response Propensity Models

We begin with an examination of results from a group of six response propensity models predicting cooperation with a SMS survey. Response propensity models can be estimated using logistic regression to predict survey participation (Little, 1986). These models predict SMS cooperation from a series of covariates guided by the conceptual model of SMS cooperation presented in Chapter One for which we have available measures. In total, six propensity models are estimated for this chapter – models for each portion of the conceptual model of SMS cooperation where we have proxy measures (i.e., *Respondent Characteristics*, *Social Environment* and *Survey Design*), a full model including covariates from all three cooperation mechanisms, and a final, parsimonious model which retains only significant predictors from the full model.

Throughout this chapter, cooperation with a SMS survey is operationalized as a sample unit responding providing a partial response – responding to *at least one* question – to the SMS survey (i.e., SMSCOR2). Additionally, we followed the same analytic process for cooperation operationalized as a sample unit providing a complete response – responding to *all* items – to the SMS survey (i.e., SMSCOR1). Results for complete response cooperation are provided in the Appendix and are not reviewed in the main text. Where results differ from those of partial cooperation, findings are highlighted in footnotes.

Model results predicting SMS cooperation are presented in Table 15. The models are parameterized as follows: Model 1 includes covariates measuring *Respondent Characteristics*, Model 2 includes measures of the *Social Environment*, Models 3 and 4 include *Survey Design* measures where the latter incorporates an interaction term (length x survey mode), Model 5 is the full model, and Model 6 is a final, parsimonious model. Consistent with the approach used in response propensity models for SMS consent presented in Chapter Three, a design based approach was used to account for the clustering of sample units within interviewers.

Respondent Characteristics

We begin by reviewing results for the *Respondent Characteristics* model (i.e., Model 1) presented in Table 15.

Table 15

Odds Ratios for Six Response Propensity Models Predicting SMS Cooperation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Respondent Characteristics						
Economic Costs						
Monthly Household Income	*				*	**
Under $999	0.73				0.73	0.72
$1,000 to $1,999	0.66 *				0.64 *	0.64 **
$2,000 to $2,999	0.72 †				0.71 *	0.72 *
$3,000 to $3,999	0.89				0.88	0.88
$4,000 to $4,999	0.92				0.92	0.92
$5,000 to $7,499	0.90				0.89	0.90
$7,500 to $9,999	1.10				1.09	1.11
$10,000 to $14,999	1.12				1.13	1.14
$15,000 and over (Ref.)	-				-	-
Employment Status	†					
Full Time for Employer (Ref.)	-				-	
Full Time for Self	0.97				0.96	
Part Time - Do Not Want …	1.31 †				1.33 †	
Part Time - Want Full Time	1.06				1.05	
Unemployed	0.66 †				0.74	
General Resistance						
Item Nonresponse Rate	0.99				0.97 **	0.96 ***
Call Attempts	0.96				0.96	

Table 15 continues

	Model 1		Model 2	Model 3	Model 4	Model 5		Model 6	
	Odds Ratio		Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio		Odds Ratio	
Respondent Characteristics (cont'd)									
General Resistance (cont'd)									
Party Identification		**							
Republican (Ref.)	-					-			
Lean Republican	1.03					1.03			
Independent	0.70	†				0.72	†		
Lean Democrat	0.88					0.93			
Democrat	0.93					0.97			
Refuse	0.71	**				0.90			
Political Ideology									
Very Conservative (Ref.)	-					-			
Conservative	0.79					0.79			
Moderate	0.71	*				0.73	†		
Liberal	0.74					0.77			
Very Liberal	0.84					0.88			
Perceived Ease of Use									
Age									
18-24 (Ref.)	-					-			
25-34	1.03					1.01			
35-49	0.97					0.94			
50-64	0.91					0.89			
65+	0.76	†				0.79			
Education		***					***		***
Less than high school diploma	0.44	*				0.44	*	0.44	**

Table 15 continues

	Model 1		Model 2	Model 3	Model 4	Model 5		Model 6	
	Odds Ratio		Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio		Odds Ratio	
Respondent Characteristics (cont'd)									
Perceived East of Use (cont'd)									
Education (cont'd)		**							
High school degree or diploma (Ref.)	-					-		-	
Technical/Vocational school	1.54	*				1.54	*	1.52	*
Some college	1.91	***				1.89	***	1.95	***
College graduate	2.34	***				2.35	***	2.38	***
Post graduate work or degree	2.47	***				2.48	***	2.45	***
Sociodemographics									
Gender									
Male (Ref.)	-					-			
Female	0.92					0.93			
Marital Status									
Single/Never been married	1.04					1.06			
Married (Ref.)	-					-			
Separated/Divorced	0.92					0.93			
Widowed	0.74					0.78			
Domestic partnerships/Living with …	1.36	*				1.39	*		
Religious Preference		†					†		
Protestant	1.24					1.23			
Roman Catholic	1.00					1.00			
Other Christian Religion	0.93					0.92			
Other Non-Christian Religion	0.93					0.93			
No Religion/Atheist/Agnostic (Ref.)	-					-			

Table 15 continues

	Model 1		Model 2		Model 3	Model 4	Model 5		Model 6	
	Odds Ratio		Odds Ratio		Odds Ratio	Odds Ratio	Odds Ratio		Odds Ratio	
Respondent Characteristics (cont'd)										
Sociodemographics (cont'd)										
Religion Important										
No (Ref.)	-						-			
Yes	0.96						0.97			
Religious Attendance		†						†		
At least once a week	0.68	†					0.67	*		
Almost every week	0.95						0.94			
About once a month	0.64	*					0.64	*		
Seldom	0.85						0.84			
Never (Ref.)	-						-			
Race		***						***		***
White (Ref.)	-						-		-	
Black	0.55	**					0.56	**	0.52	***
Other	0.58	***					0.61	***	0.51	***
Hispanic	0.43	***					0.44	***	0.42	***
Social Environment										
Economic Conditions										
Your Company: Hire/Reduce				*						
Hiring new people and expanding the size			0.81	*			0.88			
Not changing the size… (Ref.)			-				-			
Letting people go and the size			1.03				1.04			
Direction of the National Economy										
Getting better			0.98				0.87			
The same			0.97				0.87			
Getting worse (Ref.)			-				-			

Table 15 continues

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
Social Environment (cont'd)												
Neighborhood Characteristics												
Census Region												
Northeast			1.09						0.94			
Midwest			1.12						0.98			
South (Ref.)			-						-			
West			1.18	†					1.04			
Questionnaire												
Survey Version												
Politics/Economy			1.26	***					1.60	***	1.80	***
Wellbeing (Ref.)			-						-		-	
Survey Design												
Length												
Number of Items												
12 Items (Ref.)					-		-		-			
5 Items					1.05		0.95		1.08			
Survey Mode												
Experimental Design												
Synchronous SMS (Ref.)					-		-		-		-	
SMS with Embedded URL					0.79	**	0.71	***	0.78	***	0.78	***
Interaction												
Items x Experimental Design							1.26	†				
Constant	0.19	***	0.09	***	0.11	***	0.11	***	0.19	***	0.09	***

Table 15 continues

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Model Statistics						
N	13,333	13,333	13,333	13,333	13,333	13,333
Average RVI	0.17	0.33	0.00	0.00	0.19	0.03
Largest FMI	0.47	0.63	0.00	0.00	0.64	0.13
Complete DF	2538.95	2549.00	2549.00	2549.00	2549.00	2549.00
Model F Test	(49, 1983.4) 7.97 ***	(8, 308.5) 2.46 *	(2, 2547.0) 6.13 **	(3, 2547.0) 3.31 *	(59, 1955.8) 7.43 ***	(19, 2483.5) 20.05 ***
Prob.>F	0.000	0.014	0.002	0.019	0.000	0.000

Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10

Economic Costs

We hypothesized in Chapter One that sample units may refuse to cooperate with SMS surveys due to the economic costs associated with sending and receiving text messages. Among the measures used to examine *Economic Costs*, only monthly household income was a significant predictor of SMS cooperation, $F(8, 1786.3) = 1.98$, $p < 0.05$. Relative to those earning $15,000 or more per month, those earning the lowest monthly incomes exhibited lower odds of cooperating with the SMS survey ($1,000 to $1,999/month OR = 0.66, $p < 0.05$; $2,000 to $2,999/month OR = 0.72, $p = 0.10$). The other measure of economic costs, employment status, approached traditional statistical significance levels (i.e., $p < 0.05$), $F(4, 157.8) = 2.10$, $p < 0.10$. Compared to those employed full-time for an employer, the unemployed were less likely to cooperate (OR = 0.66, $p < 0.10$). Both of these findings are consistent with the economic costs expectation where those with greater discretionary income may be more willing to incur the costs associated with actually sending and receiving SMS relative to those with lower discretionary income.[8]

General Resistance

Sample units may refuse to cooperate with a SMS survey if they harbor a higher degree of general resistance to the survey. Findings are mixed relative to our measures of *General Resistance*. Both the item missing rate and number of call attempts do not reach

[8] Where cooperation is operationalized as responding to *all* survey questions (SMSCOR1), the covariates for economic costs did not reach statistical significance: monthly household income $F(8, 1835.5) = 1.55$, $p > 0.05$), employment status $F(4, 38.9) = 0.98$, $p > 0.05$). Model results are provided in the Appendix (see Table 42).

statistical significance in Model 1. The measure of political party identification does, but, in the opposite direction anticipated by theory.

Political scientists have identified a relationship between social and political attitudes/beliefs and the physiological traits associated with threat (Ahn, 2014; Hibbing et al., 2014; Oxley et al., 2008) suggesting a negativity bias amongst ideological conservatives (Hibbing et al., 2014). As such, we anticipated that conservatives would be less likely to cooperate with a SMS survey. Results for measures of political party identification and ideology were mixed. Party identification was, overall, found to be significant, $F(5, 2470.0) = 3.11$, $p < 0.01$. However, results were not as we expected. Relative to Republicans, Independents and Refusers were less likely to cooperate with SMS surveys (Independent OR = 0.70, $p < 0.10$; Refuse OR = 0.71, $p < 0.01$). Overall, the measure for political ideology was not associated with cooperation, $F(4, 78.1) = 1.13$, $p > 0.10$. This finding is interesting and may be explained by privacy concerns if Independents and those who refuse to reveal their political ideology harbor greater concerns over privacy and, thus, are less likely to cooperate with a survey request.

Perceived Ease of Use

For some sample units, the use of mobile ICTs can be cumbersome and confusing. The Technological Adoption Model (TAM) suggests perceptions about the ease of use of technology may influence technological adoption (Davis, 1989; Davis et al., 1989). We similarly hypothesized that sample units may be less likely to cooperate with a SMS survey if they perceive the use of technology associated with text messaging to be challenging or burdensome. Results are mixed where one measure of *Perceived*

Ease of Use – education $F(5, 2473.2) = 14.89$, $p < 0.001$ – was found to be a significant predictor of cooperation. The second measure – age $F(4, 2022.9) = 1.18$, $p > 0.05$ – did not reach statistical significance.

Compared to those having earned a high school diploma, those with less than a high school degree were less likely to cooperate (OR = 0.44, p = 0.01). Alternatively, relative to those with a high school diploma, those having completed higher levels of education were more likely to cooperate – technical/vocational school (OR = 1.54, p < 0.05), some college (OR = 1.91, p < 0.001), college graduate (OR = 2.34, p < 0.001) and post-graduate work or degree (OR = 2.47, p < 0.001). This finding is consistent with our expectation where higher levels of education serve as a measure of access to technology and thus perceived ease of use of technology.

Sociodemographics

Similar to findings for traditional survey modes (Groves & Couper, 1998), we hypothesized that *Sociodemographics* may serve as indirect mechanisms of SMS cooperation. Often, sociodemographics serve as proxies for the notions of social isolation (Goyder, 1987; Groves & Couper, 1998), social engagement (Abraham et al., 2006; Groves & Couper, 1998) or social participation (Brehm, 1993; Couper et al., 1998; Putnam, 2000). Results for sociodemographic measures are mixed. Overall, only one measure was found to be significant – race $F(3, 2180.7) = 15.97$, $p < 0.001$. Relative to whites, blacks, Hispanics and those classified as "other race" were less likely to cooperate (black OR = 0.55, p < 0.01; other race OR = 0.58, p < 0.001; Hispanic OR = 0.43, p < 0.001). This finding is consistent with expectations rooted in social isolation (Goyder, 1987; Groves & Couper, 1998). Alternatively, this finding may reflect privacy concerns where, relative to white respondents, minorities hold greater concerns for the privacy of their responses and the risk of disclosure (Couper, Singer, Conrad, & Groves, 2008). Measures of gender, marital status, religious preference, the importance of religion, and frequency of religious service attendance did not reach traditional levels of statistical significance (i.e., $p < 0.05$).

Social Environment

Surveys are inherently social events (Groves & Couper, 1998), as such we hypothesized that social environmental mechanisms are at play in causing noncooperation with SMS surveys. Model 2 in Table 15 presents results for the *Social Environment* mechanism. One measure of *Economic Conditions* – whether one's company was hiring or reducing workforce – was found to be significant $F(2, 58.8) = 3.91$, $p < 0.05$. Relative to those experiencing no change in the workforce, those hiring new people and expanding were less likely to cooperate with the SMS survey (OR = 0.81, $p < 0.05$). In many cases, sending or receiving SMS transmissions may come at a cost to individuals. We expected that positive economic conditions might serve as an advantageous context for SMS cooperation. These results run opposite to our expectation. Instead, to the degree that those working for companies that are hiring and expanding have less time available to complete surveys, this finding may be explained by discretionary time constraints of respondents.[9]

[9] Where cooperation is operationalized as responding to *all* survey questions (SMSCOR1), the covariate for whether one's company was hiring or reducing workforce did not reach traditional statistical significance $F(2, 43.2) = 2.97$, $p > 0.05$). Model results are provided in the Appendix (see Table 44).

In addition, Model 2 includes a measure of the survey version employed during the initial Gallup Daily survey. Originally, this variable was not included in the model parameterization as the questionnaire was not identified as a proxy for the *Social Environmental* mechanism of SMS cooperation in our conceptual model. However, results from the original analytic model omitting the questionnaire variable resulted in a poor model fit as indicated by the model F test, $F(7, 221.0) = 1.49$, $p > 0.10$.[10] In turn, a measure of the questionnaire version was added. Upon including the survey version variable, Model 2 attained an acceptable fit $F(8, 308.5) = 2.46$, $p < 0.05$.

As part of the experimental design, sample units were randomly assigned to receive one of two survey versions with questions related to either politics and the economy or wellbeing. Results indicate that relative to those receiving the wellbeing survey version, those receiving the politics and economy were more likely to cooperate (OR = 1.26, p = 0.001). This finding indicates that there is something about the politics and economy version of the survey itself that, relative to the wellbeing version, increases cooperation with the SMS survey.

Survey Design

As discussed in the Data section (p. 112), the study included a fully crossed 2x3 factorial experiment. Factor one represents the number of items included in the SMS survey (5 or 12) and factor two represents the survey response mode (outbound phone, synchronous SMS, or SMS Web). The analysis provided in this chapter is restricted to those sample units assigned to the synchronous SMS and SMS Web treatments only.

[10] For original model results omitting the survey version variable, see the Appendix.

This design provides experimental covariates for *Survey Design* models (i.e., Model 3 and Model 4) included in Table 15.

Length

The first experimental treatment for factor one was the number of items included in the SMS survey. When the interaction term between the experimental treatments was not included (Model 3), *Length* – the number of items included in the SMS survey (5 or 12 items) – was not statistically significant (OR = 1.05, $p > 0.10$).[11]

Survey Mode

For Model 3, the experimental treatment for factor two, *survey mode*, did reach statistical significance (OR = 0.79, $p < 0.01$). Relative to those receiving a synchronous SMS survey, those receiving a SMS with embedded URL were less likely to cooperate.[12]

Length x Survey Mode Interaction

Finally, in Model 4 we examine the interaction between factors one and two, length and survey mode. The interaction did not reach the traditional level of statistical significance (OR = 1.26, $p > 0.05$). In other words, there were no significant differences in the effect of the survey mode (synchronous SMS or SMS with embedded URL) depending on survey length (5 items or 12 items). The interaction was not included in any of the subsequent models.

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[11] Where cooperation is operationalized as responding to *all* survey questions, the covariate for length was statistically significant (OR = 1.18, $p < 0.05$). Complete model results are provided in the Appendix (see Table 47).

[12] Where cooperation is operationalized as responding to *all* survey questions, the covariate for survey mode did not reach traditional statistical significance (OR = 0.89, $p > 0.05$). Complete model results are provided in the Appendix (see Table 47).

Full Model

In the full model (i.e., Model 5) displayed in Table 15 (p. 116), all measures of *Respondent Characteristics, Social Environment* and *Survey Design Characteristics* were included. For this combined model, most of the predictors that were significant in the models for each individual mechanism of cooperation were also significant and in the same direction of association as the full model. Exceptions are as follows: For the *Respondent Characteristics* model, the item missing rate measure gained statistical significance in the full model (Model 1 OR = 0.99, $p > 0.10$; Model 5 OR = 0.97, $p < 0.01$). Conversely, the party identification measure lost statistical significance in the full model (Model 1 $F(5, 2470.0) = 3.11$, $p < 0.05$; Model 5 $F(5, 2354.8) = 0.83$, $p > 0.10$). Looking to results from the *Social Environment* model, the measure of hire/reduce workforce lost statistical significance in the full model (Model 2 $F(2, 58.8) = 3.91$, $p < 0.05$; Model 5 $F(2, 48.2) = 1.24$, $p > 0.10$).[13]

Parsimonious Model

Results for our final, parsimonious model (i.e., Model 6) are presented in Table 15. This model was parameterized by retaining all predictors achieving at least a $p < 0.05$ level of statistical significance from the full model (i.e., Model 5). All covariates retained their statistical significance and direction of association as in the full model.

Step Two: Correlation between Response Propensity and Survey Variables

[13] Where cooperation is operationalized as responding to *all* survey questions (SMSCOR1), the covariate for the item missing rate gained statistical significance (OR=0.96, $p < 0.01$) in the full model. Full model results for cooperation operationalized as responding to *all* survey items is provided in the Appendix (see Table 50 and Table 52).

For step two of our analysis, we examine the correlations between the cooperation propensities (*p*s) and survey variables of interest (*y*s). Specifically, we are examining the direction and strength of the association as an indicator of potential noncooperation bias. Correlations range from $r = 0.00$ between the survey variable measuring one's Health Rating and cooperation propensity from the *Survey Design* model to $r = -0.27$ between Health Rating and cooperation propensity from the *Respondent Characteristics* model (see Table 16).

Looking to the correlations presented in Table 16, we see the direction and strength of the correlation between *p* and *y* changes. Propensities calculated via the *Respondent Characteristics* model (Model 1) yield relatively strong correlations with the survey items of registered to vote, health rating, and health insurance coverage. These correlations are lower for the other political, economic and health-related variables of interest. Of note, the correlation for Economic Conditions was relatively small at r = 0.05. The *Social Environmental* model (Model 2) produces propensities that yield relatively strong correlations with the economic conditions and own health rating variables, but lower correlations for the other *y* variables. The *Survey Design* models (Model 3 and 4) produces propensities that yield relative weak correlation across all *y* variables of interest.

Table 16

Correlations of Survey Variables of Interest (y) and Response Propensity (p) for SMS Cooperation

	Respondent Characteristics Model	Social Environment Model	Survey Design Model	Survey Design (Interaction) Model	Full Model	Parsimonious Model
Registered to Vote	0.2218***	0.0498*	-0.0111	-0.0175	0.2079***	0.2393***
Obama Job Approval	-0.1313***	-0.0892†	0.0082	0.0036	-0.1308***	-0.1343***
Economic Conditions	0.0468***	-0.1237	-0.0158	-0.0057	0.0038	0.0417**
Own Health Rating	-0.2700***	0.1659***	0.0008	0.0066	-0.2428***	-0.2672***
Do you Smoke?	-0.1602***	-0.0558†	-0.0311*	-0.0292	-0.1536***	-0.1829***
Health Insurance Coverage?	0.2344***	-0.0339*	-0.0034	0.0042	0.2166***	0.2501***

Note: ***p < 0.001, **p < 0.01, *p < 0.05, †p < 0.10

Results highlight the relative effect of each section of our conceptual model of cooperation with SMS surveys. The *Respondent Characteristics* model produces the strongest association between cooperation propensities (*p*s) and the survey variables of interest (*y*s). However, this effect is different for each *y* variable, but greatest for estimates of political, health rating and health insurance measures.

Step Three: Estimating Empirical Bias

For step three, we examined the empirical bias of the *y*s by reviewing the difference in base-weighted estimates among those who cooperated with the SMS survey and the base-weighted consenting sample:

$$\text{Noncooperation Bias}\left(\bar{y}_{Full,original}\right) = \bar{y}_{Coop,bw} - \bar{y}_{ConsentSam,bw}$$

Additionally, we look at the difference between base-weighted SMS cooperators and noncooperators:

$$\text{Difference}\left(\bar{y}_{Full}\right) = \bar{y}_{Coop,bw} - \bar{y}_{Noncoop,bw}$$

Results are presented in Table 17. They indicate that noncooperation bias ranges from zero to nearly 13 percentage points. For example, looking to the item measuring if a respondent is registered to vote, the consenting sample estimate is about 76%, but nearly 89% of SMS survey cooperators indicated “yes” compared to 75% of noncooperators. This yields a noncooperation bias in the estimate of about 13 percentage points. The difference between those cooperating and noncooperating sample units exceeds 14 percentage points for the same item.

Table 17

Base-Weighted Percentages and Standard Errors for SMS Cooperators, SMS Noncooperators, Consenting Sample Percentages, Empirical Noncooperation Bias, and the Difference between Cooperators and Noncooperators for SMS Cooperation

Survey Variables of Interest	Cooperation %	S.E.	Noncooperation %	S.E.	Consent Sample %	S.E.	Noncoop. Bias	Cooperation - Noncooperation
Registered to Vote								
Yes, Registered	88.56%	2.23%	74.49%	1.09%	75.77%	1.02%	12.80%	14.07%
No, Not Registered/Plan to/Don't Need to Register	11.44%	2.23%	25.51%	1.09%	24.23%	1.02%	-12.80%	-14.07%
Obama Job Approval								
Approve	40.56%	1.58%	51.57%	1.52%	50.57%	1.38%	-10.01%	-11.01%
Disapprove	59.44%	1.58%	48.43%	1.52%	49.43%	1.38%	10.01%	11.01%
Economic Conditions								
Poor	37.37%	2.97%	35.52%	1.19%	35.69%	1.24%	1.68%	1.85%
Only Fair	43.51%	1.93%	45.19%	0.76%	45.04%	0.70%	-1.53%	-1.68%
Good/Excellent	19.11%	2.53%	19.29%	0.95%	19.27%	1.02%	-0.16%	-0.17%
Own Health Rating								
Excellent	18.87%	1.70%	14.81%	0.60%	15.17%	0.63%	3.70%	4.07%
Very Good	31.80%	1.99%	26.35%	0.60%	26.84%	0.58%	4.96%	5.45%
Good	30.71%	1.91%	31.50%	0.59%	31.43%	0.54%	-0.72%	-0.79%
Fair	14.18%	1.52%	19.17%	0.72%	18.72%	0.72%	-4.54%	-4.99%
Poor	4.43%	0.88%	8.18%	0.44%	7.84%	0.40%	-3.40%	-3.74%

Table 17 continues

Survey Variables of Interest	Cooperation %	S.E.	Noncooperation %	S.E.	Consent Sample %	S.E.	Noncoop. Bias	Cooperation - Noncooperation
Do you Smoke?								
Yes	16.78%	1.80%	26.80%	1.34%	25.89%	1.29%	-9.11%	-10.01%
No	83.22%	1.80%	73.20%	1.34%	74.11%	1.29%	9.11%	10.01%
Health Insurance Coverage?								
Yes	84.24%	2.24%	72.50%	1.12%	73.57%	0.93%	10.67%	11.74%
No	15.76%	2.24%	27.50%	1.12%	26.43%	0.93%	-10.67%	-11.74%

Looking to the question about economic conditions, almost 19% of respondents cooperating with the SMS survey indicated that economic conditions are "good" or "excellent," similarly nearly 19% of noncooperating sample units responded the same, resulting in an estimate of about 19% for the consenting sample. This produces almost no difference between estimates from cooperators and noncooperators and yields almost no bias in the survey estimate based only on the cooperators. The survey variables of interest with the greatest nonresponse bias are consistent with those that have the strongest correlations with cooperation propensities reviewed in *Step Two: Correlation between Response Propensity and Survey Variables* section (p. 128).

Step Four: Noncooperation Weighting Adjustments

In analytic step four, we use the parsimonious cooperation propensity model reviewed above to create SMS noncooperation weighting adjustments as the inverse of the cooperation propensity ($1/p$). The product of this noncooperation weight and the base weight (($1/p$) * base weight) was created and applied to examine the impact of the parsimonious model at reducing noncooperation bias in the survey variables of interest (ys). Descriptive statistics for the noncooperation weights are created from the parsimonious propensity model and the combined weight created as the product of the parsimonious model weights and original base weights are displayed in Table 18.

Results indicate the parsimonious model weights average 14.26 (15.49) and range from 3.74 to 163.27 for the consenting sample, i.e., SMS cooperators plus SMS noncooperators. The mean weight for the cooperators only is 8.83 (6.69) ranging from

Table 18

Descriptive Statistics SMS Noncooperation Adjustment Weights

	N	Mean	S.D.	Min.	Max.
Noncooperation Weights					
Cooperation	1,502	8.83	6.69	3.74	105.14
Noncooperation	11,831	14.95	16.14	3.74	163.27
Consenting Sample	13,333	14.26	15.49	3.74	163.27
*Noncooperation Weights * Base Weights*					
Cooperation	1,502	8.49	15.90	0.85	317.41
Noncooperation	11,831	22.18	45.11	0.84	561.97
Consenting Sample	13,333	20.64	43.05	0.84	561.97

3.74 to 105.14 while for noncooperators, weights averaged 14.95 (16.14) with a range of 3.74 to 163.27. Figures 14 and 15 display kernel density plots for the distribution of the noncooperation weights and the combined weights (noncooperation weight * base weight) for both cooperators and noncooperators.

The descriptive statistics and kernel density plots for the noncooperation adjustment weights indicate there is a group of nonrespondents who are not represented in the cooperation data. As such, the weights may not fully account for this group of nonrespondents where we do not have data with a comparable set of characteristics in the respondent pool. To allow for the potential that our model for the weights is not well specified, we proceed with a weight trimming procedure to potentially minimize the impact of these weights on estimate variances.

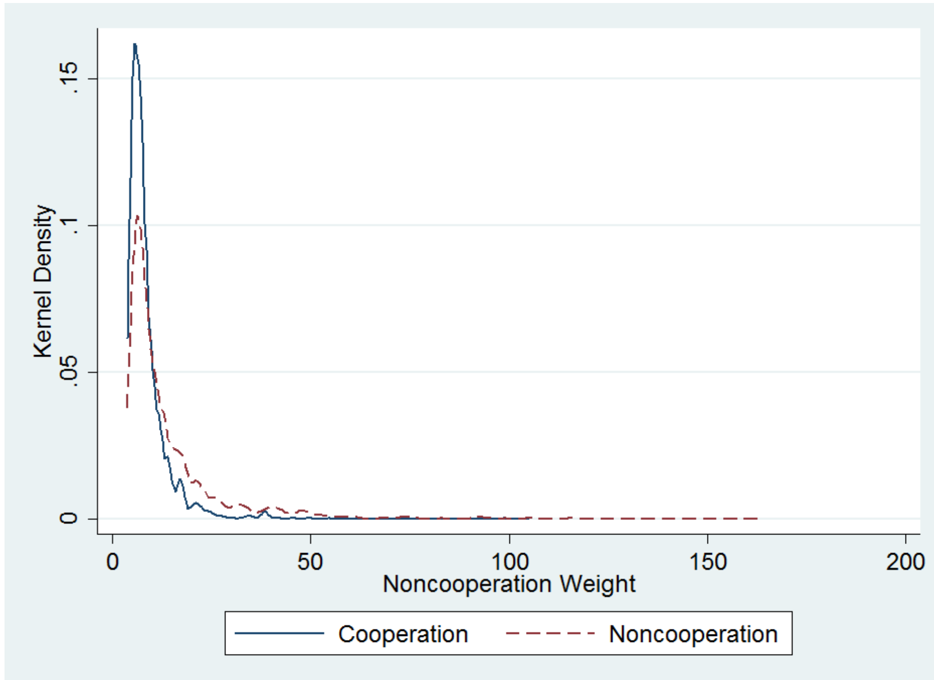

Figure 14. Kernel density plot of SMS noncooperation adjustment weights (1/p).

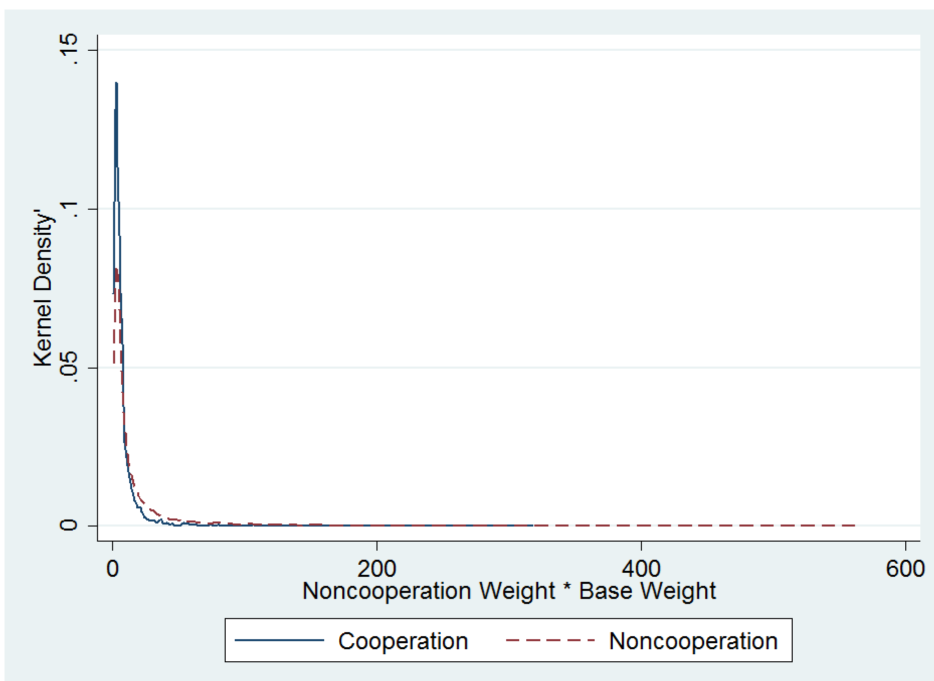

Figure 15. Kernel density plot of SMS noncooperation adjustment weights (1/p * base weight).

Weight Trimming

While different approaches have been suggested for weight trimming (e.g., Potter, 1990, 1993), there is no one accepted standard. The method used in this dissertation is to trim the weights at a maximum value located two standard deviations above the mean (M = 45.23). Any noncooperation weight greater than this threshold (+2 SDs) was set equal to this value (i.e., 45.23). At this point in the weight distribution there is still overlap between respondents and nonrespondents. In effect, this resulted in trimming the weights of seven (< 0.5%) cooperators. The product of the trimmed noncooperation weights and the base weights ((trimmed 1/*p*) * base weight) was then created and applied to examine the impact of the parsimonious model at reducing noncooperation bias in the survey variables of interest (*y*s) and to minimize the effect on estimate variances compared to the non-trimmed weighting approach described in *Step Four: Noncooperation Weighting Adjustments* section (p. 134). Descriptive statistics for the trimmed noncooperation weights derived from the parsimonious propensity model and the combined weights created as the product of the trimmed parsimonious model weight and original base weights are displayed in Table 19 located below.

Results indicate the trimmed, parsimonious model weights average 13.12 (10.52) and range from 3.74 to 45.23 for the consenting sample, i.e., SMS cooperators plus SMS noncooperators. The mean weight for the cooperators only is 8.74 (5.75) ranging from 3.74 to 45.23 while for noncooperators, weights averaged 13.68 (10.85) with a range of 3.74 to 45.23. Figures 16 and 17 display kernel density plots for the distribution of the

Table 19

SMS Noncooperation Adjustment Weights Trimmed to +2 SD above the Mean (45.29)

	N	Mean	S.D.	Min.	Max.
Trimmed Noncooperation Weights					
Cooperation	1,502	8.74	5.75	3.74	45.23
Noncooperation	11,831	13.68	10.85	3.74	45.23
Consenting Sample	13,333	13.12	10.52	3.74	45.23
*Trimmed Noncooperation Weights * Base Weights*					
Cooperation	1,502	8.28	13.51	0.85	145.41
Noncooperation	11,831	19.03	30.29	0.84	158.67
Consenting Sample	13,333	17.82	29.09	0.84	158.67

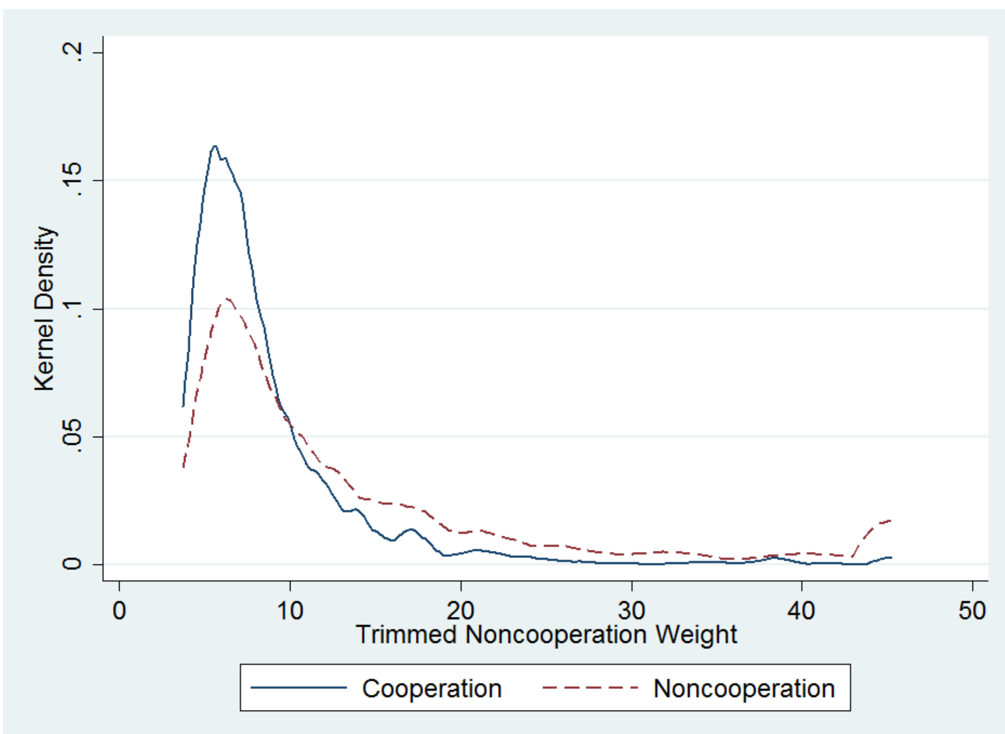

Figure 16. Kernel density plot of SMS noncooperation adjustment weights (1/p) trimmed to +2 SDs above the mean.

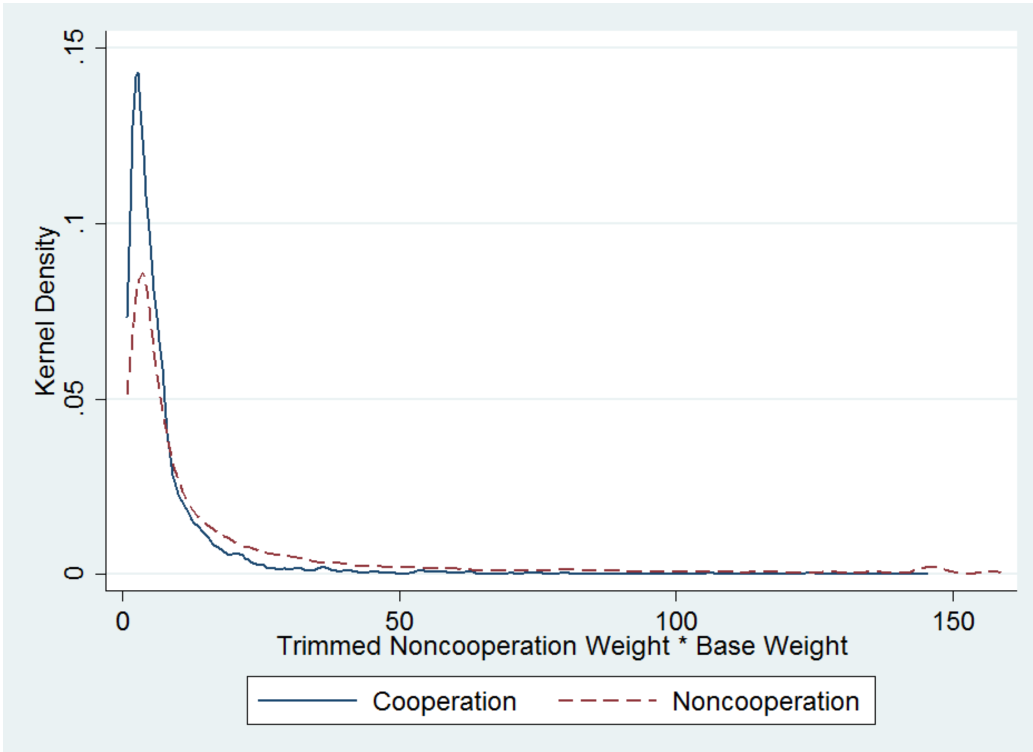

Figure 17. Kernel density plot of SMS noncooperation adjustment weights (1/p * base weight) trimmed to +2 SDs above the mean.

trimmed noncooperation weights and combined weights for both cooperators and noncooperators.

Step Five: Evaluating Reductions in Bias

For step five, the combined noncooperation weighting adjustments (noncooperation weight * base weight) and trimmed noncooperation weighting adjustments (trimmed noncooperation weight * base weight) were applied to the survey variables of interest and re-estimated in order to evaluate their effectiveness at reducing noncooperation bias:

$$\text{Remaining Noncooperation Bias } (\bar{y}_{Full,remaining}) = \bar{y}_{Coop,fw} - \bar{y}_{ConsentSam,bw}$$

$$\text{Remaining Noncooperation Bias } (\bar{y}_{Full,remaining,t}) = \bar{y}_{Coop,fw,t} - \bar{y}_{ConsentSam,bw}$$

Tables 24 and 25 display the re-estimated proportions for cooperators using the noncooperation weighting adjustments$(\bar{y}_{Coop,fw})$, the trimmed noncooperation weighting adjustments $(\bar{y}_{Coop,fw,t})$, and the base-weighted consenting sample proportions $(\bar{y}_{ConsentSam,bw})$ along with their standard errors. Results were mixed as to the effectiveness of the new weights at reducing noncooperation bias across the survey variables of interest. The variable with the largest magnitude of noncooperation bias – the measure of whether or not one is registered to vote – was reduced from about 13 percentage points to about 9 percentage points. Looking at the variable measuring the President's job approval rating, the nonresponse weighting adjustments reduced noncooperation bias about 1 percentage point. For the measure of Economic Conditions, noncooperation bias increased about 2 to 4 percentage points across the three proportions relative to the bias present in the original, non-adjusted estimates. However, the weighting adjustments performed particularly well for the Health Rating measure where noncooperation bias was reduced almost completely for two of the five proportions ("excellent" and "poor") and by as much as four percentage points for other proportions leaving empirical bias estimates of 1 to 2 percentage points ("very good," "good" and "poor"). The item asking if a sample unit is a smoker exhibited the largest reduction in bias, from almost 10 percentage points to slightly more than 3 percentage points. Similarly, the estimate for bias in the health insurance item was reduced from nearly 11 percentage points to about 5 percentage points.

Table 20

Noncooperation Weighting Adjusted Percentages and Standard Errors for Cooperators to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Cooperation %	S.E.	Noncooperation Bias
Registered to Vote			
Yes, Registered	84.84%	3.75%	9.08%
No, Not Registered/Plan to/Don't Need to Register	15.16%	3.75%	-9.08%
Obama Job Approval			
Approve	41.70%	2.93%	-8.87%
Disapprove	58.30%	2.93%	8.87%
Economic Conditions			
Poor	41.47%	3.88%	5.78%
Only Fair	40.95%	3.08%	-4.09%
The Good/Excellent	17.58%	2.84%	-1.69%
Own Health Rating			
Excellent	14.39%	1.69%	-0.78%
Very Good	27.13%	2.37%	0.29%
Good	31.82%	2.84%	0.39%
Fair	20.40%	3.35%	1.68%
Poor	6.25%	1.85%	-1.59%
Do you smoke?			
Yes	24.41%	3.65%	-1.48%
No	75.59%	3.65%	1.48%
Health Insurance Coverage?			
Yes	78.16%	3.60%	4.60%
No	21.84%	3.60%	-4.60%

Table 21

Trimmed Noncooperation Weighting Adjusted Percentages and Standard Error for Cooperators to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Cooperation %	S.E.	Noncooperation Bias
Registered to Vote			
Yes, Registered	84.95%	3.43%	9.18%
No, Not Registered/Plan to/Don't Need to Register	15.05%	3.43%	-9.18%
Obama Job Approval			
Approve	42.11%	2.63%	-8.46%
Disapprove	57.89%	2.63%	8.46%
Economic Conditions			
Poor	40.84%	3.56%	5.15%
Only Fair	41.17%	2.81%	-3.87%
Good/Excellent	17.99%	2.86%	-1.28%
Own Health Rating			
Excellent	14.77%	1.68%	-0.41%
Very Good	27.73%	2.26%	0.88%
Good	32.41%	2.73%	0.98%
Fair	18.74%	2.71%	0.02%
Poor	6.36%	1.89%	-1.48%
Do you smoke?			
Yes	22.87%	3.18%	-3.02%
No	77.13%	3.18%	3.02%
Health Insurance Coverage?			
Yes	78.62%	3.49%	5.05%
No	21.38%	3.49%	-5.05%

To further evaluate the effectiveness of the noncooperation weighting adjustments, Figure 18 depicts graphically the reduction (or increase) in bias by plotting the empirical bias estimates detailed in Tables 24 and 25 (pp. 161-162) relative to the original empirical bias obtained using only base weights provided in Table 17 (p. 132). Each bar represents the number of percentage points of empirical bias present in a percentage above or below the true estimate, that of the consenting sample ($\bar{y}_{ConsentSam,bw}$). The closer the bar is to the midline (zero percent or no bias), the less bias is present in the estimate. As such, by applying the noncooperation weighting adjustments we are hoping to reduce noncooperation bias, thereby making the bars appear as close as possible to the midline. The darkest bar represents the bias present in the original estimates calculated with base weights only $(\bar{y}_{Full,original}) = \bar{y}_{Coop,bw} - \bar{y}_{ConsentSam,bw}$. The two lighter bars (light blue and gray) represent the noncooperation bias remaining after applying the noncooperation weighting adjustments $(\bar{y}_{Full,remaining}) = \bar{y}_{Coop,fw} - \bar{y}_{ConsentSam,bw}$ and trimmed noncooperation weighting adjustments $(\bar{y}_{Full,remaining,t}) = \bar{y}_{Coop,fw,t} - \bar{y}_{ConsentSam,bw}$.

This figure highlights that effectiveness of the weighting adjustments are in fact mixed. For almost all survey variables of interest bias was reduced. But for the Economic Conditions measure, the variable of interest with the weakest association with cooperation propensity (r = 0.04), bias actually increased. As such, the effectiveness of the weighting scheme is differential across variables of interest. Additionally, we see little difference in the effectiveness of the trimmed versus untrimmed weights in bias

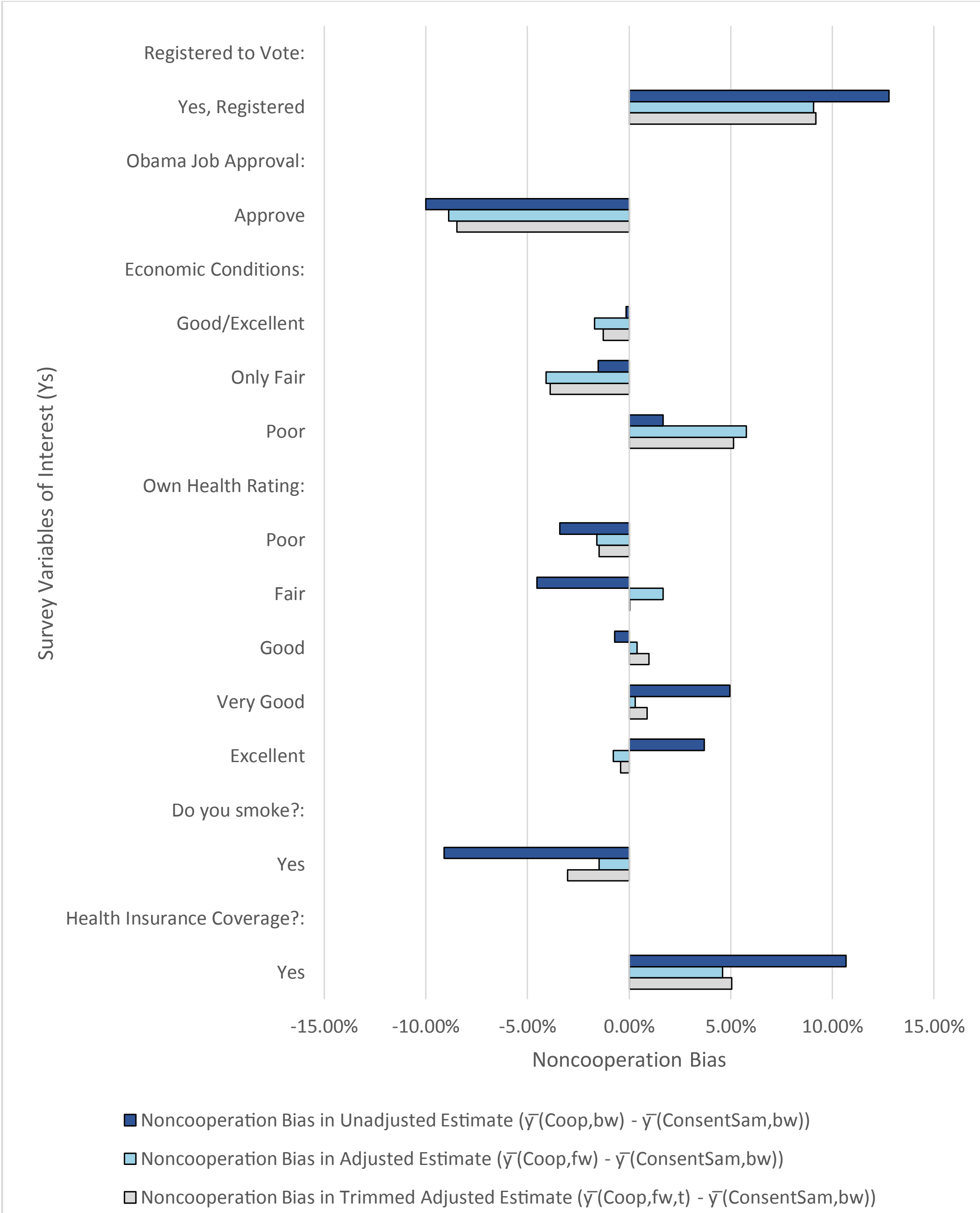

Figure 18. Difference in noncooperation bias for survey variables of interest (*y*s) estimated using base weights, noncooperation weight * base weight, and trimmed noncooperation weight * base weight adjustments.

reduction. However, there is yet another consideration as to whether or not the trimmed weights perform better at reducing the variances of the estimates relative to the untrimmed weights.

To review the effect of the weights on the standard errors of the survey variables of interest (ys), Table 22 details the standard errors of the estimates for the percentages estimated with the original base weights, the noncooperation weights, and the trimmed noncooperation weights. Results indicate that use of the trimmed weights have only a slight effect of reducing the standard errors relative to the non-trimmed noncooperation weights. However, both noncooperation weighting adjustments (trimmed and non-trimmed) produced increased standard errors of the estimates relative to use of the base weights only.

Summary

Chapter Four examines nonresponse bias resulting from noncooperation with a SMS survey. Empirical results indicate the presence of SMS noncooperation bias for all survey variables of interest (ys) reviewed here. Guided by the conceptual model of SMS cooperation discussed in Chapter One (see Figure 4), nonresponse weighting adjustments were created. Results were mixed as to their effectiveness at reducing noncooperation bias in survey estimates.

Model Results

This chapter began with the development of a series of logistic regression models aimed at predicting cooperation with a SMS survey guided by the conceptual model of

Table 22

Evaluating Reductions in Standard Errors Using Trimmed Weights

Survey Variables of Interest	Base Weight Only Cooperation S.E.	Weighting Adjustment Cooperation S.E.	Trimmed Weighting Adjustment Cooperation S.E.
Registered to Vote			
Yes, Registered	2.23%	3.75%	3.43%
No, Not Registered/Plan to/Don't Need to Register	2.23%	3.75%	3.43%
Obama Job Approval			
Approve	1.58%	2.93%	2.63%
Disapprove	1.58%	2.93%	2.63%
Economic Conditions			
Poor	2.97%	3.88%	3.56%
Only Fair	1.93%	3.08%	2.81%
Good/Excellent	2.53%	2.84%	2.86%
Own Health Rating			
Excellent	1.70%	1.69%	1.68%
Very Good	1.99%	2.37%	2.26%
Good	1.91%	2.84%	2.73%
Fair	1.52%	3.35%	2.71%
Poor	0.88%	1.85%	1.89%
Do you smoke?			
Yes	1.80%	3.65%	3.18%
No	1.80%	3.65%	3.18%
Health Insurance Coverage?			
Yes	2.24%	3.60%	3.49%
No	2.24%	3.60%	3.49%

SMS cooperation developed in Chapter One (Figure 4). Three mechanisms of noncooperation included in the conceptual model for which we had available measures were examined, including: *Respondent Characteristics*, *Social Environment*, and *Survey Design*. The final model included covariates from all three of the aforementioned mechanisms of SMS cooperation.

Reviewing Correlations – Corr(y, p)

The degree of noncooperation bias present in the percentages reviewed here is indicated by the strength of the correlations between the survey variables of interest (y) and cooperation propensities (p). Results indicate the y-p correlations are differential across items and across the three mechanisms of noncooperation modeled in this chapter, ranging from $r = 0.004$ to $r = -0.27$. The *Respondent Characteristics* model revealed the largest y-p correlations – especially for political measures and the health insurance item. The *Survey Design* model yielded the weakest y-p correlations overall, but were largest for political and health-related items. As such, different cooperation mechanisms were more or less at play in contributing to y-p correlations.

Empirical Noncooperation Bias

Noncooperation bias estimates ranged from -0.16% to 12.80%. As such, for some survey variables of interest, noncooperation bias was relatively large – reaching into double digits. To our knowledge, this finding provides the first evidence of noncooperation bias for SMS surveys. Consistent with the y-p correlations reviewed previously, we see that the magnitude of empirical bias was differential across survey items (*y*s). Bias was largest for the political and health-related items – those variables for which we identified the largest *y*-*p* correlations.

Effectiveness of Weighting Adjustments

The effectiveness of noncooperation weighting adjustments created from the cooperation propensity models were mixed. In some cases, bias was reduced almost completely (e.g., health rating). For other items, bias was only marginally affected (e.g., presidential job approval rating) or actually increased (e.g., economic conditions). Additionally, we saw little difference in the effectiveness of the trimmed weights at reducing standard errors of the proportions relative to the untrimmed weights. However, it should be stressed that in some cases noncooperation bias was large, again, reaching into double digit percentage point differences.

Implications for Understanding SMS Cooperation

What are the implications of these results for our understanding of SMS cooperation? In Chapter One we began this dissertation by developing a series of conceptual models of SMS-related nonresponse, including a model of noncooperation with a SMS survey. It was designed to help anticipate the mechanisms or causes (*z*s) of SMS noncooperation and proved useful in doing so. The implication then is that having and using an organizing framework for SMS-related nonresponse can help to not only identify the potential drivers of SMS noncooperation, but to anticipate when and how those drivers might result in noncooperation bias. For example, the conceptual model of SMS cooperation suggests the perceived ease of use of technology as one *Respondent Characteristic* that contributes to one’s decisions whether or not to cooperate with a SMS survey. As such, if one was creating a SMS survey to measure, for example, the usage of an internet streaming television service, if one believed the perceived ease of use of technology as a common cause of both the usage of streaming TV and SMS cooperation they can anticipate noncooperation biases may arise.

As we saw from the results of the propensity models, in this chapter the causes of SMS noncooperation were largely a series of *Respondent Characteristics* – proxies for economic costs, general resistance, the perceived ease of use of technology, and respondent sociodemographics. The survey version variable (politics and economy or wellbeing) was also identified as a cause. As such, the main drivers of SMS noncooperation were found to be mainly factors beyond researcher control. The implication here is that, unfortunately, researchers are limited as to what can be done *a priori* to avoid SMS noncooperation.

That said, this situation is most problematic when the SMS noncooperation mechanisms (*z*s) are also the cause of our survey variables of interest (*y*s). In such cases, SMS noncooperation is nonignorable, and will result in a bias in survey estimates. However, as depicted by the varying strengths of the *p*-*y* correlations, this association is different across survey items. Our results show that, in some cases, noncooperation bias was quite large – nearly 13%. For other items, noncooperation bias was barely detectable – less than 1%. The implication of these findings is that noncooperation bias is item-specific. While some statistics may be affected by SMS noncooperation, others derived from the very same survey can go unaffected. The upshot then is that noncooperation rates alone are likely not sufficient to accurately indicate the presence or degree of noncooperation bias in survey estimates.

Implications for Survey Practice

What do these findings mean for the practical implementation of surveys? Despite the benefits of mobile data services like SMS, as shown in this study, SMS-related noncooperation bias present in statistics can be large. Using the results from this chapter, we highlight the z variables most predictive of SMS cooperation propensity (p), and most strongly associated with our survey variables of interest (ys), to identify items that may prove most useful to monitor during data collection. The hope is that monitoring these variables will allow survey researchers to assess the potential for SMS noncooperation bias in survey estimates during fielding and in time to adapt protocols to mitigate the risk of SMS noncooperation bias.

Generally speaking, based on the results from this chapter, the items that would be most useful to monitor come from the *Respondent Characteristics* mechanism of SMS noncooperation. In particular, proxies for economic costs, general resistance, the perceived ease of use of technology, and respondent sociodemographics. The result here suggest that sample units who are racial minorities, those with lower incomes, and those of lower education levels are less likely to cooperate with a SMS survey relative to whites, those making higher monthly income, and those with a high school diploma as their highest level of education. As such, especially where survey variables of interest relate to issues of politics and personal health, survey practitioners may reduce the risk of noncooperation bias by aggressively recruiting or incentivizing SMS cooperation from sample units with these characteristics.

As noted earlier, we present evidence in this chapter indicating that empirical bias can, for some variables, be quite large. In an attempt to address this bias we created SMS noncooperation weighting adjustments. As discussed previously, the results of this process were mixed. Still, the effectiveness of such weights depends on the strength of the correlation between p and y. Where this correlation is stronger, SMS noncooperation weighting adjustments should perform better at reducing SMS noncooperation bias. Based on the findings presented in this chapter, we believe survey practitioners would generally benefit from the use of weighting adjustments created from, especially, measures of the *Respondent Characteristics* mechanism, including economic costs, general resistance, the perceived ease of use of technology, and respondent sociodemographics. Of course, any additional measures that might be related to both cooperation propensity (p) and the survey variable(s) of interest (y) should also be included in the model for the weights. Survey researchers may find the conceptual model of SMS cooperation useful in identifying such variables, as we did.

Limitations

As with any study, there are limitations to the analyses conducted in this chapter. The first relates to the experimental design. As described in *Results* section (p. 114), the analyses provided in this chapter are restricted to the 13,333 sample units assigned to the synchronous SMS and SMS Web response modes (experimental groups 2, 5, 3, and 6 from Table 1). Because we only have SMS delivery information for the synchronous

SMS treatments (experimental groups 2 and 5), we ignored the distinction between delivered and nondelivered SMS. What does this mean for our analysis? Some sample units identified as noncooperators, in fact, failed to receive the SMS survey altogether. Unfortunately, we have no way of knowing exactly how many SMS delivery failures occurred within the SMS Web response mode. We do know that of the 6,667 sample units assigned to the synchronous SMS treatment, 5,814 SMS transmissions were successfully delivered (about 87% SMSDR). As such, our analysis of SMS noncooperation bias, in effect, merges together nondelivery and noncooperation nonresponse.

Next, as noted in *Social Environment* section (p. 125), we identified a poor model fit for the *Social Environment* propensity model (Model 2). The overall model F test did not reach the traditional threshold of statistical significance (i.e., $p < 0.05$). Therefore, we included as an additional covariate in the model – an indicator of the survey version (political and economy or wellbeing) randomly assigned to each sample unit. While this resolved the issue, the exact cause of the poor fit is not immediately clear. In the end, however, the final parsimonious propensity model (Model 6) did not include any of the original proxies for the *Social Environmental* mechanism of noncooperation.

Conclusions

In Chapter Four we provide an examination of SMS-related noncooperation bias. To begin, for some of the survey variables of interest examined here empirical SMS noncooperation bias here was relatively large – especially for the items measuring voter registration status, presidential job approval, smoking status, and health insurance coverage status. As such, making use of SMS in survey research is not without risk. Second, SMS nonconsent bias is item-specific ranging from about 0% to nearly 13%. As such, the use of SMS noncooperation rates alone may a limited or even misleading means for assessing the risk of bias in survey estimates. Finally, generally speaking the nonconsent adjustment weights were mixed in their effectiveness at reducing bias.

CHAPTER FIVE

THE RELATIVE CONTRIBUTION OF NONCONSENT AND NONCOOPERATION TO TOTAL SMS-RELATED NONRESPONSE BIAS

Introduction

An important question yet to be examined in this dissertation concerns the relative contribution of each form of SMS-related nonresponse bias to the total nonresponse bias of an estimate. This chapter provides such an analysis. In Chapters Three and Four we separately examine two forms of SMS-related nonresponse bias – SMS nonconsent and SMS noncooperation. Where these two forms of nonresponse bias are in opposite directions, however, the overall estimate of empirical nonresponse bias may be effectively cancelled out. On the other hand, where we find contributions to nonresponse bias from both nonconsent and noncooperation in the same direction, the result would be an even greater impact on nonresponse bias of the survey estimates. Alternatively, if one form of SMS-related nonresponse bias is substantially greater than the other, it will have the effect of largely driving the overall nonresponse bias present in estimates. As such, knowing the relative contribution of each form of SMS-related nonresponse bias towards the overall estimate of nonresponse bias is important. This is especially true where the mechanisms of nonresponse bias – the *z* proxies that are the common cause of both cooperation propensity (*p*) and the survey variables of interest (*y*s) – are distinct. Why? Because the methods used to address SMS-related nonresponse bias are effective only to the degree that we can correctly identify the common cause(s) of both *p* and *y* – the cause(s) of nonresponse bias.

Better understanding this common cause has implications for how best to mitigate the risk of, and adjust for, SMS-related nonresponse bias in survey estimates. For example, during survey design efforts, if the information is not already available on the sampling frame, researchers will want to include proxies for these common cause mechanisms in the initial survey used to recruit participants (e.g., the Gallup Daily as used in this dissertation). This information can be monitored during fielding as an indicator of the risk of SMS-related nonresponse bias and, perhaps, be used to gauge the value of incentives to recruit sample units with certain common cause characteristics into the consent/respondent pools. Additionally, this information will be valuable in the development of post-survey adjustments to most effectively mitigate the presence nonresponse bias in survey estimates.

Nonresponse Rates and the Difference between Respondents and Nonrespondents

As described in the *Nonresponse Bias* section (p. 40), nonresponse bias is the item-specific function of two parameters – the nonresponse rate and the difference between respondents and nonrespondents (Groves, 1989). As such, the nonresponse rate can be relatively large, but where respondents do not differ substantially from nonrespondents, bias will be minimal. On the other hand, if the nonresponse rate is relatively small but there are substantial differences in the estimate between respondents and nonrespondents, nonresponse bias can still be relatively large. That is why, alone, nonresponse rates serve only as an indicator of the potential for the risk of nonresponse bias – they are not the sole determinant of bias. For our purposes then, it is helpful to know which of these two parameters might be driving the nonresponse bias in estimates and how it differs, if at all, between the two forms of SMS-related nonresponse (i.e., nonconsent and noncooperation). The upshot is that if bias is largely driven by the nonresponse rate researchers will want to focus efforts especially on recruiting more consenters/cooperators wholesale. Alternatively, where bias is largely the result of the difference in estimates between respondents and nonrespondents, the focus should be on persuading and perhaps incentivizing those persons with unique characteristics that are the common cause of both response propensity (p) and the survey variables of interest (ys) into the respondent pool.

Data

The data used to examine the relative contributions of each form of SMS-related nonresponse bias comes from an experiment conducted by the Gallup Organization using Gallup Daily tracking polls taken from July 29, 2013 – October 14, 2013. This dataset is described in detail in Chapter Two, and at the outset of Chapter Three (*Data* section, p. 72) and Chapter Four (*Data* section, p. 111). Additionally, in *Step Five: Develop Combined SMS Nonconsent and SMS Noncooperation Adjustment Weights* section (p. 167) below we provide a full explanation of the weights used in the analyses provided in this chapter.

Analytic Approach

To evaluate the relative contribution of SMS nonconsent and SMS noncooperation to the overall estimate of SMS-related nonresponse bias, the analytic plan for this chapter follows a six-step process:

1. Estimate the difference between consenters and nonconsent, those selected and not selected into the SMS experimental design, and cooperators and noncooperation with the SMS survey for a set of variables of interest (*y*s);
2. Estimate nonconsent (SMSCR) and noncooperation rates (SMSCOR1 and SMSCOR2);
3. Estimate SMS nonconsent, SMS experimental selection, SMS noncooperation, and total SMS-related nonresponse bias for a set of variables of interest (*y*s);
4. Evaluate the relative contribution of the parameters estimated in Step One and Step Two above towards the total SMS-related nonresponse bias estimated in Step Three for a set of survey variables of interest (*y*s);
5. Develop nonresponse adjustment weights as the product of the nonconsent weights created in Chapter Three, the noncooperation weights created in Chapter Four, and the base weights; and
6. Examine the effectiveness of the propensity models created in Chapter Three and Four at addressing total SMS-related nonresponse bias by applying the combined SMS-related nonresponse adjustment weights created in Step Five above assessing the reduction in bias characterized by estimates that are closer to those of the full sample, $\bar{y}_{Full,bw}$.

Results

Step One: Estimating the Difference between SMS Consenters and Nonconsenters, those Selected and Not Selected into the SMS Experimental Design, and Cooperators and Noncooperators with the SMS Survey

To begin, Table 23 below details the weighted percentages (and standard errors) for all six variables of interest (*y*s) under investigation in this dissertation. Table 24 highlights the difference between consenters/selected/cooperating and nonconsenters/nonselected/noncooperating sample units. Results indicate that for SMS consent, the difference between consenters and nonconsenters was relatively small, ranging from -0.15% for those selecting "good" as their own health rating to 9.10% for the item measuring health insurance status. The difference between cooperators and noncooperators was larger, ranging from -0.17% for those selecting "good or excellent" as the direction of the national economy to 14.07% for the item measuring voter registration status. Finally, the difference between those selected and not selected into the SMS experiment varied widely and, in some cases, were substantial. For example, looking to the measure of one's own health rating, the difference between sample units selected and not selected into the SMS experiment was as small as -0.13% for those identifying their own health rating as "good." However, for the voter registration status item, the difference between selected and not selected sample units was 43.30%.

Table 23

Base-Weighted Proportions and Standard Errors for Full Sample, SMS Consenters, SMS Nonconsenters, Experiment Selected, SMS Experiment Nonselected, SMS Cooperators, and SMS Noncooperators

Survey Variables of Interest	Full Sample %	S.E.	SMS Consent %	S.E.	SMS Nonconsent %	S.E.	SMS Experiment Selected %	S.E.	SMS Experiment Nonselected %	S.E.	SMS Cooperator %	S.E	SMS Non-cooperator %	S.E.
Registered to Vote?														
Yes, Registered	72.81%	1.11%	70.13%	1.31%	76.74%	1.05%	75.39%	1.10%	32.09%	2.54%	88.56%	2.23%	74.49%	1.09%
No, Not Registered	27.19%	1.11%	29.87%	1.31%	23.26%	1.05%	24.61%	1.10%	67.91%	2.54%	11.44%	2.23%	25.51%	1.09%
Obama Job Approval														
Approve	50.46%	1.00%	53.12%	1.17%	46.54%	0.94%	50.56%	1.37%	71.70%	3.23%	40.56%	1.58%	51.57%	1.52%
Disapprove	49.54%	1.00%	46.88%	1.17%	53.46%	0.94%	49.44%	1.37%	28.30%	3.23%	59.44%	1.58%	48.43%	1.52%
Economic Conditions														
Poor	35.59%	1.38%	33.93%	1.22%	38.03%	1.84%	35.36%	1.22%	23.53%	2.29%	37.37%	2.97%	35.52%	1.19%
Only Fair	45.59%	0.84%	46.40%	0.69%	44.39%	1.38%	45.11%	0.73%	55.72%	2.36%	43.51%	1.93%	45.19%	0.76%
Good/Excellent	18.82%	0.82%	19.67%	1.01%	17.58%	0.76%	19.53%	0.99%	20.74%	1.96%	19.11%	2.53%	19.29%	0.95%
Own Health Rating														
Excellent	14.93%	0.38%	14.12%	0.50%	16.13%	0.46%	15.20%	0.58%	6.31%	0.99%	18.87%	1.70%	14.81%	0.60%
Very Good	25.79%	0.66%	24.77%	0.63%	27.29%	1.06%	26.99%	0.59%	8.73%	1.24%	31.80%	1.99%	26.35%	0.60%
Good	31.50%	0.40%	31.44%	0.48%	31.59%	0.75%	31.42%	0.51%	31.56%	1.65%	30.71%	1.91%	31.50%	0.59%
Fair	19.77%	0.68%	21.00%	0.64%	17.97%	0.98%	18.56%	0.69%	38.65%	2.05%	14.18%	1.52%	19.17%	0.72%
Poor	8.00%	0.35%	8.67%	0.44%	7.02%	0.39%	7.83%	0.37%	14.75%	1.93%	4.43%	0.88%	8.18%	0.44%
Do you smoke?														
Yes	22.57%	1.11%	24.63%	1.18%	19.54%	1.13%	25.86%	1.26%	15.75%	1.78%	16.78%	1.80%	26.80%	1.34%
No	77.43%	1.11%	75.37%	1.18%	80.46%	1.13%	74.14%	1.26%	84.25%	1.78%	83.22%	1.80%	73.20%	1.34%

Table 23 continues

Survey Variables of Interest	Full Sample %	S.E.	SMS Consent %	S.E.	SMS Nonconsent %	S.E.	SMS Experiment Selected %	S.E.	SMS Experiment Nonselected %	S.E.	SMS Cooperator %	S.E	SMS Non-cooperator %	S.E.
Health Insurance Coverage?														
Yes	72.59%	0.88%	68.91%	1.03%	78.00%	0.82%	73.81%	0.89%	33.40%	1.99%	84.24%	2.24%	72.50%	1.12%
No	27.41%	0.88%	31.09%	1.03%	22.00%	0.82%	26.19%	0.89%	66.60%	1.99%	15.76%	2.24%	27.50%	1.12%

Table 24

Difference in Proportions for SMS Consenters and Nonconsenters, Selected and Not Selected Sample Units into the SMS Experiment, and SMS Cooperators and Noncooperators

Survey Variables of Interest	Diff. Consent - Nonconsent	Diff. Selected - Nonselected	Diff. Cooperation - Noncooperation
Registered to Vote?			
Yes, Registered	-6.61%	43.30%	14.07%
No, Not Registered	6.61%	-43.30%	-14.07%
Obama Job Approval			
Approve	6.58%	-21.14%	-11.01%
Disapprove	-6.58%	21.14%	11.01%
Economic Conditions			
Poor	-4.10%	11.83%	1.85%
Only Fair	2.00%	-10.61%	-1.68%
Good/Excellent	2.09%	-1.22%	-0.17%
Own Health Rating			
Excellent	-2.01%	8.89%	4.07%
Very Good	-2.52%	18.26%	5.45%
Good	-0.15%	-0.13%	-0.79%
Fair	3.03%	-20.09%	-4.99%
Poor	1.65%	-6.92%	-3.74%
Do you smoke?			
Yes	5.09%	10.11%	-10.01%
No	-5.09%	-10.11%	10.01%
Health Insurance Coverage?			
Yes	-9.10%	40.41%	11.74%
No	9.10%	-40.41%	-11.74%

Step Two: Estimate SMS Nonconsent and SMS Noncooperation Rates

In the *Standardized SMS Consent Rates* sections (p. 43) and the *Standardized SMS Cooperation Rates* section (p. 45) we noted that a standardized calculation of SMS consent and SMS cooperation is not included in the AAPOR Standard Definitions. As such, we operationalized the SMS consent rate (SMSCR) as the ratio of the number of individuals who consent to receive SMS communications over all those asked to provide SMS consent. The SMS cooperation rates (SMSCOR1 and SMSCOR2) were calculated as the ratio of sample units who provided a response to *all survey items* (5 or 12 depending on the assigned treatment group) and *at least one* item regardless of the number of items contained in the survey over all those invited to participate. In the *Dependent Variables* section (p. 51) we reviewed the key outcome rates under investigation for this dissertation. We present these rates in Table 25 below and add the inverse rate (1/outcome rate) which is representative of the *non*consent or *non*response rate used in the calculation of nonresponse bias detailed in the *Nonresponse Rates and the Difference between Respondents and Nonrespondents* section (p. 155).

Table 25

SMS Consent Rate (SMSCR), SMS Complete Cooperation Rate (SMSCOR1), Partial SMS Cooperation Rate (SMSCOR2) and Inverse Rates (Nonconsent and Noncooperation Rates)

	Consent (SMSCR)	Cooperation (SMSCOR1)	Cooperation (SMSCOR2)
Numerator	16,413	1,355	1,502
Denominator	29,780	13,333	13,333
Outcome Rate	55.11%	10.16%	11.27%
Inverse Rate (1/Outcome Rate)	44.89%	89.84%	88.73%

From this table we see that approximately 45% of sample units failed to consent to receive survey items via text message from the Gallup Organization. For the combined synchronous SMS and SMS Web treatments (experimental groups 2, 3, 5, and 6), complete and partial noncooperation rates were about 90% and 89%, respectively.

Step Three: Estimate SMS Nonconsent Bias, Experimental Selection Bias, SMS Noncooperation Bias and Total Nonresponse Bias

In step three, we estimate empirical bias due to SMS nonconsent, SMS experimental selection, SMS noncooperation, and total SMS-related nonresponse. These estimates are calculated for all six survey variables of interest (*y*s) as follows:

$$\text{Nonconsent Bias}\left(\bar{y}_{Full,original}\right) = \bar{y}_{Consent,bw} - \bar{y}_{Full,bw}$$

$$\text{Experimental Selection Bias}\left(\bar{y}_{Full,original}\right) = \bar{y}_{Select,bw} - \bar{y}_{Consent,bw}$$

$$\text{Noncooperation Bias}\left(\bar{y}_{Full,original}\right) = \bar{y}_{Coop,bw} - \bar{y}_{Select,bw}$$

$$\text{Total Nonresponse Bias}\left(\bar{y}_{Full,original}\right) = \bar{y}_{Coop,bw} - \bar{y}_{Full,bw}$$

Empirical bias due to SMS nonconsent and SMS noncooperation were discussed in detail as part of Chapters Three and Four of this dissertation. As such, we do not review them again here. Instead, we focus our attention on bias due to SMS experimental selection and total SMS-related nonresponse.

Given the random assignment of sample units to experimental conditions, we would not expect to find a difference between those selected and not selected into the SMS experimental sample. The results presented in Table 26 indicate that selection bias was generally less than 2.5% across the survey variables of interest (*y*s) and ranged from -2.44% to 5.25%. For example, the variable measuring one's own health rating, for the "good" response option selection bias was -2.44%. Looking to the item measuring if a respondent is registered to vote, we find selection bias in the estimate to be 5.25%.

Table 26

Empirical Bias for SMS Nonconsent, SMS Experimental Selection, SMS Noncooperation, and Total Nonresponse Bias

Survey Variables of Interest	SMS Nonconsent Bias	SMS Experimental Selection Bias	SMS Noncooperation Bias	Total SMS-Related Nonresponse Bias
Registered to Vote?				
Yes, Registered	-2.68%	5.25%	12.80%	15.75%
No, Not Registered	2.68%	-5.25%	-12.80%	-15.75%
Obama Job Approval				
Approve	2.67%	-2.56%	-10.01%	-9.90%
Disapprove	-2.67%	2.56%	10.01%	9.90%
Economic Conditions				
Poor	-1.66%	1.44%	1.68%	1.78%
Only Fair	0.81%	-1.29%	-1.53%	-2.07%
Good/Excellent	0.85%	-0.15%	-0.16%	0.29%
Own Health Rating				
Excellent	-0.81%	1.08%	3.70%	3.94%
Very Good	-1.02%	2.21%	4.96%	6.01%
Good	-0.06%	-0.02%	-0.72%	-0.79%
Fair	1.23%	-2.44%	-4.54%	-5.59%
Poor	0.67%	-0.84%	-3.40%	-3.57%
Do you smoke?				
Yes	2.06%	1.23%	-9.11%	-5.79%
No	-2.06%	-1.23%	9.11%	5.79%
Health Insurance Coverage?				
Yes	-3.68%	4.90%	10.67%	11.65%
No	3.68%	-4.90%	-10.67%	-11.65%

Next, looking to estimates of the total SMS-related nonresponse bias we see that bias ranged from -5.59% to 15.75%. The estimate with the largest degree of total nonresponse bias was the covariate measuring voter registration status. For this item, total empirical nonresponse bias was 15.75%. For the item measuring economic conditions, total bias was 1.78% for those answering "Poor," -2.07% for those responding "only fair" and 0.29% for those stating "Good" or "Excellent."

Step Four: Evaluate the Relative Contributions of Each Form of SMS-Related Nonresponse to Total Nonresponse Bias

Knowing the difference in percentages between respondents and nonrespondents for our survey variables of interest (*y*s), in addition to the SMS nonconsent and noncooperation rates, we have the information necessary to evaluate the relative contribution of each form of SMS-related nonresponse to estimates of total SMS-related nonresponse bias. As depicted in Table 24 (p. 161), looking across the six survey variables of interest (*y*s) under investigation in this dissertation, we see that for almost every variable, the difference between respondents and nonrespondents is larger for the SMS cooperation sample compared to the SMS consent sample. The one exception to this is for the variable measuring economic conditions. In this case, there is a larger deviation between consenters and nonconsenters for each of the three proportions than is found between cooperators and noncooperators. As we discussed in the introduction and as shown in the formula for nonresponse bias in the *Nonresponse Rates and the Difference between Respondents and Nonrespondents* section (p. 155), the difference in survey estimates between respondents and nonrespondents is only half the story in the calculation of nonresponse bias. Additionally, we must consider the magnitude of the nonresponse rate. For this parameter of nonresponse bias, we can see from the results presented in *Step One* section (157) and *Step Two* section (p. 161) above that the SMS noncooperation rate is twice that of SMS nonconsent – about 90% for SMS noncooperation relative to 45% for SMS nonconsent. Considering these two factors together – the fact that the deviation between cooperators and noncooperators is consistently larger than that of consenters and nonconsenters, as well the noncooperation rate being considerably larger than nonconsent rate – it is clear that SMS noncooperation bias makes up a significant portion of the contribution to total SMS-related nonresponse bias.

That said, the presence of selection bias is not irrelevant in this analysis. While the magnitude of selection bias differs across the six survey variables of interest (*y*s), selection bias generally appears to have the effect of cancelling out the effect of nonconsent bias. In almost all cases estimates of nonconsent bias and selection bias are in opposite directions. The one exception to this is the covariate measuring whether or not a sample unit is a smoker. For this variable, both nonconsent bias and selection bias estimates are in the same direction resulting in a compounding effect on the estimate of total SMS-related nonresponse bias. In this case, for sample units responding “yes” they smoke, nonconsent bias is 2.06% and selection bias is 1.23%.

Another key finding as it relates to the relative contribution of each form of nonresponse bias on total SMS-related nonresponse bias is that, for all six survey variables of interest, nonconsent and noncooperation bias are opposite directions. For example, looking to the covariate measuring whether or not a sample unit is registered to vote, we see nonconsent bias is -2.68% for the “yes” response option, while the noncooperation bias in the estimate is 12.80%. Similarly, looking to the measure of health insurance coverage we see nonconsent bias is -3.68% for the “yes” response option relative to 10.67% for the estimate of noncooperation bias. Taking a look at the last column of Table 24 (p. 161), it is clear that the SMS nonconsent and SMS noncooperation biases are in opposite directions. Taken together, they have the effect of cancelling each other out. However, given the magnitude of noncooperation bias is generally larger than that of SMS nonconsent bias, in addition to the fact that selection bias nearly always presents in the direction of noncooperation bias, for all six variables of interest total SMS-related nonresponse bias is in the direction of the estimate of SMS noncooperation bias.

Step Five: Develop Combined SMS Nonconsent and SMS Noncooperation Adjustment Weights

Next, we create the combined SMS nonconsent and SMS noncooperation adjustment weights. To do so, we combine the SMS nonconsent weights created in Chapter Three and the SMS noncooperation weights created in Chapter Four with the original base weights. Both the SMS nonconsent and SMS noncooperation weights were created as the inverse of the response propensity ($1/p$) derived from their respective parsimonious response propensity models. As such, the weighting adjustment developed here is the product of the SMS nonconsent weight, SMS noncooperation weight, and the original base weight base weight:

$$= \left(\left({}^{1}/_{\hat{p}_{Consent}} \right) \times \left({}^{1}/_{\hat{p}_{Cooperation}} \right) \times Base\ Weight \right)$$

This new, combined weight was created and applied to examine the impact of the parsimonious models of SMS consent propensity and SMS cooperation propensity at reducing the total SMS-related nonresponse bias in the survey variables of interest (*y*s). In addition, we created a trimmed version of the new combined nonresponse adjustment weights as the product of the SMS nonconsent weight created in Chapter Three, the trimmed SMS noncooperation adjustment weight created in Chapter Four, and the original base weights:

$$= \left(\left({}^{1}/_{\hat{p}_{Consent}} \right) \times \left({}^{1}/_{\hat{p}_{CooperationTR}} \right) \times Base\ Weight \right)$$

Descriptive statistics for the untrimmed and trimmed versions of the combined nonresponse weights are displayed in Table 27 below.

Table 27

Descriptive Statistics for Untrimmed and Trimmed SMS Nonresponse Adjustment Weights

	N	Mean	S.D.	Min.	Max.
*Nonconsent Weights * Noncooperation Weights * Base Weights*					
Respondents	1,502	14.68	22.93	1.65	397.95
Nonrespondents	11,831	34.54	63.31	1.62	730.44
Experimental Sample	13,333	32.30	60.46	1.62	730.44
*Nonconsent Weights * Trimmed Noncooperation Weights * Base Weights*					
Respondents	1,502	14.41	20.44	1.65	211.71
Nonrespondents	11,831	30.15	43.58	1.62	318.13
Experimental Sample	13,333	28.38	41.91	1.62	318.13

Results indicate the combined nonresponse weights average 32.30 (60.46) and range from 1.62 to 730.44 for the full experimental sample, i.e., the 13,333 sample units randomly selected into the SMS experiment. The mean weight for respondents only is 14.68 (22.93) ranging from 1.65 to 397.95 while for nonrespondents, weights averaged 34.54 (63.31) with a range of 1.62 to 730.44. The combined, trimmed nonresponse weights averaged 28.38 (41.91) ranging from 1.62 to 318.13 for the experimental sample. The combined, trimmed weight mean for respondents was 14.41 (20.44) with a range of 1.65 to 211.71. For nonrespondents, the trimmed weights averaged 30.15 (43.58) ranging from 1.62 to 318.13. Figures 19 and 20 below display kernel density plots for the distribution of the untrimmed and trimmed versions of the combined nonresponse adjustment weights for both respondents and nonrespondents.

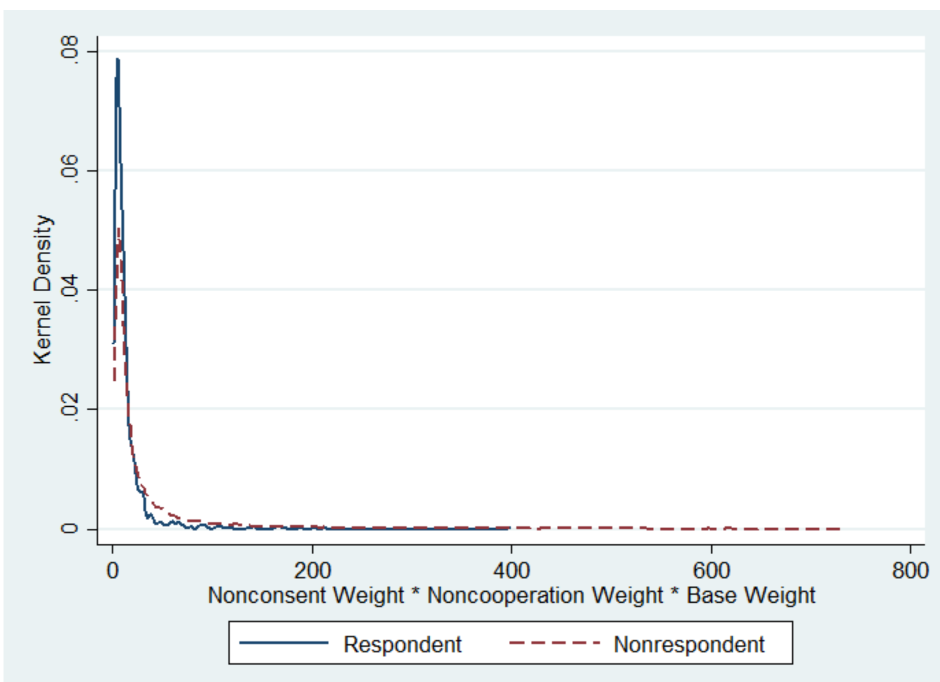

Figure 19. Kernel density plot of combined SMS nonresponse adjustment weights (nonconsent weight * noncooperation weight * base weight).

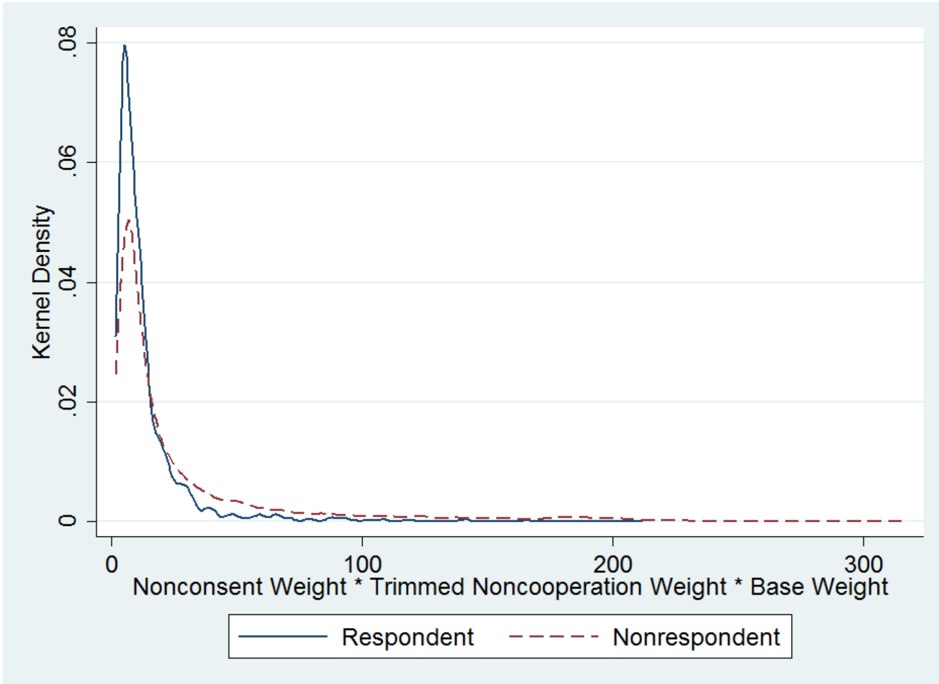

Figure 20. Kernel density plot of combined trimmed SMS nonresponse adjustment weights (nonconsent weight * trimmed noncooperation weight * base weight)

Step Six: Evaluating Reductions in Bias

For our final step, the combined nonresponse weighting adjustments (nonconsent weight * noncooperation weight * base weight) and trimmed nonresponse weighting adjustments (trimmed nonconsent weight * trimmed noncooperation weight * base weight) were applied to the survey variables of interest and re-estimated in order to evaluate their effectiveness at reducing total SMS-related nonresponse bias:

$$\text{Remaining Total Nonresponse Bias}\left(\bar{y}_{Full,remaining}\right) = \bar{y}_{Coop,f3w} - \bar{y}_{Full,bw}$$

$$\text{Remaining Total Nonresponse Bias}\left(\bar{y}_{Full,remaining,t}\right) = \bar{y}_{Coop,f3w,t} - \bar{y}_{Full,bw}$$

The re-estimated percentages for cooperators using the nonresponse weighting adjustments $(\bar{y}_{Coop,f3w})$, the trimmed nonresponse weighting adjustments $(\bar{y}_{Coop,f3w,t})$, and the base-weighted full sample percentages $(\bar{y}_{Full,bw})$ along with their standard errors are presented in Tables 28 and 29.

Results of the weighting effort were mixed. For example, the variable with the most total nonresponse bias – the measure of whether or not one is registered to vote – decreased by about 3 percentage point from about 16 percentage points to about 13 percentage points. For the variable measuring the Presidential job approval, we saw an increase in total SMS-related nonresponse bias by a small amount, less than one half of 1 percentage point. Looking to the measure of Economic Conditions, across the three proportions total SMS-related nonresponse bias increased anywhere from 2 to 4 percentage points. For the Health Rating measure total SMS-related nonresponse bias was reduced to within 1 percentage point for three of the five proportions ("excellent," "good" and "fair"). The weighting adjustments performed well for the item asking if a sample unit is a smoker. In this case, total nonresponse bias was reduced to 0.5 percentage points. The estimate for bias in the health insurance item was reduced from nearly 12 percentage points to about seven percentage points.

Below, we present this same information in graphic format. Figure 21 shows the reduction (or increase) in total SMS-related nonresponse using the empirical bias estimates from Tables 28 and 29 plotted relative to the original total SMS-related nonresponse bias. Following the process used in Chapters Three and Four, each bar

Table 28

Nonresponse Weighting Adjusted Percentage and Standard Errors for Cooperators to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Respondent %	S.E.	Remaining Total SMS-Related Nonresponse Bias
Registered to Vote			
Yes, Registered	85.50%	3.28%	12.70%
No, Not Registered/Plan to/Don't Need to Register	14.50%	3.28%	-12.70%
Obama Job Approval			
Approve	40.19%	2.46%	-10.27%
Disapprove	59.81%	2.46%	10.27%
Economic Conditions			
Poor	41.56%	3.54%	5.97%
Only Fair	41.17%	2.67%	-4.42%
The Good/Excellent	17.28%	2.69%	-1.55%
Own Health Rating			
Excellent	15.04%	1.61%	0.11%
Very Good	27.57%	2.12%	1.78%
Good	31.82%	2.45%	0.32%
Fair	19.36%	2.82%	-0.41%
Poor	6.21%	1.66%	-1.79%
Do you smoke?			
Yes	22.52%	3.16%	-0.05%
No	77.48%	3.16%	0.05%
Health Insurance Coverage?			
Yes	79.36%	3.26%	6.77%
No	20.64%	3.26%	-6.77%

Table 29

Trimmed Nonresponse Weighting Adjusted Percentage and Standard Errors for Cooperators to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Respondent %	S.E.	Remaining Total SMS-Related Nonresponse Bias
Registered to Vote			
Yes, Registered	85.59%	3.11%	12.78%
No, Not Registered/Plan to/Don't Need to Register	14.41%	3.11%	-12.78%
Obama Job Approval			
Approve	40.46%	2.29%	-9.99%
Disapprove	59.54%	2.29%	9.99%
Economic Conditions			
Poor	41.09%	3.35%	5.50%
Only Fair	41.35%	2.50%	-4.23%
Good/Excellent	17.55%	2.70%	-1.27%
Own Health Rating			
Excellent	15.32%	1.60%	0.39%
Very Good	28.01%	2.07%	2.22%
Good	32.23%	2.39%	0.72%
Fair	18.17%	2.41%	-1.60%
Poor	6.27%	1.69%	-1.73%
Do you smoke?			
Yes	21.41%	2.87%	-1.16%
No	78.59%	2.87%	1.16%
Health Insurance Coverage?			
Yes	79.69%	3.20%	7.10%
No	20.31%	3.20%	-7.10%

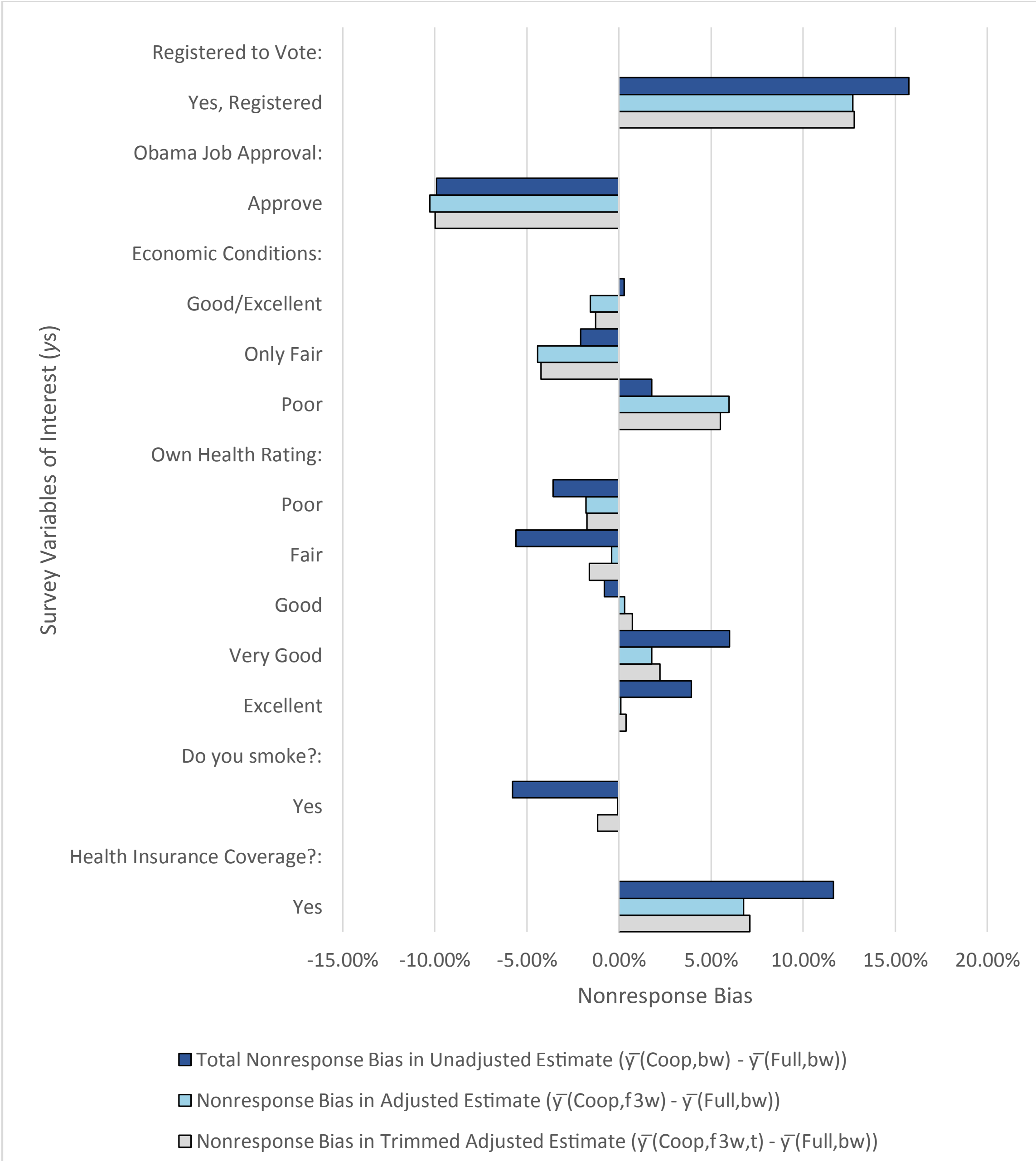

Figure 21. Difference in total SMS-related nonresponse bias for survey variables of interest (ys) estimated using base weights, nonconsent weights * noncooperation weights * base weights, and trimmed nonconsent weights * trimmed noncooperation weights * noncooperation weights * base weight adjustments.

depicts the percentage points of total SMS-related nonresponse bias for each percentage above or below the true estimate, that of the base-weighted, full sample ($\bar{y}_{Full,bw}$). The goal of the weighting adjustments then is to reduce total SMS-related nonresponse bias which would result in the bars appearing closer to the midline. The total SMS-related nonresponse bias for the original estimates calculated with base weights only $\left(\bar{y}_{Full,original}\right) = \bar{y}_{Coop,bw} - \bar{y}_{Full,bw}$ is depicted by the dark blue bar. The light blue and gray bars represent the total SMS-related nonresponse bias remaining after applying the combined nonresponse weighting adjustments $\left(\bar{y}_{Full,remaining}\right) = \bar{y}_{Coop,f3w} - \bar{y}_{Full,bw}$ and trimmed combined nonresponse weighting adjustments $\left(\bar{y}_{Full,remaining,t}\right) = \bar{y}_{Coop,f3w,t} - \bar{y}_{Full,bw}$.

From this figure, again we can see that the weighting adjustments were mixed in their effectiveness at reducing total SMS-related nonresponse bias. First, bias was reduced for four of the six variables of interest (*y*s). However, empirical bias increased for the Presidential Job Approval and Economic Conditions items. This finding indicates that the effectiveness of the weighting scheme is, in fact, differential across the six survey variables (*y*s) of interest examined in this dissertation. That said, we did not account for experimental selection in our weighting adjustments, so the effect of selection bias is not accounted for in these results. Next, in comparing the relative effectiveness of the trimmed versus untrimmed weights, we see little difference between the two. As detailed in Table 30, the effect of the trimmed weights on the standard errors of the survey variables of interest (*y*s) was negligible compared to the effect of the untrimmed weights.

Table 30

Evaluating Reductions in Standard Errors Using Trimmed Weights

Survey Variables of Interest	Base Weight Only Cooperation S.E.	Weighting Adjustment Cooperation S.E.	Trimmed Weighting Adjustment Cooperation S.E.
Registered to Vote			
Yes, Registered	2.23%	3.28%	3.11%
No, Not Registered/Plan to/Don't Need to Register	2.23%	3.28%	3.11%
Obama Job Approval			
Approve	1.58%	2.46%	2.29%
Disapprove	1.58%	2.46%	2.29%
Economic Conditions			
Poor	2.97%	3.54%	3.35%
Only Fair	1.93%	2.67%	2.50%
Good/Excellent	2.53%	2.69%	2.70%
Own Health Rating			
Excellent	1.70%	1.61%	1.60%
Very Good	1.99%	2.12%	2.07%
Good	1.91%	2.45%	2.39%
Fair	1.52%	2.82%	2.41%
Poor	0.88%	1.66%	1.69%
Do you smoke?			
Yes	1.80%	3.16%	2.87%
No	1.80%	3.16%	2.87%
Health Insurance Coverage?			
Yes	2.24%	3.26%	3.20%
No	2.24%	3.26%	3.20%

Finally, we find only a slight increase in the standard errors of the estimates for both weighting adjustments relative to use of the base weights.

Summary

The stochastic understanding of nonresponse bias suggests that bias is the product of two parameters – the nonresponse rate and the difference between respondents and nonrespondents (Groves, 1989). In this chapter we reviewed two forms of SMS-related nonresponse bias analyzed originally in Chapter Three (SMS nonconsent bias) and Chapter Four (SMS noncooperation bias) by breaking them down into their component parts – the nonconsent/noncooperation rate and the difference between consenters/ cooperators and nonconsenters/noncooperators. In so doing, we have shown that total SMS-related nonresponse bias is largely driven by noncooperation with a SMS survey. This is due to the fact that the noncooperation rate is twice that of SMS nonconsent. Additionally, we generally see larger deviations between SMS cooperators and noncooperators for the survey variables of interest (*y*s) examined in this dissertation relative to the deviations between SMS consenters and nonconsenters. That said, SMS noncooperation and SMS nonconsent bias present in opposite directions. This has the effect of attenuating the presence of total nonresponse bias. However, since in our analysis SMS noncooperation bias is almost always larger than SMS nonconsent bias, as well as the effect of SMS experimental selection bias, total SMS-related nonresponse bias follows the direction and magnitude of SMS noncooperation bias.

In addition to the analysis of nonresponse rates and the deviations between respondents and nonrespondents, we reviewed the effect of nonresponse weighting adjustments designed to account for the combined effect of SMS nonconsent and SMS noncooperation. Results were mixed. In some cases total SMS-related nonresponse bias was large – even presenting in the double digits (e.g., 15.75% for Voter Registration Status and 11.65% for Health Insurance Coverage Status). Still, for four of the six variables of interest (*y*s) examined, total nonresponse bias was reduced - almost completely for the covariates measuring one's own health rating and smoking status. However, for the variables measuring Presidential job approval and economic conditions, total nonresponse bias increased slightly as a result of the weighting adjustments.

Implications for Understanding Total SMS-Related Nonresponse Bias

What are the implications of this work for understanding total SMS-related nonresponse bias? We present evidence here in Chapter Five that total SMS-related nonresponse bias is present for a selection of estimates from a national survey. That said, SMS-related nonresponse bias is item-specific. For some covariates total SMS-related nonresponse bias is large, reaching into the double digits (e.g., Voter Registration Status and Health Insurance Coverage Status). In other cases, SMS-related nonresponse bias appears to be negligible (e.g., Economic Conditions). The implication is that nonconsent and noncooperation rates alone may be limited in suggesting the presence or absence of SMS-related nonresponse bias. Instead, a theoretical approach is needed to anticipate when survey variables of interest (*y*) have a common cause with SMS consent/cooperation propensity (*p*). The conceptual models of SMS consent and SMS cooperation developed in Chapter One provide support for this effort.

However, as the results from this chapter indicate, identifying the common cause(s) of both survey variables of interest (*y*s) and response propensity (*p*) is complicated by the fact that total SMS-related nonresponse bias results from multiple types of SMS-related nonresponse. In this analysis we consider specifically the contributions of SMS nonconsent and SMS noncooperation to total SMS-related nonresponse bias. Relatively speaking, the largest contribution comes from SMS noncooperation bias. What's more, our analyses suggest that SMS nonconsent bias and SMS noncooperation bias, while both largely driven by *Respondent Characteristics*, are the result of unique causes. In other words, the effect of the *Respondent Characteristics* mechanism on survey estimates is distinct for SMS nonconsent versus SMS noncooperation. This explains why the estimates of SMS nonconsent bias and SMS noncooperation bias move in opposite directions. Similarly, reviewing the *p*-*y* correlations for SMS consent and SMS cooperation presented in the *Step Two* section (p. 90) and the *Step Two* section (p. 128) we see that, for the parsimonious models, correlation coefficients present in opposite directions for five of the six survey variables of interest (*y*s) when comparing SMS consent and SMS cooperation. Results from the parsimonious propensity model of SMS consent developed in Chapter Three indicates the effect of *Respondent Characteristics* appears to be driven largely by "busyness" or discretionary time constraints, general resistance, and the ease of use of technology. Alternatively, looking to the results from the parsimonious propensity model of SMS cooperation from Chapter Four the *Respondent Characteristics* affecting SMS cooperation align more with economic costs, general resistance, perceived ease of use, privacy concerns. The upshot is that these distinct mechanisms have opposite effects on survey estimates.

Understanding this, we address the implications for understanding how best to deal with SMS-related nonresponse bias. Of course, our best chance at doing this is to identify the common causes of both response propensity and our survey variables of interest. Looking across the two forms of SMS-related nonresponse bias, we see that both are largely driven by *Respondent Characteristics*. That said, given the aforementioned difference, there is an important distinction to be made here between the effects of this mechanism on SMS consent relative to SMS cooperation. Our efforts to adjust for one may be counterproductive for the other. As such, it is important to model response propensities distinctly for each form of SMS-related nonresponse taking into account their unique causes.

Practical Implications for Survey Implementation

What are the practical implications of this analysis for survey implementation? The results presented here showcase that SMS noncooperation contributes, relatively, most heavily to total SMS-related nonresponse bias and that total SMS-related nonresponse bias is largely driven by noncooperation bias. In addition, nonconsent bias and noncooperation bias present in opposite directions with nonconsent bias having the effect of reducing total SMS-related nonresponse bias. Knowing this, during fielding survey researchers might best benefit from monitoring and aggressively recruiting or incentivizing sample units with the characteristics associated with SMS cooperation propensity and the survey variables of interest discussed in Chapter Four. Specifically, the results from Chapter Four suggests focusing on proxies for economic costs, general resistance, the perceived ease of use of technology, and respondent sociodemographics.

The effectiveness of SMS-related nonresponse weighting adjustments were mixed. In part, however, the impact of the weights was attenuated by the bias originating from the selection of sample units into the SMS experiment – biases which consistently presented in the same direction as noncooperation bias. As such, overall we believe the use of nonresponse weighting adjustments to be of value in reducing total SMS-related nonresponse bias. The findings here suggest, as a practical matter, the models for the weights should be developed independently for SMS nonconsent and SMS noncooperation given the presence of unique *z* variables that are proxies for the common cause of *p* and *y* across the two types of SMS-related nonresponse.

Limitations

There are limitations to the analysis conducted in Chapter Five. The first is that while respondents were randomly selected and assigned to participation in the SMS experimental design, the random assignment was not a simple random sample of the consenters. As such, we detected selection bias present in the estimates of total SMS-related nonresponse bias. In almost every case, selection bias was in the direction of noncooperation bias giving the effect of exacerbating total SMS-related nonresponse bias in that direction. Therefore, our analysis of the effectiveness of the nonresponse weighting adjustments are confounded by the presence of an additional bias component not accounted for in the development of the nonresponse weighting adjustments. In effect, the noted selection bias has the effect of attenuated the impact of the nonresponse adjustment weights at achieving estimates for the *y* variables that are closer to those of the base-weighted, unadjusted estimates.

Additionally, as was previously mentioned as a limitation for the analyses presented in Chapter Four, due to the limitations of the experimental design and data collection, the analysis in Chapter Five does not account for the potential impact of nondelivery bias. As such, nondelivery was ignored for the purposes of the analyses presented in Chapter Five. What this means is that some sample units identified as noncooperators may not actually have received the SMS survey invitation or items. As such, where present, nondelivery bias is effectively subsumed into our estimates of SMS noncooperation bias.

CHAPTER SIX

CONCLUSION

Introduction

This dissertation offers an examination of nonresponse bias arising from the use of short message service (SMS) or "text messaging" during the survey process. As we have discussed, SMS is a flexible mobile data service that can be exploited by survey researchers in different ways to mitigate the challenges associated with survey nonresponse. For example, SMS can be used for: prenotifications or reminders (Bosnjak et al., 2008; Brick et al., 2007; De Bruijne & Wijnant, 2014; Goldberg et al., 2006; Mavletova & Couper, 2013, 2014; Virtanen et al., 2007), to deliver a survey invitation (Bosnjak et al., 2008; Crawford et al., 2013; De Bruijne & Wijnant, 2014; Mavletova & Couper, 2013, 2014; Marlar & McGeeney, 2014; Maxl et al., 2010; Steeh et al., 2007), transmit survey items directly to sample units for synchronous survey interviews (Conrad et al., 2013; Cooke et al., 2003; Down & Duke, 2003; Goldberg et al., 2006; Marlar & McGeeney, 2014; Schober et al., 2013; Widman & Vogelius, 2002), to obtain paradata about the working status of a mobile telephone number (Buskirk et al., 2004; Callegaro 2002; Steeh et al., 2007), and to collect diary and experiential data (Andrews et al., 2011; Anhoj & Moldrup, 2004; Brenner & DeLamater, 2012; Kuntsche & Robert, 2009). Given these many uses of SMS for survey research, in Chapter One we provide a framework for the use of SMS in the survey process (see Figure 1, p. 8). This framework outlines the temporal location of three unique types of SMS-related nonresponse: SMS nonconsent, SMS nondelivery, and SMS noncooperation. We identify where different forms of SMS-related nonresponse can arise depending on how SMS is integrated into the survey process.

To better understand when SMS-related nonresponse might pose a risk of producing bias in survey estimates, we created three conceptual models – one for each of the three types of SMS-related nonresponse identified in our framework for SMS in the survey process. These conceptual models identify theoretical mechanics (*z*s) involved in producing SMS-related nonresponse bias. As detailed in Chapter Two, using data from an experiment conducted by the Gallup Organization employing SMS design features, we analyzed two of the three forms of SMS-related nonresponse bias defined in this dissertation, namely SMS nonconsent bias (see Chapter Three) and SMS noncooperation bias (see Chapter Four). Finally, we examined the relative impact of each of these two forms of bias on a series of national estimates (*y*s) ranging from politics, to the economy and personal health (see Chapter Five). For each analysis, we created weighting adjustments, guided by the mechanisms of nonresponse (*z*s) hypothesized in our conceptual models (see Figures 2 and 4), and examined whether the weights effectively mitigated SMS-related nonresponse bias.

This chapter synthesizes the dissertation's results. In so doing, we aim to specifically address the proxies for the mechanisms of SMS-related nonresponse included in our conceptual models. We highlight where these proxies successfully predict SMS consent and SMS cooperation, in addition to when the response propensities derived from our analytic models are associated with the survey variables of interest.

Summary of Findings and Implications

Respondent Characteristics

For both the conceptual model of SMS consent and SMS cooperation, *Respondent Characteristics* were included as a mechanism of nonresponse operating outside of researcher control. For both types of SMS-related nonresponse, relative to the other mechanisms examined in this dissertation, the *Respondent Characteristics* mechanism generally exhibited the strongest correlations with SMS consent and SMS cooperation propensities (*p*s). That is, for our survey variables of interest (*y*s), *Respondent Characteristics* provide the largest contribution to empirical bias detected in survey estimates. As a result, proxies for the *Respondent Characteristics* mechanism were the most effective covariates in nonresponse weighting adjustments. That said, as we detailed in Chapter Five, empirical nonresponse bias was larger for SMS cooperation relative to SMS consent. Further, estimates of empirical bias were in opposite directions (one positive the other negative) across the two types of SMS-related nonresponse (SMS nonconsent and SMS noncooperation).

For both SMS consent and SMS cooperation, we tested proxies of *Respondent Characteristics* related to economic costs, general resistance, the perceived ease of use of technology, and sociodemographics. We start our review with the proxies for *economic costs*. Monthly household income was positively/negatively significantly related to SMS cooperation, as expected, but not related to SMS consent. Employment status was significantly positively/negatively associated with SMS consent, but not as we expected. Unemployed and underemployed (those employed part-time but wanting full-time work) sample units were more likely to consent to SMS while those employed part-time but not wanting full-time work were less likely to consent. As such, we suspect that employment status may instead be operating as a proxy for the availability of time rather than as an economic costs measure. Looking to the measures of *general resistance*, as anticipated, the item missing rate was significantly negatively associated with both SMS consent and SMS cooperation. The number of call attempts was significantly positively associated with SMS consent, opposite the anticipated direction, but was not associated with SMS cooperation. We suspect that the number of call attempts may instead be serving as a proxy for the availability of time rather than as a measure of general resistance. As expected, relative to Republicans, sample units identified as Democrats were more likely to consent to receive SMS transmissions. The political measures were unrelated to SMS cooperation, however. Turning to the proxy measures for the *perceived ease of use of technology*, age was significant for both SMS consent and SMS cooperation. However, for SMS consent, this association was not consistent with our hypothesis. Contrary to expectations, older sample units were less likely to consent to SMS relative to the youngest sample units (age 18-24). The covariate for education was significant only for the model of SMS consent. Finally, looking to our measures of *sociodemographics*, race was a significant predictor of both SMS consent and SMS cooperation. Consistent with a social exchange perspective, relative to white sample units, those identified as Hispanic and other race were more likely to consent to SMS. Alternatively, consistent with expectations rooted in social isolation, minority race sample units (Black, Hispanic, and other race) were less likely to cooperate with a SMS survey relative to white sample units. Measures for gender and marital status were significant for SMS consent only. As anticipated, females were more likely to provide SMS consent. Relative to married sample units, those who are separated or divorced and those in a domestic partnership were more likely to consent to receive SMS transmissions.

Social Environment

The *Social Environment* mechanism is a theoretical cause outside of researcher control for both SMS consent and SMS cooperation. For both, proxies for the *Social Environmental* mechanism were significant predictors of response propensity (*p*). However, the correlations between response propensities (*p*s) derived from the *Social Environment* models and our survey variables of interest (*y*s) were generally weak relative to those of the *Respondent Characteristics* models. An exception to this trend was the correlation between SMS consent propensity derived from the *Social Environment* model and the survey variable of interest measuring economic conditions.

Different proxies were relevant across the two models. For the model of SMS consent, measures for the direction of the national economy and neighborhood characteristics were significant. These measure were unrelated to SMS cooperation, however. These results imply that the *Social Environmental* mechanisms matters for predicting SMS consent propensity (*p*) but not for SMS cooperation. Still, consent propensities (*p*s) from this model were largely unassociated with our survey variables of interest (*y*s). As such, the *Social Environment* mechanism contributes relatively little to the empirical estimates of SMS-related nonresponse bias.

Consent/Survey Design

For the conceptual model for SMS Consent, a series of *Consent Design* proxies were identified as theoretical causes, including incentives, the location of the request, and opt-out provisions. Unfortunately, we did not have data to test this portion of the conceptual model. For the conceptual model of SMS cooperation, the *Survey Design* mechanism replaced the *Consent Design* mechanism. That is, instead of including consent design mechanisms, the model for SMS cooperation included mechanisms relating to features of the survey design, such as survey length and survey mode. Both of these mechanisms (consent design and survey design) are under researcher control.

For the SMS cooperation model, the measure of survey mode was a significant predictor. Those who received a SMS with embedded URL were significantly less likely to cooperate compared to those receiving the synchronous SMS treatment. In addition, for SMS cooperation, the indicator of questionnaire type was significant.[14] Together, this suggests that *Survey Design* mechanisms are associated with response propensity (*p*) for SMS cooperation. Despite this, correlations between response propensities (*ps*) from the *Survey Design* model and our survey variables of interest (*y*s) were weak. As such, *Survey Design* mechanisms contribute little to estimates of SMS-related nonresponse bias.

[14] To address estimation challenges, the questionnaire type measure was included as a covariate in the analytic model for the Social Environmental mechanisms of SMS cooperation. The discussion is provided here in the Survey Design section for consistency with the conceptual model.

Interviewer Characteristics

The *Interviewer Characteristics* mechanism was identified as another theoretical cause of SMS consent under researcher control. However, none of the proxies for *Interviewer Characteristics* – including interviewer experience and sociodemographic covariates gender and race – were found to be predictive of SMS consent. Moreover, the *p-y* correlations for the *Interviewer Characteristics* model were quite weak indicating this mechanism was largely uninvolved in producing SMS nonconsent bias. *Interviewer characteristics* were not included in the conceptual model of SMS cooperation.

Limitations and Future Research

As we have noted throughout the dissertation, there are limitations to the analyses presented. To begin, this dissertation makes use of secondary data produced from a study conducted by the Gallup Organization for other intents and purposes. This has ramifications for our work. To begin, we were limited in testing the full breadth of the conceptual models (SMS consent, SMS delivery and SMS cooperation) discussed in Chapter One. In particular, we were unable to examine a number of the mechanisms in whole or in part, especially many of those under researcher control, including the *Consent Design* and the *Respondent-Interviewer Interaction* from the conceptual model for SMS consent, as well as the *Device/Plan Characteristics* and the *Respondent-Device Interaction* from the SMS cooperation model. Future research should examine these potential mechanisms of SMS consent/cooperation. Particular attention should be given to those that can be manipulated by survey researchers.

Likewise, making use of secondary data also limits our access to ideal proxies for SMS-related nonresponse mechanisms. As such, in some cases, variables may have been poorly measured for our purposes. At times, our proxies could have been used to represent other response mechanisms that were not included in our conceptual models. As an example, we used the covariate "education" as a proxy measure of the perceived ease of use of technology. However, as discussed in the model results section from Chapter Three, findings suggest education may be better suited as a proxy for some other mechanism of nonconsent, namely discretionary time. Our results indicated that, relative to those with a high school degree, those with higher levels of education (technical vocational school, some college, college graduate, and post graduate work or degree) were less likely to consent to SMS while those with less than a high school degree were more likely to consent. This finding is more consistent with expectations related to the discretionary time of sample units.

Another limitation of using secondary data relates to the missing-by-design structure of this dataset. For some of our variables, half of the information is missing by design. As discussed previously, the questionnaire version (Politics and Economy or Wellbeing) used in this study was randomly assigned to initial survey respondents. Anywhere from 50% to 63% of information was missing from respondents for our survey variables of interest (*y*s) and 0% to 51% for our *z* variables. As such, we utilized multiple imputation (five imputations) to fill in missing data for our analyses. Future research may benefit from less reliance on the specification of imputation models or the creation of more imputations for use in analytic procedures.

Additionally, the experimental design contributed to study limitations. For example, in Chapter Four our sample is restricted to the 13,333 sample units assigned to the synchronous SMS and SMS Web response modes (experimental groups 2, 5, 3, and 6 from Table 1, p. 50). We only have SMS delivery information for the synchronous SMS treatments (experimental groups 2 and 5). As such, we ignored the distinction between delivered and nondelivered SMS. Therefore, some sample units identified as noncooperators would have failed to receive the SMS survey altogether. As a result, our analysis merges together nondelivery and noncooperation nonresponse. Future research into SMS-related nonresponse should seek to account specifically for delivery failures. As noted in Chapter One (p. 43), depending on how SMS is deployed as a survey design feature, SMS delivery is an item-specific characteristic. That is, one message may be delivered while the next is not. The paradata obtainable from SMS functionality can be used to identify the successful delivery (or failure) of SMS transmissions.

The final limitation related to our use of secondary data is that, while the experimental design called for respondents to be randomly selected and assigned to SMS experimental treatments, we detected the presence of selection bias for the respondents selected into the experiment in the six survey variables of interest (*y*s) examined in this dissertation. As such, it appears the random selection from consenters was not a simple random sample of consenters. For our analyses, in almost every case, selection bias was in the direction of noncooperation bias. This has the effect of exacerbating total SMS-related nonresponse bias in that direction. As such, our analysis of the effectiveness of the nonresponse weighting adjustments are confounded by the presence of an additional bias component not accounted for in the development of the nonresponse weighting adjustments. In effect, selection bias has the effect of attenuating the impact of the nonresponse adjustment weights at achieving estimates for the *y* variables that are closer to those of the base-weighted, unadjusted estimates. Future research should seek to design *a priori* experimental procedures to ideally test SMS-related nonresponse bias or, if selection criteria are known, adjust the estimates using selection weights.

The conceptual models proposed in Chapter One and re-presented in Chapters Three and Four adapted a model of traditional, household survey participation (Groves & Couper, 1998) to the SMS context in order to anticipate the *y*-*p* relationship. Future work should continue to test and refine this new model and expand by considering, perhaps, other causal relationships between response propensity (*p*) and survey variables of interest (*y*s) beyond the common cause model (Groves, 2006).

Finally, as noted in the *Social Environment* section (p. 125), we identified a poor model fit for the *Social Environment* propensity model (Model 2 from Chapter Four). The overall model F test did not reach the traditional threshold of statistical significance (i.e., $p < 0.05$). Therefore, we included as an additional covariate in the model an indicator of the survey version (political and economy or wellbeing) randomly assigned to each sample unit. While this resolved the issue, the exact cause of the poor fit is not immediately clear. In the end, however, the final parsimonious propensity model (Model 6) from Chapter Four did not include any of the original proxies for the *Social Environmental* mechanism of noncooperation.

Conclusions

In the context of declining survey response rates, advances in mobile information and communications technologies (ICTs), and the proliferation of mobile data services (e.g., SMS or "text messaging"), today survey researchers are presented with new opportunities for data collection and new challenges to data quality. In this dissertation we provide an examination of SMS-related nonresponse bias. Results suggest this form of bias may pose a threat to data quality. We find evidence for SMS-related nonresponse bias in a range of national survey estimates ranging from politics, to the economy, and measures personal health and wellbeing. For some survey variables of interest, estimates of total SMS-related nonresponse bias reaches the double digits. However, the magnitude of these results should be taken with caution given the presence of selection bias noted in our estimates.

We detected the presence of two unique forms of SMS-related nonresponse bias – SMS nonconsent bias and SMS noncooperation bias. Due to relatively larger noncooperation rates and a greater difference between respondents and nonrespondents, total SMS-related nonresponse bias is largely driven by SMS noncooperation. Our findings indicate that respondent characteristics mechanisms contribute most to the presence of SMS-related nonresponse bias. Weighting adjustment models that include, especially, covariates for respondent characteristics, those items that are the common cause of both response propensity and survey variables of interest, are most effective at mitigating SMS-related nonresponse bias. The nonresponse weighting adjustment models performed well at reducing nonresponse bias due to SMS nonconsent. They were less effective at reducing SMS noncooperation bias, however.

References

Abraham, K. G., Maitland, A., & Bianchi, S. M. (2006). Non-response in the American time use survey: Who is missing from the data and how much does it matter?. *Public Opinion Quarterly*, *70*(5), 676-703.

Acker, A. (2014). The short message service: Standards, infrastructure and innovation. *Telematics and Informatics, 31*(2014), 559-568.

Ahn, W. Y., Kishida, K. T., Gu, X., Lohrenz, T., Harvey, A., Alford, J. R., Smith, K. B., Yaffe, G., Hibbing, J. R., Dayan, P., & Montague, P. R. (2014). Nonpolitical images evoke neural predictors of political ideology. *Current Biology*, *24*(22), 2693-2699.

American Association for Public Opinion Research (AAPOR). (2015). *Standard definitions: Final dispositions of case codes and outcome rates for surveys* (8th ed.). Ann Arbor, MI: American Association for Public Opinion Research.

American Association for Public Opinion Research (AAPOR) Cell Phone Task Force. (2010). *New considerations for survey researchers when planning and conducting RDD telephone surveys in the U.S. With respondents reached via cell phone numbers*. Available online at <http://www.aapor.org/AAPORKentico/Education-Resources/Reports/Cell-Phone-Task-Force-Report.aspx>

American Association for Public Opinion Research (AAPOR) Task Force on the Future of U.S. General Population Telephone Surveys. (2017). *The future of U.S. general population telephone survey research.* Available online at

< http://www.aapor.org/Education-Resources/Reports/The-Future-Of-U-S-General-Population-Telephone-Sur.aspx>

Anderson, M. (2015). Technology device ownership: 2015. *Washington, DC: Pew Research Center.* Accessed online at <http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015/>

Andrews, L., Russell-Bennett, R., & Drennan, J. (2011). Capturing affective experiences using the SMS Experience Sampling (SMS-ES) method. *International Journal of Market Research*, *53*(4), 1-27.

Anhøj, J., & Møldrup, C. (2004). Feasibility of collecting diary data from asthma patients through mobile phones and SMS (short message service): Response rate analysis and focus group evaluation from a pilot study. *Journal of Medical Internet Research*, *6*(4).

Baruffol, E., Verger, P., & Rotily, M. (2001). Using the telephone for mental health surveys: An analysis of the impact of call rank, non-response and interviewer effect. *Population*, (6), 987-1010.

Benson, S., Booman, W. P., & Clark, K. E. (1951). Study of interview refusals. *Journal of Applied Psychology, 35,* 116-119.

Bethlehem, J. G. (2002). Weighting nonresponse adjustments based on auxiliary information. In R. M. Groves, D. A. Dillman, J. L. Eltinge, & R. J. A. Little (Eds.), *Survey nonresponse* (pp. 275-287). New York: John Wiley and Sons.

Black, E., & Black, M. (1987). *Politics and society in the South*. Cambridge, MA: Harvard University Press.

Black, E., & Black, M. (2002). *The rise of southern Republicans*. Cambridge, MA: Harvard University Press.

Blumberg, S. J., Luke, & J. V. (2007). *Wireless substitution: Early release of estimates based on data from the National Health Interview Survey, July - December 2006.* Available online at <http://www.cdc.gov/nchs/nhis.htm>

Blumberg, S. J., & Luke, J. V. (2017). *Wireless substitution: Early release of estimates from the National Health Interview Survey, July - December 2016.* Available online at <http://www.cdc.gov/nchs/nhis.htm>

Blumberg, S. J., Luke, J. V., & Cynamon, M. L. (2006). Telephone coverage and health survey estimates: evaluating the need for concern about wireless substitution. *American Journal of Public Health*, *96*(5), 926-931.

Bosnjak, M., Metzger, G., & Gräf, L. (2010). Understanding the willingness to participate in mobile surveys: Exploring the role of utilitarian, affective, hedonic, social, self-expressive, and trust-related factors. *Social Science Computer Review*, *28*(3), 350-370.

Bosnjak, M., Neubarth, W., Couper, M. P., Bandilla, W., & Kaczmirek, L. (2008). Prenotification in web-based access panel surveys: The influence of mobile text messaging versus e-mail on response rates and sample composition. *Social Science Computer Review*, *26*(2), 213-223.

Brannon, R., Cypers, G., Hesse, S., Hesselbart, S., Keane, R., Schuman, H., Vaccaro, T. & Wright, D. (1973). Attitude and action: A field experiment joined to a general population survey. *American Sociological Review,* 38(October), 625-636.

Brehm, J. (1993). *The phantom respondents: Opinion surveys and political representation*. Ann Arbor, MI: University of Michigan Press.

Brenner, P., & DeLamater, J. (2012). *Using SMS text messaging to collect time use data*. Paper presented at the annual meeting of the American Association of Public Opinion Research (AAPOR).

Brick, J. M., Brick, P. D., Dipko, S., Presser, S., Tucker, C., & Yuan, Y. (2007). Cell phone survey feasibility in the US: Sampling and calling cell numbers versus landline numbers. *Public Opinion Quarterly*, *71*(1), 23-39.

Buskirk, T., Callegaro, M., & Steeh, C. (2004). Text 2 U: Contacting wireless subscribers using text messaging for mobile phone surveys. In *Annual Conference of the American Association of Public Opinion Research,* Phoenix, AZ.

Callegaro, M. (2002). *The cellular phone situation in Italy: Coverage, frames & billing systems.* Roundtable Presentation at the Joint WAPOR/AAPOR 57th Annual Conference of the American Association for Public Opinion Research, St. Petersburg Beach, FL.

Callegaro, M., & DiSogra, C. (2008). Computing response metrics for online panels. *Public Opinion Quarterly*, *72*(5), 1008-1032.

Callegaro, M., McCutcheon, A. L., & Ludwig, J. (2010). Who’s calling? The impact of caller ID on telephone survey response. *Field Methods*, *22*(2), 175-191.

Campanelli, P., & O’Muircheartaigh, C. (1999). Interviewers, interviewer continuity, and panel survey nonresponse. *Quality & Quantity 33*, 59-76.

Charoenruk, N. (2015). Interviewer voice characteristics and data quality (doctoral dissertation). Retrieved from http://digitalcommons.unl.edu/sramdiss/7/

Conrad, F. G., Schober, M. F., Zhang, C., Yan, H. G.., Vickers, L., Johnston, M., Hupp, A. G., Hemingway, L., Fail, S., Ehlen, P., & Antoun, C. (2013). *Mode choice on an iphone increases survey data quality*. Paper presented at the annual meeting of the American Association of Public Opinion Research (AAPOR), Boston, MA.

Cooke, M., Nielsen, A., & Strong, C. (2003). The use of SMS as a research tool. In *ASC 4th International Conference on Survey and Statistical Computing, 2003: The impact of technology on survey process* (pp. 267-276).

Couper, M. P. (1991). *Modeling survey participation at the interviewer level. Proceedings of the Survey Research Methods Section of the American Statistical Association.* Alexandria, VA: American Statistical Association.

Couper, M. P. (1997, August). Survey introductions and data quality. *Public Opinion Quarterly*, *61*(2), 317-338.

Couper, M. P., Singer, E., Conrad, F. G., & Groves, R. M. (2008). Risk of disclosure, perceptions of risk, and concerns about privacy and confidentiality as factors in survey participation. *Journal of Official Statistics*, *24*(2), 255-275.

Couper, M. P., Singer, E., & Kulka, D. A. (1998). Nonresponse to the 1990 census: Politics, privacy, and/or pressures. *American Politics Quarterly*, 26, 59-80.

Crawford, S. D., McClain, C. A., O’Brien, S., & Nelson, T. F. (2013). *Examining the feasibility of SMS as a contact mode for a college student survey*. Paper presented at the annual meeting of the American Association of Public Opinion Research (AAPOR), Boston, MA.

Curtin, R., Presser, S., & Singer, E. (2005). Changes in telephone survey nonresponse over the past quarter century. *Public Opinion Quarterly*, *69*(1), 87-98.

Dahlhamer, J. M., & Cox, C. S. (2007, November). Respondent consent to link survey data with administrative records: Results from a split-ballot field test with the 2007 National Health Interview survey. In *Proceedings of the Federal Committee on Statistical Methodology Research Conference*.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*, 319–339.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35,* 982-1002.

De Bruijne, M. & Wijnant, A. (2014, January). Improving response rates and questionnaire design for mobile web surveys. *Public Opinion Quarterly*, *78*(4), 951–962.

de Leeuw, E. D. (2004). I am not selling anything: 29 experiments in telephone introductions. *International Journal of Public Opinion Research,* 16, 464-473.

de Leeuw, E. D., & Heer, W. D. (2002, January). Trends in household survey nonresponse: A longitudinal and international comparison. In E. de Leeuw, W. de Heer, R. Groves, D. Dillman, J. L. Eltinge (Eds.), *Survey nonresponse* (pp. 41-54). New York: John Wiley & Sons.

Dillman, D. A. (1978). *Mail and telephone surveys: The total design method.* New York: John Wiley & Sons.

Dillman, D. A., Sinclair, M. D., & Clark, J. R. (1993). Effects of questionnaire length, respondent-friendly design, and a difficult question on response rates for occupant-addressed census mail surveys. *Public Opinion Quarterly*, *57*(3), 289-304.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method*. New York: John Wiley & Sons.

Down, J., & Duke, S. (2003). SMS polling. A methodological review. In *ASC 2003: The Impact of technology on the survey process* (pp. 277-286).

Duggan, M. (2013). *Cell phone activities 2013*. Washington, DC: Pew Research Center. Accessed online at <http://www.pewinternet.org/2013/09/19/cell-phone-activities-2013/>

Dunn, K. M., Jordan, K., Lacey, R. J., Shapley, M., & Jinks, C. (2004). Patterns of consent in epidemiologic research: Evidence from over 25,000 responders. *American Journal of Epidemiology*, *159*(11), 1087-1094.

Dutwin, D., Herrmann, M., Porath, E. B., & Sherr, S. (2011). A collection of caller ID experiments. *Survey Practice, 4*(4). Accessed online at <http://www.surveypractice.org/index.php/SurveyPractice/article/view/110>

Ehlen, J., & Ehlen, P. (2007). Cellular-only substitution in the United States as lifestyle adoption implications for telephone survey coverage. *Public Opinion Quarterly*, *71*(5), 717-733.

Enck, W., Traynor, P., McDaniel, P., & La Porta, T. (2005). Exploiting open functionality in SMS-capable cellular networks. In *Proceedings of the 12th ACM Conference on Computer and Communications Security* (pp. 393-404). Alexandria, VA: ACM.

Everett, S. E., & Everett, S. C. (1989). *Effects of interviewer affiliation and sex upon telephone survey refusal rates.* Paper presented at the Annual Conference of the Midwest Association for Public Opinion Research, Chicago.

Galesic, M., & Bosnjak, M. (2009). Effects of questionnaire length on participation and indicators of response quality in a web survey. *Public Opinion Quarterly*, *73*(2), 349-360.

Gallup. (2013, July). *Gallup daily methodology*. Unpublished documentation.

Goldberg, K., Pearson, C., & Eyers, L. (2006). *SMS and WAP: The shortcut to faster and better survey response?* ESOMAR, Panel Research, Barcelona. Located online at <https://www.esomar.org/web/research_papers/Web-Panel_1487_SMS-and-WAP.php>.

Goyder, J. (1985). Face-to-face interviews and mailed questionnaires: The net difference in response rates. *Public Opinion Quarterly*, 49, 234-252.

Goyder, J. (1987). *The silent minority: Nonrespondents on sample surveys*. Boulder, CO: Westview Press.

Groves, R. M. (2006). Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly*, *70*(5), 646-675.

Groves, R. M., Cialdini, R. B., & Couper, M. P. (1992, January). Understanding the decision to participate in a survey. *Public Opinion Quarterly*, *56*(4), 475–495.

Groves, R. M., & Coupler, M. P. (1998). *Nonresponse in household interview surveys*. New York: John Wiley & Sons.

Groves, R. M., Couper, M. P., Presser, S., Singer, E., Tourangeau, R., Acosta, G. P., & Nelson, L. (2006). Experiments in producing nonresponse bias. *Public Opinion Quarterly*, *70*(5), 720-736.

Groves, R. M., Fowler, F. J., Couper, M. P., Lepkowski, J. M., Singer, E., & Tourangeau, R. (2009). *Survey methodology*. New York: John Wiley & Sons.

Groves, R. M., & Fultz, N. H. (1985). Gender effects among telephone interviewers in a survey of economic attitudes. *Sociological Methods & Research*, *14*(1), 31-52.

Groves, R. M., & Peytcheva, E. (2008). The impact of nonresponse rates on nonresponse bias a meta-analysis. *Public Opinion Quarterly*, *72*(2), 167-189.

Groves, R. M., Presser, S., & Dipko, S. (2004). The role of topic interest in survey participation decisions. *Public Opinion Quarterly*, *68*(1), 2-31.

Groves, R. M., Singer, E., & Corning, A. (2000). Leverage-saliency theory of survey participation: description and an illustration. *Public Opinion Quarterly*, *64*(3), 299-308.

Hansen, K. M. (2006). The effects of incentives, interview length, and interviewer characteristics on response rates in a CATI-study. *International Journal of Public Opinion Research*, *19*(1), 112-121.

Hawkins, D. F. (1975, May). Estimation of nonresponse bias. *Sociological Methods and Research, 3*(May), 461-488.

Health and Retirement Study. (2004). *Sample weights, sample selection indicators and response rates for the psychosocial and disability leave-behind questionnaires in HRS 2004. HRS Technical Report*. Ann Arbor, MI: Author.

Heberlein, T. A., & Baumgartner, R. (1978, August). Factors affecting response rates to mailed questionnaires: A quantitative analysis of the published literature. *American Sociological Review, 43*(4), 447-462.

Hibbing, J. R., Smith, K. B., & Alford, J. R. (2014). Differences in negativity bias underlie variations in political ideology. *Behavioral and Brain Sciences*, *37*(03), 297-307.

Hillebrand, F. (2010). Who invented SMS? In short message service (SMS). In F. Hillebrand, F. Trosby, K. Holley, & I. Harris (Eds.), *Short message service (SMS): The creation of personal global text messaging*. New York: John Wiley & Sons.

Hillygus, D. S., & Shields, T. (2008). Southern discomfort? Regional differences in voter decision making in the 2000 presidential election. *Presidential Studies Quarterly, 38,* 506-520.

Hong, S., & Tam, K. Y. (2006). Understanding the adoption of multipurpose information appliances: The case of mobile data services. *Information Systems Research, 17*(2), 162-179.

House, J. S., & Wolf, S. (1978). Effects of urban residence on interpersonal trust and helping behavior. *Journal of Personality and Social Psychology, 36*, 1029-1043.

Jenkins, S. P., Cappellari, L., Lynn, P., Jäckle, A., & Sala, E. (2006). Patterns of consent: Evidence from a general household survey. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *169*(4), 701-722.

Jones, W. H. (1979). Generalizing main survey inducement methods: Population interactions with anonymity and sponsorship. *Public Opinion Quarterly*, *43*, 102-111.

Keeter, S., Dimock, M., Kennedy, C., Best, J., & Horrigan, J. (2008). Cost and benefits of full dual frame sample telephone survey design. In *63th Annual conference of the American Association for Public Opinion Research,* New Orleans, LA.

Keeter, S., Kennedy, C., Clark, A., Tompson, T., & Mokrzycki, M. (2007). What's missing from national landline RDD surveys? The impact of the growing cell-only population. *Public Opinion Quarterly*, *71*(5), 772-792.

Key, V. O., Jr. (2006 [1949]). *Southern politics in state and nation*. Knoxville, TN: University of Tennessee Press.

Kho, M. E., Duffett, M., Willison, D. J., Cook, D. J., & Brouwers, M. C. (2009). Written informed consent and selection bias in observational studies using medical records: Systematic review. *BMJ*, *338*, b866.

Korbmacher, J. M., & Schröder, M. (2013). Consent when linking survey data with administrative records: The role of the interviewer. *Survey Research Methods, 7*(2), 115-131. Southampton: European Survey Research Association.

Kousser, J. M. (2010). The immutability of categories and the reshaping of southern politics. *Annual Review of Political Science*, *13*, 365-383.

Krosnick, J. A. (1991). Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology*, *5*(3), 213-236.

Krosnick, J. A. (1999). Survey research. *Annual Review of Psychology*, *50*(1), 537-567.

Kuntsche, E., & Robert, B. (2009, July). Short message service (SMS) technology in alcohol research—A feasibility study. *Alcohol and Alcoholism*, *44*(4), 423–428.

Lee, S., Brick, J. M., Brown, E. R., & Grant, D. (2010). Growing cell-phone population and noncoverage bias in traditional random digit dial telephone health surveys. *Health Services Research*, *45*(4), 1121-1139.

Lenhart, A. (2010). *Cell phones and American adults: They make just as many calls, but text less often than teens*. Washington, DC: Pew Research Center. Accessed online at <http://www.pewinternet.org/2010/09/02/cell-phones-and-american-adults/>

Link, M. W., Mokdad, A. H., Kulp, D., & Hyon, A. (2006). Has the national do not call registry helped or hurt state-level response rates?: A time series analysis. *Public Opinion Quarterly, 70*(5), 794-809.

Link, M. W., Murphy, J., Schober, M. F., Buskirk, T. D., Childs, J. H., & Tesfaye, C. L. (2014). *Mobile technologies for conducting, augmenting and potentially replacing surveys: report of the AAPOR task force on emerging technologies in public opinion research.* Accessed online at <http://www.aapor.org/AAPORKentico/Education-Resources/Reports.aspx>

Link, M. W., & Oldendick, R. W. (1999). Call screening: Is it really a problem for survey research? *Public Opinion Quarterly*, *63*(4), 577-589.

Little, R. J. A. (1986). Survey nonresponse adjustments for estimates of means. *International Statistical Review*, *54*(2), 139-157.

Lozar Manfreda, K., & Vehovar, V. (2002). *Survey design features influencing response rates in web surveys*. Paper presented at International Conference on Improving Surveys, August 25-28, Copenhagen, Denmark.

Madden, M., & Rainie, L. (2015). *Americans' attitudes about privacy, security and surveillance*. Pew Research Center. Accessed online at < http://www.pewinternet.org/2015/05/20/americans-attitudes-about-privacy-security-and-surveillance/>

Marlar, J., & McGeeney, K. (2014). *May we text you a question? An experiment using text messages for survey research.* Paper presented at the annual conference of the American Association of Public Opinion Research, Anaheim, CA.

Mavletova, A., & Couper, M. P. (2013). Sensitive topics in PC web and mobile web surveys: is there a difference?. *Survey Research Methods*, *7*(3), 191-205.

Mavletova, A., & Couper, M. P. (2014). Mobile web survey design: Scrolling versus paging, SMS versus e-mail invitations. *Journal of Survey Statistics and Methodology*, *2*(4), 498-518.

Maxl, E., Haring, W., Tarkus, A., Altenstrasser, M., & Dolinar, M. (2010). Effects of mobile web survey invitation modes on non-response. *International Journal of Mobile Marketing*, *5*(1).

McCarty, C., House, M., Harman, J., & Richards, S. (2006). Effort in phone survey response rates: The effects of vendor and client-controlled factors. *Field Methods, 18*, 172-188.

Meng, X., Zerfos, P., Samanta, Y., Wong, S. H., & Lu, S. (2007, May). Analysis of the reliability of a nationwide short message service. In *INFOCOM 2007. 26th IEEE International Conference on Computer Communications. IEEE* (pp. 1811-1819). IEEE.

Nielsen. (2008). *In U.S. SMS text messaging tops mobile phone calling*. Available online at <http://acnielsen.no/us/en/insights/news/2008/in-us-text-messaging-tops-mobile-phone-calling.html>

Norris, D. A., & Hatcher, J. (1994). The impact of interviewer characteristics on response in a national survey of violence against women. *Screening*, *40*, 74-3.

Ofstedal, M. B., Guyer, H., Sakshaug, J. W., & Couper, M. P. (2010, July). *Changes in biomarker participation rates in the HRS.* Presented at the Panel Survey Methods Workshop, Mannheim, Germany.

Oksenberg, L., & Cannell, C. (1988). Effects of interviewer vocal characteristics on nonresponse. In R. M. Groves, P. B. Biemer, L. E. Lyberg, J. T. Massey, W. L. Nichols II, & J. Waksberg (Eds.), *Telephone survey methodology* (pp. 252-272). New York: John Wiley and Sons.

Oldendick, R. W., & Link, M. W. (1994). The answering machine generation: Who are they and what problem do they pose for survey research? *Public Opinion Quarterly*, *58*(2), 264-273.

Oxley, D. R., Smith, K. B., Alford, J. R., Hibbing, M. V., Miller, J. L., Scalora, M., Hatemi, P. K., & Hibbing, J. R. (2008). Political attitudes vary with physiological traits. *Science, 321*(5896), 1667-1670.

Pew Research Center. (2017). *Mobile fact sheet*. Available online at <http://www.pewinternet.org/fact-sheet/mobile/>

Peytchev, A., Carley-Baxter, L. R., & Black, M. C. (2010). Coverage bias in variances, associations, and total error from exclusion of the cell phone-only population in the United States. *Social Science Computer Review*, *28*(3), 287-302.

Peytchev, A., Carley-Baxter, L. R., & Black, M. L. (2008). *Coverage error in telephone surveys: Bias in estimates of intimate partner violence, variances, associations, and total error from exclusion of the cell phone-only population*. Ann Arbor, MI: AAPOR Proceedings.

Peytchev, A., & Neely, B. (2013, January). RDD telephone surveys toward a single-frame cell-phone design. *Public Opinion Quarterly*, *77*(1), 283-304.

Phan, K., & Daim, T. (2011). Exploring technology acceptance for mobile services. *Journal of Industrial Engineering and Management, 4*(2), 339-360.

Pickery, J., & Loosveldt, G. (2002). A multilevel multinomial analysis of interviewer effects on various components of unit nonresponse. *Quality and Quantity*, *36*(4), 427-437.

Potter, F. J. (1991). A study of procedures to identify and trim extreme sampling weights. *Proceedings of the Section on Survey Research Methods,* American Statistical Association (pp. 225-230).

Potter, F. J. (1993). The effect of weight trimming on nonlinear survey estimates. *Proceedings of the Section on Survey Research Methods*, American Statistical Association (pp. 758-768).

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. New York: Simon & Schuster.

Raghunathan, T. E., Lepkowski, J. M., Van Hoewyk, J., & Solenberger, P. (2001). A multivariate technique for multiply imputing missing values using a sequence of regression models. *Survey Methodology*, *27*, 85–95.

Royston, P. (2005a). Multiple imputation of missing values: Update. *Stata Journal*, *5*(2), 188-201.

Royston, P. (2005b). Multiple imputation of missing values: Update of ice. *Stata Journal, 5*(4), 527-536.

Royston, P. (2007). Multiple imputation of missing values: Further update of ice, with an emphasis on interval censoring. *Stata Journal, 7*(4), 445–464.

Royston, P. (2009). Multiple imputation of missing values: Further update of ice, with an emphasis on categorical variables. *Stata Journal, 9*(3), 466–477.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Rubin, D. B. (1996). Multiple imputation after 18+ years. *Journal of the American Statistical Association, 91*, 473–489.

Sakshaug, J. W. (2013). Using paradata to study response to within-survey requests. In F. Kreuter (Ed.), *Improving surveys with paradata* (pp. 171-190). New Jersey: John Wiley & Sons.

Sakshaug, J. W., Couper, M., & Ofstedal, M. (2010). Characteristics of physical measurement consent in a population-based survey of older adults. *Medical Car*e, *48*(1), 64-71.

Sakshaug, J. W., Couper, M. P., Ofstedal, M. B., & Weir, D. R. (2012). Linking survey and administrative records mechanisms of consent. *Sociological Methods & Research*, *41*(4), 535-569.

Sakshaug, J. W., & Kreuter, F. (2011). Using paradata and other auxiliary data to examine mode switch nonresponse in a "recruit-and-switch" telephone survey. *Journal of Official Statistics*, *27*(2), 339.

Sakshaug, J. W., Yan, T., & Tourangeau, R. (2010). Nonresponse error, measurement error, and mode of data collection: Tradeoffs in a multi-mode survey of sensitive and nonsensitive items. *Public Opinion Quarterly*, *74*(5), 907-933.

Sala, E., Burton, J., & Knies, G. (2012). Correlates of obtaining informed consent: Respondents, interviews, and interviewer characteristics. *Sociological Methods and Research, 41*(3), 414-439.

Schober, M. F., Conrad, G. G., Antoun, C., Bowers, A. W., Hupp, A. L., & Yan, H. (2013). *Conversational interaction and survey data quality in SMS text interviews*. Paper presented at the annual meeting of the American Association of Public Opinion Research (AAPOR).

Schuman, H., & Gruendberg, B. (1970, September). The impact of city on racial attitudes. *American Journal of Sociology, 76*, 213-261.

Schyberger, B. W. (1967). A study of interviewer behavior. *Journal of Marketing Research, 4*(1), 32-35.

Singer, E., Frankel, M. R., & Glassman, M. B. (1983). The effect of interviewer characteristics and expectations on response. *Public Opinion Quarterly*, *47*(1), 68-83.

Singer, E., Van Hoewyk, J., & Neugebauer, R. J. (2003). Attitudes and behavior: the impact of privacy and confidentiality concerns on participation in the 2000 Census. *Public Opinion Quarterly*, *67*(3), 368-384.

Singer, E., Von Thurn, D. R., & Miller, E. R. (1995, Spring). Confidentiality assurances and response: A quantitative review of the experimental literature. *Public Opinion Quarterly, 59*(1), 66-77.

Smith, A. (2015). *U.S. smartphone use in 2015*. Washington, DC: Pew Research Center. Accessed online at <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>

Smith, T. W. (1984). Estimating nonresponse bias with temporary refusals. *Sociological Perspectives*, *24*(4), 473-489.

Steeh, C., Buskirk, T. D., & Callegaro, M. (2007). Using text messages in U.S. mobile phone surveys. *Field Methods*, *19*(1), 59-75.

Steeh, C., & Piekarski, L. (2008). Accommodating new technologies: Mobile and VoIP communication. In J. M. Lepkowski, C. Tucker, J. M. Brick, E. D. de Leeuw, L.

Japec, P. J. Lavrakas, M. W. Link, & R. L. Sangster (Eds.), *Advances in telephone survey methodology* (pp. 423-446). New York: John Wiley Sons.

Telephone Consumer Protection Act of 1991, 47 U.S.C. §227. (2015).

Tourangeau, R., Groves, R. M., Kennedy, C., & Yan, T. (2009). The presentation of a web survey, nonresponse and measurement error among members of web panel. *Journal of Official Statistics*, *25*(3), 299.

Tuckel, P., & O'Neill, H. (2002). The vanishing respondent in telephone surveys. *Journal of Advertising Research*, *42*(5), 26-48.

U.S. Department of Education, National Center for Education Statistics. (2016). *Digest of Education Statistics, 2015* (NCES 2016-014), Chapter 7.

Virtanen, V., Sirkiä, T., & Jokiranta, V. (2007). Reducing nonresponse by SMS reminders in mail surveys. *Social Science Computer Review*, *25*(3), 384-395.

Widman, L., & Vogelius, L. (2002, June). *Daily reach using SMS measuring and reporting reach in real time*. ESOMAR/ARF WAM Conference. Cannes, France.

Zerfos, P., Meng, X., Wong, S. H. Y., Samanta, V., & Lu, S. (2006). A study of the short message service of a nationwide cellular network. In *Proceedings of the 6th ACM SIGCOMM conference on Internet measurement* (IMC '06) (pp. 263-268). ACM, New York.

Appendix

Table 31

Independent Variables: Percent Missing and Base-Weighted Descriptive Statistics for Imputed Respondent Characteristics

Respondent Characteristics	% Missing	%/Mean	S.E.	95% LB	95% UB
Economic Costs					
Household Income	15.56				
Under $999		14.04	0.33	13.37	14.71
$1,000 to $1,999		16.71	0.40	15.93	17.49
$2,000 to $2,999		15.19	0.25	14.70	15.69
$3,000 to $3,999		11.83	0.24	11.35	12.31
$4,000 to $4,999		10.06	0.21	9.66	10.47
$5,000 to $7,499		14.63	0.27	14.10	15.16
$7,500 to $9,999		6.18	0.15	5.88	6.47
$10,000 to $14,999		6.11	0.15	5.82	6.40
$15,000 and over		5.25	0.16	4.95	5.56
Employment Status	25.19				
Employed Full Time (Employer)		61.57	0.39	60.77	62.37
Employed Full Time (Self)		7.55	0.19	7.17	7.92
Employed Part Time (Do Not Want Full Time)		9.32	0.20	8.93	9.70
Employed Part Time (Want Full Time)		10.66	0.28	10.09	11.24
Unemployed		10.90	0.26	10.39	11.41
General Resistance					
Item Missing Rate	0.00	7.23	0.15	6.94	7.52
Call Attempts	0.00	2.22	0.02	2.17	2.27
Party Identification	0.00				
Republican		14.09	0.29	13.51	14.66
Lean Republican		8.44	0.20	8.05	8.83
Independent		8.79	0.26	8.27	9.30
Lean Democrat		9.40	0.22	8.96	9.83
Democrat		19.23	0.34	18.57	19.89
Refused		40.06	0.74	38.60	41.52
Political Views	49.39				
Very Conservative		6.84	0.19	6.45	7.23
Conservative		27.00	0.60	25.59	28.41
Moderate		39.73	0.54	38.52	40.95
Liberal		20.96	0.53	19.73	22.20
Very Liberal		5.46	0.18	5.09	5.83

Table 31 continues

Respondent Characteristics	% Missing	%/Mean	S.E.	95% LB	95% UB
Perceived Ease of Use					
Age	1.33				
15-24		21.69	0.33	21.05	22.32
25-34		23.25	0.30	22.66	23.85
35-49		27.65	0.32	27.01	28.28
50-64		19.40	0.24	18.94	19.86
65+		8.02	0.15	7.72	8.31
Education	2.07				
Less than high school diploma		12.93	0.51	11.93	13.93
High school degree or diploma		30.82	0.32	30.20	31.44
Technical/Vocational school		5.63	0.13	5.37	5.88
Some college		23.39	0.33	22.75	24.03
College graduate		16.50	0.26	15.99	17.00
Post graduate work or degree		10.74	0.20	10.35	11.13
Sociodemographics					
Gender	0.00				
Male		54.01	0.32	53.39	54.62
Female		45.99	0.32	45.38	46.61
Marital Status	1.04				
Single/Never been married		35.17	0.31	34.56	35.79
Married		42.02	0.31	41.41	42.62
Separated/Divorced		12.49	0.21	12.09	12.90
Widowed		3.25	0.10	3.06	3.44
Domestic partnerships/Living with partner (not legally married)		7.07	0.18	6.72	7.42
Religious Preference	3.25				
Protestant		16.72	0.28	16.18	17.26
Roman Catholic		23.48	0.60	22.31	24.65
Other Christian Religion		31.73	0.40	30.95	32.51
Other Non-Christian Religion		5.85	0.17	5.52	6.18
No Religion/Atheist/Agnostic		22.22	0.31	21.61	22.82
Religion Important	45.29				
Yes		60.61	0.63	59.20	62.02
No		39.39	0.63	37.98	40.80
Religious Attendance	45.79				
At least once a week		28.86	0.41	28.02	29.71
Almost every week		8.58	0.21	8.16	9.01
About once a month		13.48	0.31	12.84	14.13
Seldom		24.51	0.46	23.49	25.53
Never		24.56	0.36	23.86	25.26

Table 31 continues

Respondent Characteristics	% Missing	%/Mean	S.E.	95% LB	95% UB
Sociodemographics (cont'd)					
Race	2.99				
White		61.55	0.80	59.99	63.11
Black		4.10	0.13	3.85	4.35
Other		14.27	0.33	13.61	14.92
Hispanic		20.09	0.98	18.16	22.02

Notes. "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Table 32

Independent Variables: Percent Missing and Base-Weighted Descriptive Statistics for Imputed Social Environment

Social Environment	% Missing	Percent	S.E.	95% LB	95% UB
Economic Conditions					
Your Company: Hire/Reduce	34.38				
Hiring new people and expanding the size		42.84	0.48	41.80	43.88
Not changing the size of its workforce		41.63	0.41	40.77	42.50
Letting people go and the size		15.52	0.28	14.96	16.08
Direction of the National Economy	50.77				
Getting better		42.21	1.78	37.39	47.03
The same		3.17	0.15	2.86	3.49
Getting worse		54.62	1.69	50.05	59.18
Neighborhood Characteristics					
Census Region	0.00				
Northeast		18.16	0.77	16.66	19.66
Midwest		21.18	0.82	19.58	22.79
South		37.31	1.18	35.00	39.61
West		23.35	0.96	21.46	25.24

Notes. "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Table 33

Independent Variables: Percent Missing and Base-Weighted Descriptive Statistics for Imputed Interviewer Characteristics

Interviewer Characteristics	% Missing	%/Mean	S.E.	95% LB	95% UB
Experience					
Tenure (Months)	0.05	25.92	1.54	22.90	28.93
Sociodemographics					
Interviewer Gender	0.00				
Male		46.90	1.46	44.03	49.77
Female		53.10	1.46	50.23	55.97
Interviewer Race	0.00				
White		82.24	0.25	81.75	82.72
African American/Black		8.60	0.17	8.26	8.94
Other		9.16	0.20	8.77	9.55

Notes. “S.E.” represents standard error, “95% LB” represents the lower bound 95% confidence interval, and “95% UB” represents the upper bound 95% confidence interval. Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Table 34

Independent Variables: Percent Missing and Base-Weighted Descriptive Statistics for Imputed Survey Design

Survey Design	% Missing	Percent	S.E.	95% LB	95% UB
Questionnaire					
Survey Version	0.00				
Politics and Economy		50.08	1.12	47.88	52.28
Wellbeing		49.92	1.12	47.72	52.12
Length					
Number of Items*	0.00				
5 Items		50.32	0.55	49.24	51.40
12 Items		49.68	0.55	48.60	50.76
Survey Mode					
Experimental Design*	0.00				
Synchronous SMS		50.00	0.54	48.94	51.06
SMS with Embedded URL		50.00	0.54	48.94	51.06

Notes. *Sample restricted to the 13,333 sample units assigned to SMS experimental treatment groups. "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Table 35

Independent Variables: Percent Missing and Base-Weighted Descriptive Statistics for Imputed Survey Variables of Interest.

Survey Variables of Interest	% Missing	Percent	S.E.	95% LB	95% UB
Registered to Vote	62.84				
Yes, Registered		71.85	0.01	69.38	74.33
No, Not Registered/Plan to/Don't Need to Register		28.15	0.01	25.67	30.62
Obama Job Approval	53.52				
Approve		50.30	0.88	48.23	52.37
Disapprove		49.70	0.88	47.63	51.77
Economic Conditions	50.31				
Poor		36.05	1.65	31.57	40.53
Only Fair		45.51	0.92	43.19	47.84
Good/Excellent		18.44	0.92	16.00	20.88
Own Health Rating	50.20				
Excellent		14.40	0.34	13.69	15.11
Very Good		25.06	0.61	23.67	26.45
Good		31.42	0.32	30.78	32.05
Fair		20.23	0.68	18.65	21.81
Poor		8.90	0.35	8.17	9.63
Do you smoke?	50.16				
Yes		21.46	1.00	18.84	24.07
No		78.54	1.00	75.93	81.16
Health Insurance Coverage?	50.27				
Yes		72.57	0.87	70.70	74.43
No		27.43	0.87	25.57	29.30

Notes. "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors for weighted estimates are calculated using Taylor series linearization to account for complex sample survey design.

Table 36

Respondent Characteristics Model for SMS Consent

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 2096.6) 1.63	0.1104
Under $999	1.00	0.0006	0.0827	0.01	0.9950	-0.1619	0.1630		
$1,000 to $1,999	1.01	0.0073	0.0785	0.09	0.9260	-0.1469	0.1616		
$2,000 to $2,999	0.96	-0.0369	0.0750	-0.49	0.6230	-0.1841	0.1103		
$3,000 to $3,999	0.87	-0.1342	0.0704	-1.91	0.0570	-0.2722	0.0038		
$4,000 to $4,999	0.89	-0.1120	0.0705	-1.59	0.1120	-0.2504	0.0263		
$5,000 to $7,499	0.90	-0.1018	0.0640	-1.59	0.1120	-0.2273	0.0237		
$7,500 to $9,999	0.88	-0.1259	0.0737	-1.71	0.0870	-0.2704	0.0185		
$10,000 to $14,999	1.01	0.0077	0.0748	0.10	0.9180	-0.1391	0.1545		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 283.0) 4.69	0.0011
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.98	-0.0202	0.0606	-0.33	0.7400	-0.1404	0.1000		
Employed Part Time - Do Not Want Full Time	0.87	-0.1403	0.0631	-2.23	0.0270	-0.2644	-0.0163		
Employed Part Time - Want Full Time	1.16	0.1459	0.0641	2.28	0.0240	0.0193	0.2724		
Unemployed	1.21	0.1923	0.0695	2.77	0.0060	0.0550	0.3296		

Table 36 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance									
Item Nonresponse Rate	0.98	-0.0197	0.0028	-6.99	0.0000	-0.0252	-0.0141		
Call Attempts	1.03	0.0255	0.0127	2.01	0.0450	0.0006	0.0505		
Party Identification								(5, 2483.5) 3.85	0.0018
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	1.09	0.0868	0.0593	1.46	0.1440	-0.0296	0.2031		
Independent	0.91	-0.0982	0.0730	-1.34	0.1790	-0.2414	0.0451		
Lean Democrat	1.09	0.0863	0.0692	1.25	0.2120	-0.0494	0.2221		
Democrat	1.17	0.1552	0.0599	2.59	0.0100	0.0373	0.2731		
Refuse	1.00	0.0000	0.0518	0.00	1.0000	-0.1017	0.1017		
Political Views								(4, 56.6) 1.87	0.1279
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.94	-0.0589	0.0795	-0.74	0.4650	-0.2226	0.1047		
Moderate	0.98	-0.0243	0.0678	-0.36	0.7210	-0.1577	0.1091		
Liberal	1.09	0.0885	0.0910	0.97	0.3390	-0.0980	0.2750		
Very Liberal	1.15	0.1411	0.1037	1.36	0.1770	-0.0650	0.3473		
Perceived Ease of Use									
Age								(4, 2242.3) 31.36	0.0000
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.04	0.0437	0.0559	0.78	0.4340	-0.0659	0.1533		
35-49	1.13	0.1233	0.0561	2.20	0.0280	0.0134	0.2333		
50-64	0.84	-0.1765	0.0593	-2.97	0.0030	-0.2929	-0.0601		
65+	0.60	-0.5083	0.0725	-7.01	0.0000	-0.6505	-0.3661		

Table 36 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Perceived Ease of Use (cont'd)									
Education								(5, 3006.7) 22.14	0.0000
Less than high school diploma	1.42	0.3513	0.0697	5.04	0.0000	0.2146	0.4881		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	0.86	-0.1474	0.0632	-2.33	0.0200	-0.2714	-0.0234		
Some college	0.89	-0.1193	0.0429	-2.78	0.0050	-0.2035	-0.0351		
College graduate	0.72	-0.3323	0.0451	-7.37	0.0000	-0.4206	-0.2439		
Post graduate work or degree	0.76	-0.2797	0.0500	-5.59	0.0000	-0.3778	-0.1816		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	1.13	0.1184	0.0316	3.75	0.0000	0.0565	0.1803		
Marital Status								(4, 2854.9) 7.27	0.0000
Single/Never been married (Reference)	1.00	0.0029	0.0446	0.07	0.9480	-0.0844	0.0903		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	1.25	0.2240	0.0479	4.68	0.0000	0.1301	0.3179		
Widowed	1.02	0.0202	0.0926	0.22	0.8280	-0.1615	0.2019		
Domestic partnerships/Living with partner…	1.21	0.1908	0.0697	2.74	0.0060	0.0542	0.3274		
Religious Preference								(4, 1248.7) 1.75	0.1356
Protestant	1.05	0.0474	0.0631	0.75	0.4540	-0.0776	0.1724		
Roman Catholic	1.01	0.0069	0.0593	0.12	0.9080	-0.1099	0.1237		
Other Christian Religion	0.95	-0.0508	0.0594	-0.86	0.3930	-0.1682	0.0666		

Table 36 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographic (cont'd)									
Religious Preference (cont'd)									
Other Non-Christian Religion	0.90	-0.1077	0.0785	-1.37	0.1700	-0.2618	0.0463		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	1.06	0.0602	0.0566	1.07	0.2950	-0.0551	0.1756		
Religious Attendance								(4, 109.9) 1.63	0.1712
At least once a week	1.18	0.1645	0.0774	2.12	0.0450	0.0041	0.3249		
Almost every week	1.17	0.1610	0.0802	2.01	0.0470	0.0021	0.3199		
About once a month	1.07	0.0670	0.0665	1.01	0.3150	-0.0641	0.1980		
Seldom	1.07	0.0722	0.0594	1.22	0.2320	-0.0485	0.1929		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 2708.1) 46.74	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.94	-0.0607	0.0743	-0.82	0.4140	-0.2063	0.0850		
Other	1.69	0.5219	0.0564	9.25	0.0000	0.4112	0.6325		
Hispanic	1.49	0.4003	0.0518	7.73	0.0000	0.2987	0.5018		

Table 36 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Constant	1.22	0.1952	0.1150	1.70	0.0900	-0.0303	0.4207		
Model Statistics									
Average RVI:	0.1482								
Largest VFI:	0.4648								
Complete DF:	3,088								
DF:									
Min	22.44								
Average	1,331.90								
Max	3,081.77								
F(49, 2405.1)	14.84								
Prob>F	0.0000								

Note: Imputations=5; N=29,780; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 37

Social Environment Model for SMS Consent

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 45.5) 1.23	0.3021
Hiring new people and expanding the size	1.05	0.0475	0.0363	1.31	0.1940	-0.0244	0.1193		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.07	0.0662	0.0474	1.40	0.1650	-0.0277	0.1600		
Direction of the National Economy									
Getting better	1.25	0.2221	0.0347	6.40	0.0000	0.1536	0.2907	(2, 38.0) 17.51	0.0000
The same	1.10	0.0926	0.1091	0.85	0.4030	-0.1304	0.3157		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 3075.5) 9.71	0.0000
Northeast	0.80	-0.2288	0.0530	-4.32	0.0000	-0.3327	-0.1250		
Midwest	0.81	-0.2098	0.0457	-4.59	0.0000	-0.2995	-0.1201		
South (Reference)	-	-	-	-	-	-	-		
West	0.86	-0.1536	0.0477	-3.22	0.0010	-0.2471	-0.0601		
Constant	1.46	0.3775	0.0363	10.40	0.0000	0.3064	0.4487		

Table 37 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Model Statistics									
Average RVI:	0.1906								
Largest VFI:	0.4075								
Complete DF:	3088								
DF:									
Min	29.02								
Average	1,505.52								
Max	3,085.23								
F(7, 564.1)	9.14								
Prob>F	0.0000								

Note: Imputations=5; N=29,780; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 38

Interviewer Characteristics and Survey Design Model for SMS Consent

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Interviewer Characteristics									
Experience									
Tenure (Months)	0.9997	-0.0003	0.0003	-1.18	0.2380	-0.0009	0.0002		
Sociodemographics									
Interviewer Gender									
Female (Reference)	-	-	-	-	-	-	-		
Male	0.9353	-0.0669	0.0358	-1.87	0.0610	-0.1370	0.0032		
Interviewer Race								(2, 3086.0) 6.21	0.002
White (Reference)	-	-	-	-	-	-	-		
African American or Black	1.0430	0.0421	0.0587	0.72	0.4730	-0.0729	0.1572		
Other	1.2698	0.2389	0.0681	3.51	0.0000	0.1053	0.3724		
Questionnaire									
Survey Version									
Politics and Economy	0.8923	-0.1140	0.0356	-3.20	0.0010	-0.1837	-0.0442		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Constant	1.5773	0.4557	0.0339	13.45	0.0000	0.3893	0.5222		
Model Statistics									
Average RVI:	0.0005								
Largest VFI:	0.0027								
Complete DF:	3,088								

Table 38 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
DF:									
Min	3,061.15								
Average	3,081.72								
Max	3,085.99								
F(5, 3085.8)	5.80								
Prob>F	0.00								

Note: Imputations=5; N=29,780; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 39

Full Model for SMS Consent

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 2090.0) 1.62	0.1127
Under $999	1.01	0.0105	0.0834	0.13	0.8990	-0.1532	0.1743		
$1,000 to $1,999	1.02	0.0197	0.0805	0.25	0.8070	-0.1389	0.1783		
$2,000 to $2,999	0.97	-0.0278	0.0758	-0.37	0.7140	-0.1768	0.1211		
$3,000 to $3,999	0.88	-0.1260	0.0713	-1.77	0.0780	-0.2659	0.0139		
$4,000 to $4,999	0.90	-0.1061	0.0715	-1.48	0.1380	-0.2464	0.0342		
$5,000 to $7,499	0.91	-0.0949	0.0652	-1.45	0.1460	-0.2230	0.0333		
$7,500 to $9,999	0.88	-0.1226	0.0743	-1.65	0.0990	-0.2683	0.0231		
$10,000 to $14,999	1.01	0.0121	0.0752	0.16	0.8720	-0.1355	0.1597		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 234.1) 5.04	0.0007
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.98	-0.0190	0.0628	-0.30	0.7630	-0.1444	0.1064		
Employed Part Time - Do Not Want Full Time	0.87	-0.1409	0.0632	-2.23	0.0260	-0.2652	-0.0166		
Employed Part Time - Want Full Time	1.16	0.1459	0.0651	2.24	0.0270	0.0172	0.2745		
Unemployed	1.24	0.2181	0.0707	3.09	0.0020	0.0785	0.3577		

Table 39 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance									
Item Nonresponse Rate	0.98	-0.0239	0.0039	-6.18	0.0000	-0.0315	-0.0163		
Call Attempts	1.03	0.0256	0.0128	1.99	0.0460	0.0004	0.0507		
Party Identification								(5, 2570.2) 2.49	0.0295
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	1.09	0.0868	0.0597	1.45	0.1460	-0.0302	0.2037		
Independent	0.91	-0.0900	0.0727	-1.24	0.2160	-0.2326	0.0525		
Lean Democrat	1.07	0.0671	0.0694	0.97	0.3340	-0.0692	0.2034		
Democrat	1.14	0.1315	0.0606	2.17	0.0310	0.0124	0.2507		
Refuse	1.04	0.0371	0.0575	0.65	0.5190	-0.0756	0.1498		
Political Views								(4, 57.9) 1.79	0.1431
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.94	-0.0592	0.0770	-0.77	0.4480	-0.2162	0.0978		
Moderate	0.97	-0.0279	0.0684	-0.41	0.6840	-0.1625	0.1067		
Liberal	1.09	0.0831	0.0891	0.93	0.3580	-0.0983	0.2644		
Very Liberal	1.15	0.1355	0.1024	1.32	0.1890	-0.0675	0.3385		
Perceived Ease of Use									
Age								(4, 2133.9) 28.50	0.0000
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.04	0.0426	0.0554	0.77	0.4420	-0.0661	0.1513		

Table 39 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Perceived Ease of Use (cont'd)									
Age (cont'd)									
35-49	1.14	0.1280	0.0561	2.28	0.0230	0.0179	0.2381		
50-64	0.85	-0.1622	0.0597	-2.72	0.0070	-0.2793	-0.0452		
65+	0.62	-0.4845	0.0738	-6.56	0.0000	-0.6293	-0.3396		
Education								(5, 2957.2) 22.64	0.0000
Less than high school diploma	1.41	0.3454	0.0701	4.93	0.0000	0.2080	0.4828		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	0.86	-0.1534	0.0634	-2.42	0.0160	-0.2777	-0.0291		
Some college	0.88	-0.1224	0.0430	-2.85	0.0040	-0.2067	-0.0381		
College graduate	0.71	-0.3432	0.0454	-7.57	0.0000	-0.4321	-0.2542		
Post graduate work or degree	0.74	-0.3015	0.0506	-5.95	0.0000	-0.4008	-0.2022		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	1.14	0.1292	0.0317	4.07	0.0000	0.0670	0.1913		
Marital Status								(4, 2857.2) 7.20	0.0000
Single/Never been married (Reference)	1.01	0.0088	0.0446	0.20	0.8440	-0.0787	0.0963		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	1.25	0.2245	0.0479	4.68	0.0000	0.1305	0.3185		
Widowed	1.02	0.0167	0.0927	0.18	0.8570	-0.1651	0.1986		
Domestic partnerships/Living with partner…	1.21	0.1921	0.0696	2.76	0.0060	0.0557	0.3286		

Table 39 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographics (cont'd)									
Religious Preference								(4, 1543.2) 1.57	0.1801
Protestant	1.04	0.0409	0.0623	0.66	0.5120	-0.0823	0.1642		
Roman Catholic	1.02	0.0177	0.0593	0.30	0.7660	-0.0990	0.1343		
Other Christian Religion	0.95	-0.0502	0.0583	-0.86	0.3910	-0.1652	0.0648		
Other Non-Christian Religion	0.91	-0.0974	0.0784	-1.24	0.2140	-0.2511	0.0564		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	1.06	0.0568	0.0572	0.99	0.3290	-0.0601	0.1738		
Religious Attendance								(4, 118.7) 1.53	0.1970
At least once a week	1.17	0.1589	0.0753	2.11	0.0440	0.0045	0.3133		
Almost every week	1.16	0.1512	0.0794	1.91	0.0590	-0.0057	0.3082		
About once a month	1.06	0.0616	0.0661	0.93	0.3520	-0.0684	0.1917		
Seldom	1.07	0.0720	0.0583	1.23	0.2240	-0.0458	0.1899		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 2696.9) 40.16	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.94	-0.0641	0.0748	-0.86	0.3910	-0.2107	0.0825		
Other	1.64	0.4926	0.0575	8.57	0.0000	0.3798	0.6054		
Hispanic	1.45	0.3716	0.0528	7.04	0.0000	0.2682	0.4751		

Table 39 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 41.1) 1.15	0.3274
Hiring new people and expanding the size	0.97	-0.0303	0.0366	-0.83	0.4080	-0.1026	0.0419		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.05	0.0472	0.0513	0.92	0.3620	-0.0560	0.1504		
Direction of the National Economy								(2, 42.0) 7.65	0.0015
Getting better	1.17	0.1556	0.0357	4.36	0.0000	0.0855	0.2258		
The same	1.08	0.0763	0.1119	0.68	0.5000	-0.1521	0.3048		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 3049.4) 5.50	0.0009
Northeast	0.84	-0.1774	0.0473	-3.75	0.0000	-0.2701	-0.0847		
Midwest	0.90	-0.1083	0.0434	-2.50	0.0130	-0.1933	-0.0232		
South (Reference)	-	-	-	-	-	-	-		
West	0.89	-0.1143	0.0435	-2.63	0.0090	-0.1996	-0.0291		
Interviewer Characteristics									
Experience									
Tenure (Months)	1.00	-0.0002	0.0003	-0.68	0.4980	-0.0007	0.0003		
Interviewer Gender									
Female (Reference)	-	-	-	-	-	-	-		
Male	0.96	-0.0434	0.0318	-1.36	0.1720	-0.1057	0.0189		

Table 39 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Interviewer Characteristics (cont'd)									
Experience (cont'd)									
Interviewer Race								(2, 3079.1) 1.19	0.3040
White (Reference)	-	-	-	-	-	-	-		
African American or Black	1.08	0.0815	0.0560	1.45	0.1460	-0.0283	0.1913		
Other	1.04	0.0380	0.0595	0.64	0.5240	-0.0788	0.1547		
Design									
Politics and Economy	1.10	0.0983	0.0583	1.69	0.0920	-0.0160	0.2126		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Constant	1.22	0.1969	0.1203	1.64	0.1020	-0.0390	0.4328		
Model Statistics									
Average RVI:	0.1464								
Largest VFI:	0.4224								
Complete DF:	3088								
DF:									
Min	27.04								
Average	1,455.03								
Max	3,085.04								
F(61, 2532.4)	12.47								
Prob>F	0.000								

Note: Imputations=5; N=29,780; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 40

Parsimonious Model for SMS Consent

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Employment Status								(4, 228.9) 5.47	0.0003
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.99	-0.0140	0.0613	-0.23	0.8200	-0.1360	0.1080		
Employed Part Time - Do Not Want Full Time	0.89	-0.1186	0.0625	-1.90	0.0590	-0.2418	0.0045		
Employed Part Time - Want Full Time	1.19	0.1739	0.0648	2.68	0.0090	0.0451	0.3028		
Unemployed	1.25	0.2200	0.0671	3.28	0.0010	0.0874	0.3525		
General Resistance									
Item Missing Rate	0.98	-0.0190	0.0028	-6.69	0.0000	-0.0245	-0.0134		
Call Attempts	1.03	0.0293	0.0128	2.29	0.0220	0.0042	0.0544		
Party Identification								(5, 3060.5) 3.72	0.0023
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	1.07	0.0685	0.0593	1.16	0.2480	-0.0478	0.1848		
Independent	0.88	-0.1253	0.0702	-1.79	0.0740	-0.2629	0.0123		
Lean Democrat	1.05	0.0473	0.0644	0.73	0.4630	-0.0791	0.1736		
Democrat	1.14	0.1298	0.0528	2.46	0.0140	0.0262	0.2333		
Refuse	0.98	-0.0228	0.0488	-0.47	0.6410	-0.1184	0.0729		

Table 40 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Perceived Ease of Use									
Age								(4, 2484.6) 28.25	0.0000
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.05	0.0448	0.0553	0.81	0.4170	-0.0636	0.1532		
35-49	1.15	0.1406	0.0556	2.53	0.0120	0.0315	0.2497		
50-64	0.87	-0.1368	0.0587	-2.33	0.0200	-0.2519	-0.0217		
65+	0.63	-0.4587	0.0717	-6.39	0.0000	-0.5994	-0.3180		
Education								(5,2995.2) 26.22	0.0000
Less than high school diploma	1.44	0.3630	0.0692	5.24	0.0000	0.2273	0.4987		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	0.86	-0.1539	0.0633	-2.43	0.0150	-0.2780	-0.0299		
Some college	0.88	-0.1269	0.0427	-2.97	0.0030	-0.2106	-0.0432		
College graduate	0.71	-0.3384	0.0437	-7.75	0.0000	-0.4241	-0.2528		
Post graduate work or degree	0.76	-0.2759	0.0470	-5.87	0.0000	-0.3681	-0.1837		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	1.15	0.1426	0.0314	4.54	0.0000	0.0810	0.2041		
Marital Status								(4, 2921.5) 7.05	0.0000
Single/Never been married (Reference)	1.01	0.0058	0.0432	0.13	0.8940	-0.0790	0.0905		
Married (Reference)	-	-	-	-	-	-	-		

Table 40 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographic (con'td)									
Marital Status (cont'd)									
Separated/Divorced	1.25	0.2226	0.0467	4.77	0.0000	0.1310	0.3142		
Widowed	1.03	0.0311	0.0913	0.34	0.7340	-0.1480	0.2101		
Domestic partnerships/Living with partner…	1.20	0.1785	0.0692	2.58	0.0100	0.0428	0.3141		
Race								(3, 2793.8) 50.09	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.94	-0.0638	0.0733	-0.87	0.3840	-0.2077	0.0800		
Other	1.67	0.5102	0.0535	9.53	0.0000	0.4053	0.6152		
Hispanic	1.53	0.4248	0.0514	8.26	0.0000	0.3240	0.5256		
Social Environment									
Economic Conditions									
Direction of the National Economy								(2, 33.2) 6.69	0.0036
Getting better	1.16	0.1468	0.0364	4.03	0.0000	0.0748	0.2187		
The same	1.07	0.0681	0.1119	0.61	0.5470	-0.1606	0.2969		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3,3082.1) 6.53	0.0002
Northeast	0.83	-0.1869	0.0463	-4.04	0.0000	-0.2776	-0.0962		
Midwest	0.89	-0.1115	0.0429	-2.60	0.0090	-0.1956	-0.0274		
South (Reference)	-	-	-	-	-	-	-		
West	0.88	-0.1294	0.0432	-3.00	0.0030	-0.2141	-0.0447		
Constant	1.28	0.2465	0.0781	3.16	0.0020	0.0934	0.3996		

Table 40 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Model Statistics									
Average RVI:	0.0641								
Largest VFI:	0.4065								
Complete DF:	3088								
DF:									
Min	29.16								
Average	2,220.60								
Max	3,084.15								
F(33, 2821.1)	22.79								
Prob>F	0.000								

Note: Imputations=5; N=29,780; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 41

Respondent Characteristics Model for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1786.3) 1.98	0.0459
Under $999	0.73	-0.3083	0.2248	-1.37	0.1720	-0.7518	0.1351		
$1,000 to $1,999	0.66	-0.4191	0.1741	-2.41	0.0160	-0.7605	-0.0777		
$2,000 to $2,999	0.72	-0.3231	0.1669	-1.94	0.0540	-0.6518	0.0055		
$3,000 to $3,999	0.89	-0.1166	0.1576	-0.74	0.4590	-0.4258	0.1926		
$4,000 to $4,999	0.92	-0.0830	0.1521	-0.55	0.5850	-0.3814	0.2154		
$5,000 to $7,499	0.90	-0.1042	0.1306	-0.80	0.4260	-0.3609	0.1525		
$7,500 to $9,999	1.10	0.0914	0.1451	0.63	0.5290	-0.1934	0.3762		
$10,000 to $14,999	1.12	0.1168	0.1474	0.79	0.4280	-0.1729	0.4066		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 157.8) 2.10	0.0834
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.97	-0.0355	0.1398	-0.25	0.8000	-0.3117	0.2408		
Employed Part Time - Do Not Want Full Time	1.31	0.2667	0.1543	1.73	0.0930	-0.0471	0.5804		
Employed Part Time - Want Full Time	1.06	0.0572	0.1536	0.37	0.7100	-0.2447	0.3590		
Unemployed	0.66	-0.4163	0.2168	-1.92	0.0610	-0.8528	0.0201		

Table 41 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
General Resistance									
Item Missing Rate	0.99	-0.0068	0.0068	-0.99	0.3200	-0.0202	0.0066		
Call Attempts	0.96	-0.0382	0.0317	-1.21	0.2280	-0.1004	0.0239		
Party Identification								(5, 2470.0) 3.11	0.0084
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	1.03	0.0322	0.1296	0.25	0.8040	-0.2220	0.2863		
Independent	0.70	-0.3536	0.1878	-1.88	0.0600	-0.7219	0.0148		
Lean Democrat	0.88	-0.1247	0.1500	-0.83	0.4060	-0.4189	0.1694		
Democrat	0.93	-0.0760	0.1231	-0.62	0.5370	-0.3174	0.1654		
Refuse	0.71	-0.3408	0.1200	-2.84	0.0050	-0.5762	-0.1055		
Political Views								(4, 78.1) 1.13	0.3493
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.79	-0.2349	0.1571	-1.49	0.1400	-0.5484	0.0786		
Moderate	0.71	-0.3410	0.1597	-2.13	0.0370	-0.6606	-0.0214		
Liberal	0.74	-0.3062	0.1862	-1.64	0.1070	-0.6814	0.0691		
Very Liberal	0.84	-0.1739	0.2184	-0.80	0.4300	-0.6129	0.2652		
Perceived Ease of Use									
Age								(4, 2022.9) 1.18	0.3156
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.03	0.0321	0.1282	0.25	0.8020	-0.2194	0.2836		
35-49	0.97	-0.0337	0.1359	-0.25	0.8040	-0.3001	0.2328		
50-64	0.91	-0.0931	0.1430	-0.65	0.5150	-0.3737	0.1874		
65+	0.76	-0.2705	0.1648	-1.64	0.1010	-0.5938	0.0527		

Table 41 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Perceived Ease of Use (cont'd)									
Education								(5, 2473.2) 14.89	0.0000
Less than high school diploma	0.44	-0.8264	0.3188	-2.59	0.0100	-1.4515	-0.2013		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.54	0.4326	0.1786	2.42	0.0160	0.0822	0.7829		
Some college	1.91	0.6453	0.1238	5.21	0.0000	0.4027	0.8880		
College graduate	2.34	0.8509	0.1282	6.64	0.0000	0.5994	1.1023		
Post graduate work or degree	2.47	0.9026	0.1370	6.59	0.0000	0.6339	1.1713		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	0.92	-0.0826	0.0743	-1.11	0.2670	-0.2285	0.0633		
Marital Status								(4, 2455.5) 1.77	0.1323
Single/Never been married (Reference)	1.04	0.0352	0.0989	0.36	0.7220	-0.1588	0.2292		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	0.92	-0.0781	0.1099	-0.71	0.4780	-0.2937	0.1375		
Widowed	0.74	-0.2979	0.2196	-1.36	0.1750	-0.7285	0.1326		
Domestic partnerships/Living with partner…	1.36	0.3080	0.1513	2.04	0.0420	0.0113	0.6047		
Religious Preference								(4, 1543.5) 2.26	0.0604
Protestant	1.24	0.2127	0.1345	1.58	0.1150	-0.0527	0.4781		
Roman Catholic	1.00	-0.0007	0.1280	-0.01	0.9960	-0.2521	0.2507		
Other Christian Religion	0.93	-0.0779	0.1345	-0.58	0.5630	-0.3425	0.1867		

Table 41 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Sociodemographics (cont'd)									
Religious Preference (cont'd)									
Other Non-Christian Religion	0.93	-0.0710	0.1672	-0.42	0.6710	-0.3992	0.2572		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	0.96	-0.0380	0.1245	-0.31	0.7610	-0.2848	0.2088		
Religious Attendance								(4, 61.5) 2.27	0.0717
At least once a week	0.68	-0.3872	0.1885	-2.05	0.0520	-0.7780	0.0035		
Almost every week	0.95	-0.0553	0.2232	-0.25	0.8060	-0.5146	0.4040		
About once a month	0.64	-0.4391	0.1802	-2.44	0.0200	-0.8039	-0.0743		
Seldom	0.85	-0.1645	0.1376	-1.20	0.2440	-0.4486	0.1196		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 2180.7) 15.97	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.55	-0.5962	0.1920	-3.10	0.0020	-0.9728	-0.2197		
Other	0.58	-0.5491	0.1339	-4.10	0.0000	-0.8117	-0.2866		
Hispanic	0.43	-0.8442	0.1511	-5.59	0.0000	-1.1404	-0.5479		
Constant	0.19	-1.6366	0.2647	-6.18	0.0000	-2.1571	-1.1161		
Model Statistics									
Average RVI:	0.1665								
Largest VFI:	0.4665								
Complete DF:	2,549.00								

Table 41 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
DF:									
Min	22.21								
Average	1,217.68								
Max	2,538.95								
F(49, 1983.4)	7.97								
Prob>F	0.0000								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 42

Respondent Characteristics Model for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1835.5) 1.55	0.1350
Under $999	0.69	-0.3707	0.2732	-1.36	0.1750	-0.9069	0.1656		
$1,000 to $1,999	0.70	-0.3633	0.2318	-1.57	0.1170	-0.8178	0.0912		
$2,000 to $2,999	0.82	-0.1926	0.2145	-0.9	0.3690	-0.6137	0.2284		
$3,000 to $3,999	0.90	-0.1080	0.2014	-0.54	0.5920	-0.5032	0.2871		
$4,000 to $4,999	0.89	-0.1137	0.1822	-0.62	0.5330	-0.4715	0.2442		
$5,000 to $7,499	0.92	-0.0822	0.1534	-0.54	0.5930	-0.3837	0.2194		
$7,500 to $9,999	1.21	0.1895	0.1813	1.05	0.2960	-0.1661	0.5452		
$10,000 to $14,999	1.29	0.2545	0.1856	1.37	0.1710	-0.1107	0.6197		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 38.9) 0.98	0.4320
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.91	-0.0996	0.2767	-0.36	0.7260	-0.7155	0.5164		
Employed Part Time - Do Not Want Full Time	1.31	0.2702	0.2911	0.93	0.3750	-0.3780	0.9185		
Employed Part Time - Want Full Time	1.00	0.0030	0.2580	0.01	0.9910	-0.5149	0.5210		
Unemployed	0.57	-0.5577	0.3019	-1.85	0.0740	-1.1715	0.0561		

Table 42 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance									
Item Nonresponse Rate	0.98	-0.0172	0.0110	-1.56	0.1190	-0.0390	0.0045		
Call Attempts	0.95	-0.0556	0.0447	-1.24	0.2130	-0.1432	0.0320		
Party Identification								(5, 2404.5) 5.56	0.0000
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	0.85	-0.1585	0.2270	-0.7	0.4850	-0.6036	0.2866		
Independent	0.35	-1.0372	0.2929	-3.54	0.0000	-1.6116	-0.4629		
Lean Democrat	0.65	-0.4369	0.2777	-1.57	0.1160	-0.9817	0.1078		
Democrat	0.78	-0.2474	0.2507	-0.99	0.3240	-0.7391	0.2442		
Refuse	0.48	-0.7399	0.2471	-2.99	0.0030	-1.2245	-0.2553		
Political Views								(4, 107.9) 0.28	0.8926
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.85	-0.1675	0.3151	-0.53	0.6020	-0.8320	0.4971		
Moderate	0.78	-0.2470	0.2823	-0.87	0.3900	-0.8272	0.3332		
Liberal	0.77	-0.2659	0.3244	-0.82	0.4210	-0.9382	0.4064		
Very Liberal	0.86	-0.1536	0.3038	-0.51	0.6140	-0.7539	0.4466		
Perceived Ease of Use									
Age								(4, 1403.5) 0.35	0.8460
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.02	0.0228	0.2057	0.11	0.9120	-0.3807	0.4263		
35-49	0.98	-0.0236	0.2092	-0.11	0.9100	-0.4338	0.3866		
50-64	0.97	-0.0269	0.2230	-0.12	0.9040	-0.4642	0.4104		
65+	0.80	-0.2235	0.2655	-0.84	0.4000	-0.7443	0.2972		

Table 42 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Perceived Ease of Use (cont'd)									
Education								(5, 2325.1) 16.58	0.0000
Less than high school diploma	0.52	-0.6603	0.3753	-1.76	0.0790	-1.3964	0.0757		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.52	0.4156	0.1990	2.09	0.0370	0.0254	0.8059		
Some college	2.08	0.7339	0.1447	5.07	0.0000	0.4501	1.0177		
College graduate	2.72	1.0006	0.1436	6.97	0.0000	0.7190	1.2822		
Post graduate work or degree	3.06	1.1181	0.1591	7.03	0.0000	0.8061	1.4302		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	0.96	-0.0452	0.1269	-0.36	0.7220	-0.2943	0.2038		
Marital Status								(4, 2394.2) 1.92	0.1042
Single/Never been married (Reference)	1.05	0.0494	0.1589	0.31	0.7560	-0.2624	0.3612		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	0.94	-0.0618	0.1734	-0.36	0.7220	-0.4019	0.2783		
Widowed	0.53	-0.6401	0.2759	-2.32	0.0200	-1.1812	-0.0990		
Domestic partnerships/Living with partner…	1.34	0.2950	0.2238	1.32	0.1880	-0.1439	0.7339		
Religious Preference								(4, 1496.1) 1.50	0.2012
Protestant	1.21	0.1920	0.2101	0.91	0.3620	-0.2232	0.6072		
Roman Catholic	0.90	-0.1075	0.1847	-0.58	0.5610	-0.4705	0.2556		
Other Christian Religion	1.08	0.0798	0.2122	0.38	0.7070	-0.3371	0.4967		

Table 42 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographics (cont'd)									
Religious Preference (cont'd)									
Other Non-Christian Religion	0.82	-0.2034	0.2178	-0.93	0.3510	-0.6310	0.2242		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	1.07	0.0716	0.2133	0.34	0.7380	-0.3527	0.4959		
Religious Attendance								(4, 61.1) 1.58	0.1902
At least once a week	0.52	-0.6491	0.2933	-2.21	0.0290	-1.2302	-0.0679		
Almost every week	0.78	-0.2500	0.3568	-0.7	0.4880	-0.9714	0.4714		
About once a month	0.53	-0.6357	0.3518	-1.81	0.0840	-1.3638	0.0923		
Seldom	0.85	-0.1655	0.2546	-0.65	0.5230	-0.6977	0.3667		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 1733.0) 13.47	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.38	-0.9559	0.2066	-4.63	0.0000	-1.3610	-0.5509		
Other	0.61	-0.4946	0.2153	-2.3	0.0220	-0.9175	-0.0717		
Hispanic	0.34	-1.0682	0.2053	-5.2	0.0000	-1.4710	-0.6655		
Constant	0.19	-1.6367	0.3998	-4.09	0.0000	-2.4287	-0.8447		
Model Statistics									
Average RVI:	0.26								
Largest VFI:	0.68								
Complete DF:	2,549.00								

Table 42 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
DF:									
Min	10.05								
Average	1,082.75								
Max	2,490.65								
F(49, 1610.8)	13.48								
Prob>F	0.00								

Note**:** Imputations=5; N=13,333; “S.E.” represents standard error, “95% LB” represents the lower bound 95% confidence interval, and “95% UB” represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 43

Social Environment Model for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 58.8) 3.91	0.025
Hiring new people and expanding the size	0.81	-0.2126	0.0853	-2.49	0.0150	-0.3825	-0.0426		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.03	0.0301	0.1026	0.29	0.7690	-0.1724	0.2326		
Direction of the National Economy								(2, 14.3) 0.01	0.987
Getting better	0.98	-0.0154	0.1071	-0.14	0.8880	-0.2490	0.2182		
The same	0.97	-0.0296	0.2840	-0.10	0.9180	-0.6203	0.5611		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 2543.5) 1.30	0.271
Northeast	1.09	0.0898	0.0964	0.93	0.3520	-0.0992	0.2788		
Midwest	1.12	0.1158	0.0947	1.22	0.2220	-0.0699	0.3014		
South (Reference)	-	-	-	-	-	-	-		
West	1.18	0.1621	0.0860	1.89	0.0590	-0.0065	0.3307		

Table 43 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment (cont'd)									
Questionnaire									
Survey Version									
Politics/Economy	1.26	0.2339	0.0697	3.35	0.0010	0.0971	0.3706		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Constant	0.09	-2.4116	0.0842	-28.63	0.0000	-2.5770	-2.2462		
Model Statistics									
Average RVI:	0.3300								
Largest VFI:	0.6335								
Complete DF:	2549.00								
DF:									
Min	11.88								
Average	1,229.91								
Max	2,537.49								
F(8, 308.5)	2.46								
Prob>F	0.0135								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 44

Social Environment Model for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 43.2) 2.97	0.0616
Hiring new people and expanding the size	0.82	-0.2015	0.0880	-2.29	0.0240	-0.3761	-0.0269		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.03	0.0263	0.1124	0.23	0.8150	-0.1975	0.2502		
Direction of the National Economy								(2, 15.4) 0.01	0.9895
Getting better	1.01	0.0136	0.1094	0.12	0.9030	-0.2222	0.2494		
The same	0.99	-0.0151	0.3009	-0.05	0.9600	-0.6406	0.6104		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 2544.1) 1.01	0.3893
Northeast	1.06	0.0547	0.1030	0.53	0.5960	-0.1473	0.2567		
Midwest	1.11	0.1045	0.0987	1.06	0.2900	-0.0891	0.2981		
South (Reference)	-	-	-	-	-	-	-		
West	1.16	0.1499	0.0903	1.66	0.0970	-0.0272	0.3269		
Questionnaire									
Survey Version									
Politics/Economy	1.26	0.2341	0.0729	3.21	0.0010	0.0911	0.3771		
Wellbeing (Reference)	-	-	-	-	-	-	-		

Table 44 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment (cont'd)									
Constant	0.08	-2.5424	0.0899	-28.29	0.0000	-2.7191	-2.3658		
Model Statistics									
Average RVI:	0.31								
Largest VFI:	0.60								
Complete DF:	2,549								
DF:									
Min	13.35								
Average	1,192.87								
Max	2,539.76								
F(8, 337.4)	2.10								
Prob>F	0.04								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 45

Survey Design Model Without Interaction for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.05	0.0505	0.0695	0.73	0.4680	-0.0858	0.1869		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.79	-0.2307	0.0686	-3.4	0.0010	-0.3653	-0.0962		
Constant	0.11	-2.2223	0.0591	-38	0.0000	-2.3383	-2.1064		
Model Statistics									
Average RVI:	0.00								
Largest VFI:	0.00								
Complete DF:	2549.00								
DF:									
Min	2,547.00								
Average	2,547.00								
Max	2,547.00								
F(2, 2547.0)	6.13								
Prob>F	0.00								

Note: Imputations=5; N=13,333; “S.E.” represents standard error, “95% LB” represents the lower bound 95% confidence interval, and “95% UB” represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 46

Survey Design Model With Interaction for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	0.95	-0.0532	0.0936	-0.6	0.5700	-0.2368	0.1305		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.71	-0.3492	0.0994	-3.5	0.0000	-0.5440	-0.1543		
Interaction									
Items x Experimental Design	1.26	0.2294	0.1371	1.67	0.0940	-0.0394	0.4981		
Constant	0.11	-2.1704	0.0662	-33	0.0000	-2.3002	-2.0405		
Model Statistics									
Average RVI:	0.00								
Largest VFI:	0.00								
Complete DF:	2549.00								
DF:									
Min	2547.00								
Average	2547.00								
Max	2547.00								
F(3, 2547.0)	4.80								
Prob>F	0.00								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 47

Survey Design Model Without Interaction for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.18	0.1695	0.0725	2.34	0.0200	0.0273	0.3117		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.89	-0.1170	0.0709	-1.65	0.0990	-0.2560	0.0220		
Constant	0.09	-2.4629	0.0639	-38.54	0.0000	-2.5882	-2.3376		
Model Statistics									
Average RVI:	0.00								
Largest VFI:	0.00								
Complete DF:	2549.00								
DF:									
Min	2547.00								
Average	2547.00								
Max	2547.00								
F(2, 2547.0)	4.43								
Prob>F	0.01								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 48

Survey Design Model With Interaction for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.08	0.0754	0.0987	0.76	0.4450	-0.1182	0.2690		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.80	-0.2243	0.1066	-2.1	0.0360	-0.4333	-0.0152		
Interaction									
Items x Experimental Design	1.22	0.1987	0.1423	1.4	0.1630	-0.0803	0.4777		
Constant	0.09	-2.4133	0.0732	-32.97	0.0000	-2.5568	-2.2698		
Model Statistics									
Average RVI:	0.00								
Largest VFI:	0.00								
Complete DF:	2,549.00								
DF:									
Min	2,547.00								
Average	2,547.00								
Max	2,547.00								
F(3, 2547.0)	3.31								
Prob>F	0.02								

Note: Imputations=5; N=13,333; “S.E.” represents standard error, “95% LB” represents the lower bound 95% confidence interval, and “95% UB” represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 49

Full Model Without Interaction for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1808.7) 2.12	0.0313
Under $999	0.73	-0.3176	0.2247	-1.41	0.1590	-0.7604	0.1252		
$1,000 to $1,999	0.64	-0.4388	0.1741	-2.52	0.0120	-0.7802	-0.0974		
$2,000 to $2,999	0.71	-0.3367	0.1674	-2.01	0.0450	-0.6663	-0.0072		
$3,000 to $3,999	0.88	-0.1332	0.1580	-0.84	0.3990	-0.4433	0.1769		
$4,000 to $4,999	0.92	-0.0867	0.1519	-0.57	0.5680	-0.3847	0.2112		
$5,000 to $7,499	0.89	-0.1156	0.1311	-0.88	0.3780	-0.3733	0.1421		
$7,500 to $9,999	1.09	0.0905	0.1459	0.62	0.5350	-0.1960	0.3770		
$10,000 to $14,999	1.13	0.1185	0.1470	0.81	0.4200	-0.1701	0.4072		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 142.6) 1.60	0.1781
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.96	-0.0455	0.1399	-0.33	0.7460	-0.3220	0.2310		
Employed Part Time - Do Not Want Full Time	1.33	0.2817	0.1567	1.80	0.0820	-0.0383	0.6017		
Employed Part Time - Want Full Time	1.05	0.0473	0.1552	0.30	0.7610	-0.2578	0.3524		
Unemployed	0.74	-0.2968	0.2263	-1.31	0.1970	-0.7535	0.1598		
General Resistance									
Item Nonresponse Rate	0.97	-0.0300	0.0101	-2.96	0.0030	-0.0499	-0.0101		
Call Attempts	0.96	-0.0385	0.0319	-1.21	0.2270	-0.1010	0.0239		
Party Identification								(5, 2354.8) 0.83	0.5274
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	1.03	0.0319	0.1308	0.24	0.8070	-0.2245	0.2884		
Independent	0.72	-0.3236	0.1876	-1.72	0.0850	-0.6915	0.0443		

Table 49 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance (cont'd)									
Party Identification (cont'd)									
Lean Democrat	0.93	-0.0780	0.1515	-0.51	0.6070	-0.3750	0.2191		
Democrat	0.97	-0.0276	0.1268	-0.22	0.8280	-0.2763	0.2212		
Refuse	0.90	-0.1033	0.1355	-0.76	0.4460	-0.3690	0.1624		
Political Views								(4, 78.7) 1.04	0.3903
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.79	-0.2306	0.1594	-1.45	0.1530	-0.5493	0.0880		
Moderate	0.73	-0.3193	0.1634	-1.95	0.0560	-0.6473	0.0086		
Liberal	0.77	-0.2637	0.1886	-1.40	0.1690	-0.6439	0.1165		
Very Liberal	0.88	-0.1275	0.2207	-0.58	0.5660	-0.5708	0.3159		
Perceived Ease of Use									
Age								(4, 1788.2) 0.83	0.5058
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.01	0.0122	0.1279	0.10	0.9240	-0.2387	0.2630		
35-49	0.94	-0.0652	0.1360	-0.48	0.6310	-0.3318	0.2014		
50-64	0.89	-0.1213	0.1441	-0.84	0.4000	-0.4039	0.1612		
65+	0.79	-0.2398	0.1687	-1.42	0.1550	-0.5707	0.0911		
Education								(5, 2509.5) 14.80	0.0000
Less than high school diploma	0.44	-0.8127	0.3186	-2.55	0.0110	-1.4375	-0.1879		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.54	0.4294	0.1788	2.40	0.0160	0.0788	0.7800		
Some college	1.89	0.6383	0.1242	5.14	0.0000	0.3948	0.8818		
College graduate	2.35	0.8529	0.1284	6.64	0.0000	0.6011	1.1047		
Post graduate work or degree	2.48	0.9085	0.1378	6.59	0.0000	0.6382	1.1787		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	0.93	-0.0724	0.0755	-0.96	0.3380	-0.2205	0.0757		

Table 49 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographics (cont'd)									
Marital Status								(4, 2402.0) 1.80	0.1255
Single/Never been married (Reference)	1.06	0.0570	0.1002	0.57	0.5700	-0.1396	0.2536		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	0.93	-0.0735	0.1109	-0.66	0.5070	-0.2910	0.1439		
Widowed	0.78	-0.2511	0.2208	-1.14	0.2550	-0.6841	0.1818		
Domestic partnerships/Living with partner…	1.39	0.3305	0.1513	2.18	0.0290	0.0338	0.6272		
Religious Preference								(4, 1502.2) 2.13	0.0750
Protestant	1.23	0.2033	0.1361	1.49	0.1370	-0.0653	0.4719		
Roman Catholic	1.00	0.0009	0.1287	0.01	0.9940	-0.2519	0.2537		
Other Christian Religion	0.92	-0.0832	0.1364	-0.61	0.5420	-0.3520	0.1855		
Other Non-Christian Religion	0.93	-0.0692	0.1674	-0.41	0.6790	-0.3977	0.2592		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	0.97	-0.0331	0.1258	-0.26	0.7930	-0.2827	0.2165		
Religious Attendance								(4, 63.5) 2.42	0.0576
At least once a week	0.67	-0.4040	0.1870	-2.16	0.0410	-0.7899	-0.0181		
Almost every week	0.94	-0.0641	0.2264	-0.28	0.7800	-0.5307	0.4026		
About once a month	0.64	-0.4536	0.1750	-2.59	0.0120	-0.8047	-0.1026		
Seldom	0.84	-0.1760	0.1359	-1.30	0.2070	-0.4554	0.1034		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 2217.6) 14.11	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.56	-0.5811	0.1937	-3.00	0.0030	-0.9609	-0.2012		
Other	0.61	-0.4961	0.1357	-3.65	0.0000	-0.7624	-0.2299		
Hispanic	0.44	-0.8239	0.1507	-5.47	0.0000	-1.1195	-0.5284		

Table 49 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 48.2) 1.24	0.2989
Hiring new people and expanding the size	0.88	-0.1222	0.0879	-1.39	0.1680	-0.2967	0.0522		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.04	0.0373	0.1102	0.34	0.7360	-0.1818	0.2564		
Direction of the National Economy								(2, 15.1) 0.89	0.4302
Getting better	0.87	-0.1433	0.1169	-1.23	0.2450	-0.3995	0.1128		
The same	0.87	-0.1426	0.2712	-0.53	0.6030	-0.6949	0.4097		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 2518.0) 0.27	0.8499
Northeast	0.94	-0.0575	0.1067	-0.54	0.5900	-0.2668	0.1518		
Midwest	0.98	-0.0222	0.0993	-0.22	0.8230	-0.2170	0.1726		
South (Reference)	-	-	-	-	-	-	-		
West	1.04	0.0372	0.0899	0.41	0.6790	-0.1390	0.2135		
Questionnaire									
Survey Version									
Politics/Economy	1.60	0.4688	0.1257	3.73	0.0000	0.2223	0.7154		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.08	0.0801	0.0712	1.13	0.2610	-0.0595	0.2198		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.78	-0.2445	0.0697	-3.51	0.0000	-0.3812	-0.1078		
Constant	0.19	-1.6818	0.2863	-5.88	0.0000	-2.2447	-1.1189		

Table 49 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Model Statistics									
Average RVI:	0.1937								
Largest VFI:	0.6448								
Complete DF:	2549								
DF:									
Min	11.44								
Average	1,202.24								
Max	2,529.68								
F(59, 1955.8)	7.43								
Prob>F	0.00								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 50

Full Model With Interaction for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1806.5) 2.09	0.0333
Under $999	0.73	-0.3184	0.2248	-1.42	0.1580	-0.7615	0.1247		
$1,000 to $1,999	0.65	-0.4385	0.1741	-2.52	0.0120	-0.7800	-0.0970		
$2,000 to $2,999	0.71	-0.3369	0.1674	-2.01	0.0450	-0.6663	-0.0076		
$3,000 to $3,999	0.88	-0.1317	0.1581	-0.83	0.4050	-0.4420	0.1786		
$4,000 to $4,999	0.92	-0.0869	0.1519	-0.57	0.5670	-0.3848	0.2110		
$5,000 to $7,499	0.89	-0.1149	0.1312	-0.88	0.3810	-0.3726	0.1428		
$7,500 to $9,999	1.09	0.0886	0.1460	0.61	0.5440	-0.1979	0.3751		
$10,000 to $14,999	1.12	0.1163	0.1470	0.79	0.4290	-0.1724	0.4049		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 141.0) 1.60	0.1764
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.96	-0.0458	0.1401	-0.33	0.7440	-0.3228	0.2313		
Employed Part Time - Do Not Want Full Time	1.33	0.2826	0.1570	1.80	0.0820	-0.0383	0.6034		
Employed Part Time - Want Full Time	1.05	0.0489	0.1552	0.31	0.7530	-0.2564	0.3541		
Unemployed	0.74	-0.2952	0.2264	-1.30	0.1990	-0.7519	0.1614		
General Resistance									
Item Nonresponse Rate	0.97	-0.0299	0.0101	-2.95	0.0030	-0.0497	-0.0100		
Call Attempts	0.96	-0.0381	0.0318	-1.20	0.2320	-0.1005	0.0244		
Party Identification								(5, 2349.7) 0.82	0.5324
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	1.03	0.0295	0.1308	0.23	0.8220	-0.2271	0.2861		
Independent	0.72	-0.3243	0.1876	-1.73	0.0840	-0.6922	0.0436		

Table 50 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance (cont'd)									
Party Identification (cont'd)									
Lean Democrat	0.93	-0.0778	0.1516	-0.51	0.6080	-0.3751	0.2195		
Democrat	0.97	-0.0292	0.1269	-0.23	0.8180	-0.2783	0.2199		
Refuse	0.90	-0.1034	0.1356	-0.76	0.4460	-0.3695	0.1626		
Political Views								(4, 79.2) 1.04	0.3911
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.79	-0.2308	0.1592	-1.45	0.1520	-0.5491	0.0876		
Moderate	0.73	-0.3183	0.1631	-1.95	0.0560	-0.6453	0.0088		
Liberal	0.77	-0.2633	0.1882	-1.40	0.1690	-0.6424	0.1158		
Very Liberal	0.88	-0.1264	0.2200	-0.57	0.5680	-0.5678	0.3151		
Perceived Ease of Use									
Age								(4, 1787.6) 0.84	0.4994
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	1.01	0.0108	0.1281	0.08	0.9330	-0.2404	0.2619		
35-49	0.94	-0.0646	0.1360	-0.48	0.6350	-0.3312	0.2020		
50-64	0.89	-0.1216	0.1441	-0.84	0.3990	-0.4043	0.1611		
65+	0.79	-0.2409	0.1687	-1.43	0.1530	-0.5717	0.0900		
Education								(5, 2508.8) 14.81	0.0000
Less than high school diploma	0.45	-0.8095	0.3185	-2.54	0.0110	-1.4341	-0.1850		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.54	0.4330	0.1787	2.42	0.0150	0.0826	0.7835		
Some college	1.89	0.6389	0.1241	5.15	0.0000	0.3955	0.8823		
College graduate	2.35	0.8535	0.1283	6.65	0.0000	0.6019	1.1051		
Post graduate work or degree	2.48	0.9092	0.1378	6.60	0.0000	0.6391	1.1793		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	0.93	0.0568	0.1002	0.57	0.5710	-0.1398	0.2535		

Table 50 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographics (cont'd)									
Marital Status								(4, 2398.4) 1.78	0.1294
Single/Never been married (Reference)	1.06	0.0568	0.1002	0.57	0.5710	-0.1398	0.2535		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	0.93	-0.0723	0.1109	-0.65	0.5140	-0.2898	0.1451		
Widowed	0.78	-0.2518	0.2206	-1.14	0.2540	-0.6844	0.1808		
Domestic partnerships/Living with partner…	1.39	0.3288	0.1516	2.17	0.0300	0.0316	0.6260		
Religious Preference								(4, 1495.3) 2.17	0.0701
Protestant	1.23	0.2078	0.1357	1.53	0.1280	-0.0601	0.4758		
Roman Catholic	1.00	0.0033	0.1286	0.03	0.9800	-0.2493	0.2558		
Other Christian Religion	0.92	-0.0807	0.1362	-0.59	0.5540	-0.3491	0.1877		
Other Non-Christian Religion	0.93	-0.0685	0.1675	-0.41	0.6830	-0.3972	0.2603		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	0.97	-0.0348	0.1258	-0.28	0.7830	-0.2846	0.2150		
Religious Attendance								(4, 62.9) 2.39	0.0599
At least once a week	0.67	-0.4028	0.1872	-2.15	0.0420	-0.7893	-0.0164		
Almost every week	0.94	-0.0662	0.2266	-0.29	0.7730	-0.5337	0.4014		
About once a month	0.64	-0.4535	0.1751	-2.59	0.0120	-0.8048	-0.1021		
Seldom	0.84	-0.1761	0.1362	-1.29	0.2070	-0.4562	0.1040		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 2221.2) 14.05	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.56	-0.5781	0.1936	-2.99	0.0030	-0.9579	-0.1984		
Other	0.61	-0.4939	0.1358	-3.64	0.0000	-0.7603	-0.2275		
Hispanic	0.44	-0.8238	0.1507	-5.47	0.0000	-1.1193	-0.5284		

Table 50 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 48.4) 1.25	0.2968
Hiring new people and expanding the size	0.88	-0.1226	0.0876	-1.40	0.1650	-0.2964	0.0512		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.04	0.0371	0.1105	0.34	0.7380	-0.1825	0.2568		
Direction of the National Economy								(2, 15.1) 0.90	0.4269
Getting better	0.87	-0.1439	0.1167	-1.23	0.2420	-0.3995	0.1118		
The same	0.87	-0.1407	0.2702	-0.52	0.6060	-0.6906	0.4092		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 2517.7) 0.27	0.8483
Northeast	0.94	-0.0579	0.1067	-0.54	0.5870	-0.2671	0.1513		
Midwest	0.98	-0.0201	0.0991	-0.20	0.8390	-0.2145	0.1742		
South (Reference)	-	-	-	-	-	-	-		
West	1.04	0.0378	0.0899	0.42	0.6740	-0.1384	0.2141		
Questionnaire									
Survey Version									
Politics/Economy	1.60	0.4690	0.1257	3.73	0.0000	0.2225	0.7154		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.00	0.0008	0.0959	0.01	0.9940	-0.1872	0.1888		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.72	-0.3346	0.1007	-3.32	0.0010	-0.5321	-0.1371		
Interaction									
Number of Items x Experimental Design	1.19	0.1746	0.1411	1.24	0.2160	-0.1021	0.4512		
Constant	0.19	-1.6456	0.2893	-5.69	0.0000	-2.2143	-1.0769		

Table 50 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Model Statistics									
Average RVI:	0.191								
Largest VFI:	0.6439								
Complete DF:	2549								
DF:									
Min	11.48								
Average	1,221.99								
Max	2,542.97								
F(60, 1974.3)	7.37								
Prob>F	0.00								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 51

Full Model Without Interaction for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1825.8) 1.64	0.1092
Under $999	0.69	-0.3751	0.2792	-1.34	0.1800	-0.9232	0.1730		
$1,000 to $1,999	0.69	-0.3663	0.2258	-1.62	0.1050	-0.8093	0.0766		
$2,000 to $2,999	0.82	-0.1988	0.2165	-0.92	0.3590	-0.6237	0.2262		
$3,000 to $3,999	0.90	-0.1101	0.2027	-0.54	0.5870	-0.5076	0.2874		
$4,000 to $4,999	0.90	-0.1081	0.1816	-0.60	0.5520	-0.4645	0.2483		
$5,000 to $7,499	0.91	-0.0896	0.1539	-0.58	0.5610	-0.3921	0.2128		
$7,500 to $9,999	1.22	0.1979	0.1825	1.08	0.2790	-0.1602	0.5560		
$10,000 to $14,999	1.30	0.2627	0.1843	1.42	0.1550	-0.0995	0.6248		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 38.3) 0.79	0.5358
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.89	-0.1196	0.2883	-0.41	0.6870	-0.7668	0.5276		
Employed Part Time - Do Not Want Full Time	1.33	0.2856	0.2855	1.00	0.3400	-0.3477	0.9189		
Employed Part Time - Want Full Time	0.99	-0.0093	0.2596	-0.04	0.9720	-0.5296	0.5110		
Unemployed	0.63	-0.4678	0.3185	-1.47	0.1520	-1.1161	0.1806		
General Resistance									
Item Nonresponse Rate	0.96	-0.0369	0.0134	-2.75	0.0070	-0.0634	-0.0104		
Call Attempts	0.95	-0.0559	0.0457	-1.22	0.2220	-0.1456	0.0338		
Party Identification								(5, 2297.9) 3.25	0.0063
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	0.85	-0.1626	0.2300	-0.71	0.4800	-0.6137	0.2885		
Independent	0.37	-0.9935	0.2951	-3.37	0.0010	-1.5723	-0.4147		

Table 51 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance (cont'd)									
Party Identification (cont'd)									
Lean Democrat	0.67	-0.3972	0.2793	-1.42	0.1550	-0.9452	0.1509		
Democrat	0.82	-0.1972	0.2449	-0.81	0.4210	-0.6778	0.2833		
Refuse	0.59	-0.5269	0.2823	-1.87	0.0620	-1.0806	0.0268		
Political Views								(4, 105.4) 0.24	0.9168
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.86	-0.1553	0.3163	-0.49	0.6300	-0.8232	0.5126		
Moderate	0.80	-0.2245	0.2860	-0.78	0.4400	-0.8157	0.3667		
Liberal	0.80	-0.2248	0.3237	-0.69	0.4950	-0.8960	0.4465		
Very Liberal	0.90	-0.1074	0.3078	-0.35	0.7280	-0.7174	0.5026		
Perceived Ease of Use									
Age								(4, 1346.7) 0.23	0.9196
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	0.99	-0.0085	0.2025	-0.04	0.9660	-0.4056	0.3886		
35-49	0.94	-0.0580	0.2067	-0.28	0.7790	-0.4633	0.3474		
50-64	0.94	-0.0605	0.2226	-0.27	0.7860	-0.4970	0.3760		
65+	0.81	-0.2137	0.2643	-0.81	0.4190	-0.7322	0.3048		
Education								(5, 2325.6) 16.32	0.0000
Less than high school diploma	0.52	-0.6481	0.3675	-1.76	0.0780	-1.3688	0.0727		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.51	0.4114	0.1994	2.06	0.0390	0.0203	0.8025		
Some college	2.08	0.7307	0.1455	5.02	0.0000	0.4453	1.0162		
College graduate	2.71	0.9977	0.1442	6.92	0.0000	0.7150	1.2805		
Post graduate work or degree	3.06	1.1199	0.1609	6.96	0.0000	0.8041	1.4357		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	0.96	-0.0378	0.1254	-0.30	0.7630	-0.2839	0.2083		

Table 51 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographics (cont'd)									
Marital Status								(4, 2385.5) 1.82	0.1215
Single/Never been married	1.07	0.0687	0.1612	0.43	0.6700	-0.2475	0.3849		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	0.94	-0.0616	0.1757	-0.35	0.7260	-0.4061	0.2829		
Widowed	0.55	-0.6010	0.2794	-2.15	0.0320	-1.1490	-0.0531		
Domestic partnerships/Living with partner…	1.37	0.3177	0.2236	1.42	0.1560	-0.1208	0.7561		
Religious Preference								(4, 1452.2) 1.42	0.2260
Protestant	1.20	0.1851	0.2133	0.87	0.3870	-0.2366	0.6069		
Roman Catholic	0.89	-0.1165	0.1846	-0.63	0.5280	-0.4796	0.2466		
Other Christian Religion	1.08	0.0805	0.2136	0.38	0.7060	-0.3395	0.5005		
Other Non-Christian Religion	0.81	-0.2117	0.2169	-0.98	0.3290	-0.6375	0.2141		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	1.08	0.0811	0.2159	0.38	0.7080	-0.3492	0.5113		
Religious Attendance								(4, 61.0) 1.66	0.1701
At least once a week	0.51	-0.6695	0.2905	-2.30	0.0230	-1.2442	-0.0948		
Almost every week	0.77	-0.2583	0.3553	-0.73	0.4710	-0.9763	0.4598		
About once a month	0.52	-0.6507	0.3443	-1.89	0.0700	-1.3597	0.0584		
Seldom	0.84	-0.1793	0.2543	-0.71	0.4890	-0.7112	0.3525		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 1913.5) 13.04	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.39	-0.9318	0.2077	-4.49	0.0000	-1.3390	-0.5245		
Other	0.64	-0.4498	0.2152	-2.09	0.0370	-0.8723	-0.0273		
Hispanic	0.35	-1.0396	0.2010	-5.17	0.0000	-1.4339	-0.6454		

Table 51 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 39.0) 0.77	0.4696
Hiring new people and expanding the size	0.87	-0.1405	0.1398	-1.00	0.3200	-0.4220	0.1410		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.10	0.0983	0.1883	0.52	0.6030	-0.2746	0.4712		
Direction of the National Economy								(2, 16.4) 0.32	0.7326
Getting better	0.88	-0.1229	0.1565	-0.78	0.4430	-0.4534	0.2077		
The same	0.99	-0.0078	0.4531	-0.02	0.9860	-0.9652	0.9497		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 2354.4) 0.04	0.9900
Northeast	1.02	0.0241	0.1703	0.14	0.8870	-0.3099	0.3582		
Midwest	0.97	-0.0267	0.1410	-0.19	0.8500	-0.3032	0.2497		
South (Reference)	-	-	-	-	-	-	-		
West	1.02	0.0184	0.1371	0.13	0.8930	-0.2503	0.2872		
Questionnaire									
Survey Version									
Politics/Economy	1.57	0.4481	0.1921	2.33	0.0200	0.0715	0.8248		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.19	0.1766	0.1117	1.58	0.1140	-0.0424	0.3956		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.92	-0.0852	0.1040	-0.82	0.4130	-0.2891	0.1188		
Constant	0.16	-1.8107	0.4269	-4.24	0.0000	-2.6543	-0.9671		

Table 51 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Model Statistics									
Average RVI:	0.2978								
Largest VFI:	0.7024								
Complete DF:	2549								
DF:									
Min	9.49								
Average	1,068.44								
Max	2,502.88								
F(59, 1592.2)	11.01								
Prob>F	0.00								

Note: Imputations=5; N=13,333; “S.E.” represents standard error, “95% LB” represents the lower bound 95% confidence interval, and “95% UB” represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 52

Full Model With Interaction for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1830.8) 1.63	0.1115
Under $999	0.69	-0.3764	0.2795	-1.35	0.1780	-0.9250	0.1722		
$1,000 to $1,999	0.69	-0.3672	0.2254	-1.63	0.1030	-0.8093	0.0748		
$2,000 to $2,999	0.82	-0.1992	0.2165	-0.92	0.3580	-0.6242	0.2258		
$3,000 to $3,999	0.90	-0.1094	0.2028	-0.54	0.5900	-0.5072	0.2883		
$4,000 to $4,999	0.90	-0.1079	0.1817	-0.59	0.5530	-0.4645	0.2486		
$5,000 to $7,499	0.91	-0.0892	0.1540	-0.58	0.5630	-0.3919	0.2136		
$7,500 to $9,999	1.22	0.1969	0.1825	1.08	0.2810	-0.1612	0.5550		
$10,000 to $14,999	1.30	0.2614	0.1844	1.42	0.1570	-0.1010	0.6237		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
Employment Status								(4, 38.1) 0.79	0.5378
Employed Full Time for Employer (Reference)	-	-	-	-	-	-	-		
Employed Full Time for Self	0.89	-0.1201	0.2891	-0.42	0.6870	-0.7697	0.5295		
Employed Part Time - Do Not Want Full Time	1.33	0.2867	0.2860	1.00	0.3390	-0.3481	0.9215		
Employed Part Time - Want Full Time	0.99	-0.0075	0.2595	-0.03	0.9770	-0.5278	0.5128		
Unemployed	0.63	-0.4661	0.3184	-1.46	0.1530	-1.1140	0.1819		
General Resistance									
Item Nonresponse Rate	0.96	-0.0368	0.0134	-2.75	0.0070	-0.0632	-0.0104		
Call Attempts	0.95	-0.0556	0.0457	-1.22	0.2230	-0.1451	0.0339		
Party Identification								(5, 2293.5) 3.24	0.0064
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	0.85	-0.1642	0.2307	-0.71	0.4770	-0.6166	0.2883		
Independent	0.37	-0.9954	0.2957	-3.37	0.0010	-1.5754	-0.4155		

Table 52 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
General Resistance (cont'd)									
Party Identification (cont'd)									
Lean Democrat	0.67	-0.3958	0.2787	-1.42	0.1560	-0.9427	0.1510		
Democrat	0.82	-0.1988	0.2452	-0.81	0.4180	-0.6801	0.2826		
Refuse	0.59	-0.5276	0.2825	-1.87	0.0620	-1.0817	0.0265		
Political Views								(4, 105.1) 0.24	0.9174
Very Conservative (Reference)	-	-	-	-	-	-	-		
Conservative	0.86	-0.1552	0.3162	-0.49	0.6300	-0.8228	0.5124		
Moderate	0.80	-0.2238	0.2856	-0.78	0.4410	-0.8140	0.3664		
Liberal	0.80	-0.2243	0.3235	-0.69	0.4950	-0.8950	0.4463		
Very Liberal	0.90	-0.1068	0.3072	-0.35	0.7290	-0.7152	0.5017		
Perceived Ease of Use									
Age								(4, 1357.3) 0.23	0.9199
18-24 (Reference)	-	-	-	-	-	-	-		
25-34	0.99	-0.0089	0.2025	-0.04	0.9650	-0.4061	0.3883		
35-49	0.94	-0.0577	0.2066	-0.28	0.7800	-0.4629	0.3476		
50-64	0.94	-0.0607	0.2228	-0.27	0.7850	-0.4976	0.3762		
65+	0.81	-0.2135	0.2641	-0.81	0.4190	-0.7316	0.3045		
Education								(5, 2325.2) 16.31	0.0000
Less than high school diploma	0.52	-0.6467	0.3673	-1.76	0.0780	-1.3670	0.0737		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.51	0.4139	0.1995	2.08	0.0380	0.0227	0.8051		
Some college	2.08	0.7308	0.1455	5.02	0.0000	0.4453	1.0163		
College graduate	2.71	0.9977	0.1441	6.93	0.0000	0.7152	1.2803		
Post graduate work or degree	3.06	1.1200	0.1609	6.96	0.0000	0.8043	1.4357		
Sociodemographics									
Gender									
Male (Reference)	-	-	-	-	-	-	-		
Female	0.96	-0.0377	0.1255	-0.30	0.7640	-0.2840	0.2086		

Table 52 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Sociodemographics (cont'd)									
Marital Status								(4, 2385.7) 1.83	0.1196
Single/Never been married (Reference)	1.07	0.0682	0.1612	0.42	0.6720	-0.2480	0.3844		
Married (Reference)	-	-	-	-	-	-	-		
Separated/Divorced	0.94	-0.0597	0.1752	-0.34	0.7330	-0.4031	0.2838		
Widowed	0.55	-0.6038	0.2798	-2.16	0.0310	-1.1525	-0.0550		
Domestic partnerships/Living with partner…	1.38	0.3189	0.2235	1.43	0.1540	-0.1194	0.7572		
Religious Preference								(4, 1467.9) 1.43	0.2211
Protestant	1.21	0.1875	0.2129	0.88	0.3800	-0.2334	0.6084		
Roman Catholic	0.89	-0.1148	0.1846	-0.62	0.5350	-0.4778	0.2483		
Other Christian Religion	1.09	0.0827	0.2137	0.39	0.6990	-0.3373	0.5028		
Other Non-Christian Religion	0.81	-0.2117	0.2170	-0.98	0.3300	-0.6378	0.2143		
No Religion/Atheist/Agnostic (Reference)	-	-	-	-	-	-	-		
Religion Important									
No (Reference)	-	-	-	-	-	-	-		
Yes	1.08	0.0799	0.2159	0.37	0.7120	-0.3503	0.5102		
Religious Attendance								(4, 60.6) 1.66	0.1720
At least once a week	0.51	-0.6687	0.2903	-2.30	0.0230	-1.2430	-0.0944		
Almost every week	0.77	-0.2603	0.3557	-0.73	0.4690	-0.9795	0.4588		
About once a month	0.52	-0.6508	0.3437	-1.89	0.0700	-1.3585	0.0570		
Seldom	0.84	-0.1798	0.2546	-0.71	0.4890	-0.7121	0.3526		
Never (Reference)	-	-	-	-	-	-	-		
Race								(3, 1903.5) 13.01	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.39	-0.9301	0.2077	-4.48	0.0000	-1.3373	-0.5228		
Other	0.64	-0.4488	0.2153	-2.08	0.0370	-0.8715	-0.0261		
Hispanic	0.35	-1.0394	0.2010	-5.17	0.0000	-1.4337	-0.6452		

Table 52 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Social Environment									
Economic Conditions									
Your Company: Hire/Reduce								(2, 39.0) 0.77	0.4686
Hiring new people and expanding the size	0.87	-0.1412	0.1398	-1.01	0.3180	-0.4227	0.1402		
Not changing the size of its workforce (Reference)	-	-	-	-	-	-	-		
Letting people go and the size	1.10	0.0975	0.1879	0.52	0.6050	-0.2745	0.4695		
Direction of the National Economy								(2, 16.4) 0.32	0.7301
Getting better	0.88	-0.1234	0.1564	-0.79	0.4410	-0.4534	0.2066		
The same	0.99	-0.0070	0.4526	-0.02	0.9880	-0.9630	0.9489		
Getting worse (Reference)	-	-	-	-	-	-	-		
Neighborhood Characteristics									
Census Region								(3, 2353.0) 0.04	0.9908
Northeast	1.02	0.0241	0.1703	0.14	0.8870	-0.3099	0.3582		
Midwest	0.97	-0.0257	0.1406	-0.18	0.8550	-0.3014	0.2501		
South (Reference)	-	-	-	-	-	-	-		
West	1.02	0.0178	0.1372	0.13	0.8970	-0.2513	0.2869		
Questionnaire									
Survey Version									
Politics/Economy	1.56	0.4468	0.1923	2.32	0.0200	0.0696	0.8241		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Survey Design									
Length									
Number of Items									
12 Items (Reference)	-	-	-	-	-	-	-		
5 Items	1.11	0.1018	0.1407	0.72	0.4690	-0.1741	0.3776		
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.85	-0.1598	0.1539	-1.04	0.2990	-0.4615	0.1418		

Table 52 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Survey Design (cont'd)									
Interaction									
Items x Experimental Design	1.15	0.1389	0.2168	0.64	0.5220	-0.2862	0.5640		
Constant	0.17	-1.7725	0.4409	-4.02	0.0000	-2.6422	-0.9027		
Model Statistics									
Average RVI:	0.2936								
Largest VFI:	0.7046								
Complete DF:	2549								
DF:									
Min	9.42								
Average	1,090.91								
Max	2,534.47								
F(60, 1615.9)	10.89								
Prob>F	0.00								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 53

Parsimonious Model for SMS Cooperation (At Least One Item)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics									
Economic Costs									
Monthly Household Income								(8, 1940.1) 2.63	0.0073
Under $999	0.72	-0.3325	0.2140	-1.55	0.1220	-0.7542	0.0893		
$1,000 to $1,999	0.64	-0.4530	0.1723	-2.63	0.0090	-0.7910	-0.1151		
$2,000 to $2,999	0.72	-0.3340	0.1582	-2.11	0.0350	-0.6447	-0.0232		
$3,000 to $3,999	0.88	-0.1231	0.1543	-0.80	0.4250	-0.4257	0.1795		
$4,000 to $4,999	0.92	-0.0790	0.1503	-0.53	0.6000	-0.3739	0.2160		
$5,000 to $7,499	0.90	-0.1091	0.1308	-0.83	0.4050	-0.3663	0.1480		
$7,500 to $9,999	1.11	0.1012	0.1445	0.70	0.4840	-0.1825	0.3848		
$10,000 to $14,999	1.14	0.1273	0.1457	0.87	0.3830	-0.1589	0.4134		
$15,000 and over (Reference)	-	-	-	-	-	-	-		
General Resistance									
Item Missing Rate	0.96	-0.0399	0.0091	-4.36	0.0000	-0.0578	-0.0220		
Perceived Ease of Use									
Education								(5, 2541.0) 16.18	0.0000
Less than high school diploma	0.44	-0.8252	0.3155	-2.62	0.0090	-1.4439	-0.2066		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.52	0.4206	0.1775	2.37	0.0180	0.0726	0.7687		
Some college	1.95	0.6693	0.1232	5.43	0.0000	0.4277	0.9109		

Table 53 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics (cont'd)									
Perceived Ease of Use (cont'd)									
Education (cont'd)	1.15	0.1389	0.2168	0.64	0.5220	-0.2862	0.5640		
College graduate	2.38	0.8683	0.1252	6.93	0.0000	0.6227	1.1138		
Post graduate work or degree	2.45	0.8973	0.1317	6.81	0.0000	0.6391	1.1555		
Sociodemographics									
Race								(3, 2540.5) 22.16	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.52	-0.6535	0.1873	-3.49	0.0000	-1.0207	-0.2863		
Other	0.51	-0.6653	0.1276	-5.22	0.0000	-0.9155	-0.4152		
Hispanic	0.42	-0.8779	0.1444	-6.08	0.0000	-1.1610	-0.5948		
Social Environment									
Questionnaire									
Survey Version									
Politics/Economy	1.80	0.5866	0.1019	5.76	0.0000	0.3869	0.7864		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Survey Design									
Survey Mode									
Experimental Design									
Synchronous SMS (Reference)	-	-	-	-	-	-	-		
SMS with Embedded URL	0.78	-0.2423	0.0691	-3.50	0.0000	-0.3778	-0.1067		
Constant	0.09	-2.3963	0.1580	-15.16	0.0000	-2.7063	-2.0863		

Model Statistics	
Average RVI:	0.0256
Largest VFI:	0.1347
Complete DF:	2549

Table 53 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
DF:									
Min	221.16								
Average	1,842.44								
Max	2,546.98								
F(19, 2483.5)	20.05								
Prob>F	0.00								

Note: Imputations=5; N=13,333; "S.E." represents standard error, "95% LB" represents the lower bound 95% confidence interval, and "95% UB" represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 54

Parsimonious Model for SMS Cooperation (All Items)

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Respondent Characteristics								.	
General Resistance									
Item Missing Rate	0.95	-0.0544	0.0116	-4.68	0.0000	-0.0772	-0.0316		
P:arty Identification								(5, 2538.4) 3.00	0.0106
Republican (Reference)	-	-	-	-	-	-	-		
Lean Republican	0.90	-0.1107	0.2287	-0.48	0.6280	-0.5591	0.3377		
Independent	0.40	-0.9175	0.2792	-3.29	0.0010	-1.4650	-0.3700		
Lean Democrat	0.70	-0.3551	0.2669	-1.33	0.1830	-0.8784	0.1682		
Democrat	0.81	-0.2165	0.2278	-0.95	0.3420	-0.6631	0.2301		
Refuse	0.59	-0.5249	0.2822	-1.86	0.0630	-1.0783	0.0285		
Perceived Ease of Use									
Education								(5, 2522.9) 22.33	0.0000
Less than high school diploma	0.50	-0.6948	0.3653	-1.90	0.0570	-1.4112	0.0216		
High school degree or diploma (Reference)	-	-	-	-	-	-	-		
Technical/Vocational school	1.54	0.4333	0.1983	2.18	0.0290	0.0444	0.8223		
Some college	2.20	0.7898	0.1457	5.42	0.0000	0.5042	1.0755		
College graduate	2.97	1.0896	0.1470	7.41	0.0000	0.8012	1.3779		
Post graduate work or degree	3.44	1.2366	0.1565	7.90	0.0000	0.9297	1.5434		
Sociodemographics									
Race								(3, 2447.3) 19.73	0.0000
White (Reference)	-	-	-	-	-	-	-		
Black	0.35	-1.0397	0.1978	-5.26	0.0000	-1.4275	-0.6518		
Other	0.54	-0.6180	0.2166	-2.85	0.0040	-1.0427	-0.1932		
Hispanic	0.31	-1.1714	0.1860	-6.30	0.0000	-1.5362	-0.8067		

Table 54 continues

	Odds Ratio	Coefficient	S.E.	t	p>t	95% C.I. Lower Bound	95% C.I. Upper Bound	F	p>F
Social Environment									
Questionnaire									
Survey Version									
Politics/Economy	1.78	0.5764	0.1872	3.08	0.0020	0.2093	0.9435		
Wellbeing (Reference)	-	-	-	-	-	-	-		
Constant	0.08	-2.5456	0.2492	-10.21	0.0000	-3.0343	-2.0569		
Model Statistics									
Average RVI:	0.0100								
Largest VFI:	0.0289								
Complete DF:	2549								
DF:									
Min	1648.64								
Average	2,380.66								
Max	2,544.19								
F(15, 2534.1)	36.75								
Prob>F	0.00								

Note: Imputations=5; N=13,333; “S.E.” represents standard error, “95% LB” represents the lower bound 95% confidence interval, and “95% UB” represents the upper bound 95% confidence interval. Standard errors are calculated using Taylor series linearization to account for complex sample survey design; S.E., t, p>t, and 95% confidence interval statistics are calculated for the coefficient.

Table 55

Response Propensity Models for SMS Cooperation (All Items)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Respondent Characteristics						
Economic Costs						
Monthly Household Income						
Under $999	0.69				0.69	
$1,000 to $1,999	0.70				0.69	
$2,000 to $2,999	0.82				0.82	
$3,000 to $3,999	0.90				0.90	
$4,000 to $4,999	0.89				0.90	
$5,000 to $7,499	0.92				0.91	
$7,500 to $9,999	1.21				1.22	
$10,000 to $14,999	1.29				1.30	
$15,000 and over (Reference)	-				-	
Employment Status						
Employed Full Time for Employer (Reference)	-				-	
Employed Full Time for Self	0.91				0.89	
Employed Part Time - Do Not Want Full Time	1.31				1.33	
Employed Part Time - Want Full Time	1.00				0.99	
Unemployed	0.57 †				0.63	
General Resistance						
Item Nonresponse Rate	0.98				0.96 **	0.95 ***
Call Attempts	0.95				0.95	

Table 55 continues

	Model 1		Model 2	Model 3	Model 4	Model 5		Model 6	
	Odds Ratio		Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio		Odds Ratio	
Respondent Characteristics (cont'd)									
General Resistance (cont'd)									
Party Identification		***					**		
Republican (Reference)	-					-		-	
Lean Republican	0.85					0.85		0.90	
Independent	0.35	***				0.37	**	0.40	**
Lean Democrat	0.65					0.67		0.70	
Democrat	0.78					0.82		0.81	
Refuse	0.48	**				0.59	†	0.59	†
Political Views									
Very Conservative (Reference)	-					-			
Conservative	0.85					0.86			
Moderate	0.78					0.80			
Liberal	0.77					0.80			
Very Liberal	0.86					0.90			
Perceived Ease of Use									
Age									
18-24 (Reference)	-					-			
25-34	1.02					0.99			
35-49	0.98					0.94			
50-64	0.97					0.94			
65+	0.80					0.81			
Education		***					***		***
Less than high school diploma	0.52	†				0.52	†	0.50	†
High school degree or diploma (Reference)	-					-		-	
Technical/Vocational school	1.52	*				1.51	*	1.54	*

Table 55 continues

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Respondent Characteristics (cont'd)						
Perceived Ease of Use (cont'd)						
Education (cont'd)						
Some college	2.08 ***				2.08 ***	2.20 ***
College graduate	2.72 ***				2.71 ***	2.97 ***
Post graduate work or degree	3.06 ***				3.06 ***	3.44 ***
Sociodemographics						
Gender						
Male (Reference)	-				-	
Female	0.96				0.96	
Marital Status						
Single/Never been married	1.05				1.07	
Married (Reference)	-				-	
Separated/Divorced	0.94				0.94	
Widowed	0.53 *				0.55 *	
Domestic partnerships/Living with partner…	1.34				1.37	
Religious Preference						
Protestant	1.21				1.20	
Roman Catholic	0.90				0.89	
Other Christian Religion	1.08				1.08	
Other Non-Christian Religion	0.82				0.81	
No Religion/Atheist/Agnostic (Reference)	-				-	
Religion Important						
No (Reference)	-				-	
Yes	1.07				1.08	

Table 55 continues

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
Respondent Characteristics (cont'd)												
Sociodemographics (cont'd)												
Religious Attendance												
At least once a week	0.52	*							0.51	*		
Almost every week	0.78								0.77			
About once a month	0.53	†							0.52	†		
Seldom	0.85								0.84			
Never (Reference)	-								-			
Race		***								***		***
White (Reference)	-								-		-	
Black	0.38	***							0.39	***	0.35	***
Other	0.61	*							0.64	*	0.54	**
Hispanic	0.34	***							0.35	***	0.31	***
Social Environment												
Economic Conditions												
Your Company: Hire/Reduce				†								
Hiring new people and expanding the size			0.82	*					0.87			
Not changing the size of its workforce (Reference)			-						-			
Letting people go and the size			1.03						1.10			
Direction of the National Economy												
Getting better			1.01						0.88			
The same			0.99						0.99			
Getting worse (Reference)			-						-			

Table 55 continues

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Social Environment (cont'd)						
Neighborhood Characteristics						
Census Region						
Northeast		1.06			1.02	
Midwest		1.11			0.97	
South (Reference)		-			-	
West		1.16 †			1.02	
Questionnaire						
Survey Version						
Politics and Economy		1.26 **			1.57 *	1.78 **
Wellbeing (Reference)		-			-	-
Survey Design						
Length						
Number of Items						
12 Items (Reference)			-	-	-	
5 Items			1.18 *	1.08	1.19	
Survey Mode						
Experimental Design						
Synchronous SMS (Reference)			-	-	-	
SMS with Embedded URL			0.89 †	0.80 *	0.92	
Interaction						
Items x Experimental Design				1.22		
Constant	0.19 ***	0.08 ***	0.09 ***	0.09 ***	0.16 ***	0.08 ***

Table 55 continues

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
Model Statistics												
N	13,333		13,333		13,333		13,333		13,333		13,333	
Average RVI	0.26		0.31		0.00		0.00		0.30		0.01	
Largest FMI	0.68		0.60		0.00		0.00		0.70		0.03	
Complete DF	2549.00		2549.00		2549.00		2549.00		2549.00		2549.00	
Model F Test	(49, 1610.8) 13.48	***	(8, 337.4) 2.10	*	(2, 2547.0) 4.43	*	(3, 2547.0) 3.31	*	(59, 1592.2) 11.01	***	(15, 2534.1) 36.75	***
Prob>F	0.000		0.036		0.010		0.019		0.000		0.000	

Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10

Table 56

Correlations of Survey Variables of Interest (y) and Response Propensity (p) for SMS Cooperation (All Items)

	Respondent Characteristics Model	Social Environment Model	Survey Design Model	Survey Design (Interaction) Model	Full Model	Parsi-monious Model
Registered to Vote	0.2152***	0.0499†	-0.0125	0.0188	0.2065***	0.2374***
Obama Job Approval	-0.1163***	-0.0728	0.0105	0.0058	-0.1192***	-0.1396***
Economic Conditions	0.0380***	-0.0847	0.0079	0.0015	0.0047	0.0272†
Own Health Rating	-0.2323***	0.1662***	0.0028	0.0085	-0.2099***	-0.2261***
Do you Smoke?	-0.1363***	-0.0617†	-0.0242*	-0.0232*	0.1325***	-0.1604***
Health Insurance Coverage?	0.2145***	-0.0399*	0.0090	0.0155	0.2035***	0.2156***

Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10

Table 57

Empirical Bias for SMS Cooperation (All Items)

Survey Variables of Interest	Cooperation Mean	S.E.	Noncooperation Mean	S.E.	Sample Mean	S.E.	Noncooperation Bias	Diff.
Registered to Vote								
Yes, Registered	88.75%	2.42%	74.62%	1.08%	72.81%	1.11%	15.94%	14.12%
No, Not Registered/Plan to/Don't Need to Register	11.25%	2.42%	25.38%	1.08%	27.19%	1.11%	-15.94%	-14.12%
Obama Job Approval								
Approve	39.94%	1.72%	51.50%	1.51%	50.46%	1.00%	-10.51%	-11.56%
Disapprove	60.06%	1.72%	48.50%	1.51%	49.54%	1.00%	10.51%	11.56%
Economic Conditions								
Poor	36.62%	3.49%	35.61%	1.16%	35.59%	1.38%	1.03%	1.01%
Only Fair	44.14%	2.29%	45.12%	0.74%	45.59%	0.84%	-1.45%	-0.98%
Good/Excellent	19.24%	2.54%	19.27%	0.95%	18.82%	0.82%	0.42%	-0.03%
Own Health Rating								
Excellent	19.38%	1.71%	14.80%	0.61%	14.93%	0.38%	4.45%	4.58%
Very Good	32.23%	2.23%	26.37%	0.59%	25.79%	0.66%	6.44%	5.86%
Good	30.35%	1.95%	31.52%	0.59%	31.50%	0.40%	-1.16%	-1.18%
Fair	13.85%	1.55%	19.15%	0.73%	19.77%	0.68%	-5.92%	-5.30%
Poor	4.19%	0.94%	8.16%	0.44%	8.00%	0.35%	-3.81%	-3.97%
Do you Smoke?								
Yes	15.96%	1.66%	26.76%	1.35%	22.57%	1.11%	-6.61%	-10.80%
No	84.04%	1.66%	73.24%	1.35%	77.43%	1.11%	6.61%	10.80%
Health Insurance Coverage?								
Yes	84.31%	2.34%	72.62%	1.10%	72.59%	0.88%	11.72%	11.69%
No	15.69%	2.34%	27.38%	1.10%	27.41%	0.88%	-11.72%	-11.69%

Table 58

Descriptive Statistics SMS Noncooperation Adjustment Weights (All Items)

	N	Mean	S.D.	Min.	Max.
Noncooperation Weights					
Cooperation	1,355	10.46	8.25	3.81	87.43
Noncooperation	11,978	19.73	26.61	3.81	525.78
Sample	13,333	18.78	25.51	3.81	525.78
*Noncooperation Weights * Base Weights*					
Cooperation	1,355	9.82	16.17	0.85	165.21
Noncooperation	11,978	29.95	70.45	0.84	1701.95
Sample	13,333	27.91	67.25	0.84	1701.95

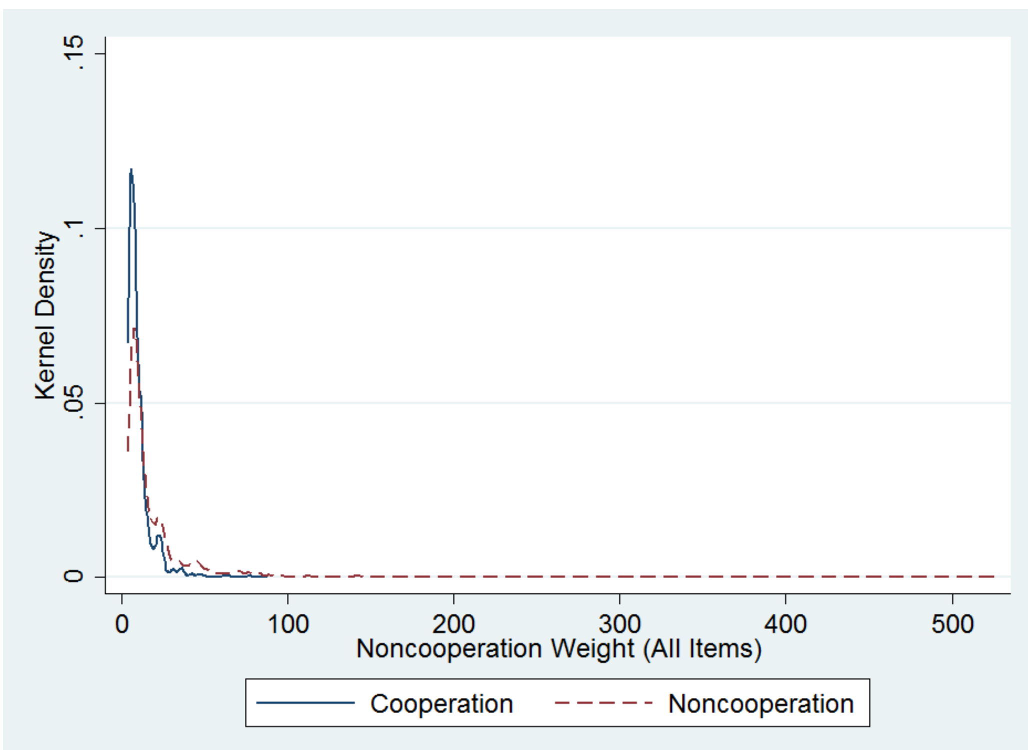

Figure 22. Kernel density plot of SMS noncooperation (all items) adjustment weights (1/p).

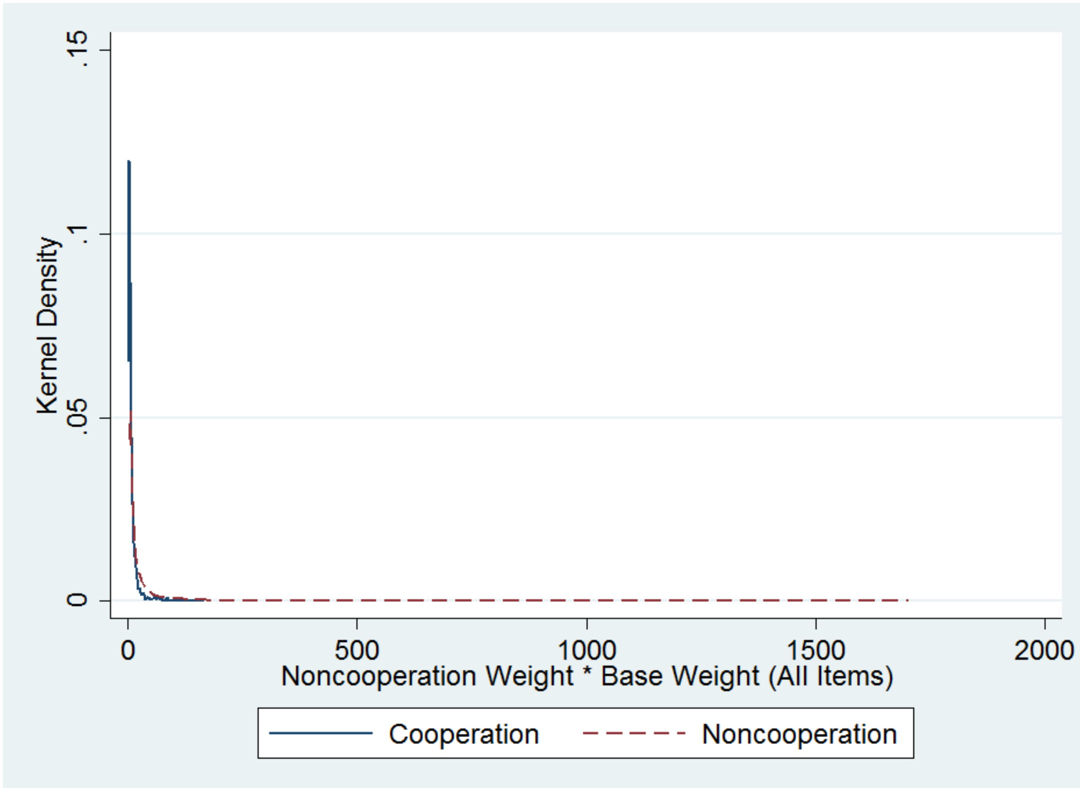

Figure 23. Kernel density plot of SMS noncooperation (all items) adjustment weights (1/p * base weight).

Table 59

SMS Noncooperation (All Items) Adjustment Weights Trimmed to +2 SD above the Mean (90.87)

	N	Mean	S.D.	Min.	Max.
Trimmed Noncooperation Weights					
Cooperation	1,355	10.44	8.06	3.81	69.80
Noncooperation	11,978	17.78	16.71	3.81	69.80
Consenting Sample	13,333	17.04	16.20	3.81	69.80
*Trimmed Noncooperation Weights * Base Weights*					
Cooperation	1,355	9.80	16.08	0.85	165.21
Noncooperation	11,978	25.35	43.55	0.84	244.86
Consenting Sample	13,333	23.77	41.86	0.84	244.86

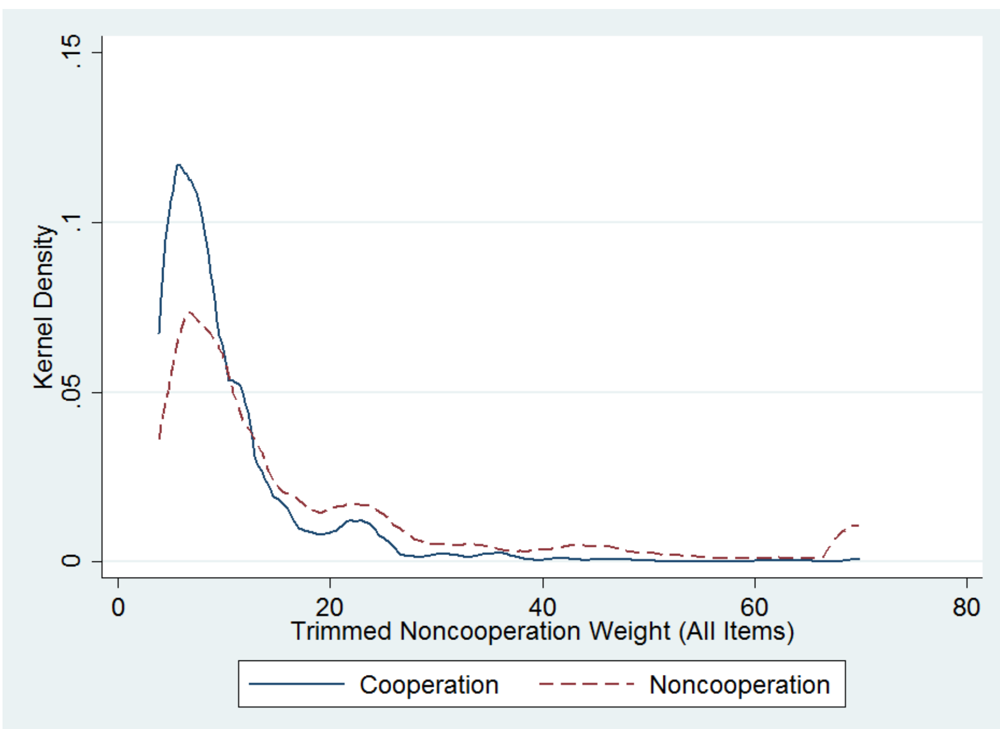

Figure 24. Kernel density plot of SMS noncooperation (all items) adjustment weights (1/p) trimmed to +2 SDs above the mean.

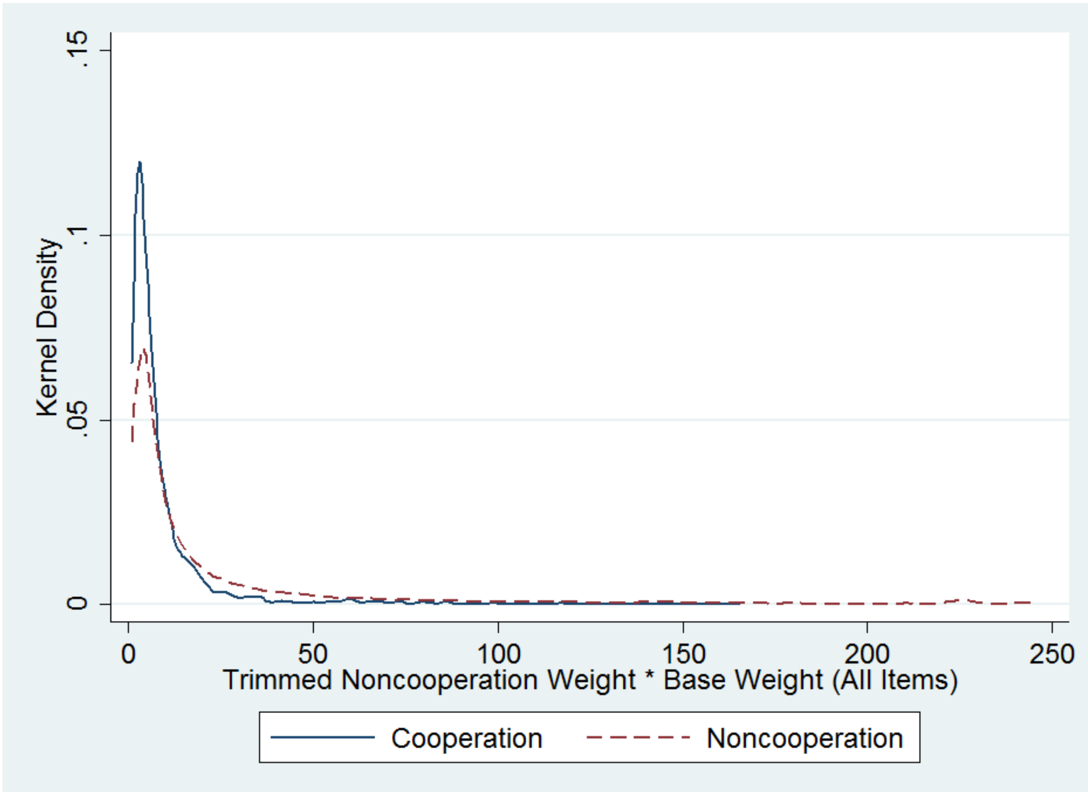

Figure 25. Kernel density plot of SMS noncooperation (all items) adjustment weights (1/p * base weight) trimmed to +2 SDs above the mean.

Table 60

Noncooperation Weighting Adjusted Means and Standard Error for Cooperators (All Items) to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Cooperation %	S.E.	Noncooperation Bias
Registered to Vote			
Yes, Registered	84.28%	3.82%	8.52%
No, Not Registered/Plan to/Don't Need to Register	15.72%	3.82%	-8.52%
Obama Job Approval			
Approve	40.20%	2.59%	-10.37%
Disapprove	59.80%	2.59%	10.37%
Economic Conditions			
Poor	39.77%	4.54%	4.08%
Only Fair	41.97%	3.21%	-3.07%
The Good/Excellent	18.26%	3.22%	-1.02%
Own Health Rating			
Excellent	15.86%	1.83%	0.69%
Very Good	29.12%	2.72%	2.27%
Good	32.29%	2.83%	0.86%
Fair	17.48%	2.62%	-1.24%
Poor	5.26%	1.70%	-2.58%
Do you smoke?			
Yes	20.86%	2.59%	-5.03%
No	79.14%	2.59%	5.03%
Health Insurance Coverage?			
Yes	79.23%	3.51%	5.66%
No	20.77%	3.51%	-5.66%

Table 61

Trimmed Noncooperation Weighting Adjusted Means and Standard Error for Cooperators (All Items) to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Cooperation %	S.E.	Noncooperation Bias
Registered to Vote			
Yes, Registered	84.29%	3.80%	8.52%
No, Not Registered/Plan to/Don't Need to Register	15.71%	3.80%	-8.52%
Obama Job Approval			
Approve	40.19%	2.57%	-10.38%
Disapprove	59.81%	2.57%	10.38%
Economic Conditions			
Poor	39.81%	4.51%	4.12%
Only Fair	41.90%	3.18%	-3.14%
Good/Excellent	18.29%	3.22%	-0.98%
Own Health Rating			
Excellent	15.89%	1.84%	0.72%
Very Good	29.18%	2.72%	2.33%
Good	32.27%	2.83%	0.84%
Fair	17.43%	2.61%	-1.29%
Poor	5.23%	1.68%	-2.61%
Do you smoke?			
Yes	20.80%	2.57%	-5.08%
No	79.20%	2.57%	5.08%
Health Insurance Coverage?			
Yes	79.28%	3.50%	5.71%
No	20.72%	3.50%	-5.71%

Table 62

Evaluating Reductions in Standard Errors Using Trimmed Weights

Survey Variables of Interest	Base Weight Only Cooperation S.E.	Weighting Adjustment Cooperation S.E.	Trimmed Weighting Adjustment Cooperation S.E.
Registered to Vote			
Yes, Registered	2.42%	3.82%	3.80%
No, Not Registered/Plan to/Don't Need to Register	2.42%	3.82%	3.80%
Obama Job Approval			
Approve	1.72%	2.59%	2.57%
Disapprove	1.72%	2.59%	2.57%
Economic Conditions			
Poor	3.49%	4.54%	4.51%
Only Fair	2.29%	3.21%	3.18%
Good/Excellent	2.54%	3.22%	3.22%
Own Health Rating			
Excellent	1.71%	1.83%	1.84%
Very Good	2.23%	2.72%	2.72%
Good	1.95%	2.83%	2.83%
Fair	1.55%	2.62%	2.61%
Poor	0.94%	1.70%	1.68%
Do you smoke?			
Yes	1.66%	2.59%	2.57%
No	1.66%	2.59%	2.57%
Health Insurance Coverage?			
Yes	2.34%	3.51%	3.50%
No	2.34%	3.51%	3.50%

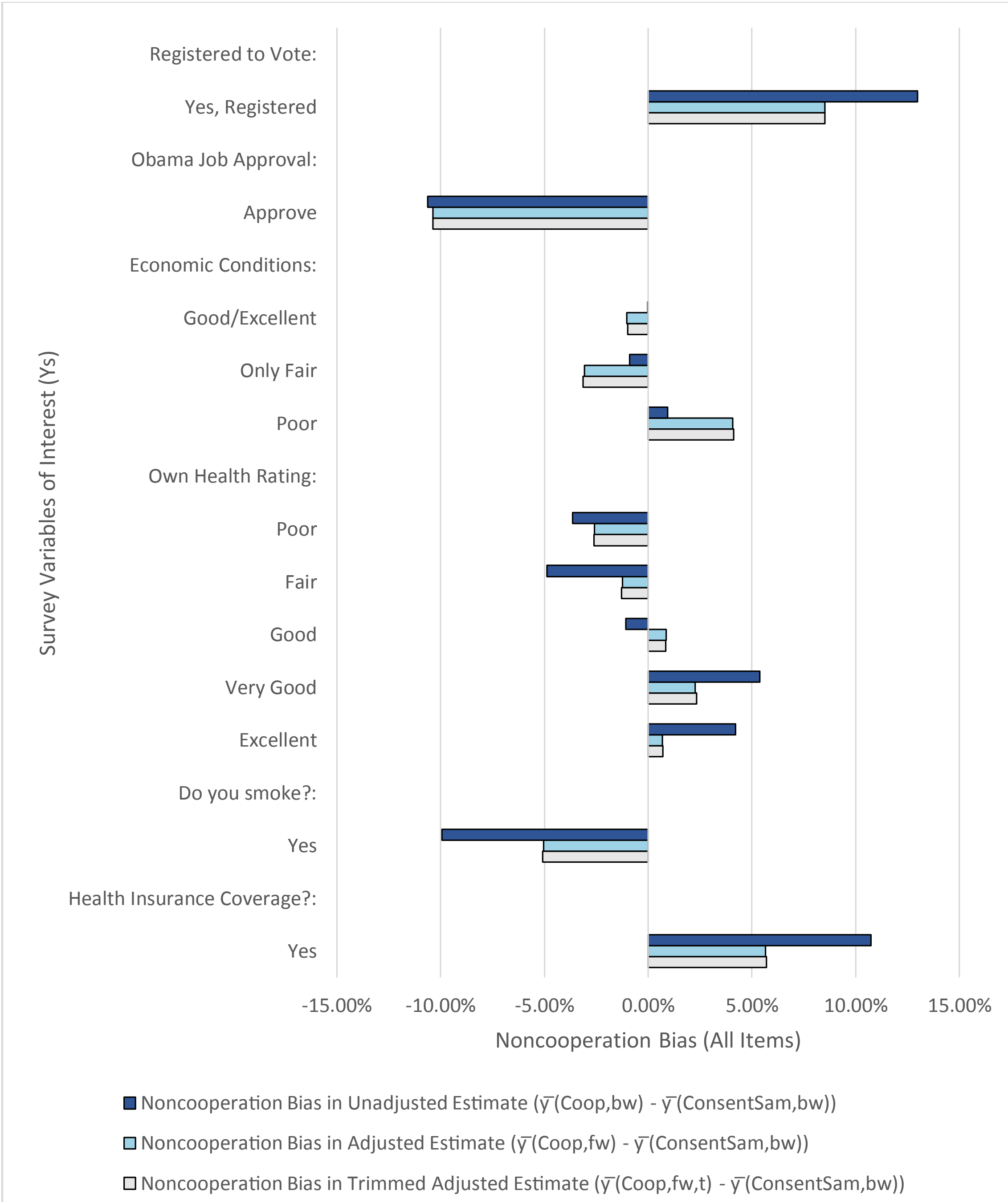

Figure 26. Difference in noncooperation bias (all items) for survey variables of interest (*y*s) estimated using base weights, noncooperation weight * base weight, and trimmed noncooperation weight * base weight adjustments.

Table 63

Base-Weighted Proportions and Standard Errors for Full Sample, SMS Consenters, SMS Nonconsenters, Experiment Selected, SMS Experiment Nonselected, SMS Cooperators (All Items), and SMS Noncooperators

Survey Variables of Interest	Full Sample %	S.E.	SMS Consent %	S.E.	SMS Nonconsent %	S.E.	SMS Experiment Selected %	S.E.	SMS Experiment Nonselected %	S.E.	SMS Cooperator (All Items) %	S.E	SMS Non-cooperator (All Items) %	S.E.
Registered to Vote?														
Yes, Registered	72.81	1.11	70.13	1.31	76.74	1.05	75.39	1.10	32.09	2.54	88.75	2.42	74.62	1.08
No, Not Registered	27.19	1.11	29.87	1.31	23.26	1.05	24.61	1.10	67.91	2.54	11.25	2.42	25.38	1.08
Obama Job Approval														
Approve	50.46	1.00	53.12	1.17	46.54	0.94	50.56	1.37	71.70	3.23	39.94	1.72	51.50	1.51
Disapprove	49.54	1.00	46.88	1.17	53.46	0.94	49.44	1.37	28.30	3.23	60.06	1.72	48.50	1.51
Economic Conditions														
Poor	35.59	1.38	33.93	1.22	38.03	1.84	35.36	1.22	23.53	2.29	36.62	3.49	35.61	1.16
Only Fair	45.59	0.84	46.40	0.69	44.39	1.38	45.11	0.73	55.72	2.36	44.14	2.29	45.12	0.74
Good/Excellent	18.82	0.82	19.67	1.01	17.58	0.76	19.53	0.99	20.74	1.96	19.24	2.54	19.27	0.95
Own Health Rating														
Excellent	14.93	0.38	14.12	0.50	16.13	0.46	15.20	0.58	6.31	0.99	19.38	1.71	14.80	0.61
Very Good	25.79	0.66	24.77	0.63	27.29	1.06	26.99	0.59	8.73	1.24	32.23	2.23	26.37	0.59
Good	31.50	0.40	31.44	0.48	31.59	0.75	31.42	0.51	31.56	1.65	30.35	1.95	31.52	0.59
Fair	19.77	0.68	21.00	0.64	17.97	0.98	18.56	0.69	38.65	2.05	13.85	1.55	19.15	0.73
Poor	8.00	0.35	8.67	0.44	7.02	0.39	7.83	0.37	14.75	1.93	4.19	0.94	8.16	0.44
Do you smoke?														
Yes	22.57	1.11	24.63	1.18	19.54	1.13	25.86	1.26	15.75	1.78	15.96	1.66	26.76	1.35
No	77.43	1.11	75.37	1.18	80.46	1.13	74.14	1.26	84.25	1.78	84.04	1.66	73.24	1.35
Health Insurance Coverage?														
Yes	72.59	0.88	68.91	1.03	78.00	0.82	73.81	0.89	33.40	1.99	84.31	2.34	72.62	1.10
No	27.41	0.88	31.09	1.03	22.00	0.82	26.19	0.89	66.60	1.99	15.69	2.34	27.38	1.10

Table 64

Difference in Proportions for SMS Consenters and Nonconsenters, Selected and Not Selected Sample Units into the SMS Experiment, and SMS Cooperators (All Items) and Noncooperators

Survey Variables of Interest	Diff. Consent - Nonconsent	Diff. Selected - Nonselected	Diff. Cooperation - Noncooperation
Registered to Vote?			
Yes, Registered	-6.61%	43.30%	14.12%
No, Not Registered	6.61%	-43.30%	-14.12%
Obama Job Approval			
Approve	6.58%	-21.14%	-11.56%
Disapprove	-6.58%	21.14%	11.56%
Economic Conditions			
Poor	-4.10%	11.83%	1.01%
Only Fair	2.00%	-10.61%	-0.98%
Good/Excellent	2.09%	-1.22%	-0.03%
Own Health Rating			
Excellent	-2.01%	8.89%	4.58%
Very Good	-2.52%	18.26%	5.86%
Good	-0.15%	-0.13%	-1.18%
Fair	3.03%	-20.09%	-5.30%
Poor	1.65%	-6.92%	-3.97%
Do you smoke?			
Yes	5.09%	10.11%	-10.80%
No	-5.09%	-10.11%	10.80%
Health Insurance Coverage?			
Yes	-9.10%	40.41%	11.69%
No	9.10%	-40.41%	-11.69%

Table 65

Empirical Bias for SMS Nonconsent, SMS Experimental Selection, SMS Noncooperation (All Items), and Total Nonresponse Bias

Survey Variables of Interest	SMS Nonconsent Bias	SMS Experimental Selection Bias	SMS Noncooperation (All Items) Bias	Total SMS-Related Nonresponse Bias
Registered to Vote?				
Yes, Registered	-2.68%	5.25%	12.98%	15.94%
No, Not Registered	2.68%	-5.25%	-12.98%	-15.94%
Obama Job Approval				
Approve	2.67%	-2.56%	-10.62%	-10.51%
Disapprove	-2.67%	2.56%	10.62%	10.51%
Economic Conditions				
Poor	-1.66%	1.44%	0.93%	1.03%
Only Fair	0.81%	-1.29%	-0.90%	-1.45%
Good/Excellent	0.85%	-0.15%	-0.03%	0.42%
Own Health Rating				
Excellent	-0.81%	1.08%	4.21%	4.45%
Very Good	-1.02%	2.21%	5.39%	6.44%
Good	-0.06%	-0.02%	-1.08%	-1.16%
Fair	1.23%	-2.44%	-4.87%	-5.92%
Poor	0.67%	-0.84%	-3.64%	-3.81%
Do you smoke?				
Yes	2.06%	1.23%	-9.93%	-6.61%
No	-2.06%	-1.23%	9.93%	6.61%
Health Insurance Coverage?				
Yes	-3.68%	4.90%	10.74%	11.72%
No	3.68%	-4.90%	-10.74%	-11.72%

Table 66

Descriptive Statistics for Untrimmed and Trimmed SMS Nonresponse Adjustment Weights (All Items)

	N	Mean	S.D.	Min.	Max.
*Nonconsent Weights * Noncooperation Weights (All Items) * Base Weights*					
Respondents	1,355	17.16	25.11	1.66	251.20
Nonrespondents	11,978	47.08	104.73	1.65	2426.70
Experimental Sample	13,333	44.04	100.00	1.65	2426.70
*Nonconsent Weights * Trimmed Noncooperation Weights (All Items) * Base Weights*					
Respondents	1,355	17.13	25.00	1.66	251.20
Nonrespondents	11,978	40.21	63.68	1.65	529.16
Experimental Sample	13,333	37.87	61.28	1.65	529.16

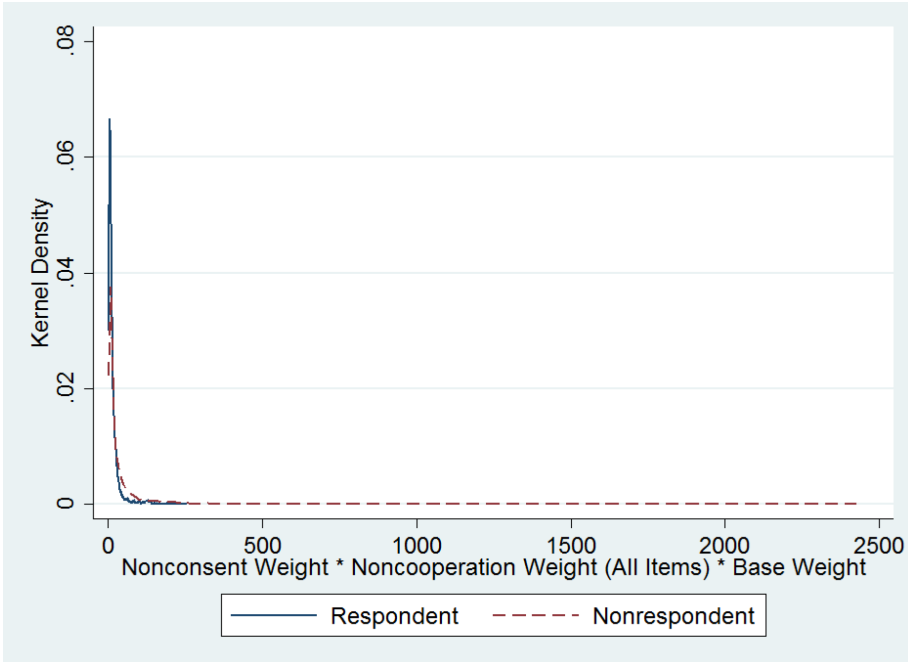

Figure 27. Kernel density plot of combined SMS nonresponse adjustment weights (nonconsent weight * noncooperation weight (all items) * base weight).

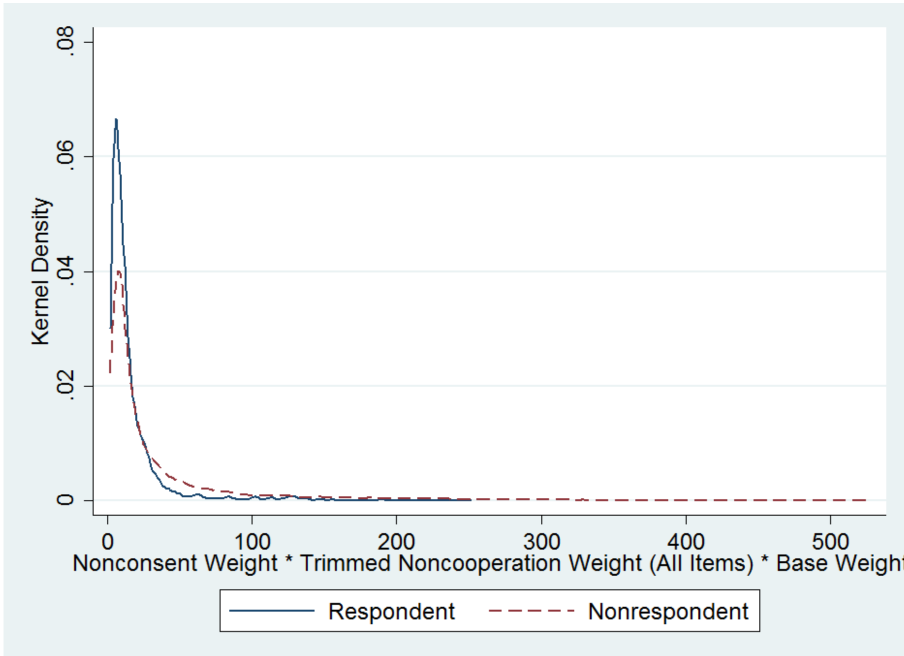

Figure 28. Kernel density plot of combined trimmed SMS nonresponse adjustment weights (nonconsent weight * trimmed noncooperation weight (all items) * base weight).

Table 67

Nonresponse Weighting Adjusted Means and Standard Errors for Cooperators (All Items) to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Respondent %	S.E.	Remaining Total SMS-Related Nonresponse Bias
Registered to Vote			
Yes, Registered	84.88%	3.56%	12.07%
No, Not Registered/Plan to/Don't Need to Register	15.12%	3.56%	-12.07%
Obama Job Approval			
Approve	38.92%	2.32%	-11.53%
Disapprove	61.08%	2.32%	11.53%
Economic Conditions			
Poor	40.01%	4.28%	4.42%
Only Fair	42.01%	2.87%	-3.57%
The Good/Excellent	17.97%	3.13%	-0.85%
Own Health Rating			
Excellent	16.25%	1.72%	1.32%
Very Good	29.31%	2.52%	3.52%
Good	32.24%	2.53%	0.74%
Fair	16.97%	2.38%	-2.80%
Poor	5.23%	1.59%	-2.77%
Do you smoke?			
Yes	19.65%	2.33%	-2.93%
No	80.35%	2.33%	2.93%
Health Insurance Coverage?			
Yes	80.27%	3.25%	7.68%
No	19.73%	3.25%	-7.68%

Table 68

Trimmed Noncooperation Weighting Adjusted Means and Standard Error for Cooperators (All Items) to SMS Survey and Empirical Noncooperation Bias

Survey Variables of Interest	Cooperation %	S.E.	Remaining Total SMS-Related Nonresponse Bias
Registered to Vote			
Yes, Registered	84.88%	3.55%	12.07%
No, Not Registered/Plan to/Don't Need to Register	15.12%	3.55%	-12.07%
Obama Job Approval			
Approve	38.92%	2.31%	-11.53%
Disapprove	61.08%	2.31%	11.53%
Economic Conditions			
Poor	40.03%	4.24%	4.45%
Only Fair	41.96%	2.84%	-3.62%
Good/Excellent	18.00%	3.13%	-0.82%
Own Health Rating			
Excellent	16.28%	1.72%	1.35%
Very Good	29.37%	2.52%	3.57%
Good	32.22%	2.53%	0.72%
Fair	16.94%	2.38%	-2.83%
Poor	5.19%	1.56%	-2.81%
Do you smoke?			
Yes	19.60%	2.32%	-2.97%
No	80.40%	2.32%	2.97%
Health Insurance Coverage?			
Yes	80.30%	3.25%	7.71%
No	19.70%	3.25%	-7.71%

Table 69

Evaluating Reductions in Standard Errors Using Trimmed Weights (Cooperators to all Items)

Survey Variables of Interest	Base Weight Only Cooperation S.E.	Weighting Adjustment Cooperation S.E.	Trimmed Weighting Adjustment Cooperation S.E.
Registered to Vote			
Yes, Registered	2.42%	3.82%	3.80%
No, Not Registered/Plan to/Don't Need to Register	2.42%	3.82%	3.80%
Obama Job Approval			
Approve	1.72%	2.59%	2.57%
Disapprove	1.72%	2.59%	2.57%
Economic Conditions			
Poor	3.49%	4.54%	4.51%
Only Fair	2.29%	3.21%	3.18%
Good/Excellent	2.54%	3.22%	3.22%
Own Health Rating			
Excellent	1.71%	1.83%	1.84%
Very Good	2.23%	2.72%	2.72%
Good	1.95%	2.83%	2.83%
Fair	1.55%	2.62%	2.61%
Poor	0.94%	1.70%	1.68%
Do you smoke?			
Yes	1.66%	2.59%	2.57%
No	1.66%	2.59%	2.57%
Health Insurance Coverage?			
Yes	2.34%	3.51%	3.50%
No	2.34%	3.51%	3.50%

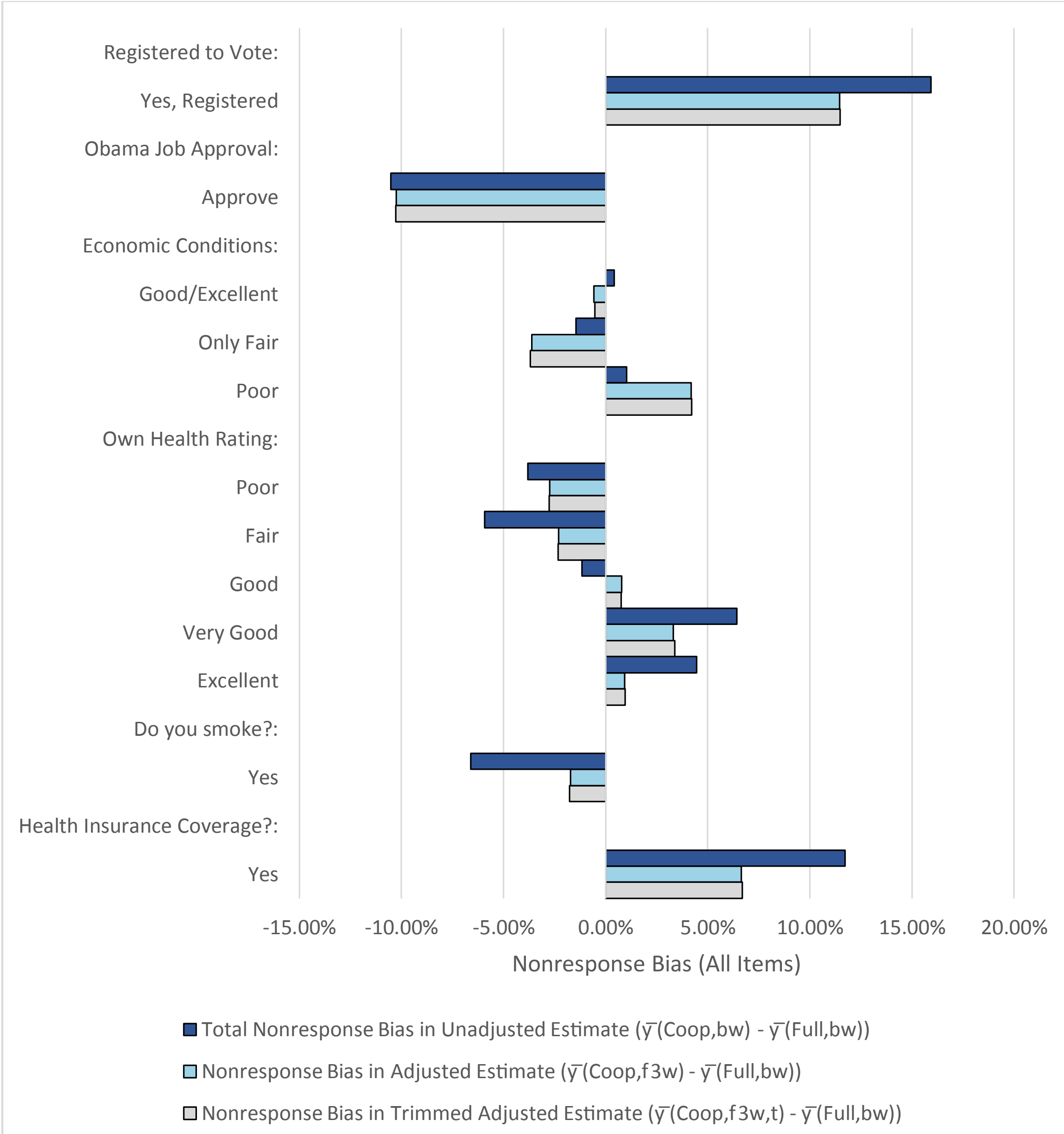

Figure 29. Difference in total SMS-related nonresponse bias for survey variables of interest (ys) estimated using base weights, nonconsent weights * noncooperation (all items) weights * base weights, and nonconsent weights * trimmed noncooperation (all items) weights * base weight adjustments.

Table 70

Hypothesized and Empirical Relationships between Common Cause (z) Covariates and Full Model Response Propensities

	Hypothesized Relationship	Empirical Relationship	Empirical Relationship
		Consent	Cooperation
Respondent Characteristics			
Economic Costs			
Monthly Household Income			
Under $999	-	+	-
$1,000 to $1,999	-	+	-
$2,000 to $2,999	-	-	-
$3,000 to $3,999	-	-	-
$4,000 to $4,999	-	-	-
$5,000 to $7,499	-	-	-
$7,500 to $9,999	-	-	+
$10,000 to $14,999	-	+	+
$15,000 and over (Reference)	n/a	n/a	n/a
Employment Status			
Employed Full Time for Employer (Reference)	n/a	n/a	n/a
Employed Full Time for Self	+/-	-	-
Employed Part Time - Do Not Want Full Time	-	-	+
Employed Part Time - Want Full Time	-	+	+
Unemployed	-	+	-
General Resistance			
Item Nonresponse Rate	-	-	-
Call Attempts	-	+	-

Table 70 continues

	Hypothesized Relationship	Empirical Relationship Consent	Empirical Relationship Cooperation
Respondent Characteristics (cont'd)			
General Resistance (cont'd)			
Party Identification			
Republican (Reference)	n/a	n/a	n/a
Lean Republican	+	+	+
Independent	+	-	-
Lean Democrat	+	+	-
Democrat	+	+	-
Refuse	+/-	+	-
Political Views			
Very Conservative (Reference)	n/a	n/a	n/a
Conservative	+	-	-
Moderate	+	-	-
Liberal	+	+	-
Very Liberal	+	+	-
Perceived Ease of Use			
Age			
18-24 (Reference)	n/a	n/a	n/a
25-34	+	+	+
35-49	+	+	-
50-64	+	-	-
65+	+	-	-
Education			
Less than high school diploma	-	+	-
High school degree or diploma (Reference)	n/a	n/a	n/a
Technical/Vocational school	+	-	+

Table 70 continues

	Hypothesized Relationship	Empirical Relationship Consent	Empirical Relationship Cooperation
Respondent Characteristics (cont'd)			
Perceived Ease of Use (cont'd)			
Education (cont'd)			
Some college	+	-	+
College graduate	+	-	+
Post graduate work or degree	+	-	+
Sociodemographics			
Gender			
Male (Reference)	n/a	n/a	n/a
Female	+	+	-
Marital Status			
Single/Never been married	-	+	+
Married (Reference)	n/a	n/a	n/a
Separated/Divorced	-	+	-
Widowed	-	+	-
Domestic partnerships/Living with partner…	+/-	+	+
Religious Preference			
Protestant	+	+	+
Roman Catholic	+	+	=
Other Christian Religion	+	-	-
Other Non-Christian Religion	+	-	-
No Religion/Atheist/Agnostic (Reference)	n/a	n/a	n/a
Religion Important			
No (Reference)	n/a	n/a	n/a
Yes	+	+	-

Table 70 continues

	Hypothesized Relationship	Empirical Relationship Consent	Empirical Relationship Cooperation
Respondent Characteristics (cont'd)			
Sociodemographics (cont'd)			
Religious Attendance			
At least once a week	+	+	-
Almost every week	+	+	-
About once a month	+	+	-
Seldom	+	+	-
Never (Reference)	n/a	n/a	n/a
Race			
White (Reference)	n/a	n/a	n/a
Black	+/-	-	-
Other	+/-	+	-
Hispanic	+/-	+	-
Social Environment			
Economic Conditions			
Your Company: Hire/Reduce			
Hiring new people and expanding the size	+	-	-
Not changing the size of its workforce (Reference)	n/a	n/a	n/a
Letting people go and the size	-	+	+
Direction of the National Economy			
Getting better	+	+	-
The same	+	+	-
Getting worse (Reference)	n/a	n/a	n/a

Table 70 continues

	Hypothesized Relationship	Empirical Relationship	Empirical Relationship
		Consent	Cooperation
Social Environment (cont'd)			
Neighborhood Characteristics			
Census Region			
Northeast	+/-	-	-
Midwest	+/-	-	-
South (Reference)	n/a	n/a	n/a
West	+/-	-	+
Interviewer Characteristics			
Experience			
Census Region			
Tenure (Months)	+	=	
Sociodemographics			
Interviewer Gender			
Female (Reference)	n/a	n/a	
Male	+/-	-	
Interviewer Race			
White (Reference)	n/a	n/a	
African American or Black	+/-	+	
Other	+/-	+	
Consent/Survey Design			
Questionnaire			
Survey Version			
Politics and Economy	+/-	+	+
Wellbeing (Reference)	n/a	n/a	n/a
Length			
Number of Items			
12 Items (Reference)	n/a		n/a
5 Items	+		+

Table 70 continues

	Hypothesized Relationship	Empirical Relationship	Empirical Relationship
		Consent	Cooperation
Consent/Survey Design (cont'd)			
Survey Mode			
Experimental Design			
Synchronous SMS (Reference)	n/a		n/a
SMS with Embedded URL	+/-		-

Note: The "Consent" and "Cooperation" columns contain results from the corresponding full models of response propensity. The "+" sign indicates an odds ration greater than one; "-" sign indicates an odds ratio less than one; "=" sign represents an odds ratio of one; "n/a" indicates the reference category; and "+/-" indicates that the anticipated direction of the covariate relative to the reference category is unclear from theory.