Incentive Experiments: NSF Experiences

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Disclaimer and Acknowledgments

Working papers are intended to report exploratory results of research and analysis undertaken by the Division of Science Resources Statistics. Any opinions, findings, conclusions, or recommendations expressed in this working paper do not necessarily reflect the views of the National Science Foundation. This working paper has been released to inform interested parties of ongoing research or activities and to encourage further discussion of the topic. This working paper is a summary of the incentive studies conducted recently by the Division of Science Resources Statistics, National Science Foundation (SRS/NSF). The author wishes to acknowledge the contractors who conducted these experiments—Mathematica Policy Research, Inc., and the National Opinion Research Center—the U.S. Census Bureau, and the staff of the Human Resources Statistics Program, SRS/NSF, who oversaw these studies. The author also wishes to thank Mary Frase and Stephen Cohen of SRS, who provided thorough review and numerous suggestions for revision of this working paper.

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Introduction

Government surveys have suffered declining response rates in recent years. Low response rates not only reduce effective sample size, but also may cause nonresponse bias. Various measures have been taken to maintain a high response rate. Among them, incentives have been effective in increasing response rates and data quality (For example, see Singer et al. 1999; Church 1993; Shettle and Mooney 1999). This working paper summarizes recent incentives studies conducted in connection with the surveys of the Scientists and Engineers Statistical Data System (SESTAT) of the National Science Foundation (NSF).

SESTAT is a database of the employment, education, and demographic characteristics of a sample of scientists and engineers in the United States. The SESTAT integrated database is constructed from data collected in three separate surveys: the National Survey of College Graduates (NSCG) (representing all individuals in the United States at the time of the decennial census with a bachelor's degree or higher), the National Survey of Recent College Graduates (NSRCG) (representing persons who obtained a bachelor's or master's degree in a science, engineering, or health [SEH] field from a U.S. institution earned within the last 2–3 years), and the Survey of Doctorate Recipients (SDR) (representing persons in the general U.S. population who have earned a doctorate in an SEH field from a U.S. institution). As a whole, SESTAT provides information on the entire U.S. population of scientists and engineers who hold at least a bachelor's degree.

Like many other federal government surveys, NSF's SESTAT surveys have also suffered from declining response rates in recent years. Historically, response rates for SESTAT surveys have been around 80%, but it has become much more challenging to achieve this response rate in recent survey cycles. For example, during the 10-year period of time from 1993 to 2003, the overall unweighted response rates for NSCG, NSRCG, and SDR declined from 80% to 63%, 85% to 67%, and 87% to 79% respectively.[1]

Low response rates reduce effective sample sizes and may cause bias. In order to find effective measures to overcome the ongoing trend of declining response rates, NSF has conducted a series

of incentive studies for the SESTAT surveys. For many years incentives have been used in surveys to increase response rates. Research has consistently shown that they are effective at increasing response rates. NSF incentive experiments tested a wide range of treatments: nonmonetary and monetary incentives, differing amounts of monetary incentives, different payment methods, different timing of incentives, etc. This working paper summarizes the evaluations of the impact of the incentive experiments on response rates and data quality. On the whole, the results have indicated positive impacts of monetary incentives on both response rate and data quality.

In the following sections, the effectiveness of promoting survey response rates and data quality using nonmonetary and monetary incentives is examined (section 1). Monetary incentives have positive impacts on both response rates and data quality; this result has justified further studies of such incentives. In section 2, the impact of alternative ways of offering monetary incentives is examined: prepaid check, which imposes an obligation to the sampled person to respond; or postpaid check, which prevents people from cashing the check without responding to the survey. To limit costs, monetary incentives often are offered toward the end of the data collection process to a small number of sampled persons who have not responded. Such individuals are either potential or known refusals and are the most difficult to convert to respondents. Section 3 examines the effectiveness of monetary incentives for refusal conversion. Section 4 evaluates the differences in impact of the timing of the incentives offered: early versus late incentives. Section 5 examines the response rates for all monetary incentive experiments to determine whether higher monetary incentives result in higher response rates. Section 6 looks at a possible “side effect” of offering monetary incentives to members of a panel survey: are panel members who received an incentive in a previous wave of the survey less likely to respond to the survey if no incentive is offered in the next round? In the following sections, NSF’s incentive experiments are summarized by the subjects mentioned above rather than by the time order in which the experiments were conducted.

The measures listed below were used in this paper to evaluate the impact of one or more of the experiments discussed (different definitions that were used for other experiments will be provided as appropriate):

- Response rate: the number of eligible completes divided by the total number of eligible sample members (which includes the total number of eligible respondents and the estimated total number of eligible nonrespondents)
- Completion rate: the number of completed surveys divided by the sample size
- Cooperation rate: the number of respondents divided by the sample size minus the number of final locating problems (respondents who could not be located during the survey despite various efforts by investigators).
- Imputation rate: the number of imputed variables divided by the total number of variables for all respondents
- Data editing rate: the number of variables requiring editing divided by the total number of variables for all respondents

1. Monetary Incentive Versus Nonmonetary Incentive

One postulated reason for survey nonresponse is that the sampled person lacks motivation to respond to the survey. This lack of motivation can be due to the sampled person's perception of the lack of relevance of the survey or any sense of obligation to respond. Some sampled persons would answer the survey if he/she felt the survey was relevant to them and it was not burdensome to fill out. Others will answer the survey only if some type of incentive is offered. According to the norm of reciprocity (Gouldner 1960), people are more likely to help those who provide a favor to them. The act of providing a favor builds a psychological obligation to reciprocate. Therefore, nonmonetary incentives, such as brochures, flyers, CD containing survey information, etc., are often used to promote the importance of a survey (and therefore increase the importance of a person responding to the survey). Monetary incentives are often used to encourage the sampled person's reciprocal response. To evaluate the effectiveness of both nonmonetary and monetary incentives to SESTAT surveys, NSF conducted an experiment during the 2003 SDR data collection period to assess the impact of nonmonetary and monetary incentives on response rates and data quality. The following is a summary of this study, mainly

drawn from Grigorian and Sederstrom (2006); Broach and Grigorian (2005); and Fecso, Broach, and Grigorian (2006).

1.1. 2003 SDR Incentive Study

The Survey of Doctorate Recipients is a longitudinal panel survey of individuals who have received doctoral level degrees from U.S. institutions in SEH fields and resided in the United States at the time of the survey. The SDR has been conducted biennially since 1973. In this survey, participants are followed throughout their careers from the year of award of the doctoral degree through age 75. Every 2 years, a sample of new SEH doctoral degree earners is added to the SDR sample from another NSF survey, the Survey of Earned Doctorates. For the 2003 cycle, a sample of individuals under the age of 76 who earned doctoral degrees in SEH fields from U.S. institutions through academic year 2002 was surveyed. For further details regarding the SDR, refer to the SRS website: http://www.nsf.gov/statistics/srvydoctoratework/.

Data collection for the 2003 SDR began in October 2003 with 40,000 sample members. In May 2004, after 7 months of data collection, 5,764 sample members had not yet responded. In all of these cases, the individuals had received the full contacting treatment protocol, which included up to 4 mail contacts, 3 e-mail contacts, and 20 computer-assisted telephone interview (CATI) attempts. From this reluctant portion of the sample, 5,578 sample members who had no locating problem were included in the 2003 SDR Incentive Study. This experiment included four treatment groups, including a control group, as follows:

1. $30 prepaid: a $30 personalized check sent via first-class mail with a gaining cooperation letter on NSF stationery. One week later, interviewers contacted sample members by telephone, requesting their participation, and an e-mail message was also sent to the sample members, referencing the $30 check and repeating the gaining cooperation text.
2. $50 postpaid: a gaining cooperation letter on NSF stationery sent via first-class mail promising a $50 incentive payment for those who completed the survey by telephone or by the experimental online version of the survey. Concurrently with the mailing, interviewers contacted sample members by telephone requesting their participation

and offering the $50 incentive, and an e-mail message was sent to the members, promising the $50 check and repeating the gaining cooperation text.

3. NSF brochure: a gaining cooperation letter on NSF stationery and an informational, four-color, SESTAT brochure with a data CD included sent via first-class mail. Concurrently with the mailing, interviewers contacted sample members by telephone, requesting their participation, and an e-mail message was also sent to the members, repeating the gaining cooperation text.
4. Control: a gaining cooperation letter on NSF stationery sent via first-class mail. Simultaneously with the mailing, interviewers contacted sample members by telephone, requesting their participation, and an e-mail message was sent to the sample members, repeating the gaining cooperation text.

TABLE 1. 2003 SDR Incentive Study: Experiment sample sizes and analysis results

SDR Incentive Experiment Treatment Group Sample Sizes		
Treatment	Initial Sample Size	Available for Analysis[a]
Control Group	4,078	3,975
$30 Prepaid	350	337
$50 Postpaid	350	340
NSF Brochure	400	390
Response Rates for 2003 SDR Incentive Experiment		
Treatment	Response Rate (%)	Significance[b]
Control Group	13.7	na
$30 Prepaid	37.7	$p < .0001$
$50 Postpaid	33.2	$p < .0001$
NSF Brochure	11.3	Not significant
Data Editing Rates for 2003 SDR Incentive Experiment		
Treatment	Data Editing Rate (%)	Significance[b]
Control Group	7.12	na
$30 Prepaid	2.23	$p < .0001$
$50 Postpaid	2.68	$p < .0001$
NSF Brochure	11.18	$p < .05$
Data Imputation Rate for 2003 SDR Incentive Experiment		
Treatment	Data Imputation Rate (%)	Significance[b]
Control Group	13.17	na
$30 Prepaid	2.79	$p < .0001$
$50 Postpaid	3.18	$p < .0001$
NSF Brochure	19.75	$p < .05$

na = not applicable

[a] Total of 146 sampled members responded to the survey before the experiment began. These cases are excluded from the analysis. Therefore, the number of cases available for analysis is less than the initial sample size.

[b] Compared with the control group.

SOURCES: Karen Grigorian and Scott Sederstrom, *Gaining Cooperation Strategies,* National Opinion Research Center (NORC), University of Chicago (2006); Ronald J. Broach and Karen H. Grigorian, *Incentives: Do You Get What You Pay For?*, NORC, University of Chicago (2005); Ronald S. Fecso, Ronald J. Broach, and Karen H. Grigorian, *Data That Do Not Persuade: Results of an Incentive Experiment,* NSF with NORC (2006).

Table 1 summarizes the sample sizes, response rates, and data quality measures. The results show that

- The nonmonetary group (NSF brochure) had a response rate similar to that of the control group. In other words, the information brochure about SESTAT did not establish better rapport than the cooperation letter on NSF stationery.
- Both monetary incentive groups ($30 prepaid group and $50 postpaid group) had significantly higher response rates than the control group. However, although the $50 postpaid group received a higher amount of money, its response rate (33.2%) is not significantly higher than the $30 prepaid group (37.7%).
- The nonmonetary group needed significantly more editing and imputation than the control group.
- Both monetary groups needed significantly less data editing and imputation than the control group.

1.2. 2006 NSRCG Prepaid Incentive Experiment

The 2003 SDR Incentive Study showed not only that the brochure as an incentive might have had a negative impact on data quality, but also that monetary incentives had significant positive effects on response rates and data quality. This latter pattern was observed in another incentive study with much lower levels of money incentives, conducted by the U.S. Census Bureau for NSF: the 2006 NSRCG Prepaid Incentive Experiment. The following is a summary of this study. For detailed information, see Zukerberg (2007) and Zukerberg, Hall, and Henly (2007).

The National Survey of Recent College Graduates provides information about individuals who recently obtained bachelor's or master's degrees in an SEH field from a U.S. institution, were living in the United States during the survey reference week, and were under age 76. The NSRCG sample is a two-stage sample: in the first stage, a sample of institutions is selected; in the second stage, a sample of graduates is selected from lists provided by the sampled institutions. For detailed information about the 2006 NSRCG, please refer to the SRS website: http://www.nsf.gov/statistics/srvyrecentgrads/.

The goal of this study was to increase the response rates during the early mail phase among traditionally low-responding demographic groups, defined as low-responding degree fields. A

degree field was considered a low-responding field if its 2003 NSRCG estimated response rate was lower than 68.6%. Nine degree fields were identified accordingly. Five of the fields were collapsed with other fields to form four groups (see table 2). The complete 2006 NSRCG sample consisted of 27,000 cases. After removing 151 cases that could not be contacted, 391 cases that were known foreign cases, and 134 cases with no name or Social Security number, the eligible frame for this study consisted of 26,324 cases. Of these cases, 13,802 were identified as cases in the low-responding degree fields defined in table 2 below. The sampled 2006 NSRCG cases from the low-responding degree fields were allocated to one of the following groups:

- $10 prepaid incentive
- $5 prepaid incentive
- $0 no incentive (control)

It should be noted that only the cases in the low-responding degree fields were included in the incentive study. Cases in the non-low-responding degree fields did not receive any type of prepaid incentive.

The 2006 NSRCG began with a paper questionnaire that was mailed to sampled individuals. Nonrespondents received a follow-up mailing with a replacement questionnaire 5 weeks later; if there was still no response, a CATI follow-up was conducted. The incentives (prepaid gift cards) were mailed along with the first questionnaire to members of the incentive groups.

Table 2 summarizes the incentive group sizes. Table 3 summarizes the response rates of all groups and the results of pairwise comparisons—the data show that monetary incentives as low as $5 can significantly increase response rates. Both tables show results through August 2006, 4 months into the data collection process; afterward, another incentive experiment with a sample that overlaps this study was implemented.

TABLE 2. 2006 NSRCG Prepaid Incentive Experiment: Treatment group sample sizes

Degree Field Group	Frame Size	Incentive Amount		
		$10	$5	$0
All Degree Fields	26,324			
Low-Responding Degree Fields	13,802			
IT Fields (Computer Science and Electrical Engineering)	3,687	647	647	2,393
Health Fields	1,998	647	647	704
Psychology and Political Science	3,547	647	647	2,253
Sociology/Economics/Other Social Sciences	4,570	647	647	3,276
Other Degree Fields	12,522			

SOURCES: Andrew Zukerberg, Results of 2006 NSRCG Prepaid Incentive Experiment, memo to National Science Foundation (2007); Andrew Zukerberg, David Hall, and Megan Henly, *Money Can Buy Me Love: Experiments To Increase Response Through the Use of Monetary Incentives,* U.S. Census Bureau (2007).

TABLE 3. 2006 NSRCG Prepaid Incentive Experiment: Response Rates by Treatment

Incentive	Response Rate	No Incentive	$5 Incentive	$10 Incentive
No Incentive	47.97%			
$5 Incentive	54.60%	$p < .10$		
$10 Incentive	57.46%	$p < .10$	Not significant	

SOURCES: Andrew Zukerberg, Results of 2006 NSRCG Prepaid Incentive Experiment, memo to National Science Foundation (2007); Andrew Zukerberg, David Hall, and Megan Henly, *Money Can Buy Me Love: Experiments To Increase Response Through the Use of Monetary Incentives,* U.S. Census Bureau (2007).

2. Prepaid Versus Postpaid

The previous section indicates a prepaid incentive as low as $5 can have a positive impact on the response rate. Does a postpaid incentive work equally as well as a prepaid incentive? If so, the use of a postpaid incentive can avoid the expense of having sampled persons taking the money without responding to the survey. During the 2003 NSRCG, an incentive experiment was conducted to test the effectiveness of different communication strategies and incentive methods. Below is a summary of this study. For more information about this experiment, refer to the 2003 NSRCG methodology report (Wilson et al. 2005); for more information about NSRCG, refer to the SRS website at http://www.nsf.gov/statistics/srvyrecentgrads/.

2.1. 2003 NSRCG Incentive Experiment

On April 21, 2004, more than 7 months after the beginning of the 2003 NSRCG data collection process, following two questionnaire mailings, CATI follow-up, and multiple e-mail/postcard reminders, an incentive experiment was conducted to test the effectiveness of various communication strategies (letter versus postcard) and payment methods (prepaid, postpaid, or no payment). For this purpose, 2,000 individuals who had not responded to the survey by April 21, 2004, were randomly assigned to five conditions (table 4).

TABLE 4. Conditions in 2003 NSRCG Incentive Experiment

Communication Strategies	Payment Methods		
	Postpaid	Prepaid	Control
Letter	Group 1 (n=400): Letter promised $20 for complete telephone response and $30 for complete Web response.	Group 2 (n=400): Letter included check for $20.	Group 3 (n=400): Letter offered no incentive.
Postcard	Group 4 (n=400): Postcard promised $20 for complete telephone response and $30 for complete Web response.	na	Group 5 (n=400): Postcard offered no incentive.

na = not applicable

SOURCE: Claire Wilson et al., *National Survey of Recent College Graduates: Methodology Report,* Mathematica (2005).

Nonrespondents to the initial mailing for all groups were sent follow-up reminders by e-mail and by telephone. During the follow-ups, the incentive was mentioned to the members of incentive groups (groups 1, 2, and 4). Table 5 below shows the results of the incentive experiment 1 week after the mailing.

TABLE 5. Results of 2003 NSRCG Incentive Experiment: Response rate 1 week after experiment started

Treatment	All Complete	CATI Complete	Web Complete	Hardcopy Complete
Prepaid Letter (Group 2)	11.5% (45)	3.6% (14)	7.9% (31)	0.0% (0)
Postpaid Letter (Group 1)	10.2% (38)	0.3% (1)	9.9% (37)	0.0% (0)
Control Letter (Group 3)	6.3% (24)	3.4% (13)	2.9% (11)	0.0% (0)
Postpaid Postcard (Group 4)	5.4% (21)	1.8% (7)	3.6% (14)	0.0% (0)
Control Postcard (Group 5)	2.6% (10)	1.0% (4)	1.3% (5)	0.3% (1)
Overall	7.2% (138)	2.0% (39)	5.1% (98)	0.1% (1)

NOTES: Except for "Overall" category, percentage represents proportion within each treatment group. Number of respondents is indicated in parentheses.

SOURCE: Claire Wilson et al., *National Survey of Recent College Graduates: Methodology Report,* Mathematica (2005).

Table 5 summarizes the response rates and sample counts for the three letter groups followed by the two postcard groups. The data indicate that there seems to be a communication effect: the postpaid–postcard group 4 seems to have a lower response rate than the postpaid–letter group 1 (5.4% versus 10.2%), and the control–postcard group 5 appears to have a lower response rate than the control–letter group 3 (2.6% versus 6.3%). These results suggest that a postcard may not be an optimal form of communication. Because of this communication effect, the two postpaid groups (postpaid–letter and postpaid–postcard) were not combined to make a comparison with the only prepaid group: the prepaid–letter group. The prepaid–letter group seems to have a similar response rate as the postpaid–letter group (11.5% vs. 10.2%), but a careful examination of the conditions shows the postpaid group had an option of getting a $30 incentive by responding via the Web. Indeed, 37 out of the 38 postpaid–letter group members responded using the Web to get the $30 incentive instead of the $20 CATI incentive. Consequently, the 10.2% response rate of the postpaid–letter group could reflect the option of a higher incentive; in contrast, the prepaid–letter group does not have the $30 Web option— thus, if not for the $10 higher incentive for the Web response option, the postpaid–letter group might have had a lower response rate. This reinforces the earlier similar observation in the 2003 SDR Incentive Study (section 1.1) in which the $50 postpaid group response rate was 33.2% while the $30 prepaid group response rate was 37.7%.

All comparisons in this experiment were not tested because the response rates were based on only 1 week of results in order to make an operational decision about treatment of all remaining

nonrespondents. On June 2, 2004, all nonrespondents were mailed a letter offering a postpaid incentive to encourage response: $20 for CATI response or $30 for Web response. This combination of incentives (group 1 in the experiment) was chosen because it yielded the highest proportion of Web responses and ensured that payment would be reserved for actual respondents.

3. Monetary Incentive as Refusal Conversion

Monetary incentives can increase response rates from all sampled persons, as seen above. But offering monetary incentives to all sampled persons incurs high cost; therefore, monetary incentives often are used toward the end of the data collection process in an attempt to convert "potential" nonrespondents. Do monetary incentives work with the "most reluctant" sampled persons? Do monetary incentives work on known refusals? Answers to these questions can be helpful in justifying the use of monetary incentives for refusal conversion toward the end of the data collection process.

3.1. 2006 NSRCG Refusal Conversion Experiment

The 2006 NSRCG Prepaid Incentive Experiment (see section 1.2) ended in August 2006, 4 months into the 2006 NSRCG data collection process. By then, thousands of sampled persons still had not completed the survey after rounds of questionnaire mailing and CATI calling—these are the *reluctant sample members.* Another incentive experiment was conducted to test whether monetary incentives also work on these members of the sample. In this experiment, approximately one-half of the eligible final refusal cases (sampled members who had already refused the requests to participate in the survey twice) and two-thirds of the potential refusal cases (other sampled members who had not yet responded) were randomly assigned to the treatment group.[2] The remaining cases were assigned to the control group (see table 6). Treatment group members received a $20 VISA gift card that would only be activated after completing the survey.

TABLE 6. 2006 NSRCG Refusal Conversion Experiment: Sample sizes

Refusal Type	Treatment ($20 Postpaid Gift Card)	Control	Total
Potential Refusal	626	369	995
Final Refusal	323	320	643

SOURCE: Andrew Zukerberg, David Hall, and Megan Henly, *Money Can Buy Me Love: Experiments To Increase Response Through the Use of Monetary Incentives,* U.S. Census Bureau (2007).

TABLE 7. 2006 NSRCG Refusal Conversion Experiment: Response rates

Refusal Type	Treatment	Control	Difference
Potential Refusal	38.52%	26.94%	11.58%*
Final Refusal	13.31%	2.19%	11.12%*

* Significant at 0.10 level.

SOURCE: Andrew Zukerberg, David Hall, and Megan Henly, *Money Can Buy Me Love: Experiments To Increase Response Through the Use of Monetary Incentives,* U.S. Census Bureau (2007).

During the experiment, telephone interviewers continued to make calls to members of the potential refusal group. Interviewers who reached a sample member in the treatment group mentioned the incentive to gain cooperation. Interviewers did not attempt to call members of the final refusal group. The final refusal sample members had to call the U.S. Census Bureau to complete the survey and have their gift cards activated. This may have contributed to the lower response rates among the final refusal group compared with the potential refusal group (table 7).

These results (table 7) show the significant impact of monetary incentives even on reluctant sample persons. For more detailed information on this experiment, refer to Zukerberg, Hall, and Henly (2007).

3.2. 2006 NSCG Refusal Conversion Experiment

An experiment similar to the 2006 NSRCG Refusal Conversion Experiment was also conducted for the 2006 National Survey of College Graduates, and the results were similar. NSCG is a longitudinal survey designed to provide data on the number and characteristics of experienced individuals with education and/or employment in SEH or SEH-related fields in the United States. The 2006 NSCG sample was the result of a multiphase, stratified sampling from 2003 NSCG

respondents, as well as from 2001 and 2003 NSRCG samples. For more information on the 2006 NSCG, refer to the SRS website at http://www.nsf.gov/statistics/survey.cfm.

In August 2006, 5 months into data collection for the 2006 NSCG, sample members who had not yet responded to the survey but were considered to have good contact information were identified.[3] These sampled members then were divided into two groups: the final refusals (sampled members who had already refused requests to participate in the survey twice) and the potential refusals (other sampled members who had not yet responded). From each group, two subsamples were selected, with one subsample to receive a monetary incentive of a $20 postpaid gift card that would be activated upon the completion of the survey and the other subsample to receive only a reminder to complete the survey (table 8). The goal of this experiment was to evaluate whether a promised $20 incentive would encourage response among these reluctant sampled persons. As there is a likelihood that some sampled persons may use a prepaid gift card without responding to the survey, postpaid gift cards were used instead in order to offer a higher value incentive to actual respondents.

TABLE 8. 2006 NSCG Refusal Conversion Experiment: Sample sizes

Refusal Type	Treatment ($20 Prepaid Gift Card)	Control	Total
Potential Refusal	1,324	657	1,981
Final Refusal	1,359	699	2,058

SOURCE: U.S. Census Bureau, *2006 National Survey of College Graduates: Methodology Report,* Special Survey Branch, Demographic Surveys Division (2008).

TABLE 9. 2006 NSCG Refusal Conversion Experiment: Response rates

Refusal Type	Treatment	Control	Difference
Potential Refusal	48.01%	34.75%	13.26%*
Final Refusal	19.33%	1.86%	17.47%*

* Significant at 0.10 level.

SOURCE: U.S. Census Bureau, *2006 National Survey of College Graduates: Methodology Report,* Special Survey Branch, Demographic Surveys Division (2008).

During the experiment, telephone interviewers continued to make calls to members of the potential refusal group. Interviewers who reached a sample member in the treatment group

mentioned the incentive to gain cooperation. Interviewers did not attempt to call members of the final refusal group. The final refusal sample members had to call the U.S. Census Bureau to complete the survey and have their gift cards activated. This may have contributed to the lower response rates among the final refusal group compared with the potential refusal group.

Similar to the results of 2006 NSRCG Refusal Conversion Experiment, the results show the postpaid monetary incentive works well on potential refusals and final refusals. Comparing table 9 with table 7, we see that except for the final refusal control group, all NSCG groups may have higher response rates than the corresponding NSRCG groups. This may reflect the fact that 2006 NSCG members had responded to at least one previous SESTAT survey. They were likely to be easier to reach and more likely to respond, while NSRCG members were new to the survey.

4. Timing of the Monetary Incentives

As seen above, a monetary incentive—as little as $5—can have positive effects on response rates and data quality. But when in the data collection process is offering an incentive most effective? Will offering an incentive early in the data collection process result in a higher response rate and better data quality than offering it later in the data collection process? To answer these questions, an incentive study was conducted to the 2006 SDR. The following is a summary of this study. For more details on this study, see Grigorian, Brown, and Jennings (2007).

4.1. 2006 SDR Incentive Experiment

The 2006 SDR Incentive Experiment was composed of an early-stage prepaid incentive distribution and a late-stage prepaid incentive distribution. The experiment sought to determine the effect of offering an incentive at different times on completion rate, response rate, and survey quality.

In September 2006, 5 months after 2006 SDR data collection began, four experiment groups were selected from 15,592 nonresponse cases from the 42,955 cases in the original sample (table 10):

- Early control group
- Early incentive group ($25 prepaid check)
- Late control group
- Late incentive group ($25 prepaid check)

Sample members assigned to the early incentive and late incentive groups were mailed an envelope containing a gaining cooperation cover letter on SDR letterhead and a $25 check via first-class mail. The early control and late control groups were mailed an envelope containing only a gaining cooperation cover letter on SDR letterhead via first-class mail.

TABLE 10. 2006 SDR Incentive Experiment: Sample sizes

Experiment Group	Sample Size
Early Control	466
Early Incentive	4,581
Late Control	464
Late Incentive	2,390
Total	7,901

SOURCE: Karen Grigorian, Shana M. Brown, and Claire Jennings, *2006 Survey of Doctorate Recipients Incentive Experiment Report,* NORC, University of Chicago (2007).

The incentive experiment schedule was the following:

September 22, 2006

- Gaining cooperation letter with $25 check mailed to early incentive group.
- Gaining cooperation letter mailed to early control group.
- Late control group and late incentive group did not receive any mailing at this time.

October 23, 2006

- Gaining cooperation letter with $25 check mailed to late incentive group.
- Gaining cooperation letter mailed to late control group.
- Early control group and early incentive group did not receive mailing at this time.

The early control and early incentive groups received gaining cooperation letters only in September; the late control group and late incentive group received gaining cooperation letters only in October. Tables 11–16 summarize the results of the experiment and are explained below.

TABLE 11. 2006 SDR Incentive Experiment: Response rates at the end of field period

Experiment Group	Response Rate	Early Control	Early Incentive	Late Control	Late Incentive
Early Control	37.2%				
Early Incentive	48.6%	$p < 0.05$			
Late Control	36.7%	Not significant	$p < 0.05$		
Late Incentive	47.1%	$p < 0.05$	Not significant	$p < 0.05$	

SOURCE: Karen Grigorian, Shana M. Brown, and Claire Jennings, *2006 Survey of Doctorate Recipients Incentive Experiment Report,* NORC, University of Chicago (2007).

TABLE 12. 2006 SDR Incentive Experiment: Completion rates by October 22, 2006, and by the end of field period

Experiment Group	Completion Rate	
	October 22, 2006 (Before Late Incentive Began)	December 2006 (End of Field Period)
Early Control	18.9%	32.0%
Early Incentive	29.9%	45.4%
Late Control	7.5%	30.6%
Late Incentive	7.2%	43.1%

SOURCE: Karen Grigorian, Shana M. Brown, and Claire Jennings, *2006 Survey of Doctorate Recipients Incentive Experiment Report,* NORC, University of Chicago (2007).

The second column of table 12 summarizes the completion rates by October 22, 2006, 1 month after the cooperation letter/incentives were sent to the early control and early incentive groups. As of October 22, neither the late control group nor the late incentive group had received anything for the experiment. By that date, however, 6 months into the data collection process, both late groups had received several mailings for the survey before their portion of the experiment began.

The third column of table 12 summarizes the completion rates by the end of the field period (December 2006). By then, the late control and late incentive groups already had their cooperation letter/incentives for at least 1 month. During this period of time, the early control

and early incentive groups did not receive any additional mailings. At the end of the data collection period, the two control groups had similar completion rates, as did the two incentive groups.

Table 11 indicates that although both incentive groups' response rates are statistically significantly higher than their corresponding control groups, at the end of the field period the two incentive groups had similar response rates. Hence, the difference in timing of offering an incentive for these two groups did not result in differences in response rates. Operationally, offering an incentive early may mean offering it to all individuals in the sample (potential respondents and nonrespondents), while offering an incentive late means offering it to fewer sampled persons (potential nonrespondents only). As shown in table 12, however, early incentives also can result in earlier completion, which may reduce the follow-up efforts and associated cost. As such, the potential extra costs for early incentives being offered to many people may be offset by cost savings in follow-up efforts. Further study is needed to determine whether the savings offsets the costs when offering incentives early in the data collection process.

TABLE 13. 2006 SDR Incentive Experiment: Imputation Rate

Experiment Group	Average Imputation Rate
Early Control	4.70%
Early Incentive	3.44%
Late Control	5.23%
Late Incentive	3.36%*
Overall	3.54%

* Significant at $p < 0.05$ compared with late control group.

SOURCE: Karen Grigorian, Shana M. Brown, and Claire Jennings, *2006 Survey of Doctorate Recipients Incentive Experiment Report,* NORC, University of Chicago (2007).

Table 13 indicates the two incentive groups also had similar imputation rates. The late incentive group had a significant lower imputation rate (3.36%) than the late control group (5.23%).

TABLE 14. 2006 SDR Incentive Experiment: Completion status among individuals who received a check, by check-cashing status

Completion Status	Cashed Check	Did Not Cash Check	Total
Completed Survey	2,033 (30.21%)	908 (13.49%)	2,941 (43.71%)
No Survey	257 (3.82%)	3,531 (52.48%)	3,788 (56.29%)
Total	2,290 (34.03%)	4,439 (65.97%)	6,729 (100%)

NOTE: Numbers in parentheses represent percentage of total cases in the experiment.

SOURCE: Karen Grigorian, Shana M. Brown, and Claire Jennings, *2006 Survey of Doctorate Recipients Incentive Experiment Report,* NORC, University of Chicago (2007).

A concern with prepaid incentives is that many people may cash incentive checks without completing the survey. As table 14 shows, this occurred with 3.8% of individuals in the experiment, while 13.5% completed the survey and did not cash their check.

TABLE 15. 2006 SDR Incentive Experiment: Cooperation Rates[a] at the end of field period, by sample type and incentive status

Sample Type	Early Control	Early Incentive	Late Control	Late Incentive
Past Refusal	10.4%	32.4%*	19.0%	29.2%*
Past Cooperative	59.5%	75.9%*	56.8%	72.6%*
Past Nonrespondent	40.0%	51.5%	37.8%	49.3%
New Doctorate	66.7%	80.1%	51.7%	80.3%*

* Significant at $p < .05$ level compared with the corresponding control group.

[a] Cooperation rate is calculated as (number of respondents)/(sample size – cases with locating problems).

SOURCE: Karen Grigorian, Shana M. Brown, and Claire Jennings, *2006 Survey of Doctorate Recipients Incentive Experiment Report,* NORC, University of Chicago (2007).

The cooperation rate is the percentage of the respondents in the sample after removing the cases with locating problems. Table 15 indicates that the early incentive and late incentive groups had similar cooperation rates across all sample types and had significantly higher cooperation rates than the corresponding control groups for more than half of the comparison groups.

5. Monetary Incentive: The More the Better?

As mentioned previously, monetary incentives—as little as $5—had positive impacts on response rates and/or data quality. But are larger incentives associated with larger gains in response rates? Although NSF has not tested a wide range of values for incentives in a single

experiment, the studies that do exist suggest the higher the monetary incentive, the higher the gain in response rate.

5.1. The Effect of the Amount of Incentive on Response Rate and Data Quality

Using the results of the existing experiments, table 16 summarizes the monetary incentive amount and the corresponding response rate increase associated with that incentive. The 2003 NSRCG experiment results are not included because the experiment ended only 1 week after its start. Table 16 also lists the decrease in imputation rate associated with the monetary incentive in experiments for which such information is available. *Imputation rate* is the percentage of the items that are imputed; therefore, a decrease in item imputation rate means an increase in data quality.

TABLE 16. Incentive Amount and Response and Imputation Rate Changes Across Experiments in 2003 and 2006 SESTAT Surveys

Survey	Incentive Amount	Response Rate Increase	Imputation Rate Decrease	Table Source
2006 NSRCG	$5 (First Mailing, Prepaid)	6.9%	NA	3
2006 NSRCG	$10 (First Mailing, Prepaid)	9.5%	NA	3
2006 NSRCG	$20 (Potential Refusal, Postpaid)	11.6%	NA	7
2006 NSRCG	$20 (Hard Refusal, Postpaid)	11.1%	NA	7
2006 NSCG	$20 (Potential Refusal, Postpaid)	13.3%	NA	9
2006 NSCG	$20 (Hard Refusal, Postpaid)	17.5%	NA	9
2006 SDR	$25 (Late Incentive, Prepaid)	10.4%	1.3%	11, 13
2006 SDR	$25 (Early Incentive, Prepaid)	11.4%	1.9%	11, 13
2003 SDR	$30 (Prepaid)	24.0%	10.4%	1
2003 SDR	$50 (Postpaid CATI or Web)	19.5%	10.0%	1

NA = not available

The data in table 16, drawn from tables 1–15, suggest that higher monetary incentives may be associated with greater gains in response rate; however, this set of experiments was not designed to test such a proposition. Further exploration of this potential association would be useful.

6. Slippery Slope?

Two of the SESTAT surveys, SDR and NSCG, are panel surveys—most sampled persons in these two surveys have responded to multiple waves of the surveys. Will a panel member who received a monetary incentive in a previous survey round develop an expectation of a monetary incentive for participating in the next round of the survey? Accordingly, will a panel member who received an incentive in the last round be less likely to respond to the survey if he or she does not receive an incentive in the next round? These are the questions that need to be answered before applying incentives to members of panel surveys.

6.1. An Ad Hoc Analysis of Expectation Effect

Using existing information from SESTAT surveys, Michael White of the U.S. Census Bureau performed an ad hoc analysis of the possible slippery-slope effect on panel members in 2008 (White 2008). The following is a summary of that report.

The 2006 NSCG sampling frame consisted of the following:

- Eligible cases from the 2003 NSCG
- Eligible cases from the 2001 and 2003 NSRCG

During the 2003 NSRCG, an incentive was offered to all nonrespondents toward the end of data collection (see section 2.1). The 2006 NSCG followed a sample of respondents to the 2003 NSRCG; as such, some of the 2006 NSCG sampled persons had received an incentive in the 2003 NSRCG data collection. During the 2006 NSCG, an incentive experiment also was conducted (see section 3.2). Therefore, it is possible to identify four groups of sampled persons from which to assess the possible effect of expectation of an incentive:

- Group 1: Received **an incentive** in 2003 NSRCG, and received **an incentive** in 2006 NSCG
- Group 2: Received **an incentive** in 2003 NSRCG, and received **no incentive** in 2006 NSCG
- Group 3: Received **no incentive** in 2003 NSRCG, and received **an incentive** in 2006 NSCG

- Group 4: Received **no incentive** in 2003 NSRCG, and received **no incentive** in 2006 NSCG

Table 17 summarizes the number of cases and response rate of each of the four groups.

Table 17. Expectation Effect of Incentives

Group	2003 Treatment	2006 Treatment	Total Cases	Respondents	Response Rate
1	Incentive	Incentive	338	174	51.28%
2	Incentive	No Incentive	170	54	31.76%
3	No Incentive	Incentive	615	350	56.91%
4	No Incentive	No Incentive	325	149	45.85%

SOURCE: Michael White, *Incentive Conditioning Evaluation,* U.S. Census Bureau (2008).

The analysis indicates there may be an expectation effect of incentives. This can be seen in various ways, e.g., Group 1 versus Group 2, Group 2 versus Group 4, etc. But it should be emphasized that the experiment was not controlled—the 2006 treatment group was not a simple random sample of the 2003 treatment sample (only potential and final nonrespondents received incentives in 2006). Consequently, no statistical test or comparison was attempted. The data strongly indicate, however, that a controlled experiment should be conducted to further assess the expectation effect.

7. Summary and Future Work

NSF's incentive experiments have covered a fairly wide range of features of offering incentives. First, the experiments show monetary incentives indeed improve response rates and data quality for the SESTAT population, scientists and engineers with at least a bachelor's degree in the United States. It seems that higher monetary incentives may yield higher response rate gains. Also, these experiments show that even for the most reluctant sample members, the hard (final) refusals, monetary incentives can improve response rates. On the other hand, nonmonetary incentives in the form of an NSF brochure did not motivate sample members to respond to the survey and may have harmed the data quality.

As to the payment methods, prepaid payments may add an obligation to respond and may turn out to be more cost-effective than postpaid payments. The concern that many people may cash a prepaid check without responding to the survey was not a major issue with the SDR sample. In fact, among SDR sample members, substantially more people did the opposite: they responded to the survey and did not cash the incentive check.

The experiments also show that the timing of offering monetary incentives may not affect their impact: early incentives did not increase the effect of monetary incentives on response rate compared with late incentives. This finding supports the offering of monetary incentives to hard refusals toward the end of the data collection process in order to reduce the cost of such incentives. However, since early incentives result in earlier responses and thus save follow-up efforts and costs, it is important to further compare early and late incentives in terms of cost-effectiveness.

To the panel members of longitudinal surveys such as NSCG and SDR, monetary incentives may need to be used with caution. Limited analysis suggests that if a panel member received a monetary incentive in a previous survey, he or she may be less likely to respond if he or she does not receive monetary incentive again in the current survey. This issue needs to be investigated more thoroughly.

Notes

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1. See: http://www.nsf.gov/statistics/sestat/datacollect.cfm and http://www.nsf.gov/statistics/nsf06320/appa.htm#rates.

2. Congressional refusals were excluded from this experiment. These are generally cases in which the respondent contacted his or her congressional representative or the NSF to opt out of the survey or was threatening in his or her correspondence with the Census Bureau.

3.Congressional refusals were excluded from this experiment. These are generally cases in which the respondent contacted his or her congressional representative or the NSF to opt out of the survey or was threatening in his or her correspondence with the Census Bureau.

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