AN INVESTIGATION OF THE NONRESPONSE – MEASUREMENT ERROR NEXUS

by

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Chapter 1

Introduction

Why do people participate in surveys? When are survey estimates affected when they do not participate? When people participate in surveys, do they provide accurate answers? Is the accuracy of a person's answers related to the person's willingness to participate in the survey?

Although there have been nonrespondents since the first application of probability sampling to study a population (de Heer, de Leeuw and van der Zouwen 1999; Hansen and Hurwitz 1946), the reasons why people participate in surveys remain elusive. While it has been commonly assumed that lower response rates will increase nonresponse bias, recent analyses called this assumption into question (Curtin, Presser and Singer 2000; Keeter et al. 2000; Merkle and Edelman 2002), Other research showed that response rates can and do affect nonresponse bias (Groves, Presser and Dipko 2004; Groves, Singer and Corning 2000). These articles triggered a debate of whether response rates matter (Martin 2004), emphasizing the importance of using theoretical understanding of causes of nonresponse when specifying which statistics will be most sensitive to nonresponse bias (Groves 2006).

Conditional on a given response rate for a given survey, there appears to be more variation in nonresponse bias on statistics within a survey than across surveys (Groves, 2006). Furthermore, although practitioners and survey analysts worry that those individuals brought in through extensive efforts will provide answers filled with measurement error, no strong empirical studies of this phenomenon have occurred. This dissertation addresses this issues.

To understand the relationship between the likelihood of survey participation and measurement error, the circumstances under which nonresponse bias will occur first must be addressed. The answer is simple statistically –when the survey variable itself is the cause of survey participation, the unadjusted respondent mean will differ from the population mean. This corresponds to a Not Missing at Random model (Little and Rubin 2002) or the Survey Variable Cause Model (Groves 2006). The unadjusted respondent mean also will differ from the population mean when there is a third variable, Z, that is related to both propensity and the survey variables. This corresponds to a missing at random model (Little and Rubin 2002) or a Common Cause Model for survey nonresponse bias (Groves 2006). Finally, if the causes of the survey variable and the causes of survey participation differ then there will be no nonresponse bias – a Missing Completely at Random model (Little and Rubin 2002) or a Separate Causes Model (Groves 2006) for nonresponse bias.

The challenge to survey methodologists and survey analysts is to predict when the relationship between survey participation and the survey variables will be strong or weak. A logical place to start is by applying current understanding of the cause of nonresponse propensity to nonresponse bias. Not all causes of survey participation should be related to all survey variables. By a priori specifying the relationship between survey participation and the survey variables, we can obtain traction on the issue of within-survey variation across estimates in nonresponse bias. To the extent that this relationship differs for different categories of survey nonresponse (e.g., contact versus cooperation), then understanding of when nonresponse bias will manifest requires separating them.

This discussion can be extended to the relationship between survey participation and measurement error in survey reports. That is, when will people who vary in their willingness to participate in surveys differ in the quality of their answers to survey questions? Careful insights into this question will be garnered by understanding the relationship between survey participation and the survey variables of interest.

1.1 Structure of This Dissertation

This dissertation has five chapters. Chapter One reviews the existing literature on causes of survey nonresponse propensity, linking those causes to statistics that should be most sensitive to nonresponse bias for that cause. Chapter One also discusses the two surveys that will be used in the dissertation, the Wisconsin Divorce Study (WDS) and the National Postsecondary Student Aid Study (NPSAS).

Chapter Two examines the relationship between nonresponse propensity and nonresponse bias. In this chapter, we use influences on survey participation identified in Chapter One for contactability and cooperation to anticipate the relationship between response propensity and the survey variables of interest. The ability to make inference about each cause is examined in light of the available proxy indicators. The relationship between nonresponse propensity and the survey variables of interest is examined using multiple propensity model specifications. The efficacy of the models for adjustment purposes also is evaluated.

Chapter Three looks at the measurement error properties of the survey variables in the WDS and NPSAS. The cognitive response process provides a starting point to specify measurement error models for the survey variables. Expert ratings are used to identify likely breakdowns in the cognitive response process, respondent characteristics, and true values of the survey variables themselves.

Chapter Four tackles the nonresponse propensity and measurement error question. This chapter introduces five conceptual models for the nonresponse propensity/ measurement error nexus.. These models are illustrated using case studies. The prevalence of each model across the two surveys is also evaluated.

Finally, Chapter Five summarizes the findings from Chapters Two, Three and Four. Directions for future research are suggested.

1.2 Linking Theories about Nonresponse Propensity to Nonresponse Bias

Traditionally nonparticipation in surveys is divided into three primary categories: noncontact nonresponse, noncooperation nonresponse, and “other” nonresponse (inability to respond due to language, physical and mental difficulties). Noncontact nonresponse arises because a sampled unit did not receive the recruitment request during a survey’s field period; noncooperation nonresponse results when a sampled unit is contacted and fails to give an interview. Other forms of nonresponse exist, such as nonresponse due to physical, mental and language difficulties and noncontact nonresponse due to nonlocation of contact information for a sample member. However, these categories usually make up a small proportion of nonresponse on a survey and have readily identifiable mechanisms (e.g., the questionnaire was not translated into the appropriate language).

We focus our attention on nonresponse due to noncontact and noncooperation. The distinction between these two sources of nonresponse has long been recognized (e.g., Deming 1947), although their mechanisms producing them have not. These two sources of nonresponse are easily separated in interviewer-administered surveys, but are more difficult to distinguish in self-administered surveys.

A useful expression for the nonresponse bias of an unadjusted respondent mean shows it as a function of the covariance between nonresponse propensity and the survey variable of interest (σ_{pY}) and the average response propensity in the population ($\bar{p}$): $Bias(\bar{y}_r) = \sigma_{pY} / \bar{p}$ (Bethlehem 2002). Three comments can be made about this expression. First, the covariance term in the numerator is clearly statistic-specific, depending on the Y variable in question. Second, within the same survey, some variables may experience a Survey Variable Cause source of nonresponse bias (e.g., $|corr(p,Y)| \doteq 1$), others may experience a Common Cause source of nonresponse bias associated with a variable Z, such that $corr(p,Y \mid Z) = 0$, and other variables still will experience a Separate Cause source of nonresponse bias (e.g., $|corr(p,Y)| \doteq 0$). Thus, within a survey there may be some variables that experience nonignorable nonresponse (Little and Rubin 2002) and others that do not. Additionally, there may be respondent means that overestimate the $\bar{Y}$ ($\sigma_{pY} > 0$) or underestimate it ($\sigma_{pY} < 0$).

We now describe the existing literature for survey contact and cooperation, suggesting the most likely candidate variables for nonresponse bias under each influence on survey participation. The suggested variables are the “low-hanging fruit” for nonresponse bias should the given mechanism be the driving source of nonresponse bias in a survey measuring those variables.

1.2.1 Causes for Noncontact Nonresponse

The reasons why people are not contacted for surveys are easier to identify than those for why people fail to cooperate when contacted. In early literature, noncontact nonresponse was called "not-at-home" nonresponse (Deming 1947; Politz and Simmons 1949), representing a large part of the mechanism for noncontact nonresponse in face to face household surveys. Understanding of the primary correlates of noncontact nonresponse in interviewer-administered surveys grew to include not only at-home patterns, but also the number of call attempts, timing of call attempts, and access impediments, the type of which vary by mode (Groves and Couper 1998). These correlates are relatively uncontroversial.[1] However, obtaining direct measures of a sample unit's at-home patterns or access impediments can be difficult.

1.2.1.1 At-home Patterns

The most consistent finding from investigations of contactability in Western countries, whether looking at face-to-face or telephone surveys, is that calls made during weekday evenings and weekends are more likely to achieve contact than calls made during weekday days (Bates 2003; Brick et al. 1996; Hoagland, Warde and Payton 1988; Piazza 1993; Purdon, Campanelli and Sturgis 1999; Weeks, Kulka and Pierson 1987; Weeks et al. 1980). These findings mirror population-level trends of being at home or

[1] An unknown, but likely small, proportion of noncontact nonresponse are latent refusals (e.g., the "fluttering curtain").

away from home measured through time-use surveys (Kropf and Blair 2000; Maitland 2006).

Subgroup differences exist in at-home patterns. The unemployed, elderly, married individuals, households with children, and women are more likely to be at home during weekday days than other persons (Maitland 2006). These groups also tend to be those who are easier to contact in surveys (Groves and Couper 1998; Stoop 2005).

In an interviewer-administered survey, noncontact nonresponse due to at-home patterns is highly dependent on the time that calls are made (telephone calls, in-person visits). At-home patterns are much more likely to be a large problem in noncontact nonresponse in surveys when calls are only made during a certain time of the day or days of the week (e.g., only during the day, only weekday evenings) and when there is a short field period, as varying the times of day and calling more times are designed to overcome the not-at-home problem.

If differential at-home patterns is the cause for noncontact, respondent means most likely to be biased due to nonresponse are those related to being away from home. Time-use measures of hours away from home, including activities done during work and during leisure time, and measures of subgroups that are least likely to be at home (e.g., employed single person households) are examples.

1.2.1.2 Access Impediments

Access impediments are devices or mechanisms used to restrict a stranger's ability to contact a household. In telephone surveys, access impediments include answering machines, caller ID devices, and privacy managers (Link and Oldendick 1999; Oldendick and Link 1994; Tortora 2004; Tuckel and O'Neill 1995; Tuckel and O'Neill

2002). All three devices may be used to screen out unwanted telephone calls from strangers, although answering machines, and to some extent caller ID devices, can be used to capture missed calls from known persons.

People who have answering machines tend to be younger, have higher income, have more education, and white (Link and Oldendick 1999; Oldendick and Link 1994; Piazza 1993; Tuckel and O'Neill 1995; Tuckel and O'Neill 2002; Tuckel and Feinberg 1991). Persons with caller ID (who use it for screening) tend to be non-white, lower income, divorced, and households with at least three adults or households with children (Link and Oldendick 1999; Tuckel and O'Neill 2002).

Although clearly a detriment for response rates in face-to-face surveys (Groves and Couper 1998), the effect of access impediments on telephone survey nonresponse rates is mixed. Answering machines have been positively associated with contact and cooperation (Tuckel and Feinberg 1991; Xu, Bates and Schweitzer 1993), and negatively associated with cooperation (Link and Oldendick 1999). Caller ID has had similarly mixed effects (Callegaro, McCutcheon and Ludwig 2005).

When the presence of access impediments is the cause of noncontact nonresponse, the most likely candidates for noncontact nonresponse bias are prevalence estimates of those access impediments, reports of how the access impediments are used (e.g., proportion using an answering machine to screen phone calls), or respondent characteristics that are strongly associated with the presence of access impediments.

1.2.2 Mechanisms for Noncooperation Nonresponse

Commonly studied correlates of survey cooperation in interviewer-administered surveys can be divided into five groups: social environmental factors, household or respondent factors, interviewer factors, survey design factors, and the interaction between interviewer and respondent (Groves and Couper 1998; Morton-Williams 1993; Stoop 2005). Social environmental factors include such covariates as urbanicity, crime rates, and population density. Household and respondent factors include household composition and demographic characteristics (e.g., age, race, sex, education) of the selected sample unit. Interviewer factors include interviewer experience, fixed attributes such as sex, age, race, or education, and attitudes toward the survey recruitment task. Survey design factors include features of the recruitment protocol, such as the mode, sponsor, length of the interview, and topic of the study. Finally, the interaction between interviewer and respondent refers to a host of features of the brief conversation that the two actors have during the recruitment request.

Theoretical explanations for survey cooperation can be divided into one of two general classes. These explanations emphasize either (1) relatively fixed attributes or (2) the role of decision making in survey participation. Views of survey participation that involve a fixed attribute assert that the sampled unit's reaction to the survey request reflects prior attitudes and behaviors that are relatively stable across survey requests. Views of survey participation as a decision making process either involve a weighing of costs and benefits or the use of shortcuts (e.g., norms, heuristics) to obtain a response.

1.2.3 Fixed Attribute Models for Survey Nonresponse

Underlying fixed characteristics may cause people to vary in response propensity. Seven such characteristics are (1) social isolation and civic engagement; (2) lack of discretionary time; (3) altruism or helping behavior; (4) social environmental factors; (5) topic interest; (6) holding positive affect toward the survey sponsor; and (7) attitudes towards surveys. Except for topic interest, little if any discussion of these attributes has resulted in understanding of when survey nonresponse rates will be related to nonresponse error.

1.2.3.1 Social Isolation

A commonly posited cause for survey participation is social isolation (Goyder 1987; Groves and Couper 1998), also called by its converse social engagement, social involvement (Voogt 2004), or social participation (Brehm 1993). Social isolation has two components – isolation from other individuals (McPherson, Smith-Lovin and Brashears 2006) and isolation from dominant social groups and/or society in general (Keyes 1998; Putnam 2000; Toppe and Galaskiewicz 2006). Theories for survey participation largely have focused on the latter type of social isolation.

Under this hypothesis, people who are less involved with society or dominant social groups, who do not share norms with society or that social group, or who are alienated or disengaged from society are less compliant with survey requests (Brehm 1993; Goyder 1987; Groves and Couper 1998; Voogt 2004). The isolated either lack the "common cause" of civic engagement that underlies helping behavior and participation in civic events or prosocial organizations (Brehm 1993; Toppe and Galaskiewicz 2006; Verba 1996) or because a request from "society at large" is rejected by those who feel rejected by society (Groves and Couper 1998).

Lower response rates among the elderly (Green 1996; Groves and Couper 1998; Holbrook, Krosnick and Pfent 2005; Voogt 2004), men (although the findings here are mixed, see Green 1996; Voogt 2004), low income or socioeconomic status households (Goyder 1987; Goyder, Warriner and Miller 2002, but see Purdie et al. 2002), racial/

ethnic/ language minorities (Collins et al. 2000; Holbrook, Krosnick and Pfent 2005; Voogt 2004), immigrants (Smith 1984), lower education (Collins et al. 2000; Goyder 1987; Green 1996; Voogt 2004), and single person households (Voogt 2004) have been explained by social isolation. Many of these characteristics (i.e., age, gender, education, race, marital status) are also associated with small or no social networks (McPherson, Smith-Lovin and Brashears 2006).

Higher levels of reports of societal participatory behaviors for survey respondents compared to nonrespondents or reluctant respondents also lend credence to the social isolation hypothesis. Political participation (Brehm 1993; Groves, Presser and Dipko 2004, but see Smith 1984), participation in neighborhood organizations and neighborhood watch activities (O'Neil 1979), and going to church (Woodberry 1998) are related to increased response propensity relative to those who do not participate in these activities. Also, students who are more integrated into a school (e.g., taking a more complex curriculum, better students, etc.) are more likely to be respondents than less integrated students (Collins et al. 2000; Grosset 1994).

Attitudinal measures of involvement in society or adoption of social norms are likely to be sensitive to this cause of survey propensity, as are reports of size of social network and number of ties to others. To the extent that social isolation is diminished by specific participatory behaviors (e.g., voting, volunteerism, charity giving), estimates of the prevalence of these behaviors should also be biased.

1.2.3.2 Discretionary Time

Being "too busy" to participate in a survey has long been mentioned as a reason for survey noncooperation, especially for long surveys (Abraham, Maitland and Bianchi

2006; Bogen 1996; Brehm 1993; Campanelli, Sturgis and Purdon 1997; Groves and Couper 1998; Morton-Williams 1993; Sosdian and Sharp 1980). Revelations of "I'm too busy" during a survey request likely reflect both busyness as perceived by the sample unit and actual lack of discretionary time. Characteristics of people who say "I'm too busy" or who are hypothesized to be low on discretionary time are those with higher income, younger, more highly educated, employed and homemakers, urban dwellers, and single person households (Brehm 1993; Callens and Croux 2003; Campanelli, Sturgis and Purdon 1997; Couper 1997; Kennickell 1999a; Korinek, Mistiaen and Ravallion 2005; Korinek, Mistiaen and Ravallion 2007; Moonesinghe, Mitchell and Pasquini 1995; Smith 1984; Stoop 2005). Temporary refusers to the GSS were found to be busier on a subjective busyness scale than on objective measures, suggesting the subjective nature of discretionary time (Smith 1984). Many of these indicators are also used as indicators of social isolation, with opposite directional predictions.

Time use statistics and self-perceived busyness measures would be particularly sensitive to this type of noncooperation nonresponse. To the extent that being "too busy" is a perceptual rather than objective state, perceptual measures of discretionary time (e.g., feeling "rushed") will be more likely to experience nonresponse bias with this source of nonresponse. If noncooperation due discretionary time is driven by objective measures, then nonresponse bias on these objective measures can be overcome through protocol components such as timing of call attempts, the number of times that follow-ups are attempted, and to the ability to set appointments.

1.2.3.3 Altruism, Helping Behavior, and Norms of Cooperation

Altruistic people are hypothesized to be more likely to participate in surveys than nonaltruistic people (Groves, Cialdini and Couper 1992). Self-reported volunteers (Abraham, Helms and Presser 2006; Bailie 2006), students with a "social activist" orientation (Sax, Gilmartin and Bryant 2003), and those involved in their community (Groves, Singer and Corning 2000) have been more likely to participate in surveys than their noninvolved counterparts. Additionally, women are likely to exhibit helping behavior (Green 1996), and are more likely than men to self-report that they participated in the survey for altruistic reasons (Porst and Briel 1995).

However, altruism does not appear to be something that can be effectively invoked to increase response propensities across a population. In a meta-analysis of advance letter messages, altruistic appeals in advance letters are not effective, relative to other appeals, in increasing response rates (de Leeuw et al. In press). Additionally, the use of donations to charity as an incentive is not more effective than cash incentives, and may be less effective (Hubbard and Little 1988; Kropf and Blair 2005; Singer 2002; Warriner et al. 1996).

Items related to volunteerism or giving to charity are likely to be overestimated in surveys. Unknown with respect to this mechanism is whether helpers are more likely to participate in surveys only when their altruistic identity is invoked (e.g., "You can help us if you participate") or whether they are always likely to participate at higher rates than nonhelpers. Additionally, one might expect the altruistic urge to be moderated by either topic or sponsor. For example, if the sponsor is seen as supporting a cause that the helper does not believe in assisting (e.g., the Society for the Self-Interested), then altruists may be less likely to participate.

1.2.3.4 Social Environmental Factors

Any survey participation request takes place in a social context. As a result, a variety of theoretical mechanisms for the influence of the social environment on survey participation have been posited, including concentration of social isolates, lack of social cohesion, feelings of being crowded or having too many interactions with strangers. Any empirical investigation using ecological variables reflects these effects of the environment, proxy for the sample unit having the characteristic, and capture other unmeasured correlates (Kennickell 1999a).

Empirically, however, social environmental factors have shown mixed success in explaining cooperation rates. The only consistent social environmental correlate of survey noncooperation is urbanicity, explained partially by crime rates (Groves 1989; Groves and Couper 1998; House and Wolf 1978). Other ecological variables have been examined including characteristics of housing units, age distributions, average household size, racial/ethnic composition, mobility, measures of employment, income, and education, and measures of commuting time (Callens and Croux 2003; Groves and Couper 1998; Johnson et al. 2006; Kalsbeek and Durham 1994; Kennickell 1999a). These correlates have shown mixed success in predicting cooperation rates, often not reaching conventional levels of significance.

If the attributes of the social environment were causes of survey participation, then statistics related to neighborhood or local area characteristics would be the most likely to be affected by nonresponse bias. These include measures of crime in the neighborhood, attitudes about fear of crime, attitudes towards one's neighborhood, the prevalence of certain institutions in the neighborhood (e.g., grocery stores, libraries), and attitudes towards social services provided locally.

1.2.3.5 Commentary on Social Isolation, Discretionary Time, Altruism, and Social Environmental Factors as Causes

The constructs of discretionary time, social isolation and altruism overlap. For example, those who have little discretionary time are those who are more likely to be in the labor force, have children, and otherwise be involved in activities (such as volunteering or church-going) that are associated with other people. Social isolates are unlikely to volunteer.

As a result, it is often impossible to distinguish empirically between discretionary time, social isolation and altruism as causes of nonresponse. Common sociodemographic indicators for social isolation such as unemployment, age, having no children, and not being married are also indicators for discretionary time. In some instances, the predicted relationships with propensity are in opposite directions. For example, being elderly, being unemployed, and being single are predicted to be negatively related to cooperation under a social isolation hypothesis. Under a discretionary time hypothesis, single person households are still predicted to have lower response propensities (having few people to share time demands), but the elderly and unemployed are expected to have more discretionary time. Similarly, indicators for being integrated into a community, such as being members of a church or volunteer organizations, are also indicators of altruism. Here, the direction of the predictions for the relationship with response propensity are in the same direction. On the other hand, these activities limit the amount of one's discretionary time, predicting negative relationships with response propensity.

Social environmental factors can be seen as the aggregate of individual characteristics or as a determinant of these characteristics. Theoretically, the social context of a neighborhood can alleviate or engender social isolation, can garner or diminish trust in strangers or the government, and can lead to variations in at-home patterns and amounts of discretionary time (i.e., provision of work, food, and transportation close to home increases discretionary time; Sampson, Morenoff and Gannon-Rowley 2002). However, the implications of this context for survey research is ill-defined.

Thus, any indicator for social isolation, discretionary time, altruism, or social environmental influences for nonresponse must be evaluated in light of the other causes. In some instances, opposite predictions can be made about the direction of the relationship with cooperation. In other instances, disentangling the causes may be impossible. We now turn to causes that more explicitly reflect protocol features.

1.2.3.6 Topic Interest

People who are interested in a survey topic or who are committed and involved with the topic participate in surveys about that topic at higher rates than people who are not interested, committed or involved in the topic (Albaum, Evangelista and Medina 1998; Burkell 2003; Connelly, Brown and Decker 2003; de Leeuw 2004; Edwards et al. 2002; Goyder 1985; Groves et al. 2006; Groves, Presser and Dipko 2004; Heberlein and Baumgartner 1978; McCarty et al. 2006; Roth and BeVier 1998; van Goor and Stuiver 1998) For example, voters and people who are interested in or knowledgeable about politics are more likely to participate in election studies (Brehm 1993; Couper 1997; Pearl and Fairley 1985; Voogt 2004); people who have a family history of a particular illness are more likely to participate in surveys that study the causes of that illness (Macera et al. 1990; Rogers et al. 2004; Voigt, Koepsell and Daling 2003); and people who enjoy recreational activities participate in surveys about those activities than those who do not enjoy these activities (Groves et al. 2006; Roose, Lievens and Waege 2007; Stein, Tay and Courval 1999).

In contrast, topics that are sensitive or burdensome will dampen cooperation rates. For example, new parents are less likely to cooperate with a survey that makes their exhausting new parent status salient (Groves, Presser and Dipko 2004); diabetics are not more likely than non-diabetics to respond to a survey about diabetes (Groves et al. 2006); and uninvolved fathers are less likely to participate in surveys about their children or children's mothers (Lin and Schaeffer 1995; Lin, Schaeffer and Seltzer 1999; Teitler, Reichman and Sprachman 2003).

Negative affect toward the topic is taken to an extreme when the topic is inherently embarrassing or violates social norms for conversations with a stranger. For instance, people who use intravenous drugs and engage in risky sexual behaviors were less likely to participate in an HIV prevalence feasibility study than people who did not engage in these behaviors (CDC/NCHS 1991; Goldberg et al. 2001), smokers tend not to participate in smoking studies (Barchielli and Balzi 2002; Brogger et al. 2003), and both heavy drinkers (Kypri, Stephenson and Langley 2004) and abstainers (Lahaut et al. 2002) tend not to participate in alcohol studies. In each case, the nonresponding groups are those who possess a counternormative attribute.

As a result, statistics that are strongly related to the topic (e.g., prevalence measures of characteristics of the professed topic and attitudinal measures related to the survey topic) are the most likely to be affected by this cause for noncooperation. Thus, single-topic studies (e.g., elections, smoking, birding) are likely to be more sensitive to nonresponse bias due to topic interest than multi-topic studies (e.g., general social surveys), especially when the relationship between the topic and propensity is monotone (e.g., those who are higher on values of the topic are higher on propensity). With a non-monotone relationship between propensity and the topic (e.g., high consumption and low consumption alcohol drinkers; pro and con on a controversial topic like abortion), there may be no bias on the respondent mean, but distributional statistics may be misestimated.

1.2.3.7 Positive affect toward sponsor

Persons who view a sponsor positively are more likely to participate in a survey with that sponsor than people who view the sponsor negatively (Donald 1960; Goldberg et al. 2001; Perneger, Chamot and Bovier 2005). This may arise due to prior positive affiliation with the sponsor (Donald 1960; Jones 1979) or because the sponsor is seen as a trusted or authority institution, such as the government or a university (Edwards et al. 2002; Etter, Perneger and Rougemont 1996; Faria and Dickenson 1996; Fox, Crask and Kim 1988; Goyder 1985; Groves and Couper 1998; Jones and Lang 1980; Jones and Linda 1978; Sudman and Ferber 1974; Wu and Vosika 1983). For example, universities achieve higher response rates than government sponsors when there is strong positive affect for the university (Jones 1979) or when there is suspicion of the government (Sudman and Ferber 1974).

Attitudinal measures about the sponsor or behavioral proxies for those attitudes are most likely to suffer nonresponse bias under this cause. For example, students who perform better academically may be more likely to have positive feelings toward a survey sponsored by their alma mater and hence be more likely to participate in a survey request from that organization.

The magnitude of the bias on variables related to the sponsor will likely depend on the prominence of the sponsor as part of the survey participation request. If the sponsor is featured prominently through recruitment materials, including the interviewer or data collection organization's affiliation, the signature on the cover letter, return address on a mail survey, or the extension of an e-mail address or Internet site, then sponsorship effects on nonresponse bias are likely to be more pronounced. Additionally, if the sample unit has a specific preexisting attitude toward the sponsor that is homogeneous across domains (e.g., University of Michigan is good regardless of topic), then a relationship between survey participation and survey variables related to the sponsor is likely to exist.

Finally, the direction of nonresponse bias will likely vary when the sponsor is seen as endorsing certain behaviors. For example, one could hypothesize that smokers will be more likely to participate in smoking surveys sponsored by Philip Morris compared to those sponsored by the U.S. Department of Health and Human Services.

1.2.3.8 Commentary on Topic Interest and Sponsorship as Causes of p

Empirically, distinguishing between sponsorship and topic interest is difficult. While the state or federal government may sponsor surveys on a variety of topics, the range of Y variables has limits. For example, government agencies may be unlikely to sponsor research on media consumption, and media companies such as Arbitron and Nielsen will be unlikely to sponsor research on the prevalence of Alzheimer's disease. Sponsors may also reinforce topics (e.g., a health study sponsored by the Centers for Disease Control and Prevention; a crime study sponsored by the Bureau of Justice

Statistics; a study on educational attainment by the National Center for Education Statistics).

As a result, the types of Y variables affected by topic interest and by sponsor are likely to overlap. Does this matter? When topic interest is affected by sponsorship, the nature of nonresponse bias on the survey variables may change. The sponsor may disproportionately attract people who are aligned or opposed to the sponsor's position on the topic. For instance, smokers may be interested in a smoking survey conducted by a large tobacco company (a presumably pro-smoking sponsor, leading to an overestimation of the prevalence of smokers), but disinterested in a smoking survey conducted by a university for epidemiological research (a presumably anti-smoking sponsor, leading to an underestimation of the prevalence of smokers). Sponsorship may also differentially distort distributional features of a statistic for a given survey topic. For instance, people with strong views on either side of the abortion debate may be more likely to participate than people with moderate views under a neutral sponsor, but may be differentially swayed to participate if the sponsor appears to be aligned with their beliefs (e.g., Planned Parenthood). The neutral sponsor attracts people who are strongly interested in the topic of abortion regardless of their position on the debate; the aligned sponsor is likely to attract people whose views are consistent with those espoused by the sponsor.

Thus, while topic interest and sponsorship effects may drive nonresponse bias, examining their effects in tandem is likely to result in clearer understandings of the effect of each individually.

1.2.3.9 Attitudes Towards Surveys

Attitudes about a behavior affect intentions to engage in that behavior (Fishbein and Ajzen 1975). If the attitudes are positive, then engaging in the behavior is more likely. In turn, people who value surveys in general or perceive their participation in surveys to be personally worthwhile are more likely to participate in surveys (Goyder 1987; Hox, De Leeuw and Vorst 1995; Nederhof 1987; Rogelberg et al. 2003; Rogelberg et al. 2001; Rogelberg et al. 2000; Schleifer 1986). Additionally, converted refusals view surveys as having no good purpose (Smith 1984) and have a low opinion of both opinion pollsters and telemarketers (Triplett et al. 2002).

The statistics that are most sensitive to nonresponse bias due to attitudes towards survey are obviously prevalence estimates from these attitudinal measures. Measuring attitudes towards surveys with a survey will undoubtedly suffer from nonresponse bias, as those with negative attitudes towards surveys are the least likely to participate.

1.2.3.10 Summary

Fixed attribute theories can be viewed through the lens of a "common cause model" (Groves 2006) when the appropriate Y variables are specified. Since many surveys are multipurpose, some statistics in the survey will be related to the influences on survey participation, while others will not. Nonresponse bias is most likely to result when the cause for survey participation is uniform across the population, and has a monotone relationship with the Y variable (e.g., is linearly related). Nonresponse bias at the end of survey field period will depend on the mix of the causes for survey participation in the population for that survey, their relationship with the survey variables of interest, and the application of follow-up efforts.[2]

1.2.4 Decision Making Models for Survey Participation

Many explanations for survey participation draw on principles of decision-making, most involving a weighing of costs and benefits. We consider three explanations for survey nonresponse here: social exchange (Dillman 1978; Goyder 1987; Goyder, Boyer and Martinelli 2006), heuristics (Groves, Cialdini and Couper 1992), and leverage-saliency theory (Groves, Singer and Corning 2000). Interviewer-based interactions of tailoring and maintaining interaction may also affect the sample unit's decision making process, but bring in the social skills of the interviewer. These interactions will not be discussed in this dissertation.

1.2.4.1 Social Exchange

Social exchange theory posits that people participate in surveys because of an ongoing relationship between the sample unit and the unit making the request for survey participation, either the sponsor, the interviewer, or the survey research organization (Childers and Skinner 1996; Dillman 1978; Goyder 1987; Goyder, Boyer and Martinelli 2006). The actions of the requestor invoke an exchange relationship through the use of design features or calling on other standing relationships, thereby obligating the sampled person to respond to resolve the sense of indebtedness (Groves and Couper 1998).

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[2] A single plausible mechanism linking nonresponse propensity and nonresponse bias may be easier to identify in studies of special populations on single topics than in studies of the general population with multiple topics. In studies of the general population, it is likely that multiple mechanisms will be at play. When the population varies in its views toward the survey, it is less likely for any particular cause to dominate, implying that multiple statistics within a survey may experience nonresponse bias for different reasons.

Dillman's (1978) exposition of social exchange makes explicit a weighing of costs and benefits, with trust that the benefits will arise. Using this rubric, the entire "Total Design Method" is created around a social exchange framework, such that any effective design feature induces an exchange relationship (Dillman 1978). Although the design feature most often justified using social exchange arguments is incentives (Dillman 1978; Kropf and Blair 2005; Singer 2002), other design features explained by social exchange include prenotification, follow-ups and reminder letters (Dillman 1978; Fox, Crask and Kim 1988; Goyder 1987), personalization (Dillman 1978), and "respondent-friendly" designs (Dillman 1978; Dillman, Sinclair and Clark 1993).

Social exchange has also been used to explain many of the demographic differences in response rates explained by social isolation, including lower response rates for lower socioeconomic status individuals, lower education, lower income, unemployed, the elderly, recipients of government transfer payments, renters, and organizational members to a membership survey (Callens and Croux 2003; Childers and Skinner 1996; Goyder 1987; Goyder, Boyer and Martinelli 2006; Goyder, Warriner and Miller 2002; Green 1996; Groves and Couper 1998). Social exchange has also been used to explain higher response rates among the lower income people to government surveys, in contrast with the prior prediction (Groves and Couper 1998).

As a result, social exchange provides an organizing framework, but its predictive ability is minimal and imprecise. As Goyder (1987, p. 178) argues, "With survey response, the circularity arises because the exchange theorist begins by stating that response behavior results from the actor's assessment of the value of answering a survey and then reasons, backwards, that value is measurable from response behavior." In other words, outside of long-standing relationships, respondents are those for whom the exchange relationship worked; nonrespondents are those for whom the exchange relationship did not work.

Social exchange can anticipate nonresponse bias only for long-standing relationships. For example, if an exchange relationship is induced from the receipt of services, then the exchange framework predicts that those who had received the services are more likely to participate than those who had not. Thus, items related to the induction of the relationship (e.g., receiving services or payments) or feelings of indebtedness to the organization would be the most likely candidates to experience nonresponse bias. When the exchange relationship is invoked through design features, it is unlikely to be the cause of nonresponse bias on items other than those that evaluate the design features themselves.

1.2.4.2 Heuristics

Sample units sometimes use short-cut decision rules known as "heuristics" when making survey participation decisions (Groves, Cialdini and Couper 1992). These decision rules require no preexisting or ongoing relationship between the requestor and the sample unit. Instead, the sample unit quickly examines the features of the request and identifies whether the request comes from a trusted authority figure ("authority"), from a similar other ("liking"), whether people similar to themselves would complete the request ("social validation"), whether similar opportunities are readily available ("scarcity"), whether the individual has done a similar activity in the past ("consistency"), or whether the requestor has done something that needs to be repaid ("reciprocity").

Evidence for the use and effectiveness of heuristics comes from diverse sources. The authority and reciprocity heuristics have received the most empirical attention. Government surveys tend to have higher response rates than academic surveys which in turn have higher response rates than surveys conducted by private firms, as anticipated by the authority heuristic (Fox, Crask and Kim 1988; Groves 1989; Groves, Cialdini and Couper 1992; Groves and Couper 1998; Houston and Nevin 1977; Jones and Lang 1980; Sudman and Ferber 1974; Wu and Vosika 1983). The authority heuristic also anticipates that members of the military and citizens are more likely to participate in government surveys than non-military or immigrants (Groves and Couper 1998). Authority has inconsistent findings across delivery mediums when explicitly invoked, showing limited to no effect in cover letters but positive relationships when delivered by interviewers (de Leeuw et al. In press; Dijkstra and Smit 2002; Hox and De Leeuw 2002).

In terms of effectiveness in raising cooperation rates, the reciprocity heuristic, usually accompanied by a prepaid or promised incentive or other promise of providing study results in the future, has been shown to be effective both in advance letters (de Leeuw et al. In press) and by interviewers (Couper and Groves 1992). The reciprocity heuristic (or norm of reciprocity) is most closely aligned with ideas of social exchange (Goyder, Boyer and Martinelli 2006), and is similarly used to explain incentive effects (Singer 2002). Other pleasantries from the interviewer (complimenting the flowers in front of the house, for example) can also be seen as invoking the reciprocity heuristic.

The other heuristics have received less empirical attention. Interviewer matching is justified by a liking heuristic, although the efficacy of this design decision remains unresolved (Brehm 1993; Crowley, Roff and Lynch 2007). The consistency heuristic is often used to anticipate a “foot-in-the-door” effect, in which compliance with a small request is followed by a request for a larger task, thought to be made easier after the initial compliance (Freedman and Fraser 1966). Consistency appeals tend not to work, showing both a positive relationship with interviewer-level cooperation rates (Hox and De Leeuw 2002), but no noticeable effect or negative effects in most other experiments or analyses (Childers and Skinner 1996; Couper and Groves 1992; Dijkstra and Smit 2002; Furse, Stewart and Rados 1981). The use of a social validation appeal is correlated with no different or lower response rates (Couper and Groves 1992; Dijkstra and Smit 2002; Hox and De Leeuw 2002). Scarcity appeals are associated with lower interviewer-level response rates (Couper and Groves 1992).

Given the fleeting nature of heuristic decisions, the most likely candidates for nonresponse bias are attitudinal measures of that heuristic. For example, people who are more likely to participate because of a “trusted authority figure” heuristics should lead to overestimation in trust of the authority figure in the population.

1.2.4.3 Leverage-Saliency Theory

Leverage-saliency theory explicitly acknowledges that sample units vary in what they consider to be a positive or negative attribute of the request and on the importance of that attribute in their decision (Groves, Singer and Corning 2000). These two components constitute “leverage.” At the time of the survey request, some design features are made salient to the sample unit by the interviewer and study materials. To make a decision, sample units weigh the salient design features by their valence and importance. When the sum is net positive, the sample unit is more likely to participate. When the sum is net negative, the sample unit is less likely to participate.

The strength of leverage-saliency theory is that it anticipates variation in receptiveness to design features across a population. For instance, the theory anticipates that people who are interested in the topic of a survey will be less influenced by incentives (Groves et al. 2006; Groves, Presser and Dipko 2004) and require fewer follow-ups (Roose, Lievens and Waege 2007). However, leverage-saliency theory does not provide insights into how the design features come to be viewed as positive or negative, or into how sample units assign weights of importance to the design features themselves. Furthermore, the theory does not account for possible variability in propensities to participate over ubiquitous correlates of survey nonresponse (e.g., urbanicity).

Statistics that are most likely to be affected by nonresponse bias under a leverage-saliency framework are those that are most closely aligned with the salient design feature (e.g., topic) or to the leverage points (e.g., community involvement). While leverage-saliency anticipates interactions among many of the fixed attributes described above and the resultant effects on nonresponse bias, the fixed attributes from above are needed as a starting point.

1.2.4.4 Summary of Decision-Making Models for Survey Participation

All of the decision-making models discussed above specify different relationships between attitudes and behavior (Helgeson, Voss and Terpening 2002). Some, such as social exchange, require a preexisting attitude (or at least one that lasts longer than a few seconds); others allow for seemingly inconsequential features to have large effects on decisions (e.g., heuristics). Some authors have taken this dichotomy to the extreme, arguing that there are two classes of nonrespondents – those who actively think about the request and those who do not (Rogelberg et al. 2003). We do not believe that this is the case, instead believing that people vary across surveys in the amount of attention and deliberate weighing of costs and benefits in which they engage. We also believe that, over the course of a survey recruitment protocol, people may vary in attention and weighing of costs and benefits.

In general, the decision-making models permit more within-individual variation across surveys and recruitment protocols than the fixed attribute models. However, some of the fixed attribute models actually require variation across some components of the survey protocols (e.g., topic interest, sponsorship effects).

1.2.5 Summary of Theories of Nonresponse Propensity

There are two general groups of theories about nonresponse propensity (ignoring the influence of the interviewer) – those that assume a fixed personal attribute and those that assume a weighing of costs and benefits in a decision-making process. Many prior attempts to unify the decision-making models combine all theories under social exchange (e.g., Goyder, Boyer and Martinelli 2006). While this essentially implies that all participation decisions involve a weighing of costs and benefits to some degree, it is not useful for saying what the costs and benefits actually are.

The decision-making models and fixed attribute models overlap in predictions. For example, the consistency heuristic makes the same predictions about topic interest and positive affect toward the sponsor when those are the targets of the consistency heuristic. Additionally, social validation appeals can only work on people who are not socially isolated; without a reference group, social validation heuristics will not work. Social validation appeals are also likely to work more effectively for altruists.

The theories on permanent attributes should be informative for telling us what may be a cost or benefit. For example, a sample unit's views of costs and benefits of survey participation may be shaped by the social, political and economic climate in which the survey request arrives. The overall impact of societal factors on the participation decision is likely to vary by survey sponsor (government more likely to be viewed as responsible for the political/economic climate). Since higher refusal rates come in better economic times, people's value of government surveys may change when the government needs to "fix" something (Harris-Kojetin and Tucker 1999). That is, the fixed attribute theories should suggest relevant "leverage" points.

Other than leverage-saliency theory and topic interest, none of the models for causes of nonresponse propensity were developed to anticipate nonresponse bias. The above discussion extended each of these theories to the "low-hanging fruit" variables, that is, those variables that would be most likely to experience nonresponse bias under that cause for nonresponse. Table A.1 summaries the above discussion.

A quick glance over Table A.1 reveals a great deal about the state of understanding of the causes of survey participation. First, the decision making theories are more likely to incorporate design features; fixed attribute causes tend to focus on respondent and household characteristics, unless the design feature is the main focus (e.g., topic interest, liking the sponsor). Second, many causes use identical respondent-level indicators, making it impossible to actually test or evaluate many of the theories as actual causes of survey participation.

Nonresponse bias due to a particular cause will be easiest to identify when the indicators for that cause are strong. Many of the theories use the same proxy indicator. In general, the relationship between the propensity estimated using proxy indicators for the cause and bias measured on survey variables depends on the strength of the relationship between the proxy indicators and the survey variables (Gerrits, van den Oord and Voogt 2001). Additionally, there may be many different causes for nonresponse at play in any given survey.

A number of reasons have been suggested for why people choose to participate in surveys. Deliberate testing of each cause for nonresponse and a priori specification of the likely relationship between the cause and its effects on nonresponse bias will help anticipate when nonresponse bias may occur.

1.3 Data Sets Used in this Dissertation

To study both measurement error bias and nonresponse bias, the ideal data set would contain the respondent's true propensity to be contacted for all stages of all possible recruitment protocols, true propensity to be capable of providing a response for all possible measurement protocols, conditional on being contacted, and true propensity to cooperate with the request for all stages of all possible recruitment protocols, conditional on being contacted and being capable, true values for a number of constructs of interest, and multiple responses for survey questions on those constructs for all possible measurement and recruitment protocols.

Denote the possible recruitment protocols as $r=(1,\ldots,R)$, the measurement protocols as $m=(1,\ldots M)$, contact as c, and cooperation as n. The ideal data set would contain a vector for each individual containing true propensities $(p_{cr}, p_{nr|c,a})$. The ideal data set would also contain a vector for each individual and each construct containing a true value, *T*, and $j=(1,\ldots,J)$ survey measurements of the construct for each protocol, $Y_{1mr}, \ldots, Y_{jmr}$.

Since this design is not possible, data sets with information on both respondents and nonrespondents that are also measured in the survey, together with call records containing levels of effort and outcomes for each call that are desired. Data sets of this nature have one recruitment protocol, *r,* one measurement protocol, *m,* true values *T* as contained in record bases, usually one survey measurement Y_{1m} for each true value *T*, and information to estimate $\hat{p}_{cr}, \hat{p}_{nr|c,a}$ for that recruitment and measurement protocol. This dissertation uses two data sets with those ingredients. They cover two topics using three modes of data collection.

Two surveys are used for this analysis – the Wisconsin Divorce Study and the National Postsecondary Student Aid Study. Both have survey variables of interest available on the respondents and nonrespondents. Because of this feature, both surveys are of special populations (divorced persons in Wisconsin and undergraduates, respectively). Both have call records available documenting the recruitment process, facilitating the distinction between noncontact and noncooperation nonresponse. Both surveys are mixed mode, combining self-administered and interviewer-administered modes.

1.3.1 The Wisconsin Divorce Study

In mid- to late 1995, the University of Wisconsin-Madison conducted the Wisconsin Divorce Study. Divorce certificates from four counties in Wisconsin from 1989 and 1993 were extracted, and a simple random sample was selected.

Recruitment in the Wisconsin Divorce Study started with personalized letters in which a sampled person was asked to participate in the "Life Events and Satisfaction Survey," sponsored and carried out by the University of Wisconsin-Madison. The survey contained questions on satisfaction with life and relationships, marital and cohabitation history, childbearing history, education and work history, satisfaction with current relationships, and demographics.

Sample unit contact attempts were first attempted by telephone. Nonrespondents to the telephone survey or persons for whom a telephone number could not be obtained were followed up with a mail request. The interviewer recruitment script is not available for this analysis; however, the mail survey prominently displays the name of the survey. The first page of questions in the mail survey are related to satisfaction on various life domains. Overall, the response rate (AAPOR RR1) was 71 percent, with a contact rate of 80.3 percent and a cooperation rate of 88.3 percent.

In addition to call record data, for purposes of response propensity estimation, a set of candidate covariates from zip code-level data available from the 1990 Census was identified. Matches to the Census data were found for 99.2 percent of the 733 cases. Appendix Table A.3 shows the means and standard errors for these variables. Appendix Table A.111 includes a full list of the Census variables used.

1.3.2 National Postsecondary Student Aid Study

In late 2004, the National Center for Education Statistics sponsored the National Postsecondary Student Aid Study (NPSAS), with data collection conducted by RTI International. The study was designed to obtain prevalence estimates and total amounts of financial aid used by undergraduate and graduate students across all types of colleges and universities, both nationally and individually for twelve states. Colleges and universities were sampled from the 2000-01 Integrated Postsecondary Education Data System (IPEDS). Student lists were obtained from cooperating colleges and universities, and students were sampled from these lists. The sample design for the NPSAS and methodology is described in detail elsewhere (Cominole et al. 2006).

The student survey recruitment protocol began with a personalized advance letter from the Associate Commissioner of the National Center for Education Statistics to participate in the NPSAS and an e-mail request from the RTI project director of NPSAS. The advance letter made salient that the respondent would be asked to provide which types of financial aid they had received and the amounts of the financial aid. The personalized e-mail request stated that the survey would provide information on how students and their families meet the costs of college. During the first four weeks, the selected student was recruited by e-mail to participate in a web survey. After four weeks, nonresponding students were followed up by telephone. During this request, students could choose their completion mode (telephone or Internet). Nonresponding students were sent refusal conversion letters and were offered a shortened interview. Both English and Spanish language questionnaires were available.

Roughly 20 percent of the respondent pool respondent online after receiving telephone prompting. The remaining 27 percent participated in the NPSAS without any telephone prompting (Cominole et al. 2006). Over half of the respondent pool (53 percent) completed the survey by telephone.

Table 1.1: Construction of the NPSAS Analytic Data Set

	(1)		(2)		(3)		(4)		(5)	
	All NPSAS, NPSAS weight		All 50 states + DC, NPSAS weight		Institutions that reported fin. aid info., NPSAS weight,		Undergrads at institutions that reported fin. aid info., NPSAS weight		Undergrads at institutions that reported fin. aid info., Student base weight	
	%	SE	%	SE	%	SE	%	SE	%	SE
Less than 2 year	2.84	0.16	2.78	0.15	2.67	0.16	2.95	0.18	1.02	0.01[a]
2 year	40.98	0.97	41.35	0.97	40.02	0.93	45.87	0.98	31.70	0.12
4 year non-doctorate granting	23.47	0.90	23.17	0.88	23.82	0.84	23.67	0.82	18.29	0.09
4 year doctorate granting	32.71	0.69	32.70	0.65	33.50	0.68	27.51	0.64	48.99	0.12
Public	73.90	0.68	74.36	0.69	74.27	0.69	77.52	0.69	80.53	0.10
Private, not-for-profit	18.54	0.58	18.11	0.58	18.47	0.61	14.94	0.58	15.25	0.10
Private, for-profit	7.56	0.44	7.53	0.44	7.26	0.40	7.54	7.54	4.22	0.03
New England	5.75	0.84	5.81	0.85	6.15	0.89	5.49	0.81	4.53	0.04
Mid East	13.92	0.92	14.05	0.93	14.51	1.01	14.08	1.03	13.40	0.10
Great Lakes	15.67	0.78	15.82	0.79	15.47	0.79	15.54	0.75	18.43	0.09
Plains	6.82	0.56	6.88	0.56	6.91	0.61	6.86	0.58	7.24	0.05
Southeast	22.16	1.00	22.37	1.01	21.02	1.05	21.13	1.11	20.24	0.09
Southwest	12.09	0.93	12.21	0.94	12.93	1.01	13.39	1.10	16.62	0.09
Rocky Mountains	4.51	0.88	4.56	0.88	4.95	0.96	5.09	1.04	5.49	0.07
Far West	18.13	0.76	18.30	0.76	18.06	0.73	18.42	0.78	14.04	0.06
Outlying Areas	0.96	0.08	--	--	--	--	--	--	--	--
Missing	1.49	0.45	1.48	0.45	1.60	0.44	1.66	0.49	0.55	0.02
Central City	55.90	1.85	56.44	1.87	56.07	1.77	54.33	1.90	64.40	0.12
Urban Fringe	26.04	1.74	26.29	1.75	26.23	1.77	26.98	1.93	20.54	0.10
Town	12.77	1.18	12.90	1.19	13.00	1.06	13.62	1.10	12.40	0.08
Rural or Not Assigned	3.80	0.66	2.89	0.66	3.11	0.72	3.41	0.82	2.10	0.04
Unweighted N	90,750		88,990		80,160		68,830		68,830	
Weighted N	21,879,870		21,669,900		19,844,700		16,930,920		6,343,050	

Note: Undergraduates exclude persons with advanced degrees taking undergraduate classes. Puerto Rico excluded from universe in columns (2)-(5).

[a] Analyses for this dissertation treat the selected sample of students as a stratified random sample. Thus, the standard errors are smaller than those that used the clustered design of the full NPSAS. In order to maintain the level of confidentiality required of NCES data, all NPSAS sample sizes have been rounded.

To define a target population from this data set, this dissertation starts with the NPSAS public use data file, fully conditioning on the colleges and universities who provided student lists (Column 1, Table 1.1). The public use data file contains all sampled students who have complete data from any source (any record set or the student interview) for type of student, age or birth date, sex; "and at least eight of the following fifteen variables: dependency status; marital status; any dependents; income; expected family contribution (EFC); degree program; class level; first-time beginner (FTB) status; months enrolled; tuition; received federal aid; received non-federal aid; student budget; race; and parent education" (Cominole et al. 2006), p. 50). Using these criteria, approximately 10 percent of the original eligible student sample (n=101,010) is excluded from the public use data file (n=90,750)[3] (Cominole et al. 2006). As information about students at nonresponding universities is not available publicly, this article ignores selection of the universities and nonresponse at the institutional level.

The target population was further refined to exclude Puerto Rico (column 2, Table 1.1) and to only include undergraduates (column 3, Table 1.1).[4] Finally, because of extensive missing data on the records, an additional restriction was made on the analytic dataset. The analyses conducted here restricts the public use dataset to the students whose universities reported financial aid application information for at least 65 percent of their students (with the vast majority of these institutions not reporting for over 90 percent of their student population). This excluded less than 150 universities and 11,340 students, resulting in a final analytic data set with over 68,000 students (column 4, Table 1.1).

For the purposes of this dissertation, analyses are conducted treating the student sample as a stratified random sample with unequal probabilities of selection. Student selection probabilities are used, accounting for the unequal probabilities of selecting the

[3] In order to maintain the level of confidentiality required of NCES data, all NPSAS sample sizes have been rounded.
[4] Undergraduates were defined based on the record data, not the interview data. Less than one-tenth of one percent of students (less than 70) were identified as being dead in the call records, and have also been excluded from these analyses. Official NPSAS publications combined record and interview data in defining the type of student. As a result, there will be differences in the total number of undergraduates compared to the official NPSAS publications.

students from the lists provided by the universities (column 5, Table 1.1). Different types of students (e.g., first-year first-time beginner students) were selected at higher rates than other students (Cominole et al. 2006). Thus the weighting brings the students in line with their representation at the university. Although some students may have been on lists for multiple universities, the weights constructed for this use different sources of information for the respondents compared to the nonrespondents. The analytic strata in the public use data file are used; these strata are institutions or combinations of institutions, designed to have a minimum number of 10 students in each stratum.[5]

The AAPOR weighted contact rate for this set of undergraduates was high – 96 percent (unweighted AAPOR CON2 96 percent)– and the AAPOR weighted cooperation rate is 73 percent (unweighted AAPOR COOP2 70 percent), with an overall AAPOR weighted response rate of 70 percent (unweighted AAPOR RR2 67 percent) (AAPOR 2006). This differs slightly from the published NPSAS contact and cooperation rates for three reasons. First, we are looking at a different subset of cases. Second, a final disposition data set was not provided for the purposes of this dissertation; instead, call records were provided that contained both case and call level dispositions. To the extent that the final dispositions did not match the call records, there will be discrepancies. Finally, extensive conversations with data collection managers at RTI were conducted to understand the nature of the call records. There were many instances in which calls were recorded after a case disposition, with no updating to the case level disposition, especially

[5] The institutions themselves could also be used as strata. There is an unknown risk that data perturbation procedures were applied to the institution identifiers in the public use data file. Additionally, the number of sampled students in any individual institution may be small. Use of the analytic strata circumvents this problem. Analyses of the mean survey variables of interest revealed minor differences in the variance estimates for the mean. Given the large sample size used here (n=68,830), the overestimation is accepted.

in the non-interviewed cases. In these instances, summaries based off the entire call record were used to determine whether the case had been contacted and cooperated.

1.3.3 Limitations of the Data Sets

Because neither of the surveys were conducted for the purpose of estimating both nonresponse bias and measurement error bias, the data sets have limitations for the present analysis. The most important limitation in each study is that not all variables of interest in the survey are contained in the records. Additionally, records may contain measurement errors, and the construct measured in the survey may deviate slightly from the construct measured in the record.

1.3.3.1 Limitations of the Wisconsin Divorce Study

In the Wisconsin Divorce Study, the frame consists of divorce certificate data in which only the divorce date, county of divorce, and child custody arrangements were recorded by an official body; all other information was provided by at least one of the two spouses in the divorcing couple. The divorce date, a date used for administrative purposes, is probably the least sensitive to measurement error in the record. Marriage date, dates of birth, and number of marriages are provided by at least one member of the couple when filing for the divorce certificate. As a result, these items may contain more measurement error in the records than other items. Exactly which member of the couple filed for divorce or if the couple filed jointly is not known.

The call records in the Wisconsin Divorce Study were kept on paper and pencil, and data entered for purposes of this project. While the call records were double-entered, data entry errors or illegible handwriting leads to limited amounts of item missing data in the call records. Additionally, information on the date of mailing and receipt of the mail questionnaire for each responding sample unit is not available electronically and cannot be included in these analyses. Documentation for the study indicates that the mail questionnaires were sent fourteen days after the end of the phone data collection, which ended in October 1995. This would correspond to a mailing time of mid-November 1995 for the mail-out of the mail questionnaires.[6]

1.3.3.2 Limitations of the NPSAS

Item nonresponse in the records is the largest issue for the NPSAS. Table A.4 and Table A.4 show missing data rates for predictor variables in the NPSAS analyses. Missing data on the outcome variables varies from less than one percent for the financial aid variables to approximately 20 percent in the academic achievement measures.

Measurement error in the NPSAS records may also be present. The federal data bases (Central Processing Services, Stafford loan, Pell Grants) are likely to contain less measurement error than the institutional data. Not all students may have reported all sources of financial aid to the college or university. Additionally, colleges and universities may vary in how employment – such as work study or paid assistantships - for undergraduate students is recorded. Finally, institutions may differ in their classification of certain sources of financial aid.

An additional source of measurement error in the records is present in the NPSAS. For purposes of disclosure limitation, undisclosed data perturbation procedures were performed on an unknown number of cases over an unknown number of variables (Cominole et al. 2006), p. 103). Thus, some degree of measurement error in both the records and reported variables will be due to data perturbation rather than the respondent.

[6] For purposes of calculating days since last contact in the dynamic models, we assign all mail surveys in the WDS a date of November 15, 1995 – a Wednesday.

The analyses use the student base weights and analytic strata[7] as provided on the public use data file.

NCES created analytic variables that collapsed the interview variables and record variables, and provided the SAS code for this construction. To the extent possible, in this dissertation, variables were created using the same code to combine the record data as used by NCES and RTI in creating the analytic variables. Record values that came from multiple sources were combined into single variables to reduce the amount of item nonresponse in the records. This decision confounds differential measurement error across the different record sources. However, this tradeoff seems negligible compared to having information on respondents and nonrespondents. Unlike the analytic variables in the NPSAS, in this dissertation, the record variables and interview variables were constructed independently and retained as separate variables.

[7] WT5*WT6, the student sampling weight and the student subsampling weight. ANALSTR is the variable for the analytic strata.

Chapter 2

Nonresponse Propensity and Nonresponse Bias

The relationship between response propensity and nonresponse bias has long interested those who conduct and analyze surveys (Deming 1953; Hansen and Hurwitz 1946). To understand the relationship between response propensity and nonresponse bias, one first needs to understand the mechanisms for response propensity and identify whether they are related to the survey variables of interest. In turn, then, one can begin to identify how this relationship affects an estimate of interest.

When will estimates made from surveys experience nonresponse bias? The answer is simple statistically – if the survey variable itself is a cause of survey nonresponse, then the unadjusted respondent mean will differ from the population mean. This corresponds to a Not Missing at Random model (Little and Rubin 2002) or the Survey Variable Cause Model (Groves 2006). Additionally, if there is a third variable, Z, that causes both propensity and the survey variables themselves, then the unadjusted respondent mean will differ from the population mean. This corresponds to a missing at random model (Little and Rubin 2002) or a Common Cause Model for survey nonresponse (Groves 2006). If the survey variable does not cause survey participation and if there is not common cause, then no nonresponse bias will be observed, corresponding to a Separate Cause Model or Completely Missing at Random.

A common view of survey participation treats it as a stochastic phenomenon, in which all sample units have an unobserved, nonzero probability of participating in a survey, or a "response propensity" (Lessler and Kalsbeek 1992; Oh and Scheuren 1983).[8] This probability exists conditional on a fully realized survey recruitment protocol. People have different response propensities for different recruitment protocols. In other words, response propensities exist, but for different surveys and different recruitment protocols, there is within-individual variation in response propensities (see Section A.5 for a discussion of within-survey, within-individual variation in response propensities).

Under the stochastic approach to survey nonresponse, the nonresponse bias of an unadjusted respondent mean is a function of the covariance between response propensity and the survey variable of interest: $Bias(\bar{y}_r) = \sigma_{pY} / \bar{p}$ (Bethlehem 2002). If the drivers of propensity are unrelated to the survey variables, then we would expect little to no covariance between propensity and the survey variables and hence no bias in the unadjusted mean.

Two comments can be made about the expression $Bias(\bar{y}_r) = \sigma_{pY} / \bar{p}$. First, the covariance term in the numerator is clearly estimate-specific, depending on the Y variable in question. Second, within the same survey, some variables may experience a Survey Variable Cause source of nonresponse bias (e.g., $corr(p,Y) \doteq 1$); others may experience a Common Cause source of nonresponse bias (e.g., $0 > corr(p,Y) > 1$ or $corr(p,Y \mid Z) \doteq 0$); and other variables still will experience a Separate Cause source of

[8] A second view of survey participation is a deterministic approach, in which all sample units are either respondents or nonrespondents (Lessler and Kalsbeek 1992). Through survey recruitment, the respondent or nonrespondent group to which the sample unit belongs is revealed.

nonresponse bias (e.g., $corr(p,Y) \doteq 0$). Thus, there may be some variables that experience nonignorable nonresponse (Little and Rubin 2002), and others that do not.

The challenge to survey methodologists and survey analysts is to anticipate the variables for which the p-Y relationship will be strong and those for which it will be weak. This paper tackles this question with the following five steps.

1. *Using social science theory to understand nonresponse bias*. Social science theory is used in two stages. First, conceptually grounded propensity models reveal differential effects of covariates on survey participation. To be conceptually grounded, contact and cooperation must be disentangled because they reflect different processes. Second, social science theory is used to identify how different influences on propensity will vary in their relationship to the survey variables. With conceptual grounding, the effects of multiple competing influences on survey participation becomes apparent. From this, one can deduce that (1) there will be variation across items in the p-Y relationship, and (2) the final respondent data set is a mixture of the multiple competing influences.

2. *Contrasting contact and cooperation propensity with overall interview propensity*. Social science theory necessitates separating contact from cooperation for understanding nonresponse bias. However, distinguishing between the two categories for nonresponse may not be necessary if the predictions about the p-Y relationships under all of the models are in the same direction.

3. *Evaluating the model-based approach to understanding nonresponse bias.* Conceptually grounded predictions for the p-Y relationship provide traction on nonresponse bias of an unadjusted respondent mean. However, how do we know that the estimated relationship reflects underlying propensities? And how sensitive are the

conclusions to the main effects specification? More complex patterns of propensity may exist, leading to improved estimation of response propensity.

4. *Examining the relationship between response propensity and nonresponse bias for other estimands*. Other complex estimands such as quantiles and correlation coefficients also are affected by nonresponse bias. We provide examples of nonresponse bias on distributional statistics and on measures of association. Further conceptual work is needed to understand or anticipate when nonresponse bias will occur on these estimands.

3. *Adjusting the sample mean using the propensity models.* Adjustment procedures may be sensitive to model specification. In particular, we look at whether a two-stage adjustment procedure moves the adjusted respondent mean closer or further from the target, the overall mean for the full sample.

2.1 Data

Two surveys are used for this analysis – the Wisconsin Divorce Study and the National Postsecondary Student Aid Study. Both surveys have administrative records available for both the respondents and nonrespondents. Because of this feature, both surveys are of special populations (divorced persons in Wisconsin and undergraduates, respectively). A strength of both surveys is that the distinction between noncontact and noncooperation nonresponse can be identified because call records documenting the recruitment process are available for both studies. Both surveys are mixed mode, combining self-administered and interviewer-administered modes. We now describe the two surveys in more detail.

2.1.1 The Wisconsin Divorce Study

In mid- to late 1995, the University of Wisconsin-Madison conducted the Wisconsin Divorce Study. Divorce certificates from 1989 and 1993 from four counties in Wisconsin were extracted, and a simple random sample was selected.

Information from the divorce certificates – divorce dates, marriage dates, birth dates, and number of marriages - are survey variables of interest that are available for both respondents and nonrespondents. The survey contained questions on satisfaction with life and relationships, marital and cohabitation history, childbearing history, education and work history, satisfaction with current relationships, and demographics.

Additionally, the divorce certificates contain demographics for both members of the divorcing couple (gender, race, education level) and information about child custody arrangements that result from the divorce (Table A.2). This information will be used in the propensity models.

For purposes of response propensity estimation, a set of candidate covariates from zip code-level data available from the 1990 Census was identified. Matches to the Census data were found for 99.2 percent of the 733 cases. Appendix Table A.3 shows the means and standard errors for these variables. Appendix Table A.111 includes a full list of the Census variables used.

Recruitment in the Wisconsin Divorce Study started with personalized letters. The sampled person was asked to participate in the "Life Events and Satisfaction Survey," sponsored and carried out by the University of Wisconsin-Madison. After the advance letters were mailed, sample units were first attempted by telephone. Nonrespondents to the telephone survey or persons for whom a telephone number could not be obtained were followed up with a mail request. The interviewer recruitment script is not available for this analysis; however, the mail survey prominently displays the name of the survey. The first page of questions in the mail survey are related to satisfaction on various life domains. Overall, the response rate (AAPOR RR1) was 71 percent, with a contact rate of 80.3 percent and a cooperation rate of 88.3 percent.

2.1.2 National Postsecondary Student Aid Study

In late 2004, the National Center for Education Statistics sponsored the National Postsecondary Student Aid Study (NPSAS), with data collected by RTI International. The study was designed to obtain prevalence estimates and total amounts of financial aid used by undergraduate and graduate students across all types of colleges and universities, both nationally and individually for twelve states. Colleges and universities were sampled from the 2000-01 Integrated Postsecondary Education Data System (IPEDS). Student lists were obtained from cooperating colleges and universities, and students were sampled from these lists. The sample design for the NPSAS and methodology is described in detail elsewhere (Cominole et al. 2006).

The NPSAS has particularly rich sets of records available for both respondents and nonrespondents. Financial aid information for each student was obtained from the sampled colleges and universities, including whether or not the student applied for financial aid, received financial aid, and, if they had received financial aid, the types of aid and amounts. Academic performance information, such as grade point average (GPA) and standardized test information (e.g., SAT or ACT scores), is also available on most sampled students. Two other sources of information are available from records for both respondents and nonrespondents. Information from the Free Application for Federal Student Aid (FAFSA), an application required for any student who applies for financial aid from the federal government, is available, as is information on federal loans and grants from the National Student Loan Data System. The financial aid records and the academic performance measures are the survey variables of interest for the nonresponse bias analyses. In addition to information on financial aid, these records provide some information on sampled students' demographics (gender, age, race, citizenship, veteran status; Table A.4). Finally, characteristics of the college or university at which the student was sampled is available from the Integrated Postsecondary Education Data System (Table A.5).[9] These latter sets of data are used in the propensity models.

The student survey recruitment protocol began with a personalized advance letter from the Associate Commissioner of the National Center for Education Statistics to participate in the NPSAS and an e-mail request from the RTI project director of NPSAS. The advance letter made salient that the respondent would be asked to provide which types of financial aid they had received and the amounts of the financial aid. The personalized e-mail request stated that the survey would provide information on how students and their families meet the costs of college. During the first four weeks, the selected student was recruited by e-mail to participate in a web survey. After four weeks, nonresponding students were followed up by telephone. During this request, students could choose their completion mode (telephone or Internet). Nonresponding students were sent refusal conversion letters and were offered a shortened interview. Both English and Spanish language questionnaires were available.

Roughly 20 percent of the respondent pool respondent online after receiving telephone prompting. The remaining 27 percent participated in the NPSAS without any

[9] These data were merged by NCES and are part of the restricted use public data file.

telephone prompting (Cominole et al. 2006). Over half of the respondent pool (53 percent) completed the survey by telephone.

To define a target population from this data set, this dissertation starts with the NPSAS public use data file, fully conditioning on the colleges and universities who provided student lists. The public use data file contains all sampled students who have complete data from any source (any record set or the student interview) for type of student, age or birth date, sex, “and at least eight of the following fifteen variables: dependency status; marital status; any dependents; income; expected family contribution (EFC); degree program; class level; first-time beginner (FTB) status; months enrolled; tuition; received federal aid; received non-federal aid; student budget; race; and parent education” (Cominole et al. 2006), p. 50). Using these criteria, approximately 10 percent of the original eligible student sample (n=101,010) is excluded from the public use data file (n=90,750) (Cominole et al. 2006). As information about students at nonresponding universities is not available publicly, this article ignores selection of the universities and nonresponse at the institutional level.

The target population was further refined to only include undergraduates[10] in the 50 states and the District of Columbia, excluding Puerto Rico. Finally, because of extensive missing data on the records, an additional restriction was made on the analytic dataset. The analyses conducted here restricts the public use dataset to the students whose universities reported financial aid application information for at least 65 percent of their students (with the vast majority of these institutions not reporting for over 90 percent of

[10] Undergraduates were defined based on the record data, not the interview data. Official NPSAS publications combined record and interview data in defining the type of student. As a result, there will be differences in the total number of undergraduates compared to the official NPSAS publications. Less than one-tenth of one percent of students (about 70) were identified as being dead in the call records, and have also been excluded from these analyses.

their student population). This excluded less than 150 universities and 11,340 students, resulting in a final analytic data set with over 68,000 students.

For the purposes of this chapter, analyses are conducted treating the student sample as a stratified random sample with unequal probabilities of selection. Student selection probabilities are used, accounting for the unequal probabilities of selecting the students from the lists provided by the universities. Different types of students (e.g., first-year first-time beginner students) were selected at higher rates than other students (Cominole et al. 2006). Thus the weighting brings the students in line with their representation at the university. Although some students may have been on lists for multiple universities, the weights constructed for this use different sources of information for the respondents compared to the nonrespondents, and hence are not included in the probabilities of selection. The analytic strata in the public use data file are used; these strata are institutions or combinations of institutions, designed to have a minimum number of 10 students in each stratum.[11]

The AAPOR weighted contact rate for this set of undergraduates was high – 96 percent (unweighted AAPOR CON2 96 percent) – and the AAPOR weighted cooperation rate is 73 percent (unweighted AAPOR COOP2 70 percent), with an overall AAPOR weighted response rate of 70 percent (unweighted AAPOR RR2 67 percent) (AAPOR 2006). This differs slightly from the published NPSAS contact and cooperation rates for three reasons. First, we are looking at a different subset of cases. Second, a final disposition data set was not provided for the purposes of this dissertation; instead, call

[11] The institutions themselves could also be used as strata. There is an unknown risk that data perturbation procedures were applied to the institution identifiers in the public use data file. Additionally, the number of sampled students in any individual institution may be small. Use of the analytic strata circumvents this problem. Analyses of the mean survey variables of interest revealed minor differences in the variance estimates for the mean. Given the large sample size used here (n=68,830), the overestimation is accepted.

records were provided that contained both case and call level dispositions. To the extent that the final dispositions did not match the call records, there will be discrepancies. Finally, extensive conversations with data collection managers at RTI were conducted to understand the nature of the call records. There were many instances in which calls were recorded after a case disposition, with no updating to the case level disposition, especially in the non-interviewed cases. In these instances, summaries based off the entire call record were used to determine whether the case had been contacted and cooperated.

2.1.3 Defining Contact and Cooperation in Mixed Mode Surveys

The nature of the mixed-mode designs in both studies makes disentangling noncontact nonresponse from noncooperation nonresponse difficult. For purposes of this dissertation, we define contact in the surveys as either (1) contact in the telephone mode, or (2) cooperation or active refusal in the self-administered mode. In the WDS, the modes were administered sequentially – everyone who did not respond to the telephone mode received a mail survey. Thus, many noncontacts in the telephone mode may become contacts in the mail mode by returning their questionnaires. In the NPSAS, the modes were not administered sequentially. While the first four weeks of the data collection period were web-only, the subsequent weeks of the data collection period permitted a web nonrespondent to complete the questionnaire via CATI or online. It is unknown whether those students who were not contacted through the phone recruitment read the e-mail request. Less than 30 percent of the NPSAS respondent pool participated without any telephone follow-up (Cominole et al. 2006). Almost identical proportions are observed in the WDS, with 32 percent participating in the mail mode.

In both surveys, cooperation refers to completing an interview in either the CATI or self-administered mode. Partial completes are considered to be completes in both studies.

2.1.4 Estimating Response Propensities

The expression for nonresponse bias of an unadjusted survey mean requires the true response propensity. Unfortunately, this is unknown, and response propensities must be estimated. To the extent that the estimated response propensity differs from the true underlying response propensity, the estimated covariance between response propensity and the survey variables of interest will be biased. In data sets that contain true values for both respondents and nonrespondents – such as those used here – some insight into the degree to which misspecification of a response propensity model leads to inaccurate conclusions about the p-Y relationship can be evaluated (see Section 2.4 for a more detailed discussion).

The most common method for estimating response propensity is through response propensity models, that is, logistic regression models predicting the probability of a case being interviewed (Little 1986). When survey participation is separated into contact and cooperation, then two logistic regression models are estimated, varying in both the case base and the outcome. A contact propensity model predicts whether or not the case was ultimately contacted, out of all eligible cases. A cooperation propensity model predicts whether the case provided an interview, conditional on being contacted. For contrast, an interview model, predicting the overall likelihood of survey cooperation without conditioning on the contacted cases, is also estimated.

Only the NPSAS employed a complex sample design. A question remains as to whether the propensity models in the NPSAS should account for the complex design. The propensity models are used for two types of inference. First, and most importantly, we are interested in the relationship between propensity to respond and the survey variables of interest in the population. This goal suggests that accounting for the complex survey design is appropriate when estimating propensity to participate and when examining the change in the survey variables over the propensity distribution. This allows the inference about the causes of nonresponse propensity to represent the population (Groves and Couper 1998). A separate, but secondary goal, of this analysis is to look at the effectiveness of the propensity models as adjustment procedures. Here, the answer is less clear, where adjustments are clearly improved by incorporating the design information into the adjustment, although weighting the propensity models may not be the best approach (Little and Vartivarian 2003).[12] Thus, since the primary goal of this analysis is to understand the relationship between propensity and the survey variables in the population, we account for the complex survey design in the NPSAS analyses.

2.1.5 Survey Variables of Interest in the WDS and NPSAS

Both studies have key variables of interest available in the records. In the Wisconsin Divorce Study, the survey variables available on the records are divorce, marriage and birth dates, and the number of marriages. Combinations of the dates such as the length of marriage (divorce date – marriage date) are used as analytic statistics. Other variables include the age at marriage (marriage date – birth date), age at divorce

[12] The causal inference literature has recently begun to tackle the question of whether survey weights and stratification should be included when estimating either propensity score models or the outcomes when making causal statements (Dolton, Azevedo, and Smith 2006; Zanutto 2006). Although the goal for the propensity model under this paradigm is different, the answer appears to be that analyses of outcomes should account for the complex survey design.

(divorce date – birth date), and the time elapsed since the marriage or the divorce (interview date – marriage date, interview date – divorce date). The number of marriages is also examined as an outcome variable.

In the National Postsecondary Student Aid Study, the survey variables of interest on the records are applying for and receiving financial aid and to academic achievement. A number of different sources of financial aid are considered, including Stafford Loans (a federal loan), Pell Grants (a grant given to low income families), work-study, state-based aid, and institution-based aid. Both the receipt and the amount of these types of financial aid are available. In addition, the student's grade point average (GPA) and information on whether SAT or ACT tests were taken prior to enrolling at the university are available. Table A.112 contains the NPSAS record variables used in this analysis.

The analysis of the survey variables of interest differs from most evaluations of nonresponse bias because true values are available on both respondents and nonrespondents. In particular, all of the nonresponse bias analyses here examine only the "true value," that is, the values for the survey variables that are available from the records. Although using record values alone limits the number of survey variables that we can examine, our analysis is strengthened in two ways. First, the same measurement is available on both respondents and nonrespondents, avoiding confounding measurement error in survey reports with nonresponse error. Second, estimation of the covariance between response propensity and the survey variables of interest can be performed for the full sample, and not just the respondents, avoiding issues of nonresponse bias on the estimated covariance term. As a comparison, Chapter Four examines how conclusions about the correlation between propensity and the survey variables would differ using the respondents alone and using the record values versus the reported values.

Table 2.1 presents means for the survey variables of interest for both studies. The first column is the overall mean; the next four columns contain means for the noncontacted, overall contacted, contacted, but not interviewed, and interviewed cases, respectively. The starred rows indicate significant differences between the contacts and noncontacts; the rows with number signs indicate significant differences between the interviewed and contacted, but not interviewed.

Table 2.1: Means and Standard Errors for Survey Variables, Overall, Contact, Noncontacted, Interviewed, and Noninterviewed Cases, WDS and NPSAS

	Overall	Non-contacts	Contacts	Contact, no interview	Interview
WDS					
Length of marriage (months)	130.34	114.3*	134.17	134.17	134.17
	3.59	7.25	4.08	13.16	4.29
Months between divorce and interview	49.69	48.41	50.00	46.68	50.44
	0.90	2.10	1.00	2.96	1.06
Number of marriages	1.22	1.27	1.20	1.28	1.20
	0.02	0.04	0.02	0.07	0.02
Age at marriage (years)	25.03	25.18	24.99	25.61	24.91
	0.23	0.50	0.26	0.73	0.27
Age at divorce (years)	35.83	34.72*	36.10	36.81	36.00
	0.32	0.72	0.35	1.04	0.38
NPSAS					
Applied for Financial Aid	72.65	72.71	72.65	70.36#	73.50
	0.25	1.31	0.25	0.51	0.29
Received Financial Aid	63.65	63.14	63.67	59.81#	65.11
	0.26	1.39	0.27	0.54	0.31
Received Stafford Loan	35.79	28.27*	36.08	32.61#	37.37
	0.26	1.28	0.26	0.53	0.31
Amount of Stafford Loan Received	1686	1358*	1699	1534#	1760
	15.35	72.39	15.75	32.14	18.48
Received Pell Grant	29.02	35.16*	28.78	28.31#	28.96
	0.24	1.32	0.25	0.48	0.29
Amount of Pell Grant Received	706	863*	700	655#	716
	7.02	38.38	7.17	13.42	8.54
Received Work Study	6.17	3.32*	6.28	4.55#	6.93
	0.12	0.48	0.12	0.21	0.15
Amount of Work Study Received	128	65*	130	88#	146
	3.40	11.81	3.51	5.15	4.47
Received State Aid	20.8	22.7	20.7	18.1#	21.7
	0.21	1.15	0.21	0.40	0.25
Amount of State Aid Received	463	433	464	365#	502
	6.16	30.03	6.33	11.12	7.84

	Overall	Non-contacts	Contacts	Contact, no interview	Interview
Received Institutional Aid	21.7	12.5*	22.0	18.6#	23.3
	0.21	0.91	0.21	0.46	0.25
Amount of Institutional Aid Received	1111	476*	1135	916#	1217
	19.58	61.78	20.25	55.94	19.91
Grade Point Average	2.91	2.74*	2.92	2.78#	2.97
	0.00	0.02	0.00	0.01	0.00
Did not take SAT or ACT	41.03	59.99*	40.37	44.37#	38.85
	0.24	1.64	0.24	0.58	0.30

Note: Due to missing or conflicting dates in the WDS records, three people are missing age at marriage and one person is missing age at divorce. About 22 percent are missing on the academic achievement variables in the NPSAS. The financial aid variable with the largest amount of missingness is the amount of institutional financial aid with less than 1 percent missing data on the records.
* indicates significant differences ($p<.05$) between the contacted and noncontacted cases.
# indicates significant differences ($p<.05$) between the contacted, but not interviewed, and the interviewed cases.

Two comments can be made about Table 2.1. First, in the WDS, there is very little difference among any of the groups (contacted vs. noncontacted; cooperators vs. noncooperators) on any of the statistics, with the largest difference being on mean length of marriage. In the NPSAS, there are much larger differences -- people who received financial aid other than Pell Grants were more likely to participate than those who did not, and better students are more likely to participate than students with lower GPAs. In other words, a small σ_{pY} term is likely to be seen for most of the variables in the WDS, but larger σ_{pY} terms are likely to be seen in the NPSAS.

Second, most of the observed differences in the WDS lie between contacts and noncontacts, not between the interviewed and not interviewed cases; the opposite is true in the NPSAS. Following this, there is a difference in observed nonresponse bias due to contact versus cooperation on many variables. For example, all of the difference in the WDS on mean length of marriage is between the contacts and noncontacts; there is no difference on this variable between the contacted, but not interviewed. We see a similar pattern for applying for financial aid and receiving financial aid in the NPSAS. In the NPSAS, the noncontacted were more likely to receive state aid and Pell Grants, whereas the noncooperators were less likely to receive state aid and Pell Grants than the interviewed cases. On the rest of the variables, nonresponse bias due to noncontact and noncooperation are in similar directions. Thus, as can be seen in Table 2.1, there is nonresponse bias in both studies. Clear variation across items and across categories of nonresponse exists.

2.2 Step One: Using Social Science Theory to Understand Nonresponse Bias

Survey participation in interviewer-administered surveys can be divided into two categories: contact and cooperation (Groves and Couper 1998). Causes of survey participation arise from respondent, household, and social environmental characteristics, each mediated by protocol decisions. There is limited theoretical framework for participation decisions in mixed mode surveys (de Leeuw 2005). As the majority of survey participants in both surveys were contacted through an interviewer-administered mode, model specification draws on the interviewer-administered household survey literature. Future work should examine participation in each mode separately.

Although there are guiding theories for survey participation, there are no established conceptual frameworks for understanding how or when nonresponse bias will occur in a production survey. Nonresponse bias is both item- and estimate-specific. To anticipate when nonresponse bias will occur, predictions must be made for individual items and the estimates using those items (e.g., means, proportions, quantiles, correlations).

Empirical tests of causes of survey participation are generally limited by weak indicators. Indeed, many theoretical explanations for survey participation can be applied to the same indicators (e.g., discretionary time and social isolation for age). Although these indicators often overlap, for purposes of simple exposition, it is useful to group variables into only one cause for survey nonresponse. Additionally, as discussed earlier, appropriately distinguishing between contacted and noncontacted households is difficult in a mixed mode survey. The contact rates are likely underestimated in both surveys, given the possibility of a household receiving the survey request through the self-administered mode, but not responding to the survey.

This section jointly identifies potential causes of response propensity and the relationship of the causes with the survey variables of interest. We hypothesize that there are two primary influences on contactability and four influences on cooperation as measured by respondent and ecological covariates. Separate propensity models are estimated for each hypothesized cause. The causes are then evaluated for their likely relationships with nineteen survey variables across the two studies.

Table 2.2 summarizes the predicted relationships between the indicators for the cause of survey participation and contact and cooperation propensity. The table contains five columns for each survey. The first column contains the covariate, Z, entered into the propensity model. The second and third columns refer to the contact propensity models. The fourth and fifth columns refer to the cooperation propensity models. Under contact and cooperation, the column labeled "+/-" indicates the direction of the expected relationship with contact or cooperation propensity. The columns labeled "Model" indicates the cause of survey nonresponse for which the covariate is used as an indicator.

The two causes considered for contact propensity are at-home patterns (AH) and access impediments (AI). The four causes considered for cooperation propensity are social isolation (SI), discretionary time (DT), positive affect toward the sponsor (SP), and social environmental factors (SE). Many of the indicators were drawn from a review of the household survey nonresponse literature (see Chapter One). We discuss justifications for the predictors for each model below.

Table 2.2: Predicted Relationships for Contact and Cooperation with Predictor Variables

WDS					NPSAS				
	Contact		Coop.			Contact		Coop.	
Covariate	+/-	Model	+/-	Model	Covariate	+/-	Model	+/-	Model
Female	+	AH	+	SI	Female	+	AH	+	SI
Age	+	AH	-	SI	Age	-	AH	-	SI
Female * Age	n/a		-	SI	Married/ independent vs. single/dependent	+	AH	+	SI
# Kids R. Sole or Joint Custody	+	AH	+	SI	No HS Diploma vs. HS	-	AH	-	SI
# Kids Spouse Sole Custody	?	AH	+	SI	FT or PT enrollment vs. Not enrolled	+	AH	-/+	DT
No HS Diploma vs. at least HS	-	AH	- / +	DT	Year in School	+	AH	-/+	DT
Prop. Drive to work alone	+	AH	+	DT	Region	varies	AH	varies	SE
Prop. Commute <15 minutes	+	AH	+	DT	Central City / Urban Fringe vs. Rural	-	AI	-	SE
Prop. Work at home	+	AH	+	DT	% Blacks	-	AI	-	SE
					% Hispanics	-	AI	-	SE
					% Native Americans	-	AI	-	SE
Live in Wisconsin	+	AH	+	SP	% Asians	+	AI	+	SE
Prop. People live in urban areas	-	AI	-	SE	School Selectivity	+	AI	+	SP
Prop. Nonwhite persons	-	AI	-	SE	School Size	-	AI	-	SE
Median Income	-	AI	+	SE	<=2 year vs. 4 year doctoral granting	-	AI	-	SE
Prop. Married	-	AI	+	SE	4 year non-doctoral granting	No diff.	AI		
Prop. Age 17 and Younger	+	AI	+	SE	Public or Private vs. For profit	+	AI		
Prop. Age 55 and Older	+	AI	-	SE	Public, Private, Not religious vs. Religious			-	SE
Prop. HH below poverty status	n/a		-	SI	Black, Hispanic, Native American vs. White	-	AI	-	SI
Prop. single person HH	n/a		-	SI	Asian vs. White			+	SI
Prop. lived in same house in 1985	n/a		+	SE	Veteran vs. Citizen, not veteran			+	SP
Prop. some college or more	n/a		+	SE	Nonresident alien vs. Citizen	+	AI	-	SP

WDS					NPSAS				
	Contact		Coop.			Contact		Coop.	
Covariate	+/-	Model	+/-	Model	Covariate	+/-	Model	+/-	Model
Married in Wisconsin	n/a		+	SP	Foreign student vs. Citizen	+	AI	-/+	SP
Divorce county close to sponsor	n/a		+	SP	HBCU	n/a		-	SE
Prop. managerial/ prof. occupations	n/a		-	DT	Hispanic serving institution	n/a		-	SE

Note: The "Contact" and "Coop." columns indicate the cause for which the covariate is being used as an indicator. For contact propensity, these include at-home patterns (AH) and access impediments (AI). For cooperation propensity, these include social isolation (SI), discretionary time (DT), positive affect toward the sponsor (SP), and social environmental factors (SE). n/a indicates that the variable was not included in the model.

Two observations can be made from Table 2.2. First, the contact models contain fewer predictors than the cooperation models. This is to be expected, as there are four hypothesized causes for cooperation, whereas only two hypothesized causes for contact. Second, the predicted directional relationship for most of the covariates is the same in both contact and cooperation models, although the reasons behind these predicted relationships differ. For example, while race in the NPSAS is used as an indicator of the digital divide, and hence lower likelihood of contactability, it is also a traditional indicator of social isolation (regardless of mode) for cooperation. Since race is expected to have consistent relationships with both contact and cooperation propensity (albeit for different reasons), we would expect no change in the direction of these variables when contact and cooperation are combined in an interview model. On the other hand, where signs differ between contact and cooperation, we expect no relationship or diminished relationships. For example, we expect that age in the WDS and being a non-resident alien rather than a citizen in the NPSAS will experience diminished effects on propensity when the distinction between the two categories of survey participation is ignored.

Table 2.3: Expected Relationships Between p and Y Under Two Contact Propensity Models and Four Cooperation Propensity Models, WDS and NPSAS

	Contact Models	Cooperation Models

	At-home patterns	Access impedi-ments	Social Isolation	Social Environ-mental factors	Discretion -ary Time	Positive affect toward sponsor
WDS						
Length of marriage	+	No	+ / -	No	+	No
Months between divorce and interview	No	No	No	No	No	No
Number of marriages	No	+	+ / -	-	No	No
Age at marriage	+	No	-	-	No	No
Age at divorce	+	No	-	No	+	No
NPSAS						
Applied for financial aid	+	-	-	+	+	+
Received financial aid	+	+	-	+	+	+
Received Stafford loan	+	+	-	+	+	+
Amount of Stafford loan	+	+	-	+	+	+
Received Pell Grant	-	-	-	-	+ / -	+ / -
Amount of Pell Grant	-	-	-	-	+ / -	+ / -
Received Work Study	+	+	-	+ / -	-	+
Amount of Work Study	+	+	-	+ / -	-	+
Received State Aid	+	+	+	+	+	+
Amount of State Aid	+	+	+	+	+	+
Received Institutional Aid	+	+	-	+	+	+
Amount of Institutional Aid	+	+	-	+	+	+
Grade Point Average (4 point scale)	+	+	+	+	+	+
Took either ACT or SAT	+	+	+	+	+	+

Note: All predictions are related to the true Y available on the records. "No" indicates that the propensity cause is not anticipated to be a common cause for the survey variable, + anticipates that the people who are higher on propensity under this model will also have higher values of the survey variable, - anticipates that the people who are higher on propensity under this model will have lower values of the survey variable. +/- anticipates that there will be a relationship between propensity and the survey variable, but theory dictates that the relationship could be in either direction.

Table 2.3 summarizes the predictions for the relationship between p and Y for the two conceptually guided contact and four cooperation models.[13] In many, but not all instances, alternative causes for survey participation yield similar predictions. While the six conceptually guided models considered here surely do not reflect all possible causes of nonresponse bias, they provide insights into how the mix of causes may interact on nonresponse bias. That is, the resulting nonresponse bias in a final (unadjusted) respondent estimate is a mixture of all of the causes of nonresponse bias.[14] For example,

[13] Appendix Table A.25 through Table A.28 show the relationship between the proxy indicators and the survey variables (estimated on the records) for each survey.
[14] Appendix Section 6.4 examines how the estimated relationship between theoretical p and Y changes given two independent causes of p and Y, each with varying strength and direction of the relationship.

in the NPSAS, people who are more socially engaged would be less likely to receive financial aid. However, the other three causes for cooperation predict a positive relationship between propensity and receipt of financial aid.

2.2.1 Contact Models

We now briefly discuss the indicators of respondent-level and ecological causes of contact propensity.[15] In interviewer-administered surveys, two main causes of noncontact nonresponse are differential at-home patterns and access impediments. As discussed in Section 2.1.3, the mixed mode design for each survey makes the distinction between access impediments and at-home patterns less clear than had only one mode been used. Future analyses should examine contactability in the telephone mode and response to the self-administered modes separately.

2.2.1.1 At-home Patterns

Contact in an interviewer-administered survey largely depends on the ability to find people at home at the time of the interviewer's call attempt, referred to as at-home patterns. In general, people in the U.S. tend to be at home during weekday evenings and weekend days. However, the unemployed, elderly, married individuals, households with children, and women are more likely to be at home during weekday days than other persons (Maitland 2006). These groups also tend to be those who are easier to contact in surveys (Groves and Couper 1998; Stoop 2005).

As such, gender, age, marital status (in the NPSAS), the number of children (in the WDS), and proxies for employment are included in both studies. While older age in

[15] Distributions of the WDS predictors can be found in Appendix Table A.2 and Table A.3. Distributions of the NPSAS predictors can be found in Appendix Table A.4 and Table A.5.

the WDS proxies for retirement or regular at-home patterns (Krantz-Kent 2005), older age in the NPSAS proxies for employment or being a non-traditional student (Berker and Horn 2003). As additional measures of possible employment or being a nontraditional student in the NPSAS, we include being a full-time student and the student's year in school. We also expect that contact rates will vary by the region of the country due to regional differences in at-home patterns (Maitland 2006).

Ecological factors also are included in the WDS at-home patterns model, all of which are anticipated to have a positive relationship with contact. These variables were selected to proxy for employment status and time away from home. These include the proportion of workers aged 16 and over who work at home, the proportion of workers whose primary means of transportation is driving alone to work (as opposed to taking public transportation, carpooling, or walking), and the proportion of workers whose commute is less than 15 minutes.

There is no particular reason why at-home patterns will cause any of the variables in either study. However, strong correlations among the proxy indicators for at-home patterns may be observed in each. In the WDS, the length of marriage can be expected to strongly vary with age (e.g., a 30 year old cannot divorce from a 30 year marriage), leading to a positive relationship between at-home propensity and length of marriage, age at marriage and age at divorce. There is no clear prediction for the length of time since the divorce or the number of marriages due to at-home patterns.

In the NPSAS, since we hypothesized that younger students and more traditional students will be easier to contact, and these groups are more likely to receive financial aid, a positive relationship between at-home patterns and financial aid is anticipated. In a student population, unlike the general population, affluence facilitates being a traditional or full-time student. Thus, a negative relationship between at-home propensity and Pell Grants is expected as these are targeted to students from low-income families. We hypothesize that students who are not employed or otherwise engaged in activities beyond their school work will be better students, with more time to do school work. Thus, a positive relationship between at-home contact propensity and academic achievement is expected.

2.2.1.2 Access Impediments

Indicators for access impediments in both surveys are related to urbanicity and other environmental factors. In the WDS, correlates of having an answering machine were selected (Tuckel and O'Neill 1995; Tuckel and O'Neill 2002; Tuckel and Feinberg 1991). Unfortunately, these covariates in the WDS are exclusively ecological variables, and unlikely to be good measures of access impediments.

Due to the mixed mode design of the NPSAS, access impediments can be of two sources – not having a computer (and hence not receiving the e-mail requests) and having answering machines, voice mail, or caller ID (impeding the telephone requests). In a student population, the prevalence of telephone access impediments (Tuckel and O'Neill 2002) or cellular telephones with these impediments (Blumberg and Luke 2007) is likely to be quite high. Thus, we focus on a separate potential cause of noncontact nonresponse in the NPSAS – not having a computer – with indicators in the propensity models reflecting the "digital divide." That is, different types of students and different schools vary in their rates of computer access at school and at home (Snyder, Tan and Hoffman 2006). Generally, these are related to race/ ethnicity of the students and school characteristics, such that schools with higher concentrations of traditionally underrepresented minorities (e.g., African-Americans, Hispanics, and Native Americans) have fewer computers.

As with at-home patterns, we do not expect that access impediments themselves are causes of the survey variables. We do not anticipate nonresponse bias from noncontact nonresponse due to access impediments on estimates for length of marriage, age at marriage, age at divorce, or time since divorce in the WDS. If we had ideal measures of at-home patterns and access impediments, we would anticipate that people who have had multiple marriages may have more access impediments as screening devices against past spouses. Given the quality of the indicators for access impediments, it is unlikely that this will be detected.

Since the NPSAS access impediments model contains correlates of the "digital divide," we expect a negative relationship between propensity due to access impediments for applying for financial aid and for the Pell Grant, and a positive relationship for the other sources of financial aid. Students at more affluent schools or four-year institutions are more likely to have computers, and hence easier to contact via the web request. More affluent schools are more expensive, with greater need for financial aid, but with fewer students who apply for financial aid or who receive the Pell Grant. Students who have access to better resources are likely to be better students. Thus, we expect a positive relationship between academic achievement and access impediments-related contact propensity.

2.2.2 Contact Models: Results

Three contact models were estimated for each survey – a model containing only the indicators for at-home patterns specified above, a model containing only the indicators for access impediments and a combined model with both sets of indicators. The contact model results are shown in Appendix Table A.6 (WDS) and Table A.7 (NPSAS). The directions of the parameters for the two conceptually guided contact propensity models for both studies are largely consistent with expectations. However, age and gender are not significantly related to the ability to make contact in the WDS, while education is positively related to contactability. In both studies, neither the direction nor the statistical significance levels of the coefficients change dramatically by combining the two blocks of variables into one model. The blocks of variables added to the contact models significantly predict contact ($p<.05$) (Table A.17), with similar distributions of predicted propensities (Table A.18).

Table 2.4: Bivariate Correlation Between Predicted Propensity and Survey Variables for Two Contact and Four Cooperation Models

	Contact Models		Cooperation Models			
	At home patterns	Access imped-iments	Social Isolation	Social Environ-mental Factors	Discre-tionary Time	Positive affect toward sponsor
WDS						
Length of marriage	0.217	-0.002	0.039	-0.022	-0.082[a]	0.046
Months between divorce and interview	-0.007	-0.029	0.024	0.013	-0.054	0.018
Number of marriages	0.029	0.018	-0.024	0.024	-0.017	-0.032
Age at marriage	0.114	0.039	-0.161	0.024	-0.041	-0.011
Age at divorce	0.286	0.022	-0.091	-0.011	-0.11[a]	0.051
NPSAS						
Applied for financial aid	-0.012[a]	0.019[a]	-0.071	0.037	0.073	-0.073
Received financial aid	0.057	0.053	-0.049	0.076	0.135	-0.003
Received Stafford loan	0.076	0.124	-0.078	0.125	0.129	0.055
Amount of Stafford loan	0.063	0.093	-0.100	0.107	0.165	0.051
Received Pell Grant	-0.096	-0.125	-0.036	-0.076	0.015	-0.153
Amount of Pell Grant	-0.039	-0.103	-0.036	-0.061	0.073	-0.114
Received Work Study	0.096	0.120	-0.007	0.104	0.082[a]	0.114
Amount of Work Study	0.079	0.090	-0.005	0.078	0.072[a]	0.081
Received State Aid	0.031	-0.007	0.030	0.018	0.069	-0.017
Amount of State Aid	0.093	0.057	0.041	0.078	0.114	0.082

	Contact Models		Cooperation Models			
	At home patterns	Access imped-iments	Social Isolation	Social Environ-mental Factors	Discre-tionary Time	Positive affect toward sponsor
Received Institutional Aid	0.179	0.205	-0.010	0.161	0.151	0.219
Amount of Institutional Aid	0.153	0.191	-0.012	0.097	0.131	0.232
GPA	0.099	0.088	0.073	0.075	0.127	0.087
Took either ACT/SAT	0.357	0.372	0.093	0.322	0.253	0.395

Note: [a] indicates that direction is inconsistent with predicted direction. NPSAS correlations are weighted by the student base weight.

The real question is whether we see the anticipated relationships between the estimated p and Y. In almost every instance, the answer is yes, although the size of the relationship is modest (Table 2.4).[16] For example, people whose at-home patterns were conducive to contact in the WDS have longer marriages. Students at schools in the NPSAS with fewer access impediments (e.g., more computers) and hence easier to contact receive more financial aid from the institution and are better students. The predicted relationship for applying for financial aid under the NPSAS contact propensity models was the only instance in which the observed relationship was opposite the predicted direction.

2.2.3 Cooperation Models

Four hypothesized causes for survey cooperation are used to specify the cooperation propensity models. These causes are (1) social isolation, (2) discretionary time, (3) positive affect toward the sponsor, and (4) social environmental factors. Social isolation argues that people who are more socially integrated are more likely to participate in surveys (Brehm 1993; Goyder 1987). The discretionary time hypothesis

[16] The bias expression for the relationship between propensity and the survey variables can be rewritten as a function of the correlation between p and Y and the standard deviations of propensity and the survey variable ($Bias(\overline{y}_r) = Corr(p,Y)\sigma_p\sigma_Y / \overline{p}$). Since a correlation coefficient is a unit-free measure and thus can be compared across the models, we use this statistic.

argues that busy people are unlikely to participate in surveys (Abraham, Maitland and Bianchi 2006). The positive affect toward the sponsor cause argues that people who are preinclined to like the sponsor are more likely to participate in surveys from that sponsor. Finally, social environmental factors have been shown to be related to survey participation, although whether the causal mechanism for these correlates resides at the individual level or in the aggregate is not clear (Groves and Couper 1998; Harris-Kojetin and Tucker 1999; House and Wolf 1978; Johnson et al. 2006).

As with contact, empirically disentangling causes for survey cooperation is difficult. Many indicators can represent the same theory; many theories describe identical phenomena. For convenience, as with contact, we assign each indicator to only one construct (Table 2.2).

2.2.3.1 Social Isolation

Groups that are traditionally considered to be more socially engaged, and hence more likely to participate in surveys include women (WDS and NPSAS), younger persons (WDS and NPSAS),[17] married people (NPSAS), people with children (WDS), and persons who are not underrepresented minorities (NPSAS).[18] We extend these traditional indicators of social isolation to include not having a high school diploma (NPSAS), and ecological zip code-level variables (WDS) that reflect higher

[17] Age is also an indicator of discretionary time. In the WDS, older respondents are more likely to be out of the labor force and hence have more discretionary time. On the other hand, in the NPSAS, being older corresponds to being in the labor force, and having less discretionary time. In the WDS, social isolation and discretionary time have opposing predictions for age; in the NPSAS, the predictions are in the same direction.

[18] Marital status on the records is constant in the WDS (divorced). Presence of children in the records is only available for a limited subgroup of persons in the NPSAS. Race is not included in the WDS models due to lack of variation on this characteristic.

concentrations of social isolates (proportion of single person households, proportion of persons with incomes below the poverty line).

People who had longer multiple marriages or were married younger may be less socially isolated, as they have had time to build up ties through the marriage and have children, suggesting a positive relationship between propensity and length of marriage. However, since the WDS only contains individuals who have ended a relationship in the recent past, persons who have had longer or multiple marriages or were married at younger ages may now be more socially isolated, having broken a tie, with a negative p-Y relationship. Notions of social isolation, however, would predict that people who divorced at older ages are likely to be less connected to others than people who were younger at the time of divorce, and hence negatively related to cooperation propensity.[19]

The conceptual relationship between social isolation and the academic achievement measures is clear – students who are less qualified academically are more socially isolated. Thus, we would expect a positive relationship between propensity and academic achievement. In terms of social isolation and financial aid, people who are socially isolated are likely to need more funding in general for higher education; thus, we expect a negative relationship between social isolation propensity and Pell Grants (e.g., socially integrated students are less likely to have a Pell Grant), applying for aid, receiving aid, receiving Stafford Loans, and work study jobs. Institutions may use

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[19] A commentary on the empirical relative strength of predictors in the propensity model is in order. Age and the number of children are indicators for social isolation in the WDS. These forces may cancel each other out. For instance, age is negatively related to cooperation propensity, but the number of children is positively related to cooperation propensity (Table A.8). Length of marriage is positively correlated with both age and the number of children (Table A.25). If either of the variables was in the model independently, the resultant relationship would be clear. However, with both predictors in the model, the strength of the p-Y relationship will depend on which one of these predictors has the strongest effect on propensity relative to its relationship to the length of marriage.

institutional aid to bring in traditionally socially isolated students (Lee, Clery and Carroll 1997). This would also suggest a negative relationship between social isolation propensity and institutional aid. State aid may behave differently than the other types of aid, being given on the basis of need or merit. We would expect stronger positive relationships for merit-based aid and stronger negative relationships for need-based aid. Since we expect that academic achievement will vary positively over the social isolation propensity distribution, we expect a positive relationship between state aid and social isolation propensity.

2.2.3.2 Discretionary Time

Busy people – those with little discretionary time – are hypothesized to be less likely to participate in surveys than people with more free time. Traditional indicators of discretionary time include employment and income. We do not have these indicators in either survey. As such, in the WDS, we include education (higher education has less discretionary time) and ecological factors related to employment – the proportion of people who drive alone to work, with driving alone to work as an indicator of more discretionary time than taking the bus or carpooling, the proportion of people with short commutes (less than 15 minutes), the proportion of people who work at home, and the proportion of people with managerial or professional occupations.

Discretionary time in a survey of students who are largely out of the labor force is difficult to measure. The year in which the student is in school and the level of enrollment during the spring term (full-time, part-time, not enrolled) are the proxy indicators of discretionary time in the NPSAS. We anticipate that higher year students will be more likely to participate given that advanced classes meet less frequently, hence providing more discretionary time. However, these students may also be more likely to have other work obligations (e.g., research assistantships) and thus have less discretionary time. We anticipate that those students who are enrolled part time or not enrolled for a given semester will be working or have other obligations outside the classroom, giving them less discretionary time than full-time students.

If we had ideal measures of discretionary time, we would not expect strong p-Y relationships in the WDS. The respondent's age at divorce is highly correlated with age at interview. Thus, we expect that persons who were older at the time of divorce to have more discretionary time, predicting a positive relationship with discretionary time propensity. On the other hand, older people may be more likely to have more education and hence be employed with less discretionary time; hence a negative relationship would be expected. We make similar predictions for length of marriage and age at marriage.

In the NPSAS, students with more discretionary time should be better students, as they have more time to study. Student with more discretionary time are also more likely to have higher tuition dollars, as their primary role is to be a student rather than other life activities (e.g., employment, family). Thus, we would expect a positive relationship between discretionary time and all types of financial aid, but especially state and institutional aid. There may be a weaker positive or even a negative relationship with Pell Grants as those students with the least amount of discretionary time, likely needing more assistance to cover some of the costs of higher education.

2.2.3.3 Positive Affect Toward Sponsor

As the sponsors for the two surveys vary (University of Wisconsin and NCES), the variables indicating positive affect toward the sponsor also differ. The WDS includes three variables, all related to being in Wisconsin - being married in Wisconsin, being divorced in a county close to the sponsor, and living in Wisconsin at the time of the survey request. Because of the restricted range of these variables, we expect any effect to be muted relative to a study conducted on a more diverse population.

In the NPSAS, indicators of positive affect toward the federal sponsor include citizenship and veteran status and school selectivity. Citizens and veterans are anticipated more likely to respond to a federal survey than nonresident aliens or foreign students. From an authority standpoint, foreign students may be more likely to cooperate with a survey request than resident aliens because they have more recently received special permission to be in the country. We also include school selectivity, measured by the proportion of students who take the SAT and ACT and proportion of students admitted, expecting that students at more selective schools will be more likely to value the sponsor. This can be viewed through many different theoretical lenses (taking exams that have national importance indicates buy-in to a federal sponsor; filling out exams is similar to filling out a survey, and may be an indication of more positive attitudes towards surveys; students in selective schools have complied with a set of normative measures used for evaluation and comparison), all of which predict a positive relationship between school selectivity and survey participation.

We do not expect a relationship between having positive affect for the sponsor and any of the survey variables of interest in the WDS.

In the NPSAS, people who received financial aid, especially federal aid (e.g., Stafford loans, Pell Grants, work study) are likely to have positive affect toward the sponsor, with a positive relationship between sponsor-related propensity and the federal aid sources. In an ideal measurement, this may be because an exchange relationship has started or because the people who receive these grants and loans simply like people who gave them money. People who received more aid from their institution or state may be less positively inclined toward the federal sponsor than to a different sponsor. However, since school selectivity is included in the sponsorship model and more selective schools are less likely to have low income students, a negative relationship between predicted propensity and Pell Grant receipt and positive relationship with institutional aid may be observed. People who are higher academic achievers are likely to have more positive feelings toward the federal sponsor, with a positive relationship between propensity and academic achievement.

2.2.3.4 Social Environmental Factors

Social environmental factors are anticipated to be related to cooperation rates, reflecting effects of the social context, proxying for the effect of the characteristic on the sample unit, and capturing other unmeasured correlates (Kennickell 1999a). In both studies, we include measures of urbanicity and racial/ethnic composition of the neighborhood or school. In the WDS, we also include measures about the age distribution of the neighborhood, expecting that people in neighborhoods with more children will be more likely to participate and people in neighborhoods with more elderly will be less likely to participate, socioeconomic status measures (median income, proportion with higher education), expecting people in higher SES neighborhoods to be more likely to participate, and measures of neighborhood stability (i.e., living in the same house for at least five years) and marriage, expecting that both characteristics contribute to higher cooperation rates.

In the NPSAS, we expect variation in cooperation rates across regions. This may proxy for differences in urbanicity, attitudes towards surveys, or aggregates of constructs outlined in the above sections. We also expect characteristics of the universities themselves to also be related to survey participation. For example, we expect that people at religious schools will be more likely to participate than other schools because of the religious nature of the school. Students at four-year institutions may be more likely to participate than students because a four-year school may foster more of a school community than other types of institutions (the aggregate of social integration).

There is no clear relationship between social environmental factors and the WDS survey variables. A relationship may be observed to the extent that people with similar marital histories are geographically clustered. On the other hand, different types of schools provide varying levels of funding for their students and provide a more or less supportive environment for academic achievement. We expect that school environments that are supportive of their students in general will be more likely to provide financial aid, will likely have fewer low income students (due to selection criteria for the school), and will facilitate academic achievement, with a positive relationship with social environmental factor-related propensity in the NPSAS. Thus, we expect a positive relationship between propensity due to social environment and financial aid measures, other than Pell Grants, and academic achievement.

2.2.4 Cooperation Models: Results

Five cooperation models are estimated for each study – one for each set of indicators discussed above and a combined model containing all of the predictors. The direction of the cooperation model coefficients are generally consistent with expectations

(Appendix Table A.8 through Table A.10 for the WDS, Appendix Table A.11 through Table A.13 for the NPSAS). Combining the individual blocks of variables in one model does not change the sign or significance level for most of the variables in the WDS. However, in the NPSAS, combining all variables in the same model lessens the effect of age, changes the sign of the student-level race/ethnicity variables, and dampens the effect of year in school. All of the NPSAS cooperation models significantly predict cooperation ($p<.05$). The WDS social isolation model is the only model that, on its own, significantly explains cooperation propensity (Table A.17).

The social isolation predictors clearly have the largest influence on cooperation propensity in the WDS (Table A.8). Contrary to expectations under this model, people living in areas with more single people are more likely to participate in the WDS. All other social isolation hypotheses are upheld. None of the social environmental or sponsorship factors predict cooperation in the WDS; only education and the proportion of people in managerial occupations are marginally related to cooperation from the other models (Table A.8 through Table A.10).

Almost of all of the NPSAS predictions are upheld. In the NPSAS, the race/ethnicity predictions are consistent with expectations (e.g., Hispanics, Blacks, and Native Americans are less likely to participate than White students) when tested on their own (Table A.11), but switch signs after the models are combined (Table A.13). Younger students are more likely to cooperate than older students (Table A.11). Students at religious schools are more likely to participate than students at other types of private schools, but are no more likely than students at public schools (Table A.11). As predicted, full-time and part-time students are more likely to cooperate than students who are not enrolled (Table A.12).

What about the relationship between the predicted propensity and the survey variables over the four models? As with the relationship between contact propensity and the survey variables, the predictions for cooperation propensity were by and large upheld (Table 2.3). This is especially important as some of the p-Y predictions ran in opposite directions across the models. For instance, a negative relationship was predicted for many of the financial aid measures in the NPSAS and social isolation propensity, but a positive relationship with the other causes of propensity. This, in fact, was found to be the case. For the cooperation models, the work study variables are those that are the least consistent with our predictions across the models, with estimated correlations not significantly different from zero in the Social Isolation model.

To further understand the relationship between p and Y, Appendix Table A.33 through Table A.57 contains the estimated means and standard errors for each variable by propensity stratum for various contact and cooperation model specifications. These tables reveal curvilinear relationships between propensity and many of the survey variables in some of the model specifications (e.g., length of marriage and the combined cooperation propensity). Since a correlation assumes a linear relationship between p and Y, any nonlinear differences across propensity strata will not be detected.

Any number of parameterizations of contact and cooperation propensity models are possible. Using theory and existing literature to guide variable selection, two specifications for contact propensity and four specifications for cooperation propensity models were estimated. Although the models vary conceptually, little clearly differentiates the models in terms of fit statistics or predicted propensities (see extended discussion in Section 6.1). The models are virtually identical in terms of their average response propensity across quintiles of the propensity distribution for each model (Table A.18). Not surprisingly, the clearest indication from the statistical criteria simply suggests that the combined models have better fit and more variation in estimated response propensity (Table A.17).

2.2.5 Summary

Since nonresponse bias is statistic-specific, a priori specification of the relationship between p and Y must be stated for individual Ys. This implies that a certain cause for p may be highly related to the Y's in one survey, but not in another. This is what we see in the comparison between the WDS and NPSAS. For example, there was little relationship between the predicted propensity in the discretionary time model with any of the outcomes in the WDS, but relatively strong relationships with the Y variables in the NPSAS (Table 2.4). Thus, it is unlikely that any single cause will be the driver of nonresponse bias across all surveys.

In order to specify a relationship between p and Y, the cause for p must be considered. This is important as different causes for propensity may vary in their relationships with different Y variables. For example, if there is a structural relationship between different Y variables (e.g., receipt and amount of financial aid by source), relationships between p and Y will necessarily be in the same direction (Table 2.4).

Finally, the theoretical relationship between the Common Cause and the survey variables must be evaluated in light of the proxy indicators available for the cause. As discussed throughout Section 2.1, while there may be no theoretical reason to expect a relationship between a true cause for propensity and Y, the proxy indicators for the cause may be empirically correlated with Y. Thus, a nonzero p-Y correlation using the estimated propensity may occur.

This form of reasoning is limited by the observational nature of the available data and the weak indicators available for each cause of propensity. As discussed in Chapter One, virtually all of the theories for why people cooperate with survey requests draw on the same set of sociodemographic indicators. Thus, while a model may be labeled as representing a cause, it simply reflects the quality of the empirical data used to indicate that cause. Additionally, the distinction between contact and cooperation propensity is hazier in these data than in a single mode survey. As data with gold standards available on respondents and nonrespondents with call records are rare, the difficulty in distinguishing between the two categories of nonresponse is acceptable. However, all conclusions about the two categories must be regarded as tentative. Finally, the theoretical paradigms drawn on for model specification arose in studies of the general population. Whether these theories apply to studies of special populations (such as divorced persons or students) requires more careful consideration.

As argued in Section 2.1 and shown in this section, contact and cooperation differ in their effects on nonresponse bias. Understanding how that happens requires disentangling the two causes of nonresponse. We now turn to a discussion of the p-Y relationship when the two sources of nonresponse are not separated.

2.3 Step Two: Contrasting Contact and Cooperation Propensity with Overall Interview Propensity

What happens when contact and cooperation aren't distinguished? We anticipate that when the relationship between the predictor variables for contact propensity and cooperation propensity have different signs, little or no relationship for that predictor variable with interview propensity will be observed (Groves and Couper 1995). Similarly, when the correlation between the predicted propensity and the survey variables is positive for one propensity model and negative for the other propensity model, little or no *p-Y* relationship will be observed using predicted interview propensity. However, if one category of nonresponse dominates, then this category will drive the propensity model and the relationship between the predicted propensity and the survey variable.

An ideal test of this comparison would identify statistics that are causes for one category of nonresponse, but not the other. Then, we would expect to see the most striking difference between the p-Y relationship estimated under separate contact and cooperation models compared to an interview model. We do not have this situation in either of these surveys. As a result, we include, to the extent possible, all variables specified in either the contact or cooperation models for each survey.

We estimated five interview models, roughly corresponding to the five cooperation models in each survey. For parsimony, the appendix only contains the final interview model. As expected, the covariates that had opposite effects in the contact versus cooperation models have no significant effect in the interview models (Table A.15 and Table A.16).

In the WDS (Table A.15), some of the main effects in the interview model are those identified in the contact model (e.g., the number of children for which the respondent was given custody); others were identified in the cooperation model (e.g., the number of shared custody children); others were not identified in either model (e.g., proportion minorities in the zip code).

The NPSAS interview model (Table A.16) largely resembles the NPSAS cooperation model. This is not surprising, as noncooperation nonresponse is a much larger component of the final response rate than noncontact nonresponse. As anticipated, the largest different between the interview models and the other models is for foreign students, who are significantly less likely to be interviewed than citizens, an effect driven by differential noncontact nonresponse rather than noncooperation.

Why does this matter? If noncontact nonresponse constitutes most of the overall response rate, then the interview model will reflect that noncontact nonresponse more that noncooperation nonresponse. The same thing holds if noncooperation dominates the nonresponse rate. Additionally, if the final contact and cooperation rates had been different, a different interview model would have been estimated, even when the predictors from the contact and cooperation models maintained exactly the same directional and magnitude of a relationship with propensity. However, the analyst using only one propensity model (not disentangling the two) will be less able to attribute inconsistencies or deviations from expectation to incorrect theorizing, poor parameterization of the theory, or mixed influences on nonresponse when contact and cooperation are not separated.

What about the relationship between p and Y? Since the interview model combines both categories of nonresponse, it is difficult to specify a priori a relationship between predicted propensity and the survey variables of interest. One question is whether the observed p-Y relationship under the interview model differs in sign or magnitude from the product of the two categories of nonresponse. In the NPSAS, the answer is not dramatically different (Table 2.5). This is likely due to the high contact rate, with noncooperation nonresponse dominating the interview propensity model. In the WDS, there is a slightly larger difference in the p-Y relationships estimated using the interview model and than those estimated using the product of the contact and cooperation propensities.

2.4 Step Three: Evaluating the Model-Based Approach to Understanding Nonresponse Bias

How do we know whether we "got it right;" that is, whether the estimated propensity reflects unobserved underlying propensities? An evaluative criteria for this model-based approach is to examine whether the direction of the observed relationship between p and Y reflects the direction of the observed difference between the estimate based on the respondents versus nonrespondents. The question of "getting it right" must be considered in light of the multiple competing influences on propensity. When the relationship between propensity and the survey variables is in the same direction across all of the models (e.g., always positive such as in receiving state aid or in GPA), then the answer will be suggestive of being on the right track. When some influences are positively related to propensity and others are negatively related to propensity (e.g., length of marriage, receiving financial aid), the answer is less clear.

Table 2.5: Correlation between Predicted Propensity and Survey Variables and Difference Between Observed Respondent and Nonrespondent Groups, for the Main Effects Contact, Cooperation, Contact*Cooperation, and Interview Models

	Contact		Cooperation		Contact* Coop.	Interview	
	Corr(p,Y)	Observed Diff. C-NC	Corr(p,Y)	Observed Diff. I - CNI	Corr(p,Y)	Corr(p,Y)	Observed Diff. R-NR
WDS							
Length of marriage	0.205	19.90	0.021[a]	0.00[a]	0.192	0.198	13.36[a]
Months between divorce and interview	-0.002[a]	1.59[a]	0.028[a]	3.70[a]	0.015	0.002[a]	2.59[a]
Number of marriages	0.015[a]	-0.07[a]	-0.022[a]	-0.10[a]	-0.001	-0.021[a]	-0.08[a]
Age at marriage	0.119	-0.19[a]	-0.112	-0.70[a]	0.013	-0.015[a]	-0.42[a]
Age at divorce	0.279	1.38[a]	-0.064[a]	-0.80[a]	0.187	0.178	0.60[a]

	Contact		Cooperation		Contact* Coop.	Interview	
	Corr(p,Y)	Observed Diff. C-NC	Corr(p,Y)	Observed Diff. I - CNI	Corr(p,Y)	Corr(p,Y)	Observed Diff. R-NR
NPSAS							
Applied for financial aid	-0.019	-0.06[a]	-0.006[a]	3.14	-0.011	-0.015	2.85
Received financial aid	0.039	0.53[a]	0.053	5.30	0.052	0.048	4.89
Received Stafford loan	0.090	7.81	0.055	4.76	0.062	0.063	5.30
Amount of Stafford loan	0.069	341	0.068	226	0.069	0.070	247
Received Pell Grant	-0.120	-6.38	-0.035[a]	0.65[a]	-0.057	-0.061	-0.20[a]
Amount of Pell Grant	-0.069	-163	0.008	61	-0.013	-0.016	36
Received Work Study	0.113	2.96	0.084	2.38	0.094	0.097	2.53
Amount of Work Study	0.087	65	0.064	58	0.073	0.076	61
Received State Aid	0.016	-2.0[a]	0.046	3.6	0.046	0.043	2.97
Amount of State Aid	0.078	31[a]	0.100	137	0.104	0.102	128
Received Institutional Aid	0.191	9.5	0.131	4.7	0.147	0.150	5.51
Amount of Institutional Aid	0.178	659	0.090	301	0.109	0.113	355
Grade Point Average	0.116	0.18	0.136	0.19	0.143	0.143	0.19
Did not take ACT/SAT	-0.379	-19.62	-0.281	-5.52	-0.318	-0.325	-0.07

Note: [a] indicates that the correlation or difference is not statistically different from zero at a p<.05 level. C-NC refers to Contacts – Noncontacts; I-CNI refers to Interview – Contact, no interview, R-NR refers to Respondents - Nonrespondents

Table 2.5 shows $corr(\hat{p},Y)$ for three models (contact, cooperation and interview) and for the product of the predicted cooperation and contact propensities (as a comparison to the interview model). The table also contains the observed difference between the responding and nonresponding groups at each step of survey participation.

The comparison between the sign of the estimated $corr(\hat{p},Y)$ and the sign of the difference $(Y_R - Y_{NR})$ is the key item of interest in the table. In almost every instance, the signs match. Where the signs do not match, by and large, neither the actual difference nor the estimated correlation between p and Y is statistically different from zero. The most striking difference is for the proportion of individuals who applied for financial aid, where the predicted correlation is negative, but approximately zero, and the actual difference is positive and nonzero. Overall, Table 2.5 indicates that the estimated model-based approach to propensity reflects the true underlying propensity distribution to some degree.

2.4.1 Sensitivity of Analyses to Main Effects Model Specification

These analyses show that carefully specified propensity models with a priori specification of the anticipated relationship between propensity and the survey variables can lead to insights into the risk of nonresponse bias. Unfortunately, the theories are imprecise and the indicators for the theories are weak. Additionally, the theory guiding model specification relies on main effects, largely ignoring the possibility for interaction effects among the predictors. As a sensitivity analysis, we tested all possible interactions among the predictors for each of the combined models in both surveys (see extended discussion in Section 5.5A.2; Table A.19 through Table A.21; and Table A.71 through Table A.73).

While inclusion of the interaction effects increased the range of the predicted propensities (Table A.73), the real question is whether including the interaction effects changes the understanding of the relationship between propensity and nonresponse bias. In every instance except for one, the answer is “no” (Table A.23). Conclusions on the sign of the relationship between p and Y are identical in both the main effects model and the interaction model, with most of the correlations between p and Y attenuated by including the interaction terms in the propensity model. The only instance in which there is a noticeable difference – applying for financial aid with the NPSAS cooperation model – the main effects model specification yields a correlation that is approximately zero (Table 2.5). The inclusion of the interaction effects for this variable improves the prediction, such that the relationship between predicted propensity and the survey variable is in the direction of the observed difference between interviews and contacted, not interviewed (Table A.23). Thus, for this variable, a more complex relationship with cooperation propensity exists than captured by the main effects models.

2.5 Step Four: Examining Nonresponse Propensity and Nonresponse Bias for Other Estimands

Although the guiding force for the above discussion has been the expression for the nonresponse bias of the survey mean, the population mean is only one estimand of interest from a survey. A common belief among many survey analysts is that measures of central tendency are the only statistics subject to nonresponse bias; distributional statistics and measures of association are considered immune from nonresponse bias. We now briefly show that this belief is misguided.

2.5.1 Distributional Measures

For distributional statistics, we consider the change in the first, median, and third quartiles over the contact, cooperation and interview strata. Table A.75 through Table A.86 contain these statistics for the WDS. Table A.87 through Table A.104 contain these statistics for the NPSAS financial aid amount variables and GPA by contact, cooperation, and interview propensity strata. As the total dollar amounts of financial aid are dominated by values of no financial aid, the tables restrict the analyses to those who received each type of aid – e.g., the distribution of the Stafford loan amounts is only for those who received Stafford Loans.[20]

[20] All NPSAS analyses conducted using SUDAAN. Restrictions on the case base conducted with the subpopulation statement in SUDAAN. WDS analyses conducted using distribution free 95% confidence limits.

The distributional properties for each of the NPSAS financial aid variables and GPA are remarkably consistent across models. In all models (contact, cooperation, interview), the spread of the Stafford loans and Pell Grants distributions (measured by the interquartile range) is relatively constant across propensity strata (Table A.87; Table A.88; Table A.93; Table A.94; Table A.99; Table A.100). This makes sense, as these financial aid sources have prespecified amounts to which an individual is entitled. The change in the variability of the amount of work study aid received is mixed across all three categories of nonresponse propensity (Table A.89; Table A.95; Table A.101), with a slight downward trend for higher propensity units. Aid from the state increases in variability across the propensity strata for all three categories of nonresponse (e.g., Figure 1; Table A.90; Table A.96; Table A.102), as does institutional aid (Table A.91; Table A.97; Table A.103). On the other hand, the variation in GPA consistently decreases across the propensity strata, no matter the model specification (Table A.92; Table A.98; Table A.104).

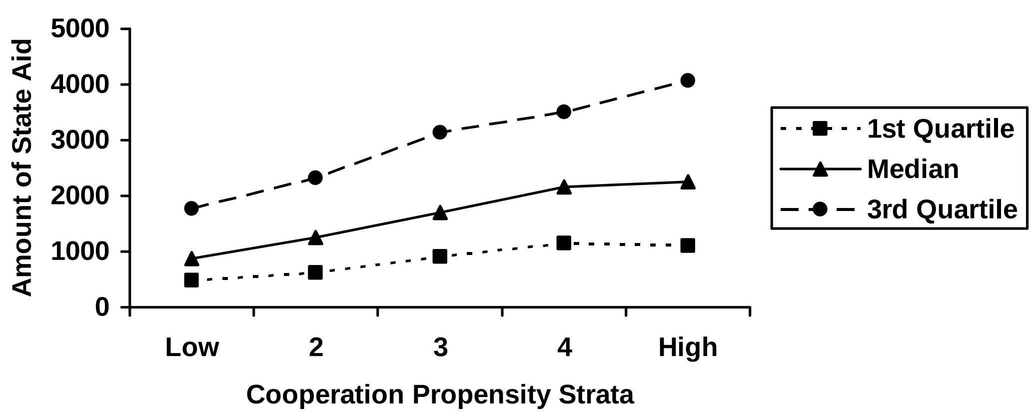

Figure 1: Quartiles of Amount of State Aid, by Cooperation Propensity Strata, Combined Cooperation Model with only Main Effects, NPSAS

Thus, there is clear evidence from Section 2.2 and this discussion that both the mean of Y and the variance of Y of many statistics in the NPSAS change as a function of nonresponse propensity. The variance of Y may increase or decrease as response propensities increase. To our knowledge, this result has never been demonstrated empirically. This is important conceptually and statistically. Conceptually, changes in the variability of the Y's may reflect changes in the mix of causes of response propensity (e.g., more variability may reflect more causes). Importantly, the direction of the relationship between the mean of Y and propensity does not necessarily translate into the direction of the relationship between the variance of Y and propensity. For example, while the mean grade point average increases over all of the estimated propensity distributions, the variability of GPA decreases. To gain insights into how distributional properties are affected by nonresponse bias, theoretical frameworks will need to be developed that extend thinking beyond the first moment. Statistically, change in variability of the Y's over probabilities of selection is an assumption of the Horvitz-Thompson estimator for PPS samples (Zheng and Little 2003). Extension of this sampling model to models for nonresponse would likely require a similar relationship between the variance of Y and response propensity. More work incorporating multiple common causes and their effects on variability of the Ys is needed statistically.

2.5.2 Measures of Association

We now turn to measures of association. Across the two surveys, variables were selected that vary in nonresponse bias of the mean, the relationship between the mean and variability of the Ys and response propensity. We also selected combinations of variables to reflect different correlational strengths. To the extent that the change in correlation across propensity strata is affected by its overall strength in the population, selecting combinations of variables that are of varying strengths will help disentangle this effect. In each study, both Y variables and one Z variable (that is, a variable included in the propensity model) were selected.

For the NPSAS, the Y variables selected were the dollar amounts of Stafford loans, Pell grants, institutional aid, and state aid (Table A.108 through Table A.110). The Z variable selected was the student's year in school because it is in the propensity models, is associated with propensity, but varies in its association with each of the types of aid (r=0.19 for Stafford loan, r=-0.01 for Pell Grants, r=0.07 for state aid, and r=0.10 for institutional aid). The correlation among the Y variables was weak to modest for both the dollar amounts of Stafford Loans and Pell Grant aid (overall r=0.25) and the correlation of institutional and state aid (overall r=0.10).

In the WDS, we look at the correlation between the number of marriages, length of marriage, and age (Table A.105 through Table A.107). These variables were selected because length of marriage experiences nonresponse bias, the number of marriages does not, and age is in the propensity model. The relationship between the number of marriages and length of marriage and with age is modest (r=-0.18 and r=0.25, respectively), the relationship between the length of marriage and age is strong (r=0.69). Each of these correlations are stronger than those for the NPSAS variables. Thus, we see a wide range of correlations experienced across the two surveys.

The relationship between propensity and measures of association is clearly different from that with measures of central tendency or of variability. Unlike the distributional statistics, whose change over propensity strata is relatively consistent and linear, the correlations vary across propensity strata, but not linearly. Additionally, the change in correlations over the propensity distribution is highly model-dependent for both surveys (Table A.106 through Table A.110). This makes sense – to the extent that the propensity model captures some of the association between the two variables, conditioning on the propensity strata will attenuate the relationship. However, there is no obvious conclusion about how this measure of association changes across propensity strata.

2.5.3 Summary

This section has clearly shown that there is a relationship between propensity and the variability of the survey variables. This is the first time such a relationship has been demonstrated. Systematic change in correlation coefficients across the propensity distributions is less clear.

This is limited by the types of variables available. Conclusions on the spread of the distributions of the NPSAS variables are on a limited subset of cases – that is, those who received any of that type of financial aid. Extensions to variables that vary systematically over the entire population would be a logical next step.

More work is clearly needed to understand the relationship between distributional properties of survey variables and response propensity. This work includes theoretical development both conceptually and analytically, and additional empirical examples of its occurrence. Similar work is also needed to anticipate when measures of association will change over the propensity distribution.

2.6 Step Five: Adjusting the Respondent Mean Using Predicted Propensities

Survey statisticians sometimes use propensity models for nonresponse adjustment weighting. There are many ways to create weights for unit nonresponse from propensity models. The goal of this section is not to evaluate alternate nonresponse adjustment models, but to look at how propensity modeling decisions are related to reduction in nonresponse bias of an adjusted mean. With this in mind, the simple inverse of the predicted propensity under the models is used as the nonresponse adjustment weight for the respondent mean. Standard errors are calculated using Taylor Series approximations. Future work should incorporate replicated variance estimates to further examine the effect of the weighting on the mean square error of the estimate.

Table 2.6: Adjusted Means Under Eight Adjustment Models, WDS and NPSAS

	Main Effects				Interaction Effects			
Mean SE	Cont.	Coop.	Two Stage	One Stage	Cont.	Coop.	Two-Stage	One Stage
WDS								
Length of marriage (months)	131.95	133.95	131.73	131.78	131.65	133.14	130.59	130.9
	4.06	4.44	4.41	4.36	4.08	4.41	4.37	4.43
Months between divorce and interview	50.00	50.42	50.41	50.49	50.05	50.44	50.4	50.01
	1.00	1.06	1.07	1.08	1.01	1.07	1.08	1.12
Number of marriages	1.20	1.19	1.19	1.19	1.20	1.19	1.19	1.20
	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Age at marriage (years)	24.87	24.98	24.86	24.87	24.91	25.00	24.91	24.99
	0.25	0.27	0.27	0.27	0.26	0.27	0.27	0.30
Age at divorce (years)	35.79	36.06	35.75	35.76	35.8	36.02	35.72	35.79
	0.35	0.38	0.38	0.38	0.36	0.38	0.38	0.39
NPSAS								
Applied for Financial Aid	72.67	73.61	73.60	73.62	72.66	73.49	73.50	73.64
	0.25	0.29	0.29	0.29	0.25	0.3	0.30	0.30
Received Financial Aid	63.61	64.85	64.77	64.79	63.61	64.67	64.60	64.74
	0.27	0.31	0.31	0.31	0.27	0.32	0.32	0.32
Received Stafford Loan	35.96	37.17	37.05	37.07	35.9	36.93	36.75	36.92
	0.26	0.31	0.31	0.31	0.26	0.31	0.31	0.31
Amt. of Stafford Loan Received	1693	1743	1738	1739	1691	1734	1727	1733
	15.67	18.11	18.10	18.12	15.67	18.22	18.22	18.22
Received Pell Grant	28.93	29.17	29.30	29.33	28.96	29.04	29.2	29.32
	0.25	0.29	0.29	0.29	0.25	0.29	0.29	0.30
Amt. of Pell Grant Received	702	717	720	721	703	714	717	719
	7.16	8.45	8.48	8.48	7.16	8.44	8.48	8.50
Received Work Study	6.20	6.68	6.59	6.59	6.19	6.61	6.51	6.54
	0.12	0.14	0.14	0.14	0.12	0.14	0.14	0.14
Amt. of Work Study Received	128	140	139	139	128	139	137	137

Mean SE	Main Effects Cont.	 Coop.	 Two Stage	 One Stage	Interaction Effects Cont.	 Coop.	 Two-Stage	 One Stage
	3.47	4.34	4.30	4.29	3.46	4.32	4.27	4.27
Received State Aid	20.70	21.46	21.42	21.44	20.69	21.34	21.30	21.37
	0.21	0.25	0.25	0.25	0.21	0.25	0.25	0.25
Amt. of State Aid Received	461	486	483	483	461	483	479	480
	6.25	7.43	7.37	7.36	6.24	7.44	7.39	7.41
Received Institutional Aid	21.81	22.69	22.44	22.42	21.79	22.55	22.29	22.31
	0.21	0.24	0.24	0.24	0.21	0.24	0.24	0.24
Amt. of Inst. Aid Received	1117	1178	1159	1157	1116	1169	1149	1157
	19.96	18.57	18.28	18.24	19.837	18.51	18.23	18.45
GPA	2.91	2.96	2.95	2.95	2.91	2.95	2.95	2.95
	0.004	0.005	0.005	0.005	0.004	0.005	0.005	0.005
Did not take SAT or ACT	40.90	40.65	41.20	41.23	40.9	40.64	41.20	41.03
	0.24	0.28	0.29	0.29	0.24	0.29	0.29	0.29

Note: Standard errors calculated with Taylor Series estimation. NPSAS estimates also weighted by selection probabilities.

We look at the effectiveness of eight of the propensity models as adjustment models on estimates of a mean (Table 2.6). First, the main effects models for contact and cooperation, applied to only the contacted and cooperating cases, respectively, permits understanding of how each stage of the two-stage adjustment procedure works. Then, the inverse of the product of the predicted propensities is used, called a "two-stage" procedure. Finally, the inverse of the propensity from the interview model is used as a nonresponse adjustment, called this a "one-stage" procedure. We repeat this process using the interaction models.

Did any of these adjustment models bring the adjusted means closer to the target? As a metric of "closer" we compare the percentage difference in the unadjusted mean from the target (for contact, the target is the overall mean; for cooperation, the target is the mean for the contacted), the adjusted mean under the main effects model and the adjusted mean under the interaction model. As seen in Table 2.6 and Table A.24, for 13 of the 19 variables (68%), using either the contact and cooperation main effects models, the adjusted contact or cooperation mean is proportionately closer to the target than the unadjusted mean. The adjusted mean is proportionately closer to the target for 12 of the 19 contact means (63%) and 15 of the 19 cooperation means (79%) using the interaction model. Thus, including the interaction effects in the cooperation model helped bring the adjusted mean closer to the target, but not in the contact model. The mean adjusted using the interaction effects models was proportionately closer to the target 58 percent of the time in the contact model and was closer 74 percent of the time in the cooperation model, although the differences are minor.

The real question in terms of remaining nonresponse bias of the adjusted mean is how well the two-stage adjustment performed, and how well the two-stage procedure performed compared to a one-stage procedure. The average absolute proportionate difference between the unadjusted respondent mean and the target was 4.4 percent across all 19 statistics (Table A.24). This average was 2.66 percent for both the one-stage and two-stage main effects models, and was 2.17 percent for the two-stage cooperation model and 2.27 percent for the one-stage cooperation model.

For 12 out of the 19 means adjusted with the main effects models, the adjusted mean using the two-stage procedure was closer to the target (again, measured as the proportionate difference from the target) than the adjusted mean using the one-stage procedure. For the interaction models, the two-stage procedure outperformed the one-stage procedure for 14 of the 19 adjusted means. Thus, it appears for this estimand and these statistics in these surveys, the two-stage procedure was a better method than the one-stage procedure. The standard errors of the means estimated using Taylor Series approximations were almost identical for the two-stage and one-stage procedures.

Thus, the adjustment procedures, on average, moved the adjusted mean closer to the target, on average cutting the bias of the estimated mean in half. The interaction models outperformed the main effects models, but the difference in average reduced bias was minimal.

2.7 Summary

When will the likelihood of participating in surveys be related to the survey variables of interest? There will be a relationship between response propensity and the survey variables of interest when the survey variables influence response propensity or when there is a common cause for propensity and the survey variables. Two hypothesized causes for contact propensity and four causes for cooperation propensity in two surveys were investigated. Through careful consideration of the relationship between the cause, the proxy indicators of the cause, and the survey variables, purchase can be had on the likely direction of nonresponse bias.

This chapter had three major findings. First, we have argued that there is theoretical justification for within-survey variation on nonresponse bias across items. We found empirical evidence for this theoretical argument, lending credence to the argument that understanding nonresponse bias will require thinking beyond response rates. We also have shown that multiple competing influences on nonresponse bias may manifest themselves differently for different statistics within the same survey and across surveys. Thus, understanding why nonresponse occurs differentially across statistics within the same survey will require thinking beyond response rates to thinking at an item level. Second, we have shown that there is variation over the response propensity distribution in the variance of the survey variables, not just in the mean of Y. Third, we have shown that statistical adjustment procedures may be improved by disentangling noncontact from noncooperation nonresponse.

Different causes are likely to have different influences on nonresponse bias. These competing influences coalesce in the final data set. This was shown in Section 2.2. Disentangling contact and cooperation is necessary for understanding the p-Y relationship conceptually. To the extent that one category of nonresponse dominates or there is little difference in the p-Y relationship for different p's then the gain empirically from separating the two categories of nonresponse may not be dramatic. Further work is clearly needed to understand the types of Y variables that are more related to noncontact nonresponse propensity and noncooperation nonresponse propensity. Finally, as shown in Section 2.5, distributional statistics may also vary systematically with propensity, although the implications for associations are less clearly defined.

The strength of the relationship between the predicted propensity and the survey variables determines the effect of an adjustment procedure. We see that the adjustment procedures made a difference in estimates using the respondent mean in Section 2.6. We also see that using a two-stage approach separating contact and cooperation in an adjustment procedure worked better, on average for the estimates examined, than estimating a one-stage interview adjustment directly. Finally**,** while inclusion of interaction effects improved nonresponse adjustment for the respondent mean overall, the observed differences tended to be minimal, at least for the first moment. Greater differences may be seen on more complex estimands.

As with any analysis, this chapter had important limitations. First, the true propensity, *p*, is necessarily unknown. Although we have attempted to overcome this limitation through estimating multiple propensity models with different predictor variables, the conclusions are still model-dependent. Second, the distinction between noncontact and noncooperation nonresponse is muddied due to the mixed mode nature of both surveys. Third, this analysis looked at approximately twenty items across two surveys. While the surveys themselves are quite distinct, the items within each survey are correlated. Thus, the conclusions about the relationship between propensity and the survey variables are limited in scope. Fourth, these two surveys were both of special populations – divorced people and undergraduate students. While this facilitated our understanding of nonresponse bias due to rich records being available on both respondents and nonrespondents, the causal mechanisms for survey participation may be different in a special population that those in the general population.

2.8 An Unexpected Discovery of the Dissertation

The above discussion made extensive use of respondent-level and ecological-level covariates. However, this discussion ignored any recruitment protocol components. The importance of the recruitment protocol in influencing response propensities has been documented in countless experimental and observational analyses. Examples of recruitment protocol components that have shown importance in influencing response propensities are the number of call attempts, call timing, the interviewer, rules for selecting the respondent, mode and mode switches, incentives, survey topic, sponsorship, and advance letters (see reviews in Groves and Couper 1998; Groves et al., 2004).

As argued by Lessler and Kalsbeek, "the goal of preventive methods is collectively, and in some instances selectively, to increase response probabilities (p_i) in the population" (Lessler and Kalsbeek, p. 164). As the protocol differs across respondents, then variations in response propensity will be observed across respondents. However, in field data collection, application of a recruitment protocol not only varies across sample units but within sample units. The application of a new feature of the protocol changes the person's response propensity. Most changes are designed to increase response propensity, but some inadvertently may decrease response propensity. For example, sample units receive additional calls at different times of the day and days of the week, receive incentives as a refusal conversion tactic, have different interviewers approach the household, have interviewers who keep or do not keep appointments, and are approached with a shortened survey or with a different mode from the initial request, among other changes in design features.

Thus, not only is the participation decision stochastic, but a sample unit's likelihood of participation is dynamic, changing as the protocol evolves. What does this mean? Sample units have more than one response propensity to any single survey, all conditional on the prior observed features of the recruitment protocol. In fact, sample units have a vector of response propensities, changing with successive implementations of the protocol. As new design features are introduced, as more effort is exerted to obtain a contact or interview, the probability of response, p_i, changes. We call this a *dynamic* view of response propensities. As the protocol evolves, so does response propensity. Any careful discussion of the stochastic model for survey nonresponse acknowledges that the observed participation or nonparticipation is conditional on the protocol used to obtain contact and cooperation, as is a sample unit's response propensity (Lessler and Kalsbeek 1992). However, often overlooked in discussion of the stochastic model is that the implementation of a protocol varies both across and within sample units. At any given point in the field period, the sample unit's propensity to respond is conditional on the protocol to which it previously has been exposed, and can change as new protocol elements are introduced. Had the sample unit been exposed to other combinations of protocol components, not only could its final response propensity be different, but the propensity observed throughout data collection could have been different.

Further, it is convenient to view any observed evolved protocol as only one realization from all possible realizations of the protocol. Even though the decision rules and decision makers may be constant over realizations of the protocol, the actual evolution of the protocol will differ over repeated implementations. For example, for any given case, the first call attempt may be made at a different time or on a different day, the respondent's own life situation will vary, and the survey taking environment may change. The outcome of the first call will lead to decisions on subsequent calls that may or may not be made in other implementations. That is, not only are response propensities stochastic (random) and dynamic (changing), but protocols are also stochastic and dynamic. However, without repeated observations of the same protocol and randomization in implementation of the protocol, this effect cannot be disentangled.

A comprehensive framework for estimating dynamic response propensities is needed. This framework should reflect the underlying phenomenon while staying as close to the observed data as possible. The student of response propensity is interested in understanding the mechanism for response propensity as it occurs. A modeling approach that permits a prospective look at response propensity is thus needed.

Appendix Section 5.5A.5 discusses this idea in greater detail, walking through an example with the Wisconsin Divorce Study. Much work remains to be done to exploit this perspective.

Chapter 3

Using Expert Reviews to Predict Appropriate Statistical Models of Measurement Error Across Survey Items

Why do people make mistakes when answering survey questions? What are the effects of mistaken reports on survey estimates? These two questions reflect the two traditions for investigating measurement error in survey methodology. The first tradition attempts to understand when and why errors in reports will occur, generally guided by principles from cognitive psychology. The second tradition attempts to understand the overall effects of measurement errors on inference from survey data, largely guided by psychometrics and survey statistics. Although both traditions tackle the same error source, by and large they ignore each other. A key component of this paper is using the cognitive response process to guide specification of statistical models of measurement.

The cognitive revolution in survey methodology has produced a wealth of research into people's ability and strategies used to interpret and answer survey questions (Sudman, Bradburn and Schwarz 1996; Tourangeau, Rips and Rasinski 2000). From this work, a four stage model for how people arrive at answers to survey questions has become the leading paradigm under which measurement error research is conducted. We will refer to this model as the cognitive response process, although it is sometimes called the cognitive response formation model. The cognitive response process has four primary components – comprehension of the survey question, retrieval of information asked in the question, judgment of how the retrieved information maps into the requested response format, and editing of the retrieved answer, usually for self-presentational reasons (Cannell, Miller and Oksenberg 1981; Sudman, Bradburn and Schwarz 1996; Tourangeau 1984; Tourangeau, Rips and Rasinski 2000).[21]

The cognitive response process literature has clearly shown that measurement error mechanisms are item-specific, often affected by the question and response structure. Classes of variables (e.g., reports of dates of events, behavioral frequency reports) or classes of measurement contexts (e.g., items in a grid in a self-administered questionnaire) may share causes, but the cause of measurement error for most survey reports is specific to that item. Thus, each item or class of items needs its own measurement error model.

A second set of research into measurement error comes from a statistical or psychometric perspective. The simplest measurement error model in these traditions is that of the True Score Model: $y_i = \mu_i + \varepsilon_i$, where y_i is the reported answer for respondent i for some continuous measure, μ_i is the "true value" for that person, and ε_i is the measurement error, often called a response deviation. The true score model often employs five basic assumptions: (1) the data come from a simple random sample without replacement, (2) a response is provided (an assumption frequently unstated), (3) the expected value of the measurement errors is zero, (4) the errors have a constant variance over replications of the measurement, and (5) the errors are uncorrelated across respondents (Fuller 1981; Biemer and Stokes 1991). While measurement error models

[21] Some formulations of this model also include encoding of the information and the role of the interviewer as a social actor. The four steps described above are common to all formulations.

have been developed for discrete measures, continuous distributions are assumed for most basic measurement error models. Other assumptions commonly made by analysts are that (6) the errors are uncorrelated across items in the questionnaire, (7) the errors are additive and uncorrelated with the true value, and (8) the "truth" exists (Fuller 1981; Biemer and Stokes 1991). That is, people give responses, and any errors that occur in the production of a response are random, unaffected by whether the value of the characteristic being measured, who the respondent is, or by whether they made errors on other questions in the questionnaire. Research linking the two approaches to measurement error – that focusing on how and why errors are made and statistical contributions of measurement error – is missing. Although research into how respondents go about making measurement errors has been bountiful, explicit discussion of how these processes can be translated into measurement error models has been largely ignored (for exceptions see Biemer and Stokes 1991; Groves 1999). While the assumptions made by analysts using the true score model have been shown not to hold empirically (Bollinger and David 2005; Rodgers, Brown and Duncan 1993; Rodgers and Herzog 1987), they provide a useful organizing framework for findings from the cognitive psychological approach to measurement error.

We specify findings from the cognitive psychological approach to measurement error in terms of measurement error models. Four of the eight key assumptions made by analysts of survey data as described above are useful starting points for these models. Since empirical investigations of the cognitive response process are difficult outside of the laboratory, we will use expert reviews of the questions' likelihood of experiencing failures at particular stages of the cognitive response process and likelihood of inducing motivational problems related to burden, sensitivity and social desirability.

The four assumptions examined are (1) an answer is provided; (2) the expected value of the measurement errors is zero; (3) the measurement errors are uncorrelated with the true value; and (4) measurement errors are uncorrelated across items. These suppositions are evaluated using data that contain “gold standard” values for the survey questions. Measurement error variance, defined as individual level variability in reporting across repeated measurements, is not considered, since repeated measurements are not available. Additionally, one of the surveys has a complex sample design, making appropriate evaluation of variance in measurement errors across individuals difficult (Biemer and Stokes 1991). Three types of behavioral, factual or autobiographical questions - questions about dates of milestone life events, questions about financial information, and questions about academic performance – are examined in two surveys. These findings are used to suggest where further research is needed on how people answer questions.

Why is this important? If raters can predict what types of measurement error structures might arise with a question, then appropriate measurement error models can be anticipated for different items. Expert raters have commonly been used as a questionnaire development technique (DeMaio and Landreth 2003; Presser and Blair 1994). However, empirical evaluations of the efficacy of the ratings have not been conducted.

While a great deal of work has done in laboratory studies, much of the measurement error literature has not been translated outside the lab. Laboratory studies of measurement error consider only one failure at a time. If multiple components of measurement error on a survey question can be explained with similar failures of the response process, then understanding of the multidimensional aspects of measurement error will be enhanced and can be fixed. In addition, to the extent that expert raters can identify failures of the cognitive response process that are also related to measurement error, steps can be taken to fix questions before fielding a survey.

In short, we investigate whether the lessons learned about survey response formatting using cognitive psychological principles can be used to enrich the specifications of statistical models of measurement error.

3.1 Data

Two studies are used for this article, the Wisconsin Divorce Study (WDS) and the National Postsecondary Student Aid Study (NPSAS). We look at four metrics of measurement error – item nonresponse, match rates, signed deviations, and absolute deviations – for six survey variables in the WDS and eleven survey variables in the NPSAS.

3.1.1 The Wisconsin Divorce Study

In mid- to late 1995, the University of Wisconsin-Madison conducted the Wisconsin Divorce Study. Divorce certificates from four counties in Wisconsin from 1989 and 1993 were extracted, and a simple random sample was selected.

Recruitment in the Wisconsin Divorce Study started with personalized letters in which a sampled person was asked to participate in the "Life Events and Satisfaction Survey," sponsored and carried out by the University of Wisconsin-Madison. The survey contained questions on satisfaction with life and relationships, marital and cohabitation history, childbearing history, education and work history, satisfaction with current relationships, and demographics. Sample units were first attempted by telephone. Nonrespondents to the telephone survey or persons for whom a telephone number could not be obtained were followed up with a mail request. Overall, the response rate (AAPOR RR1) was 71 percent, with a contact rate of 80.3 percent and a cooperation rate of 88.3 percent.

Four survey variables of interest are available from the divorce records – the date of the divorce, date of marriage, birth date, and the number of marriages for the sampled person. Additionally, as the sample was selected from divorce records, the entire sample has been married and divorced. Corresponding questions were asked in the survey (see Table A.118 for question wording).

3.1.2 National Postsecondary Student Aid Study

In late 2004, the National Center for Education Statistics sponsored the National Postsecondary Student Aid Study (NPSAS), with data collection conducted by RTI International. The sample design for the NPSAS and methodology is described in detail elsewhere (Cominole et al. 2006).

The student survey recruitment protocol began with a personalized advance letter from the Associate Commissioner of the National Center for Education Statistics to participate in the NPSAS and an e-mail request from the RTI project director of NPSAS. During the first four weeks, the selected student was recruited by e-mail to participate in a web survey. After four weeks, nonresponding students were followed up by telephone. During this request, students could choose their completion mode (telephone or Internet). Nonresponding students were sent refusal conversion letters and were offered a shortened interview. Both English and Spanish language questionnaires were available.

Roughly 20 percent of the respondent pool respondent online after receiving telephone prompting. The remaining 27 percent participated in the NPSAS without any telephone prompting (Cominole et al. 2006). Over half of the respondent pool (53 percent) completed the survey by telephone.

This analysis focuses on measurement error for undergraduates in the 50 states and the District of Columbia. Analyses are conducted treating the student sample as a stratified random sample with unequal probabilities of selection. Student selection probabilities are used, accounting for the unequal probabilities of selecting the students from the lists provided by the universities. The analytic strata in the public use data file are used; these strata are institutions or combinations of institutions, designed to have a minimum number of 10 students in each stratum.

The AAPOR weighted contact rate for this set of undergraduates was high – 96 percent (unweighted AAPOR CON2 96 percent) – and the AAPOR weighted cooperation rate is 73 percent (unweighted AAPOR COOP2 70 percent), with an overall AAPOR weighted response rate of 70 percent (unweighted AAPOR RR2 67 percent) (AAPOR 2006).

Eleven variables are available from university and federal student loan records were also asked in the survey (see Table A.119 for question wording). These variables are primarily financial aid measures – applying for any financial aid, receiving a number of types of financial aid, with dollar amounts for three types of aid, and an academic achievement measure, grade point average. While the financial aid information is available in the records for almost all of the respondents, grade point average is available for approximately 80 percent of the respondent pool.

3.1.3 Limitations of the Data Sets

Both data sets have limitations for the present analysis. The records may contain measurement errors, and the construct measured in the survey may deviate slightly from the construct measured in the record.

3.1.3.1 Limitations of the Wisconsin Divorce Study

In the Wisconsin Divorce Study, the frame consists of divorce certificate data in which only the divorce date, county of divorce, and child custody arrangements were recorded by an official body; all other information was provided by at least one of the two spouses in the divorcing couple. The divorce date, a date used for administrative purposes, is probably the least sensitive to measurement error in the record. Marriage date, dates of birth, and number of marriages are provided by at least one member of the couple when filing for the divorce certificate. As a result, these items may contain more measurement error in the records than other items. Exactly which member of the couple filed for divorce or if the couple filed jointly is not known.

3.1.3.2 Limitations of the NPSAS

Item nonresponse in the records is the largest issue for the NPSAS. Table A.4 and Table A.5 show missing data rates for predictor variables in the NPSAS analyses. Missing data on the outcome variables varies from less than one percent for the financial aid variables to approximately 20 percent in the academic achievement measures. Missingness by design also exists in the NPSAS survey reports. Questions on Stafford loans, Pell grants and grade point averages were not asked in the reduced interview. This comprises less than five percent of the final respondent pool.

Measurement error in the NPSAS records may also be present. The federal data bases (Central Processing Services, Stafford loan, Pell Grants) are likely to contain less measurement error than the institutional data. Not all students may have reported all sources of financial aid to the college or university. Additionally, colleges and universities may vary in how employment – such as work study or paid assistantships - for undergraduate students is recorded. Finally, institutions may differ in their classification of certain sources of financial aid.

An additional source of measurement error in the records is present in the NPSAS. For purposes of disclosure limitation, undisclosed data perturbation procedures were performed on an unknown number of cases over an unknown number of variables (Cominole et al. 2006), p. 103). Thus, some degree of measurement error in both the records and reported variables will be due to data perturbation rather than the respondent.

3.1.4 Description of the Expert Reviews

A key goal of this paper is use of the cognitive response process model to guide specification of measurement error models. Identifying the stages of the cognitive response process is admittedly difficult outside the laboratory. One approach to doing this uses expert reviewers to identify problems related to breakdowns in the cognitive response process. In an expert review, survey methodologists, psychologists, or other people familiar with questionnaire design identify potential problems with a survey questionnaire (Willis, Schechter and Whitaker 1999). The expert review task may be made explicit through the experts' use of a form or questionnaire where particular problems are explicitly identified (Lessler and Forsyth 1996) or applied through post hoc coding of the problems qualitatively identified by the experts (DeMaio and Landreth 2003).

A new question evaluation tool was developed for this research. For each question, the reviewers were asked to rate three groups of characteristics. First, reviewers rated whether they thought that any failure of any part of the response process was likely to occur. Second, for those questions rated as possibly experiencing failures, reviewers rated on a four-point scale ranging from "not at all likely" to "very likely that a failure of this stage will occur" the likelihood of the breakdown occurring at each stage of comprehension, retrieval, judgment and editing. Finally, reviewers rated whether the question or characteristic measured by the question was burdensome (requires a great deal of cognitive work by the respondent), sensitive (requires revealing embarrassing or private information or the topic is not discussed in everyday conversation), or socially (un)desirable (requires revealing information that may be compared against a social norm for possessing or not possessing a characteristic).

Reviewers were given a subset of questions for which record values were available.[22] All reviewers examined the same questions using forms developed by the author (see Appendix Table A.117 through Table A.119 for the coding form and question wording). Reviewers were also given response options and the subset of the respondent pool to which the question was asked.

Six expert reviewers – the author plus five additional reviewers – participated in this study. All of the expert reviewers had at least a master's degree in survey

[22] A limited subset of these items are considered in these analyses. Excluded variables had either high rates of item missingness on the records or are used as predictors in the nonresponse analyses in Chapters Two and Four. A few items that were available in the records – most notably the amount of the Stafford Loan and the amount of the Pell grant – were not asked in the interview.

methodology or a related field, most of whom were advanced doctoral students in survey methodology. All of the reviewers had taken identical coursework related to questionnaire design and/or the social and cognitive processes of survey measurement. All of the reviewers also had work experience in survey organizations developing and pretesting questionnaires. The experts conducted their review independently. To maintain independence of the reviews, all reviewers were asked to conduct the reviews individually and the identity of the other reviewers was not revealed. Additionally, all ratings were conducted without knowledge of the empirical measurement error properties of the data.

Table 3.1: Average Rating and Reliability of Ratings for Six Expert Reviewers for Two Studies, by Breakdown in the Cognitive Response Process

	WDS					NPSAS				
	Reliability			Average Rating		Reliability			Average Rating	
	Kappa	Intra-class Corr. Coef.	Prop. Match	Mean	SE	Kappa	Intra-class Corr. Coef.	Prop. Match	Mean	SE
Burden	0.87	0.89	0.94	0.306	0.028	0.35	0.39	0.75	0.267	0.071
Sensitivity	-0.08	0.13	0.61	0.306	0.080	0.03	0.13	0.53	0.417	0.156
Social Undesirability	0.28	0.33	0.80	0.167	0.043	0.35	0.40	0.83	0.150	0.072
Any Failure	0.28	0.36	0.64	0.556	0.119	0.32	0.37	0.66	0.483	0.105
Comprehension	-0.04	-0.03	0.89	0.083	0.057	-0.06	0.06	0.51	0.400	0.202
Retrieval	0.52	0.65	0.79	0.417	0.094	0.10	0.34	0.44	0.800	0.242
Judgment	1.00	--	1.00	0.000	0.000	0.03	0.07	0.77	0.233	0.141
Editing	0.11	0.18	0.64	0.278	0.102	-0.07	0.18	0.53	0.367	0.182

Note: -- All judgment ratings in the WDS were identical, indicating no judgment problems. WDS had 6 ratings for each of 6 questions, for a total of 36 ratings. NPSAS had 6 ratings for each of 10 questions, for a total of 60 ratings. Means and standard errors of the ratings are over the items in each questionnaire of the six ratings from each reviewer; standard errors reflect the clustering in ratings by reviewer. Intraclass Corr. Coef. is the intraclass correlation coefficient, treating the expert reviewers and questions as random effects.

The ratings were highly unreliable for both studies (Table 3.1). Three different measures were used to indicate the degree of agreement across the reviewers in their ratings - a multiple coder Kappa (Kalton and Stowell 1979), an intraclass correlation coefficient with reviewers and questions as random effects, and the proportion of all two-way combinations of reviewers who provide exactly the same rating across all of the questions. Kappa and the match rate across reviewers treat both items and reviewers as fixed; the intraclass correlation coefficient treat both items and reviewers as random. However, regardless of reliability measure, little consistency across reviewers was found. The greatest reliability was found in the ratings of burden and retrieval for the WDS (kappa=0.87). In the NPSAS, social (un)desirability was found to be the most reliable, but has only a kappa=0.35, still rather low. This lack of reliability across experts is consistent with other evaluations of consistency across expert reviewers (DeMaio and Landreth 2003; Presser and Blair 1994).[23]

Thus, the use of experts to identify breakdowns in the cognitive response process is itself subject to measurement error. Some stability in ratings may be gathered by having more expert reviewers. Any systematic relationship observed between the ratings and the measurement error indicators used here will be despite the measurement error in the ratings. Given the unreliability in measurement, it is likely that any relationship between the ratings and measurement error will be attenuated. Since the raters had no knowledge of the empirical distribution of the measurement errors before conducting the reviews, the ratings are likely to be unbiased, but noisy. An advantage to the use of multiple expert reviewers is that reliability measures can be calculated; the reliability of the cognitive measures taken in the lab are often unknown (e.g., in a think-aloud during a cognitive interview).

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[23] To see whether any single reviewer was diminishing the reliability of the estimates, we look at the match rate between reviewers (Appendix Table A.121). Although there is no obvious standout in the WDS, in the NPSAS, Reviewer 2 has a lower rate of agreement with all of the other reviewers than anyone else. We excluded Reviewer 2 and reestimated all of the NPSAS reliability measures. The largest differences in reliability were found in the "any failure" and "social undesirability" categories. All of the other categories were qualitatively similar. Dropping Reviewer 2 lowers the mean ratings on all categories. Thus, Reviewer 2 identified more problems with the questions than other reviewers. We retain Reviewer 2 in the analyses. Future analyses should examine sensitivity of conclusions when Reviewer 2 is excluded.

3.1.5 Empirical Ratings from Expert Review

The average ratings of likely failures at various parts of the response process, and in turn, the motivational factors of burden, sensitivity, and social undesirability, differ across the two surveys. In both surveys, breakdowns at the retrieval stage were rated as the most likely to occur (Table 3.1). Questions in the NPSAS tended to have higher ratings of comprehension difficulties than those in the WDS. Questions in both studies were rated as having higher likelihoods of editing problems than judgment problems; in particular, no question in the WDS was rated as having any judgment failures. On average, the experts were more likely to rate questions as being sensitive than socially undesirable.

Ratings for the individual items are in Appendix Table A.120. Given the limited number of items in each survey, the variation in ratings across items is small. Thus, any conclusions made from these ratings will be suggestive, but not definitive.

3.2 Measurement Error Indicators

Four metrics of measurement error in the survey reports will be examined. These four metrics include (1) mismatch rates – that is, the percentage of respondents whose reports do not match the records, (2) signed deviations (record – report), (3) absolute deviations (|record – report|), and (4) item nonresponse. All of the mismatches are calculated strictly; exact matches are required. In order to count as a match, dates had to match to the month and year (the metric queried in the questionnaire), loan amounts had to match to the dollar, and the GPA had to match to the second decimal. Table 3.2 contains descriptive statistics for these four measures of measurement error.

Table 3.2: Overall Item Nonresponse, Mismatch Rate, Signed Deviation (Record-Report), and Absolute Deviations (|Record-Report|), WDS and NPSAS

	Item Nonresponse		Mismatch		Signed Difference		Absolute Difference	
	%	SE	%	SE	Mean	SE	Mean	SE
WDS								
Ever married	0.00[a]	0.00	1.5	0.54	1.5	0.54	1.5	0.54
Ever divorced	1.34	0.50	8.1	1.19	8.1	1.19	8.1	1.19
Number of marriages	0.57	0.33	8.8	1.2	-0.01	0.01	0.09	0.01
Marriage date	2.68	0.71	32.3	2.1	-6.34	2.81	18.67	2.70
Divorce date	8.60	1.23	50.2	2.4	-6.15	1.20	8.56	1.17
Birth date	0.76	0.38	10.8	1.4	-5.51	2.60	13.04	2.55
NPSAS								
Applied for financial aid	0.53	0.05	11.6	0.2	1.3	0.23	11.6	0.2
Received financial aid	0.58	0.05	11.1	0.2	0.7	0.22	11.1	0.2
Received Stafford loan	0.80	0.06	10.3	0.2	1.2	0.21	10.3	0.2
Received Pell Grant	0.86	0.06	7.4	0.2	0.9	0.17	7.4	0.2
Received Work Study	2.19	0.10	7.4	0.2	-2.7	0.17	7.4	0.2
Amount of Work Study	2.01	0.09	10.5	0.2	-78	8.36	231	8.24
Received State Aid	0.83	0.06	17.2	0.2	6.5	0.26	17.2	0.2
Amount of State Aid	2.59	0.10	24.0	0.3	167	8.56	469	8.06
Received Institutional Aid	0.83	0.06	13.8	0.2	3.3	0.31	13.8	0.2
Amount of Institutional Aid	2.28	0.10	23.6	0.3	262	15.93	739	15.13
Grade Point Average	4.12	0.12	82.7	0.3	-0.17	0.00	0.25	0.00

Note: All mismatch rates calculated on exact matches. Dates in the WDS calculated to the month and year in the record. Financial aid items matches calculated to the exact dollar amount. GPA matches calculated to the second decimal. n/a indicates that this measurement error indicator is not appropriate for the outcome variable or is already captured in another column. Mismatch rates and absolute differences are identical for the binary items. Signed deviations are (Record – Report), so positive deviations in the NPSAS indicate underreporting by the respondent.

[a] Indicates that there was no item nonresponse on reports of ever having been married.

Measurement error variance, in terms of either intra-individual reliability on repeated measurements of the same item, is not included because repeated measurements were not conducted. Additionally, measurement error variance, in terms of cross-individual variation in measurement error, measured by the variability of the signed deviations over all respondents, is not included in this article because the NPSAS contains a complex sample design, under which obtaining appropriate estimates of cross-individual measurement error variance becomes problematic (Biemer and Stokes 1991).

3.3 Measurement Error Models and the Cognitive Response Process

We now use the expert reviews to predict failures of the cognitive response process. The ideal data set would contain a large number of items from each survey, with highly reliable reviews, such that a full meta-analytic approach on the efficacy of the reviews could be accomplished. We do not have this. Instead, we have a limited number of items in each survey, with small variation in ratings of each item. Conclusions about the efficacy of the ratings thus will be only suggestive.

We now turn to conceptual and empirical evaluations of the four unstated assumptions frequently made by analysts of survey data. Given the number of items across the two surveys and the diversity of measurement error mechanisms, not all items are examined for each assumption.

3.3.1 An Answer is Provided.

An important, although frequently unstated, assumption of any measurement error model, and the paramount property of data examined by analysts, is that the respondent answers the question. However, current understanding of the cognitive response process recognizes that respondents have a choice about whether they can or will respond to a survey question (Beatty and Herrmann 2002; Beatty et al. 1998). The decision to provide a response is a function of both question characteristics and respondent characteristics. Although complete breakdowns of measurement may occur at any stage of the cognitive response process, the two most likely places for a breakdown to occur are at the retrieval (due to burden of the task) and editing stages (due to sensitivity concerns; Beatty and Herrmann 2002; Tourangeau, Rips and Rasinski 2000). Thus, questions that are more burdensome or more sensitive are hypothesized to experience higher item nonresponse rates.

Item nonresponse may result because the respondent does not want to exert effort to retrieve, generate, or report an answer. As such, respondent characteristics related to motivation are also likely to be related to item nonresponse (Krosnick 2002), as are characteristics of the measurement situation that might affect motivation (e.g., the presence of an interviewer, Beatty and Herrmann 2002; mode, de Leeuw 1992). Thus, a plausible measurement error model for item nonresponse, generated from the cognitive response process literature is:

$$\text{Pr(Report Given=1)} = f\,(\mathit{Retrieval}, \mathit{Sensitivity}, \mathit{Motivation}, \mathit{Mode})$$

This model suggests cross-item variation in item nonresponse related to the question's retrieval difficulties and sensitivity, and cross-individual variation in item nonresponse related to the respondent's level of motivation and the mode. Variation in item nonresponse rates exists across the items in the two studies (Table 3.2). Can some of the variation be explained by differences in item retrieval difficulties or sensitivity?

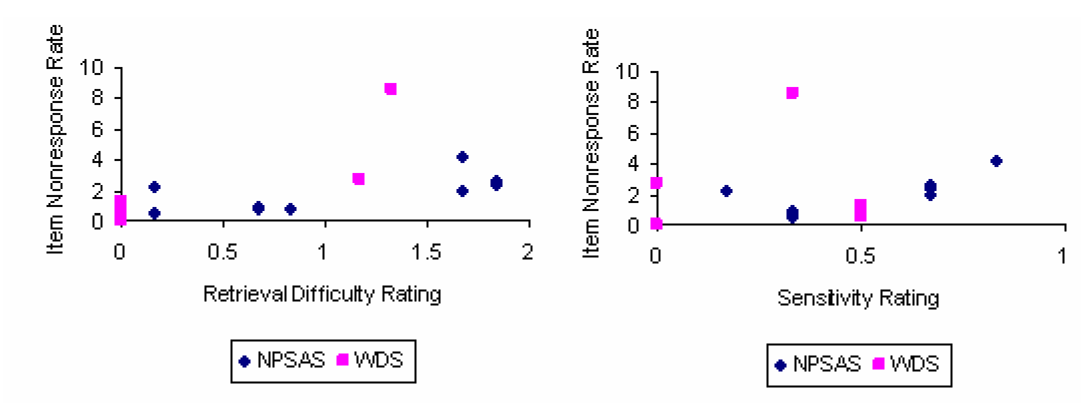

Figure 2: Question-level Item Nonresponse Rate by Ratings of Retrieval Difficulty and Sensitivity, WDS and NPSAS

Given the limited number of items in each survey, and the limited variation in ratings, we dichotomize the ratings and calculate an average item nonresponse rate for the two ratings groups. As shown in Figure 2, items that are rated as posing more retrieval difficulties or as being more sensitive in both surveys tend to have higher item nonresponse rates. For example, the five items in the NPSAS whose average retrieval difficulty rating was less than 0.67 have an average item nonresponse rate of 0.99 percent, compared to a 2.1 percent average item nonresponse rate for the six items whose retrieval difficulty rating was higher than this. Similarly, the seven NPSAS items for which one-third or fewer of the raters judged the item to be sensitive have an item nonresponse rate of 0.95 percent. The four items judged as being more sensitive have an item nonresponse rate of 2.75 percent.[24] This is consistent with what is predicted from the model for item nonresponse posed above.

What about differences by motivation? Although it is difficult to measure motivation directly, education has been used as a proxy of or moderator of motivational factors (Cannell and Fowler 1963; Krosnick, Narayan and Smith 1996; Krosnick and Narayan 1996). In the WDS, the average item nonresponse rate for people with a college education or some college is about 1.5 percent (1.6 and 1.4 percent, respectively). The average item nonresponse rate for people with a high school degree is 2.2 percent, and for people with less than a high school degree is 7.0 percent. Measuring education in a sample of students is difficult, so in the NPSAS we use the intensity of enrollment during Spring term (full-time, part-time, enrolled for unknown intensity, not enrolled) as the measure of motivation.[25] Here, the average item nonresponse rate is lower for people who

[24] In a logistic model with items nested within respondents, accounting for stratification, weighting, and the clustering of items within respondents, the beta coefficient for sensitivity<=0.33 is -1.03 (se=0.04), p<.0001. Similarly, the beta coefficient in a nested logit model for retrieval<=0.67 is -0.70 (se=0.04), p<.0001. See Appendix Table A.125 for model coefficients.

[25] An alternate measure of motivation is receipt of financial aid, where those who received aid could be considered more motivated than those who did not. There are small differences between these two groups

were enrolled full time (1.51 percent) and part time (1.53 percent) than for those whose enrollment status was unknown (1.91 percent) or who were not enrolled (1.93 percent).[26] Thus, it appears that motivational factors, measured by education, may play some role in item nonresponse. Future analyses should look at interactions between education levels and the ratings. Appendix Table A.122 and Table A.123 shows the distribution of item nonresponse rates for each education group on each item. Most of the items in both surveys show significantly different item nonresponse rates across these groups.

Mode clearly plays a role in item nonresponse rates in the WDS, where the average item nonresponse rate on these items in the mail mode is more than three times that in the telephone mode (average item nonresponse rate 4.46 percent and 1.31 percent, respectively). In the NPSAS, mode can also be used as an indicator of motivation. On average, item nonresponse rates were higher on the phone than on the web. Item nonresponse rates were lowest for those respondents who responded to the web survey without any phone prompting (average 0.68 percent), followed by those who were web respondents with phone prompting (average 0.89 percent). The item nonresponse rates in the NPSAS were highest for those who completed by telephone (2.44 percent).[27] Appendix Table A.124 shows item nonresponse rates for the two modes in both surveys for each item.

(an average of item nonresponse rate of 1.14 percent for those who did not receive financial aid, compared to an average item nonresponse rate of 1.67 percent for those who did receive financial aid).

[26] students enrolled full-time and part-time have significantly lower item nonresponse rates than students not enrolled or who have unknown enrollment in logistic models with items nested within respondents, accounting for clustering of items within respondents. See Appendix Table A.126 for model coefficients.

[27] These differences across mode are significantly different in a logistic regression of items nested within students (Appendix Table A.126). Partial interview respondents who did not receive the Stafford Loan, Pell grant, and GPA questions were excluded from this analysis. Additionally, people at schools whose GPA was not reported on a 4.0 scale were not included in the item nonresponse rate, as they received a follow-up question. The general trends in the NPSAS analyses hold excluding GPA from the calculations.

Thus, it is clear that respondents do not always answer survey questions. This has long been recognized, and many analytic techniques to account for item nonresponse have been developed (Little and Rubin 2002). However, empirical evidence that differences in item nonresponse rates across items can be predicted by expert ratings about retrieval difficulties and sensitivity of the items has received little attention. We have shown here, on a limited number of items across the two surveys, that the ratings predict variation in item nonresponse rates across items. Additionally, some cross-individual differences in item nonresponse propensity can be attributed to differences in motivation (Krosnick 2002) and mode of completion (de Leeuw 1992). Given the small number of items and the unreliability of the measurement it is encouraging that an effect was found.

3.3.2 The Expected Value of the Measurement Errors is Zero.

Most of the research conducted using the cognitive response process as a framework attempts to understand systematic biases in reports. Systematic biases may arise at any point of the cognitive response process, although the greatest attention has been paid to retrieval difficulties. In contrast, the simplest statistical models for measurement error assume that, given repeated independent trials with the same respondent, the expected value of the measurement errors is zero (Fuller 1987). Thus, reports are viewed as unbiased for the respondent's true value, but noisy. Even more complex models for measurement error tend to assume a zero mean for the response deviations, after accounting for differences across items in measurement methods (Saris and Gallhofer 2007).

Empirical examples of nonzero average measurement errors are many (Marquis et al. 1981). In these data, most of the items in both surveys have nonzero measurement errors (Table 3.2). We will discuss the nonzero average measurement errors in the NPSAS in the next section. We focus on nonzero average measurement errors in reports of dates in the WDS in this section. Marriage and divorce dates were rated as posing a difficult retrieval task and as burdensome questions (Table A.120). When might these questions be burdensome or be difficult to retrieve?

The date of an event may be systematically moved forward or backward in time when reported by a respondent. Dates for events that occurred more recently tend to be recalled more accurately, whereas reports of dates for more distant events are less accurate (Bradburn, Huttenlocher and Hedges 1994; Tourangeau, Rips and Rasinski 2000). In general, quality of reports of dates is considered to be a function of both telescoping and forgetting. "Telescoping" is a cognitive phenomenon in which the time of an event – here, marriage – is systematically moved in time when reported (Bradburn, Huttenlocher and Hedges 1994; Bradburn, Rips and Shevell 1987; Morwitz 1997). Exactly why telescoping occurs is unclear, although many explanations have been suggested (Tourangeau, Rips and Rasinski 2000).

The direction and magnitude of telescoping varies by the length of the recall period, such that distant events are forward telescoped and recent events are backward telescoped (Bradburn, Huttenlocher and Hedges 1994; Morwitz 1997). Forgetting is a function of the distinctiveness, regularity and importance of the event, and the time since the event (Tourangeau, Rips and Rasinski 2000). The resultant measurement error in the final reports is an aggregate of all of these components.

Telescoping and forgetting imply different indicators for measurement error. That is, telescoping implies an error on the same scale as the item being measured (e.g., months, years), as a function of the time elapsed since the event: $\varepsilon_{date\_telescoped,i} = \mu_{date,i} - y_{date,i} = f(\text{Time Since Event}_{\text{i}})$. On the other hand, forgetting implies that the person either recalls or does not recall the event in question at all:

$$1 - \Pr(\varepsilon_{date,i} = 0 \mid report) = f(\text{Time Since Event}_{\text{i}}, \text{Distinctiveness}_{\text{i}}, \text{Regularity}_{\text{i}}, \text{Importance}_{\text{i}}).$$

The measurement process on date variables contains two steps – any recall of the date of the event, and, conditional on the date not being forgotten, the amount of telescoping. Thus, it is almost impossible for the two factors of telescoping and forgetting to be disentangled without a careful experimental design.

In the WDS, reported marriage dates are moved back in time by an average of about six months. Reporting of marriage dates can be examined as a function of the time since the marriage occurred, the number of previous marriages (as a measure of distinctiveness), gender (as indicating likely regular rehearsal; Auriat 1993; Poulain, Riandey and Firdion 1992), and the number of children from the marriage still in the respondent's care (as a measure of importance). All of these items are available on the records. We use signed deviations as the measure of telescoping and an accuracy (match/no match) measure as the measure of forgetting. As discussed above, we expect the time since marriage to be the largest predictor of the signed deviations, and the other factors to predict overall accuracy. This is what we see (Table A.130). The time since the event is by far the largest predictor of the signed deviation; the other predictors play a reduced, if any, role. This was expected. Also as expected, gender and the number of children in joint custody are both positive predictors of overall accuracy (exact match of report and records), and the number of marriages is negatively related to accuracy in reporting of marriage dates, whereas the time elapsed since the marriage date is not.

The other item rated as being burdensome in the WDS, the divorce date, is also moved back in time by about six months. Inaccuracy in divorce date reporting can be explained by the same phenomena conceptually, with gender, the number of children, and the number of marriages also significantly predicting accuracy in divorce dates. Unlike marriage date reporting, however, the signed deviations are not explained well by the time since the divorce (Table A.131).

Thus, nonzero measurement errors may be identified by ratings of retrieval difficulty or question burden. The mechanisms for why these items – here dates – are reported inaccurately can be somewhat identified through careful specification of measurement error models derived from the cognitive response process. However, the actual meaning of the included covariates may reflect both the hypothesized mechanism and other potential mechanisms. We now turn to two additional examples in which the average of the measurement errors is nonzero. Under this situation, the errors are correlated with the true value.

3.3.3 The Measurement Errors are Uncorrelated with the True Value.

An important type of measurement error that can be derived from the cognitive psychological literature on measurement error is when measurement error is correlated with the true value. Sensitive questions, questions that require editing, and some burdensome retrieval tasks often fail this assumption frequently made by analysts. The financial aid information and grade point average reports in the NPSAS are prime examples of this case.

Systematic biases are observed on almost all of the NPSAS financial aid information. Financial information is usually underreported (Moore, Stinson and Welniak 2000). Cognitive difficulties in reporting financial information largely arise from problems of knowledge or salience, retrieval and sensitivity of the item (Moore, Stinson and Welniak 2000). These mechanisms work in the same direction. Retrieval of a category of income (or here, financial aid) is difficult, and the respondent may have incomplete knowledge of the types of financial aid, leading to underreporting of individual types of financial aid. To the extent that financial aid is a sensitive topic, then it will be less likely to be reported or the amount will be underreported. Underreporting is necessarily related to the true value. That is,

$$\Pr(Report < Truth) = \Pr(\varepsilon = \mu_i - y_i > 0) = f(Retrieval, Burden, Sensitivity, Salience) .$$

We now evaluate whether the observed underreports for most of the sources of financial aid in Table 3.2 (where underreports have a positive signed difference indicating that the mean estimated on the records is greater than that estimated on the reports) are a function of these question and respondent characteristics.

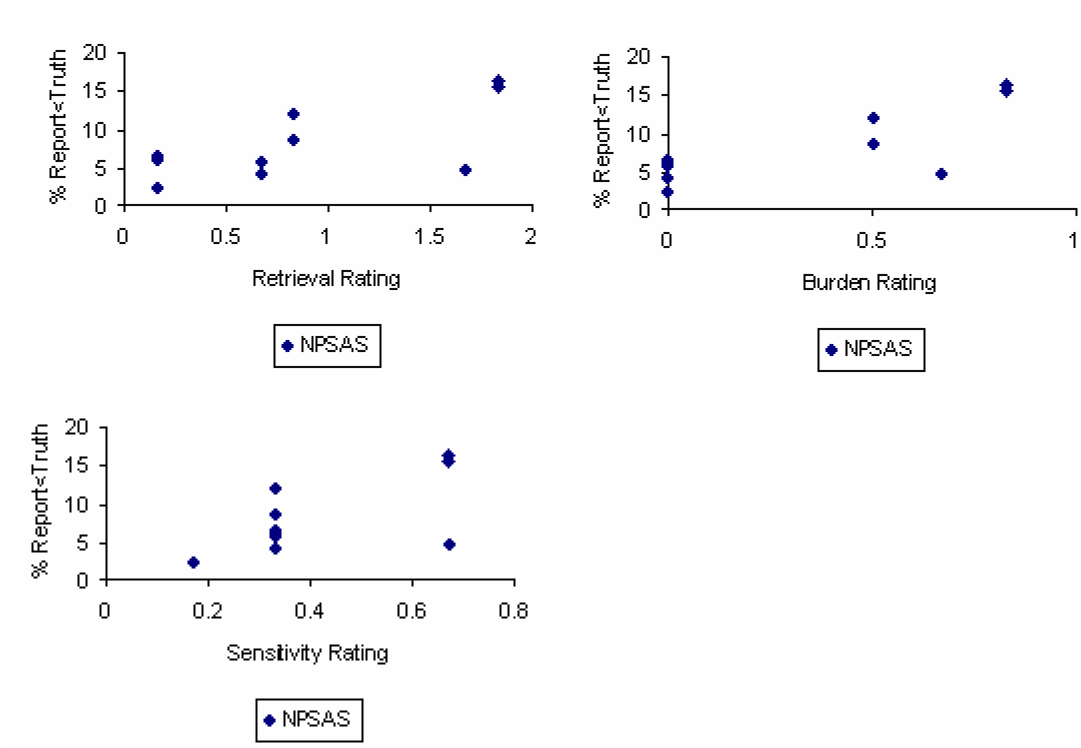

Figure 3: Item-level Underreporting Rate for Financial Aid Items only, by Retrieval, Burden, and Sensitivity Ratings, NPSAS

From Figure 3, we see a general tendency of increased underreports for financial items that are rated as being more likely to experience retrieval breakdowns, as being burdensome, or as being sensitive. The five financial aid items with ratings of no expected burden or average retrieval ratings[28] under 0.67 have underreporting rates averaging 4.93 percent, compared to the five financial aid items rated as having higher levels of burden or more difficult retrieval, averaging 13.32 percent. Items for which one-third or fewer of the reviewers judged the item to be sensitive have an underreporting rate of 6.4 percent, compared to an underreporting rate of 12.23 percent for the items which more reviewers judged to be sensitive (see Table A.129 for distribution of reports versus truth for these items in the NPSAS).

[28] Identical items are identified using the burdensome or retrieval ratings.

In the NPSAS, a relevant measure of salience is age of the student. We hypothesize that older students are more likely to be more knowledgeable of the debt they have taken on than younger students. If this is true, we should see less underreporting for older students than younger students. This is in fact what we see. On average, over all of the financial aid items, 15 to 19 year olds underreport by 10.3 percent, 20 to 21 year olds underreport by 9.4 percent, 22 to 27 year olds underreport by 6.8 percent, and students aged 28 and older underreport by 6.1 percent.[29] General trends also hold for the individual items (Appendix Table A.132).

Table 3.3: Percent Underreporting, Exact Reporting, and Overreporting of GPA by Record Value of GPA, NPSAS

	Record Value of GPA						
	As	As and Bs	Bs	Bs and Cs	Cs	Cs and Ds	Ds and Below
% Overreport	21.08	48.21	58.86	73.69	81.67	87.77	94.51
% Accurate Report	43.32	18.20	15.05	6.87	7.56	4.82	3.32
% Underreport	35.60	33.59	26.09	19.44	10.76	7.42	2.17
SE(% Overreport)	0.81	0.74	0.73	0.80	0.99	1.55	1.07
SE(% Accurate Report)	0.98	0.56	0.53	0.45	0.66	0.95	0.85
SE(% Underreport)	0.96	0.70	0.65	0.72	0.80	1.28	0.67

Academic achievement measures such as grade point average are also highly likely to experience errors related to the true value. Social desirability is necessarily a situation in which measurement error is directional and is a function of the true value. GPA was rated by almost all raters (83 percent) as likely to experience social desirability concerns and likely to experience breakdowns of the cognitive response process at the editing stage. We would then expect that the worst academic performers are the most likely to overreport their GPA. Table 3.3 clearly shows that this is the case.

[29] These differences are significant in a nested logistic regression model, accounting for clustering of items within respondents. Coefficients and standard errors in Appendix Table A.127 and Table A.128.

Thus, the cognitive response process clearly suggests classes of variables for which measurement errors are correlated with the true value. Expert reviews of these characteristics for retrieval, question burden, and social desirability are relatively strong predictors of directional measurement error, despite the unreliability of the reviews.

3.3.4 Measurement Errors are Uncorrelated Across Items.

Measurement error models usually assume that errors are uncorrelated across items. However, the cognitive response process literature clearly shows that the measurement context affects survey reports (Sudman, Bradburn and Schwarz 1996; Tourangeau, Rips and Rasinski 2000). Part of the measurement context are surrounding questions. When the respondent uses the context to guide their answers to the other questions in the questionnaire, then correlated measurement errors across items are likely to arise (Peytchev 2007; Sudman, Bradburn and Schwarz 1996). Context effects are usually discussed for attitudinal items in which a positive correlation between the true values is expected. The covariance among the measurement errors may be positive, appearing to increase the correlation between the survey reports to two items (an assimilation effect), or negative, appearing to decrease the correlation between the survey reports (a contrast effect) (Sudman, Bradburn and Schwarz 1996). That is, for two items α and β, $|\operatorname{cov}(\varepsilon_\alpha, \varepsilon_\beta \mid \mathit{Shared\ Context})| > |\operatorname{cov}(\varepsilon_\alpha, \varepsilon_\beta \mid \mathit{Separate\ Context})|$.

Translating ideas of context effects to behavioral items requires careful consideration. When asked to report on multiple categories of the same topic, errors may be correlated across categories (Rodgers, Brown and Duncan 1993; Rodgers and Herzog 1987). This may be because of context effects or because of misclassification of the category. For example, when reporting different sources of income, people often confuse different types of income (e.g., Worker's Compensation vs. Social Security), leading to correlated errors (Moore, Stinson and Welniak 2000). The reasons for measurement error may have important implications for measurement error's correlational structure. From one perspective, people may make errors in the same direction across items (e.g., consistent underreporting of all income categories). This would suggest examining correlations among signed errors. When the respondent misclassifies the category to which an item belongs (e.g., reporting state aid as institutional aid), a positive error on one item may be counterbalanced with a negative error on another item.

To the extent that people differ in how they misclassify income (or financial aid) categories, signed deviations would reveal little to no association among errors, but there should be stronger correlations among absolute deviations. That is, $\left|corr(\left|\varepsilon_{\alpha}\right|,\left|\varepsilon_{\beta}\right| \mid Misclassification)\right| > \left|corr(\varepsilon_{\alpha},\varepsilon_{\beta} \mid Misclassification)\right|$. Context effects, on the other hand, would predict that the direction of the errors made are relatively consistent across individuals. Thus, under context effects, there should be little to no difference when the signed versus absolute errors are used. With behavioral items, some structural correlation among errors is also necessary – e.g., people who report that they did not receive financial aid when the record indicates that they have received financial aid will also underreport not having individual categories of financial aid.

Empirically disentangling reasons for correlated error structures is difficult without experimental manipulation. While items placed close together in a questionnaire will be likely to have larger correlations among the errors than items that are more distant, items that are next to each other in a questionnaire also usually share topics.

Thus, an experiment manipulating question placement and topic would be needed to fully disentangle the reason behind the correlated measurement errors.

We examine the difference in correlations among errors in the reported dollar amounts of work study aid, state aid, institutional aid, and GPA. We hypothesize that there will be stronger correlations among the financial aid sources than between the financial aid sources and GPA. We also expect stronger correlations when the absolute deviations are used than when the signed deviations are used, given the likely misclassification of aid sources.

Table 3.4: Correlation Among Signed and Absolute Errors in Reporting of Amount of Work Study Aid, Amount of State Aid, Amount of Institutional Aid and Grade Point Average, NPSAS

	Amount of Work Study	Amount of State Aid	Amount of Institution Aid	Grade Point Average
Amount of Work Study		0.030	0.071	0.014
Amount of State Aid	0.054		0.008	0.014
Amount of Institution Aid	0.126	0.107		0.026
Grade Point Average	-0.014	-0.037	-0.064	

Note: Correlations among signed errors is above the diagonal. Correlations among absolute errors is below the diagonal.

The predictions largely hold up (Table 3.4). Stronger correlations tend to exist among the amounts of the different types of financial aid than for the types of financial aid with GPA. In particular, the strongest correlated errors is between institutional aid and work study. It appears that these two sources of aid may be the most likely substitutes for misclassification (e.g., work study jobs are perceived as coming from the school, although the funding may be from the institution or from the federal government). The absolute deviations show larger correlations than the signed deviations, also suggesting misclassification across types of financial aid sources. Comprehension difficulties may be predictive of correlated measurement errors across items. Work study, institutional, and state aid were the items rated as the most likely items to experience breakdowns due to comprehension difficulties. Thus, the expert ratings lend some support to this hypothesis.

Findings from the cognitive response process literature can be used to anticipate when correlated measurement errors will occur. Additionally, using the cognitive response process to guide the measurement error models allows the analyst to anticipate how different indicators of measurement error may behave in a correlated error structure.

3.4 Limitations of this approach

The above discussion is limited by the small number of items available for the analysis. Future analyses should examine more reviewers, items, and surveys. Additionally, the above analyses examined the mean ratings across all reviewers. Variability in conclusions due to individual raters has not been considered. A relevant question is how conclusions would change were only one rater at a time used in the analysis.

This chapter is limited because it has focused primarily on the failures of the cognitive response process model that manifest in biases in reporting. It has largely ignored issues of reliability, simple response variance, or measurement error variance. Part of the reason for this is conceptual; part of the reason is technical. Conceptually, the items discussed above are of classes for which biases have been observed across multiple surveys. Thus, there is evidence that a great deal of the measurement error on these items is that of a bias, not a variance.

However, which part is measurement error variance and which part is measurement error bias cannot be disentangled from the available data. Detecting intra-individual measurement error variance requires having multiple measures of the same construct on the same person. This is not present for either of these surveys. To the extent that signed and absolute deviations give different answers (e.g., as in misclassification), this suggests that some of the measurement error observed is variable error, not systematic error for all respondents.

Additionally, the cognitive response process does not clearly suggest when or why variation in reports across persons with different characteristics will be observed. Cognitive theory makes certain predictions (as illustrated above), but is silent on many other characteristics (e.g., are women better reporters than men on financial aid information, as well as on dates of milestone life events?). Most standard statistical measurement error models are silent on why differences in measurement errors across individuals may exist. As the combinations of individual characteristics and the types of items are many, we simply note that future basic research into how and why measurement error occurs should carefully consider how individual differences may affect the quality of reports and how this information can be incorporated into statistical models.

Finally, the ratings do not always work. We have already noted that the interrater reliability is lower than optimal; thus, different experts see different issues with individual items. This can attenuate the ratings' ability to predict measurement error attributes. Additionally, there was no variation in ratings of judgment across items in the WDS. This is likely because all of the responses examined in the WDS were open-ended questions, and discussions of problems judgment usually applies to closed-ended response options.

3.5 Summary

Guided by literature on the cognitive response process, predictions for variation in measurement error across items and across individuals for a given item were derived and tested empirically. Four assumptions commonly made by analysts also were evaluated in light of knowledge about how and why people make mistakes when answering questions. Functional forms of the error term suggested by the cognitive literature on measurement error were also specified, with predictions of different functional forms being appropriate for different measurement error mechanisms. Expert ratings of likely breakdowns in the cognitive response formation process were used to explain cross-item variation in measurement error.

This analysis had three main findings. First, expert reviewers can be used to discern differences across items in likely breakdowns of the cognitive response process. Second, these expert reviews are predictive of variation in measurement error across items. Third, the measurement error models deduced from the cognitive response process often suggest distributions of the measurement errors that are different from those assumed by simple statistical models.

There are, however, limitations to this analysis. This analysis focused on item nonresponse, nonzero average measurement errors, measurement errors correlated with the true value, and measurement errors correlated across items. The ratings that were most likely to be related to these items were those of question burden, sensitivity, and retrieval and comprehension difficulties. This clearly does not reflect the full range of breakdowns in the cognitive response process; however, a limited number of types of items were considered here. Other items, such as behavioral frequency questions or attitudes, would suggest different failures of the response formation process.

Correspondingly, different items would also have different expressions for measurement error.

In short, however, the use of expert reviewers to guide measurement error models across items shows promise, despite low reliability in ratings. On this limited set of items across two surveys, the reviewers discerned between those items that experienced more measurement error and those that experienced less, using a variety of metrics for measurement error. Replication with other reviewers and on additional items would strengthen these findings.

Chapter 4

The Relationship Between Nonresponse Propensity and Measurement Error

Are people who are the least likely to participate in surveys the most likely to give poor answers to the survey questions? Survey practitioners and survey analysts have asked this question for many decades, but the answer is not clear. The existing empirical investigations have mixed results. To date, no theoretical framework anticipating when the two error sources should be related has been proposed. This paper presents such a theoretical framework and gives three empirical examples. It uses two surveys for illustration.

To understand the relationship between nonresponse and measurement error, each error source must be defined. First, survey participation is not predetermined (Lessler and Kalsbeek 1992). Under the stochastic view for survey nonresponse, all persons are seen as having a probability of being a survey respondent, whether or not they actually participate.[30] People vary on their likelihood of being a survey respondent; this likelihood is referred to as "response propensity." Some people with high response propensity – those who are the most likely to participate – may not actually be

[30] There are two traditional viewpoints for survey participation, rooted in the statistical literature. An alternate view of survey participation is that of a static property of an individual for a given survey protocol; this is often referred to as a deterministic view of survey participation (Lessler and Kalsbeek 1992). There are classes of respondents or nonrespondents for any given survey, and the sample realization of the respondent and nonrespondent pool makes visible the group to which the individual belongs.

respondents. Some people with low response propensity – those who are the least likely to participate – may decide to cooperate. Response propensities are unknown and unobservable, but can be estimated. Logistic regression models are sometimes used to estimate response propensities, including respondent, household and ecological variables as covariates (e.g., Groves and Couper 1998).

While response propensity is a person-level characteristic, measurement error is an item-level attribute. Conceptually, measurement error is the difference between what one wants to measure and a respondent's report (Groves et al. 2004), and manifests through many different mechanisms (Tourangeau, Rips and Rasinski 2000). Estimates of measurement error depend on the available information. When "true values" are available for all respondents, the simplest measurement error estimate is a response deviation, that is, the signed difference between the "truth" and a respondent's report. With categorical variables, the signed difference simply is a three category variable indicating over-, under- or accurate reporting. Various functions of a response deviation (e.g., absolute deviations, which become exact match indicators for categorical variables) may be used, but differ in their implications for the understanding of measurement error. In the absence of true values, other indicators of measurement error can be used, such as item nonresponse (Beatty and Herrmann 2002; Beatty et al. 1998; Krosnick 2002), attenuated covariance structures (e.g., lower coefficient alpha values), and reduced reliability in repeated measurement (Biemer and Stokes 1991).

Given the diversity of measurement error causes and variation in how response propensity is estimated, it is not surprising that the relationship between nonresponse propensity and measurement error remains elusive. Indeed, the very question of whether those who are the least likely to participate are the most likely to provide answers filled with measurement error may be oversimplified. Measurement error may change systematically over the response propensity distribution, but may be just as likely to increase as to decrease. Rephrasing the question as "Under what circumstances will response propensity and measurement error be related?" reflects the potential for measurement error to be positively or negatively correlated with response propensity. Additionally, the question of whether the least likely to participate are the most likely to give measurement error-filled answers implies that the hypothesized relationship between response propensity and measurement error either always happens or never happens. However, as measurement error is an item-specific phenomenon, the relationship between response propensity and measurement error is also likely to be item-specific.

Thus, the relationship between response propensity and measurement error will be better understood when considering it at an item- or question-level. Exactly how they will be related must depend on the relationship between the causes for response propensity and the causes for measurement error. This paper suggests a conceptual model for understanding the relationship between the two error sources. The conceptual model can be proposed in the absence of data. Empirical evaluations of the relationship between nonresponse and measurement error can then be anticipated. The paper illustrates simplified versions of this model using three case studies from two surveys.

4.1 Theoretical Framework for the Relationship Between Response Propensity and Measurement Error

A theoretical framework for the relationship between response propensity and measurement error should articulate how the causes of survey participation and the causes of measurement error are related. Let measurement error, ε, be considered as affecting the report of a continuous variable Y such that Y = T + ε, Y=T*ε, or some similar combination, where T is the true value for the variable Y. Denote the cause for measurement error as Z_ε. Measurement error models specify how Z_ε is related to both T and ε. Let the cause for response propensity, P, be denoted as Z_p. Response propensity models, and extensions thereof to nonresponse bias, specify how Z_p is related to P and T. The question at hand is how Z_ε and Z_p are related, and as a consequence how the causes for the two error sources are related to P, T, and ε. Thus, full understanding of the nonresponse-measurement error nexus requires examining response propensity, nonresponse bias and measurement error simultaneously.

There are many scenarios under which the two error sources may be related. Two such models are presented in Figure 4. We call these scenarios (1) a Separate Cause model and (2) a Saturated model (see Figure 4).

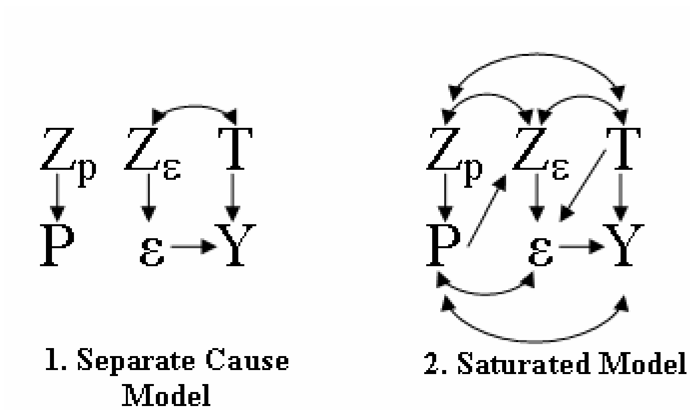

Figure 4: Two Causal Models for the Relationship between Response Propensity and Measurement Error

Model 1 is a Separate Cause model based on the assumption that most of the survey methodology literature operates under – coexisting, but independent error sources. The reported answer to a survey question is *Y*, a simple sum of the true value, *T*, and measurement error, ε. The measurement error mechanism may be related to the value of T, the true value for the survey variable in question. Importantly, the cause of measurement error, Z_ε is unrelated to Z_p, the cause for survey participation, P. That is, in this model, the causes for response propensity and measurement error are distinct, and there is no third variable that generates a correlation between the two causes. For this to happen, only one of the error sources can be related to the true value, T. However, as it does not matter which one is related, only the measurement error cause is shown as being related to the true value in the diagram. In some sense this is the extreme base model of independence of propensity and measurement error.

Model 2 is a Saturated Model. This model is the "worst case scenario." Here, the causes for the two error sources, Z_ε and Z_p, are correlated. In addition, Z_p is related to the true value T, which is also a primary driver of measurement error. There also may be change in the measurement process that occurs differentially over the response propensity distribution. Any one of these is sufficient for a correlation to be observed between response propensity and measurement error. To the extent that the multiple causes for measurement error do not completely cancel each other out over the propensity distribution, a correlation will be observed between response propensity and measurement error. This model is problematic because nonresponse bias will be induced due to the relationship between the cause for propensity, Z_p, and the true value, T. Thus, under this model, the error sources are far from independent, and may even be compounding.

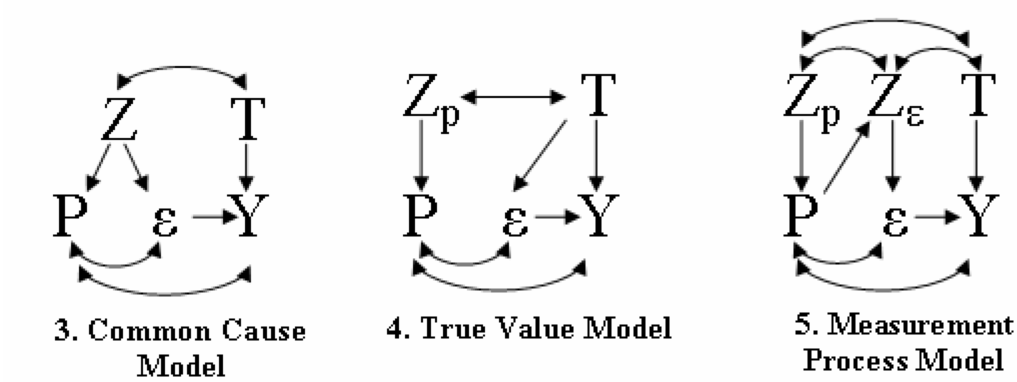

Figure 5: Three Simplified Causal Models for the Relationship Between Response Propensity and Measurement Error

The Saturated Model is very complex, and simplifications of the model may be possible. Figure 5 presents three simplified causal models that can be derived from the Saturated Model. These models are not the only simplifications possible from Model 2; they are, however, useful starting points.

Model 3 is a Common Cause Model. In this model, the cause of survey participation and the cause of measurement error are identical, Z_p=Z_ε=Z. A relationship between response propensity, *P*, and measurement error, *ε*, is observed because of the common cause, *Z*, of both response propensity and measurement error. Conditional on the Common Cause there is no net relationship between propensity and measurement error. In fact, the true value, *T*, may be the Common Cause.

A commonly posited Common Cause for response propensity and measurement error is a latent trait of "motivation" (Bollinger and David 2001; Cannell and Fowler 1963). People who are possess high values on this latent trait are likely to participate in surveys and also are likely to do the hard work of being a survey respondent. People who are low on this latent trait are more likely to be nonrespondents, and when convinced, are likely to provide answers filled with measurement error. Topic interest has also been suggested as a common cause for nonresponse propensity and measurement error (Campanelli, Sturgis and Purdon 1997; Couper 1997; Donald 1960; Martin 1994). This can be particularly troubling in terms of error properties of a statistic; to the extent that topic interest is strongly indicated by a survey variable itself as a cause of response propensity (Groves 2006) and a strong indicator for measurement error, then both nonresponse bias and measurement error bias will be observed (e.g., sick leave in Van Goor and Verhage 1999; wealth in Kennickell 1999b).

Model 4 is a True Value Model. In this model, the cause of survey participation is related to the true value of the item being measured. In some instances, the true value may be the cause of survey participation (replacing both Z_p and Z_ε with T), in which case the True Value Model becomes the Common Cause Model. Additionally, measurement error is a function of the item's true value. This feature is atypical of most continuous models of measurement error, but is a necessary feature of measurement error models for categorical variables (Biemer and Stokes 1991). Since the true value also varies over the propensity distribution, a relationship between propensity and measurement error is observed.

For example, people who have been to a doctor more frequently are more likely to participate in health-related surveys (Etter and Perneger 1997; Gasquet, Falissard and Ravaud 2001). Because recalling rare or infrequent events is cognitively burdensome, people who have been to the doctor more frequently are better reporters of the number of doctors visits (Cannell, Marquis and Laurent 1977; Madow 1976).[31] Thus, we would expect a negative relationship between response propensity and measurement error in

[31] Although this may seem counterintuitive, people who have been to the doctor less frequently tend to forget that they have been at all or to telescope the date of going to the doctor outside the reference period.

health surveys measuring the number of doctor visits; this is in fact the relationship observed in Cannell and Fowler's classic study of reporting of hospital stays by level of effort in which the easier to reach are better reporters (Cannell and Fowler 1963). This may be because of a correlation between the true value and response propensity -- that is, people who go to the doctor frequently become interested in the topic of the survey, and hence participate -- or because of a third variable, Z -- e.g., socioeconomic status, that is, people who go to the doctor have access to health insurance and hence are likely to be in a higher socioeconomic group than those who do not go to the doctor (Etter and Perneger 1997).

The final simplified model is a Measurement Process Model. In this model, a component in the measurement process induces or reduces measurement error. This component could be an interviewer behavior that is related to measurement error (e.g., probing behavior), a mode switch (e.g., a mail follow-up questionnaire), the introduction of an incentive, or any number of other protocol decisions. Under this model, the prevalence of this measurement process varies over response propensity, possibly because it was introduced deliberately for low propensity cases. Thus, a relationship between response propensity and measurement error is observed because of a protocol decision or interviewer behavior differentially made over the propensity distribution. For example, a common belief is that reluctant respondents negotiate down the respondent task, leading the interviewer to probe incompletely and rush through the questions, hence inducing measurement error. In this instance, propensity generates a change in interviewer behavior which in turn causes measurement error.

Two comments must be made about these models. First, none of the models asserts a specific directional relationship between response propensity and measurement error. Although a negative relationship is commonly hypothesized – that is, people who are higher on response propensity have less measurement error in their answers – a positive relationship may also be seen under the models. Second, the models do not assert an increase or reduction in the magnitude of measurement error as a function of response propensity. That is, people with low propensity may have large signed positive response deviations but people with high propensity may have large negative signed response deviations. This would manifest as a negative correlation between propensity and measurement error, with little or no reduction in the absolute magnitude of response deviations at the tails of the propensity distribution.

The simplified models are conceptually distinct. Models 3 and 4, the Common Cause and True Value Models, contain a Z for propensity that is linked directly to a component of the measurement error mechanism (to the error or true value, respectively). Finally, the last model permits a change in the recruitment protocol or measurement design to be generated by propensity and also affect measurement error. Other simplified versions of the Saturated Model for the relationship between nonresponse propensity and measurement error are likely to exist.

Do any of these models have empirical support? To address this question, we examine two surveys, the Wisconsin Divorce Study (WDS) and the National Postsecondary Student Aid Study (NPSAS).

4.2 Data

We look at two propensity models for each study, considering contact propensity and cooperation propensity separately. We illustrate the relationship between propensity and measurement error using four metrics of measurement error – item nonresponse, match rates, signed deviations, and absolute deviations – for six survey variables in the WDS and eleven survey variables in the NPSAS.

4.2.1 The Wisconsin Divorce Study

In mid- to late 1995, the University of Wisconsin-Madison conducted the Wisconsin Divorce Study. Divorce certificates from four counties in Wisconsin from 1989 and 1993 were extracted, and a simple random sample was selected.

Recruitment in the Wisconsin Divorce Study started with personalized letters in which a sampled person was asked to participate in the "Life Events and Satisfaction Survey," sponsored and carried out by the University of Wisconsin-Madison. The survey contained questions on satisfaction with life and relationships, marital and cohabitation history, childbearing history, education and work history, satisfaction with current relationships, and demographics.

Sample units were first attempted by telephone. Nonrespondents to the telephone survey or persons for whom a telephone number could not be obtained were followed up with a mail request. The interviewer recruitment script is not available for this analysis; however, the mail survey prominently displays the name of the survey. The first page of questions in the mail survey are related to satisfaction on various life domains. Overall, the response rate (AAPOR RR1) was 71 percent, with a contact rate of 80.3 percent and a cooperation rate of 88.3 percent.

Four variables are available from the divorce records – the date of the divorce, date of marriage, birth date, and the number of marriages for the sampled person. Additionally, as the sample was selected from divorce records, the entire sample has been married and divorced.

4.2.2 National Postsecondary Student Aid Study

In late 2004, the National Center for Education Statistics sponsored the National Postsecondary Student Aid Study (NPSAS), with data collection conducted by RTI International. The sample design for the NPSAS and methodology is described in detail elsewhere (Cominole et al. 2006).

The student survey recruitment protocol began with a personalized advance letter from the Associate Commissioner of the National Center for Education Statistics to participate in the NPSAS and an e-mail request from the RTI project director of NPSAS. During the first four weeks, the selected student was recruited by e-mail to participate in a web survey. After four weeks, nonresponding students were followed up by telephone. During this request, students could choose their completion mode (telephone or Internet). Nonresponding students were sent refusal conversion letters and were offered a shortened interview. Both English and Spanish language questionnaires were available.

Roughly 20 percent of the respondent pool respondent online after receiving telephone prompting. Over half of the respondent pool (53 percent) completed the survey by telephone. The remaining 27 percent participated in the NPSAS without any telephone prompting (Cominole et al. 2006).

This analysis focuses on nonresponse propensity and measurement error for undergraduates in the 50 states and the District of Columbia. Analyses are conducted treating the student sample as a stratified random sample with unequal probabilities of selection. Student selection probabilities are used, accounting for the unequal probabilities of selecting the students from the lists provided by the universities. The analytic strata in the public use data file are used; these strata are institutions or combinations of institutions, designed to have a minimum number of 10 students in each stratum.

The AAPOR weighted contact rate for this set of undergraduates was high – 96 percent (unweighted AAPOR CON2 96 percent)– and the AAPOR weighted cooperation rate is 73 percent (unweighted AAPOR COOP2 70 percent), with an overall AAPOR weighted response rate of 70 percent (unweighted AAPOR RR2 67 percent) (AAPOR 2006).

Eleven variables are available in the records and were asked in the survey. These variables are primarily financial aid measures – applying for any financial aid, receiving a number of types of financial aid, with dollar amounts for three types of aid, and an academic achievement measure, grade point average. While the financial aid information is available in the records for almost all of the respondents, grade point average is available for approximately 80 percent of the respondent pool.

4.2.3 Limitations of the Data Sets

Because neither of the surveys were conducted for the purpose of estimating both nonresponse bias and measurement error bias, the data sets have limitations for the present analysis. The records may contain measurement errors, and the construct measured in the survey may deviate slightly from the construct measured in the record.

4.2.3.1 Limitations of the Wisconsin Divorce Study

In the Wisconsin Divorce Study, the frame consists of divorce certificate data in which only the divorce date, county of divorce, and child custody arrangements were recorded by an official body; all other information was provided by at least one of the two spouses in the divorcing couple. The divorce date, a date used for administrative purposes, is probably the least sensitive to measurement error in the record. Marriage date, dates of birth, and number of marriages are provided by at least one member of the couple when filing for the divorce certificate. As a result, these items may contain more measurement error in the records than other items. Exactly which member of the couple filed for divorce or if the couple filed jointly is not known.

4.2.3.2 Limitations of the NPSAS

Item nonresponse in the records is the largest issue for the NPSAS. Table A.4 and Table A.5 show missing data rates for predictor variables in the NPSAS analyses. Missing data on the outcome variables varies from less than one percent for the financial aid variables to approximately 20 percent in the academic achievement measures.

Measurement error in the NPSAS records may also be present. The federal data bases (Central Processing Services, Stafford loan, Pell Grants) are likely to contain less measurement error than the institutional data. Not all students may have reported all sources of financial aid to the college or university. Additionally, colleges and universities may vary in how employment – such as work study or paid assistantships - for undergraduate students is recorded. Finally, institutions may differ in their classification of certain sources of financial aid.

An additional source of measurement error in the records is present in the NPSAS. For purposes of disclosure limitation, undisclosed data perturbation procedures were performed on an unknown number of cases over an unknown number of variables (Cominole et al. 2006, p. 103). Thus, some degree of measurement error in both the records and reported variables will be due to data perturbation rather than the respondent.

4.3 Response Propensity Models

Two propensity models for each survey are considered in this analysis – a model predicting contact and a model predicting cooperation, conditional on contact. Selection of covariates for the contact propensity models in each survey was guided by indicators for at-home patterns and access impediments. Covariates for the cooperation propensity models in each survey were selected to represent constructs of social isolation, lack of discretionary time, positive affect toward the sponsor, and social environmental influences on cooperation. This analysis focuses on models specified using main effects; we discuss sensitivity of the conclusions to model specification in Section 4.9 below. Extensive description of the models is presented in Chapter Two.

Predicted propensities were obtained under each model. The predicted propensities were grouped into quintiles for the entire sample pool. As a result, there are unequal numbers of respondents in each quintile (see Table A.29 for contact model sample sizes, Table A.31 for cooperation model sample sizes), although the number in the total sample varies.[32] All analyses using the propensity quintiles are presented in the Appendix Table A.133 through Table A.192.

[32] In order to maintain the level of confidentiality required of NCES data, all NPSAS sample sizes have been rounded.

4.4 Measurement Error in the Survey Reports

Four metrics of measurement error in the survey reports will be discussed in the case studies below. These four metrics include (1) mismatch rates – that is the percentage of respondents whose reports do not match the records, (2) signed deviations (record – report), (3) absolute deviations (|record – report|), and (4) item nonresponse. Mismatch rates indicate the rate of measurement error, but not the magnitude of the error. Signed deviations are informative about the overall effect of measurement error on the estimate. Absolute deviations are informative about the magnitude of measurement error at the person level, regardless of sign. Item nonresponse is viewed as a complete breakdown of the measurement process. All of the mismatches are calculated strictly; that is, exact matches are required. In order to count as a match, dates had to match to the month and year (the metric queried in the questionnaire), loan amounts had to match to the dollar, and the GPA had to match to the second decimal. Table 4.1 contains descriptive statistics for these four measures of measurement error.

Table 4.1: Overall Item Nonresponse Rate, Mismatch Rate, Average Signed Deviation, and Average Absolute Deviations with Standard Errors, WDS and NPSAS

	Item Nonresponse		Mismatch		Signed Difference		Absolute Difference	
	%	SE	%	SE	Mean	SE	Mean	SE
WDS								
Ever married	0.00[a]	0.00	1.5	0.54	1.5	0.54	1.5	0.54
Ever divorced	1.34	0.50	8.1	1.19	8.1	1.19	8.1	1.19
Number of marriages	0.57	0.33	8.8	1.2	-0.01	0.01	0.09	0.01
Marriage date	2.68	0.71	32.3	2.1	-6.34	2.81	18.67	2.70
Divorce date	8.60	1.23	50.2	2.4	-6.15	1.20	8.56	1.17
Birth date	0.76	0.38	10.8	1.4	-5.51	2.60	13.04	2.55
NPSAS								
Applied for financial aid	0.53	0.05	11.6	0.2	1.3	0.23	11.6	0.2
Received financial aid	0.58	0.05	11.1	0.2	0.7	0.22	11.1	0.2
Received Stafford loan	0.80	0.06	10.3	0.2	1.2	0.21	10.3	0.2
Received Pell Grant	0.86	0.06	7.4	0.2	0.9	0.17	7.4	0.2
Received Work Study	2.19	0.10	7.4	0.2	-2.7	0.17	7.4	0.2
Amount of Work Study	2.01	0.09	10.5	0.2	-78	8.36	231	8.24
Received State Aid	0.83	0.06	17.2	0.2	6.5	0.26	17.2	0.2

	Item Nonresponse		Mismatch		Signed Difference		Absolute Difference	
	%	SE	%	SE	Mean	SE	Mean	SE
Amount of State Aid	2.59	0.10	24.0	0.3	167	8.56	469	8.06
Received Institutional Aid	0.83	0.06	13.8	0.2	3.3	0.31	13.8	0.2
Amount of Institutional Aid	2.28	0.10	23.6	0.3	262	15.93	739	15.13
Grade Point Average	4.12	0.12	82.7	0.3	-0.17	0.00	0.25	0.00

Note: All mismatch rates calculated on exact matches. Dates in the WDS calculated to the month and year in the record. Financial aid items matches calculated to the exact dollar amount. GPA matches calculated to the second decimal. n/a indicates that this measurement error indicator is not appropriate for the outcome variable or is already captured in another column. Mismatch rates and absolute differences are identical for the binary items.
[a] Indicates that there was no item nonresponse on reports of ever having been married.

There is large variation over items in the direction and magnitude of measurement error. Generally variables experience small item nonresponse rates. Both studies have items that suffer from large amounts of measurement error – e.g., over half of the reported divorce dates in the Wisconsin Divorce Study fail to match to the month and year; approximately one quarter of the state and institutional aid amounts fail to match the record values in the NPSAS, and virtually all of the GPA values are incorrectly reported[33] (using the second decimal as the match criterion, although the average difference is small). Items with higher missing data rates tend to have larger levels of inaccuracy.

4.5 Empirical Relationship between Response Propensity and Measurement Error

Before we attempt to explain the relationship between response propensity and measurement error, first we must establish that such a relationship holds. The common hypothesis is for negative correlations between propensity and measurement error, such

[33] The GPA in the records refers to the GPA as of the time of the institutional reporting. The GPA in the interview referred to the 2003-2004 school year. These differences in timing could contribute to some of the discrepancies. However, the degree of systematic deviation from the record that is consistent with that predicted by theory (large overreporting of GPA for people with poor academic performance records) suggests that while the magnitude of measurement error is large, the correlates of measurement error are likely to be accurate.

that those with higher propensities have smaller measurement errors. However, as discussed above, this need not be so. Table 4.2 and Table 4.3 contains the correlation between the predicted propensity under contact and cooperation models and each measurement error indicator. Because both studies are mixed mode, with both a self-administered and an interviewer-administered component, the distinction between contact and cooperation may be tenuous. Here, contact refers to either a contact in the telephone mode or completion or active refusal of the self-administered mode. In both studies, at least 70 percent of the respondent pool was known to be contacted by telephone.

Table 4.2: Correlation of Estimated Contact Propensity and with Item Nonresponse, Mismatch Between Record and Report, Signed Deviations (Record - Report) and Absolute Deviations (|Record - Report|), WDS and NPSAS

	Corr(Contact p,ε)			
	Item Nonresponse	Mismatch	Signed Deviations	Absolute Deviations
WDS				
Ever Married	0.00[a]	-0.097*	-0.097*	-0.097*
Ever Divorced	-0.044	-0.129**	-0.129**	-0.129**
Birth date	0.030	-0.120**	0.127**	-0.140**
Marriage Date	-0.135**	-0.090*	0.103*	-0.147***
Divorce Date	-0.112*	-0.129**	0.039	-0.052
Number of marriages	-0.065	-0.097*	-0.077	-0.073
NPSAS				
Applied for financial aid	0.001	-0.045	-0.035****	-0.045
Received financial aid	0.002	-0.051****	0.001	-0.051****
Received Stafford loan	-0.006	0.002	0.035****	0.002
Received Pell Grant	0.003	-0.048****	-0.034****	-0.048****
Received Work Study	-0.024****	0.026***	0.042****	0.026***
Amount of Work Study	-0.009	0.086****	0.024****	0.020****
Received State Aid	0.004	-0.022***	-0.018****	-0.022***
Amount of State Aid	0.002	0.012*	0.048****	0.029****
Received Institutional Aid	0.004	0.040****	0.048****	0.040****
Amount of Institutional Aid	0.017**	0.156****	0.118****	0.084****
Grade Point Average	-0.063****	-0.015	0.130****	-0.119****

Note: NPSAS correlations are weighted by selection weights. Signed deviations are Record – Report. Absolute deviations for the binary variables are identical to the mismatch rates.
[a] Indicates that there was no item nonresponse on reports of ever having been married.
* p<.05, **p<.01, *** p<.001, **** p<.0001

Table 4.3: Correlation of Estimated Cooperation Propensity and with Item Nonresponse, Mismatch between Record and Report, Signed Deviations (Record - Report) and Absolute Deviations (|Record - Report|), WDS and NPSAS

	Corr(Cooperation p,ε)			
	Item Nonresponse	Mismatch	Signed Deviations	Absolute Deviations
WDS				
Ever Married	0.00[a]	0.031	0.031	0.031
Ever Divorced	-0.029	0.039	0.039	0.039
Birth date	-0.033	0.023	-0.059	0.088*
Marriage Date	-0.027	-0.053	-0.057	0.027
Divorce Date	-0.048	-0.073	0.032	-0.033
Number of marriages	0.008	0.004	0.028	0.005
NPSAS				
Applied for financial aid	-0.006	-0.020	-0.042****	-0.020
Received financial aid	-0.003	-0.023***	-0.004	-0.023***
Received Stafford loan	-0.014*	-0.007	0.004	-0.007
Received Pell Grant	-0.012	-0.023***	-0.014****	-0.023***
Received Work Study	-0.003	0.009	0.027****	0.009
Amount of Work Study	-0.005	0.046****	0.012****	0.015*
Received State Aid	-0.003	0.002	0.002	0.002
Amount of State Aid	-0.008	0.025****	0.042****	0.059****
Received Institutional Aid	-0.003	0.031****	0.029****	0.031****
Amount of Institutional Aid	-0.003	0.087****	0.025****	0.049****
Grade Point Average	-0.045****	-0.008	0.099****	-0.125****

Note: NPSAS correlations are weighted by selection weights. Signed deviations are Record – Report. Absolute deviations for the binary variables are identical to the mismatch rates.
[a] Indicates that there was no item nonresponse on reports of ever having been married.
* p<.05, **p<.01, *** p<.001, **** p<.0001

From these two tables, we clearly see that a relationship between estimated contact and cooperation propensity and measurement error sometimes exists, although the magnitude of the association is small. There are fewer relationships between the error sources when examining item nonresponse than examining the other measurement error indicators, all of which are functions of response deviations. Importantly, not all of the correlations are negative. In fact, many of the correlations are positive, especially for the financial aid items in the NPSAS, implying that persons with higher response propensities have more (or directional) measurement error.

4.6 Contact Propensity Versus Cooperation Propensity

Is there a difference in the *p-ε* relationship for contact versus cooperation propensity? The vast majority of the associations in Table 4.2 and Table 4.3 are mildly stronger for contact propensity than for cooperation propensity. In the WDS, few correlations that are statistically different from zero are observed with cooperation propensity. In the NPSAS, many statistically significant associations are found for cooperation propensity, but the relationship is slightly weaker than those with contact propensity.

What is happening here? The most likely explanation is that the multiple influences on both propensity and measurement error vary in their direction and strength of relationship with contact and cooperation propensity. For example, in the NPSAS, older students tend to be better reporters than younger students (see Chapter Three); younger students are both more likely to be contacted and to cooperate, but the association with cooperation propensity is much weaker than that of contact propensity (contact: $r=-0.36$, cooperation: $r=-0.09$). To the extent that age is also related to some of the survey variables of interest, then this could be a common correlate that would explain some of the differences between the two models.

Why is there a relationship between the predicted propensity and these measurement error indicators? Can any sense be made out of the directional relationships? We now return to the conceptual models discussed above. We illustrate each model with a case study from Table 4.2 or Table 4.3 and indicate other variables which also appear to fit the model.

4.7 Empirical Examples

We now look at three empirical examples that illustrate the simplified models of the relationship between nonresponse propensity and measurement error. These examples were selected because they had easily identifiable mechanisms that were consistent with the models presented in Section 4.1. (We note that not all p-ε relationships easily fit into these simplified models. We discuss limitations of the models in Section 4.8 below.)

4.7.1 Common Cause Model

In the Wisconsin Divorce Study, approximately 50 percent of the respondents misreport their divorce date. A systematic relationship between contact propensity and misreporting of divorce date is observed, such that people who have higher contact propensities are more likely to accurately report their divorce dates ($r=-0.13$, $p<.01$). Why might this relationship hold?

We expect a common cause model applies here. Education is frequently used as a measure of motivation to participate and to report well in surveys (Krosnick, Narayan and Smith 1996; Krosnick and Narayan 1996) or as a moderator of motivation (Cannell and Fowler 1963). Motivation has been posited as the common cause for survey participation and measurement error (Bollinger and David 2001).

People with higher levels of education are more likely to be contacted than people with lower levels of education ($r=0.43$, $p<.0001$, see Table A.6 for regression coefficients). People with higher levels of education are also consistently better reporters of divorce dates (measured by mismatches between the reports and records) than people with lower levels of education ($r=-0.15$, $p=0.002$). Under a Common Cause Model, we would then expect a significant negative relationship between contact propensity and inaccurate reporting of divorce date. This is what we see ($r=-0.13$, $p<.01$). Controlling for education, the relationship between contact propensity and accurate reporting of divorce dates disappears (partial $r=-0.08$, $p=0.11$). In contrast, the lack of a significant relationship between the accuracy of divorce date reporting and cooperation propensity may also be explainable by education as a common cause – a relationship between education and cooperation propensity is not observed ($r=-0.06$, $p=0.15$).

Can this relationship be used to explain the other WDS correlations between mismatches and contact propensity? To some degree, yes. For every variable, people with more education are better reporters, although the correlation between education and misreporting is significant only for the date variables (i.e., birth date, marriage date, divorce date).

Although the common cause model seems to account for the relationship between contact propensity and misreporting of divorce dates, other factors may be at work. If motivation were the factor, we would have expected the strongest relationship between propensity and measurement error to be with cooperation propensity rather than with contact propensity. Other variables may also account for the differences in reporting across the propensity distribution. For example, women are better reporters of divorce dates than men (58.0 percent inaccuracy rate for men; 43.3 percent inaccuracy rate for women, $p<.0001$), as are persons with only one marriage, compared to those who had multiple previous marriages (45.5 percent inaccuracy rate for those with one marriage; 71.8 percent inaccuracy rate for those with multiple previous marriages, $p<.0001$). Neither of these variables are correlated with contact propensity ($r=0.05$, $p=.26$ for gender; r=0.06, p=0.18 for number of marriages), and hence are unlikely to be the common cause. However, these variables may be associated with a third, unmeasured variable, that could account for the relationship between contactability and measurement error.

4.7.2 True Value Model

Under the True Value model, a systematic relationship exists between the true value of the item being measured, measurement error in reports on that item, and response propensity. In the NPSAS, the true value model may hold for reports of Grade Point Average. The strongest relationships between p and ε observed in the NPSAS are the signed and absolute response deviations for reporting of grade point average (GPA). Focusing on the absolute deviations, we see a negative relationship between response propensity and measurement error (contact propensity: r=-0.12, p<.0001; cooperation propensity: r=-0.13, p<.0001). This indicates that people with higher response propensities make smaller errors in reporting their GPA (see Figure 6).[34]

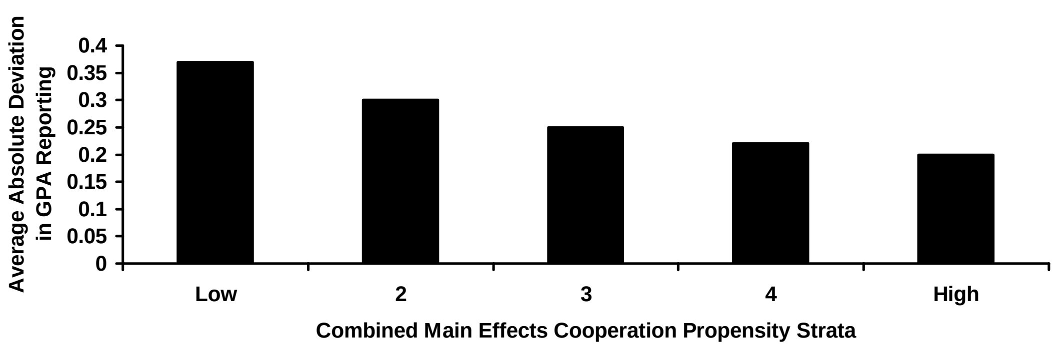

Figure 6: Average Absolute Deviation by Cooperation Propensity Strata, Combined Main Effects Model, Grade Point Average, NPSAS

[34] See Table 3.3 for distributions of reporting accuracy by GPA. Appendix Table A.146 and Table A.176 shows the signed differences by contact and cooperation propensity strata.

Students with better GPAs also make smaller errors in reporting their GPAs ($r=-0.55$ using absolute deviations, $p<.0001$). That is, measurement error is related to the true value of GPA. Students with better GPAs are more likely to be contacted and to cooperate (corr(contact p,Y)=0.116; corr(cooperation p, Y)=0.136), even though GPA does not appear as a predictor in any propensity model. So, we would expect the observed negative relationship between contact and cooperation propensity and measurement error in the reporting of GPA (Figure 6).

It is not clear which way the causal arrow goes for the GPA illustration of the True Value Model. Although GPA or other individual-level academic achievement measures are not in the propensity model, the included variables may simply proxy for good academic performance. The measurement error mechanism for GPA may be one of social desirability, persons with higher GPAs may have higher levels of cognitive capacity, or may be more likely to monitor their GPA in general. Under all of these hypotheses, persons with higher GPAs would be more accurate reporters. With a social desirability hypothesis, GPA may be a common cause for both propensity and measurement error (e.g., people who have higher GPAs are less embarrassed to talk about school-related topics in general). Under the other measurement error mechanisms, there may be a separate mechanism for response propensity.

Can other relationships between measurement error and response propensity be explained by a True Value Model? Possibly. As described in Chapter Two, a correlation between response propensity and the true value for the survey variables of interest exists for many variables, especially in the NPSAS. Almost all of the NPSAS variables also have a significant relationship between propensity and measurement error (see Table 4.2

and Table 4.3), with measurement error varying with the true value (see Table A.129). Many of these relationships are positive, in which those who are the most likely to participate are the most likely to have answers filled with measurement error. For example, people who received financial aid from their college or university are more likely to participate in the NPSAS ($r=0.19$ with contact propensity, $p<.0001$; $r=0.13$ with cooperation propensity, $p<.0001$). Measurement error in reports of institutional aid are related to the true value – more underreporting is observed than overreporting (only 7 percent overreport institutional aid; 37 percent of respondents underreport institutional aid). Under a true value model, a positive relationship between response propensity and measurement error would be expected for this variable; this is what is seen ($r=0.05$, $p<.0001$ contact propensity; $r=0.03$, $p<.0001$ cooperation propensity). This does not mean that the true value model holds for all of the NPSAS variables, but it suggests it as a likely candidate.

The true value model clearly does not identify the underlying cognitive mechanisms of measurement error, which may vary from item to item. For example, overreporting of GPA by poor academic achievers is consistent with a social desirability hypothesis, whereas underreporting of financial aid sources may be either social desirability, or lack of knowledge, or misclassification of the aid source by the respondent. However, the result of whatever cognitive process is operative is that measurement error is correlated with the true value itself. When propensities are correlated with the true value also, a compounding effect of nonresponse and measurement errors will occur.

4.7.3 Measurement Process Model

Under a measurement process model, there is a systematic difference in a component of the measurement process or recruitment protocol over the propensity distribution. One example of this could be a mode switch. Although item nonresponse could manifest theoretically from breakdowns at any point in the cognitive response process (Beatty and Herrmann 2002; Beatty et al. 1998; Krosnick 2002), self-administered modes tend to have higher levels of item nonresponse than interviewer-administered modes (de Leeuw 1992). Both of these studies had mode switches. We focus here on the WDS, as this study used a sequential mode switch, deliberately varying the prevalence of the self-administered mode over the propensity distribution.

In the WDS, people who were more likely to be contacted have less item nonresponse on divorce dates than people who were less likely to be contacted in the WDS ($r=-11$, $p<.05$). We see that whose who were easier to contact were less likely to receive the mail survey ($r=-0.10$, $p=0.02$). Additionally, those who answered by mail have higher divorce date item nonresponse rates ($r=0.18$, $p<.0001$). Thus, one possible reason for the decrease in item nonresponse in divorce dates over the propensity distribution could be an decreased prevalence of mail survey responses from those who were more likely to be contacted. That is, a change in a component of the measurement process – here, mode – is related to both response propensity and item nonresponse. It is important to note that mode is not included in any of the propensity models, so a change in prevalence of the mode switch over the contact propensity distribution is related to the other predictors in the propensity model.

Item nonresponse in reporting of the number of marriages and birth dates are also related to the mode of reporting, although the relationship is much weaker ($r=0.11$, p=0.01 for mode and item nonresponse on number of marriages, r=0.08, p=0.06 for mode and item nonresponse on birth date). This explanation does not account for item nonresponse in marriage dates, however, as no significant relationship between item nonresponse on the marriage date and the mode reporting exists (r=0.01, p=0.77).

Other factors may be at work in this example. As with inaccuracy of reporting divorce dates, people who have less than a high school degree have higher levels of item nonresponse than their more educated counterparts (less than a high school degree: 22.2 percent (SE=6.3) item nonresponse; high school degree: 9.1 percent (SE=1.9); some college: 3.7 percent (SE=1.8); college or more 7.1 percent (SE=2.4)). People with higher levels of education are also more likely to be contacted (r=0.43, p<.0001). In a multivariate logistic regression model predicting item nonresponse on reported divorce dates, education and mode both are significant predictors (Wald chi-square for mode: p<.001; education p<.05). Thus, it is possible that a common cause model with education holds for item nonresponse on divorce dates as well as for accuracy of reporting divorce dates.

4.7.4 Summary

Clear relationships between measurement error and response propensity exist in both the WDS and NPSAS. Conceptual models were introduced as explanations for the relationship between response propensity and measurement error, and empirical examples were given for three simplified models. There is evidence that people who are more likely to participate in these surveys give higher quality reports or give lower quality reports.

What are the implications of these conceptual models? First and most importantly, none of the models assert that the most reluctant or difficult to contact respondents give the worst quality data. In fact, the models can be used to understand directional measurement error even when there is no reduction in the magnitude of measurement error.

Second, the models permit many ways for the relationship between nonresponse propensity and measurement error to arise. This relationship may exist because of characteristic of the respondent that induces the relationship or because of a recruitment or measurement protocol decision that varies over the propensity distribution. To the extent that the cause for measurement error is a design feature that varies over the propensity distribution (e.g., topic interest, sponsor affiliation, interviewer behavior), experimental designs can be launched to directly test it.

Third, the models show that the causes of the two error sources may not be the same, but a common cause for the causes of response propensity and measurement error will induce a *p*-*ε* relationship. This type of relationship between propensity and measurement error may not be manipulable, but it could be anticipated.

While the case studies were chosen to illustrate each model, not all of the observed *p*-*ε* correlations can be neatly grouped into the models. We now turn to reasons why these models might fail.

4.8 Limitations of the Conceptual Models

It is difficult to diagnose why or when a correlation between response propensity and measurement error will exist. This paper illustrates three simplified models with empirical examples. It is clear that other plausible models, variants of the saturated model, could be forwarded. Much more attention on commonly-occurring relationships is warranted, especially given the state of our understanding of the nonresponse-measurement error nexus.

First, conceptual identification of the relationship between the two error sources requires understanding how and why the error sources arise in the first place. Theoretical understanding of survey participation generally relies on imprecise theories that are measured by weak indicators (see Chapter One and Two). Much, but not all, of the theoretical understanding for measurement error relies on lab experiments that attempt to isolate pieces of the cognitive response process, but may not fully reflect how or why measurement error manifests in survey conditions. Additionally, how identified causes of measurement error relate to response propensity (e.g., prevalence of interviewer probing behaviors) have not been investigated. Thus, full understanding of these models will require additional basic research looking at the joint relationship of the causes of the two error sources.

Second, empirical detection of the relationship requires having measures of the causes of the error sources. This is the largest weakness of the above analyses. For example, in the NPSAS there was no observed relationship between accuracy in reporting of Stafford loan receipt and cooperation propensity ($r=-0.007$, $p=0.27$). Is this because the Separate Causes model holds or because the appropriate joint influences on the error sources have not been identified? Both accuracy and cooperation propensity are positively, although weakly, related to the true value of having a Stafford loan (e.g., measurement error and response propensity are both related to the true value of having a Stafford loan, $r=0.13$, $p<.0001$ for measurement error; $r=0.02$, $p<.0001$ for cooperation propensity among the respondent pool), there is a negative, but nonzero relationship, between accuracy of Stafford loan receipt and cooperation propensity. This cannot be accounted for by the true value model.

The models do not explicitly account for multiple competing influences on measurement error and response propensity. There may be common or correlated causes for the two error sources, but no significant associations between propensity and measurement error when additional correlates are also in play. For example, although there is a significant association between contact propensity and the rate of accurately reporting divorce dates in the WDS, there is no association with cooperation propensity. Some of the significant predictors of cooperation propensity (gender, having children, both positive influences on propensity) are also significant predictors of the reported divorce dates matching the record divorce date (both positive influences on reporting). However, the strongest correlates of measurement error (e.g., education, $r=0.15$, $p=0.002$) are not correlated with cooperation propensity ($r=0.06$, $p=0.15$). Similarly, strong correlates of cooperation propensity (e.g., living in Wisconsin, $r=-0.19$, $p<.0001$) are not associated with accurate reporting of divorce dates ($r=0.05$, $p=0.55$). Thus, to the extent that the common or correlated causes for the error sources are offset by other influences on each error source, then no association will be observed.

Of course, nonsignificant correlations may also be due to low power to detect such a relationship. This is a likely candidate explanation for the WDS (with just over 500 respondents), but not for the NPSAS (with over 46,000 respondents).

In short, not all of the empirical results from the WDS and NPSAS fit nicely into the conceptual models. There are many reasons why this might be so. The attraction of articulating a limited number of models is that they focus on plausible mechanisms that could produce covariances between response propensities and measurement error. The next challenge is learning when they apply and when they do not, as well as confronting the issue of whether alternative models offer better explanations of empirical findings.

4.9 Sensitivity of Conclusions to Propensity Model Specification

Any model-based approach is sensitive to the specification of the model. Appendix Table A.193 through Table A.204 show the p-ε relationship for three additional contact model specifications, five alternate cooperation model specifications, and two interview model specifications (ignoring the distinction between contact and cooperation). Table A.133 through Table A.192 show each of the measurement error indicators by propensity strata. The direction of the *p-ε* relationship tends to be consistent over the various models, although the magnitude clearly differs. There is more variation in the *p-ε* relationship across models for the binary measures of measurement error (i.e., item nonresponse, mismatch rates) than for the continuous measures of measurement error (i.e., signed difference, absolute difference). The mechanisms for the direction and/or magnitude of misreporting are quite different from those for any misreporting (see Chapter Three). Additionally, there are fewer consistent or strong predictors of the continuous measures of measurement error that are also predictors of propensity than for the binary measures; thus slight variations of propensity model specification have less of an effect on the *p-ε* relationship.

Many changes in the direction or magnitude of the relationship between p and ε are also reflected in changes of the relationship between the cause and p. For instance, the relationship between item nonresponse and contact propensity is no longer statistically different from zero once interaction terms are entered in the WDS (r=-0.07, p=0.09). This is reflected in a similar lack of relationship between propensity and mode for this model (-0.07, p=0.12).

4.10 Joint Effects of Nonresponse Propensity and Measurement Error on the Statistics of Interest

Identifying drivers of the causal relationship between nonresponse propensity and measurement error is a fundamentally important goal. However, how these two error sources jointly impact the statistics of interest in the survey is equally vital. The different conceptual models vary in their implications for the statistics of interest. To the extent that the Common Cause for the error sources is known, measured, and varies over the respondent pool, conditioning on the Common Cause will ameliorate the correlation between propensity and measurement error.

The other causal models are not quite as amenable to this. The most harmful model in terms of error properties for a statistic of interest is the True Value Model. In this model, there is a nonzero relationship between p and Y, indicating that nonresponse bias exists, at least in the unadjusted respondent mean (Bethlehem 2002). The nonzero relationship between p and ε indicates that efforts to change the distribution of Y will also change the distribution of ε in the reported answers, either by increasing or decreasing the amount of measurement error.

The Common Cause model and Measurement Process model may not be directly related to the true value of interest, but show two alternate ways for the overall error properties of the respondent data set to change by bringing in lower propensity cases to the respondent pool. Again, the lower propensity cases may not be those who are higher on measurement error; but the error properties of the statistics of interest will certainly be affected.

There are many ways of evaluating the impact of measurement error on the survey estimates. A relevant question, given an observed relationship between propensity and measurement error, is whether the conclusions about the *p-Y* relationship estimated on the respondent pool alone is different using the reports instead of the records. Table 4.4 compares the *p-Y* between the reported *Y* and the record *Y* among the respondent pool only.

Table 4.4: Correlation Between Contact and Cooperation Propensity and Y for True Values and Reported Values, WDS and NPSAS

	Corr(p,Y) Contact		Corr(p,Y) Cooperation	
	Record	Report	Record	Report
WDS				
Ever Married	0.0	0.097 *	0.0	-0.031
Ever Divorced	0.0	0.129 **	0.0	-0.039
Birth date	-0.302 ****	-0.213 ****	0.080	0.043
Marriage Date	-0.194 ****	-0.126 **	0.001	-0.033
Divorce Date	-0.011	0.029	0.016	0.027
Number of marriages	0.059	0.099 *	-0.001	-0.019
NPSAS				
Applied for financial aid	0.005	0.031 ***	-0.026 ***	0.006
Received financial aid	0.061 ****	0.060 ****	0.033 ****	0.036 ****
Received Stafford loan	0.077 ****	0.054 ****	0.025 ****	0.023 ***
Received Pell Grant	-0.105 ****	-0.083 ****	-0.033 ****	-0.022 ***
Received Work Study	0.116 ****	0.061 ****	0.068 ****	0.035 ****
Amount of Work Study	0.087 ****	0.018 **	0.053 ****	0.015 *
Received State Aid	0.023 ****	0.046 ****	0.029 ****	0.032 ****
Amount of State Aid	0.084 ****	0.057 ****	0.083 ****	0.046 ****
Received Institutional Aid	0.207 ****	0.173 ****	0.106 ****	0.085 ****
Amount of Institutional Aid	0.185 ****	0.149 ****	0.069 ****	0.057 ****
Grade Point Average	0.111 ****	-0.069 ****	0.116 ****	-0.014 *

Note: NPSAS correlations are weighted. *p<.05, **p<.01, ***p<.001, ***p<.0001. Report correlations estimated on item respondents only.

Measurement error in the reports attenuates the estimated *p-Y* relationship in 11 of the 17 contact relationships and 10 of the 17 cooperation relationships. In these instances, the analyst examining the relationship between *p* and *Y* from the reports would underestimate the risk of nonresponse bias relative to that made using the records. When examined directly, the estimated nonresponse bias using the reports may be in a different direction than that using the records. This indicates that the propensity models used in Table 4.4 do not necessarily reflect the complex relationships between the true values, measurement error, and survey participation (see Table A.205 for mean record values and reports of the survey variables of interest).

In the remaining instances, the estimated correlation *p* and *Y* is stronger using the reports instead of the true value. That is, measurement error artificially inflates the estimated relationship between propensity and the survey variables (e.g., number of marriages in the WDS).[35] In these instances, there may be no relationship between the survey variable and the records, but measurement error correlated with a propensity predictor may induce an estimated relationship between the two error sources.

Measurement error may also change the direction of the *p*-*Y* relationship (e.g., grade point average). In this instance, the degree of measurement error is such that the relative ordering of the survey variables changes due to measurement error that varies in both direction and magnitude relative to the true value.

4.11 Conclusion

This article has taken a first step at developing a conceptual framework to understand the relationship between nonresponse and measurement errors. Two overall conceptual models – a Separate Causes Model and a Saturated Model – were introduced. Three special cases of the Saturated Model – a Common Cause Model, a True Value

[35] For having ever been married or ever been divorced in the WDS, no correlation between the truth and propensity could be observed in the records because of the uniformity of the true value in this special population; thus a nonzero correlation in the reports is not surprising.

model, and a Measurement Process Model – were discussed. The three special cases illustrated different ways in which propensity and measurement error could be related. These mechanisms include the measured item being subject to nonresponse bias and the true value is a primary correlate of measurement error, because other correlates of measurement error are also correlates of propensity, or because something in the measurement process changes over the propensity distribution.

These models are important for three primary reasons. First, the models suggest circumstances for a relationship between propensity and measurement error outside of the commonly hypothesized motivational cause. While motivation is one plausible common cause, many others may also exist (e.g., lack of discretionary time and rushing through the survey). Second, the models also clearly demonstrate that the relationship between propensity and measurement error may be one in which the most likely to cooperate may have higher or lower levels of measurement error in their reports. Previous discussions of the intersection of the two phenomena have asserted that only one direction is possible. Finally, the models state that the relationship between propensity and measurement error must be item-specific. Thus, we should expect variability in the p-ε relationship across items in the same survey. This also has not been previously identified.

Much work clearly remains. First, we must be cautious in diagnosing "causes" or "mechanisms" outside an experimental design. Additionally, the three special cases of the Saturated Model were selected to conveniently illustrate how the Saturated Model may be reduced to identifiable mechanisms for either nonresponse or measurement errors. We do not understand when the special cases will hold, what the likely causes may be or what are the most vulnerable items. Other special cases of the Saturated Model must exist, either in combinations of the special cases identified here or through other mechanisms.

Future research should identify how the mechanism for survey participation and for measurement error on individual items are related. Like nonresponse propensity, measurement error is a multifaceted phenomenon. Influences of the respondent, the question, and the measurement context all play a role in the final reported answer. To the extent that one measurement error mechanism dominates, then this is the most likely candidate that could link response propensity and measurement error.

This article has focused on measurement error as found in behavioral items with gold standard available in records. Measurement error on other types of items (e.g., attitudinal items) or other types of measurement error on behavioral questions (e.g., rounding) clearly could fit into a Common Cause or Concurrent Cause model. The measurement error mechanism would differ, but the rationale would be the same. Future research should explore these types of measurement error and additional types of questions.

Chapter 5

Conclusion

This dissertation examined two survey error sources – nonresponse and measurement errors – and their nexus. It did so by linking the social and psychological approaches to survey participation and measurement error with statistical approaches for each error source. Two surveys, each containing administrative records that provided a "gold standard" were examined. The two surveys covered a variety of topics, types of questions, and two different populations. What have we learned?

First, survey participation is a complex phenomenon. Ultimately, the ability to contact a sampled person and their decision to participate, after being contacted, results from a mix of multiple competing influences. As a field, we have known this for some time. This dissertation extended collective knowledge on when different causes for survey participation may manifest effects on nonresponse bias. The effects of two competing influences for contact and four competing influences for cooperation on nonresponse bias were examined for a variety of estimands.

This investigation of effects was done in two steps. First, theory was used to guide propensity model specification. Second, the same theory was used to predict the direction of the correlation between response propensity and multiple survey variables. These predictions were largely upheld. Thus, Chapter Two showed that careful consideration of the causes of survey nonparticipation, the indicators at hand for the causes, and the relationship of each to the survey variables in the study could provide purchase on the risk of nonresponse bias, at least on the unadjusted respondent mean.

Chapter Two also provided the first empirical evidence that, not only may the mean of Y vary over the propensity distribution, but the variance of the Y variables may vary as well. The variability of the Y variables over the propensity distribution may increase or decrease. While this may be a key assumption of certain statistical models (e.g., the Horvitz-Thompson estimator of the weighted mean), attention to distributional properties of the Y variables systematically changing over the propensity distribution has received little attention in the social science literature.

Predicted response propensities were also used for adjustment purposes. An empirical comparison of a two-stage adjustment, in which contact and cooperation were modeled separately, and a one-stage adjustment, in which interview was modeled directly, showed that separating contact and cooperation may yield improved adjustments, at least in terms of bias of the estimate. An evaluation of variance properties of the two-stage procedure compared to the one-stage procedure remain to be studied.

Chapter Three turned to measurement error and used the two surveys to examine current understanding about how people answer survey questions and why they make mistakes when providing an answer. Predictions were derived from the cognitive psychology approach to measurement error, and used to anticipate where failures of the true score model may occur.

Next, simple measurement error specifications were derived from the cognitive psychological literature. Cognitive psychology has often examined different functions of response deviations, ε, than that assumed by the traditional measurement error models. Any attempt to link cognitive psychological and statistical approaches to measurement error must also consider how the construct of measurement error can take different functional forms in cognitive psychology than it does in the standard statistical or psychometric literature. These different approaches to thinking about error terms were explicitly specified.

Experts were used to diagnose likely breakdowns in the cognitive response process. These expert ratings successfully discerned between items that experienced less measurement error (using a variety of indicators) and those that experienced more measurement error. Covariates of other moderators of the cognitive response process were also successfully identified.

Finally, we looked at the nexus of these two error sources in Chapter Four. The relationship between response propensity and measurement error showed great variation over items. Measurement error had no relationship with response propensity on some items, a positive relationship with response propensity for other items (counter the common hypothesis), and a negative relationship with response propensity for still other items (confirming the common hypothesis). The assertion that low propensity respondents are more likely to give answers filled with measurement error was found to be overly simple.

Chapter Four proposed conceptual models as pure types describing alternative relationships between nonresponse and measurement errors. These models explicitly state that a relationship between the two error sources arises when the causes for nonresponse propensity and measurement error interrelate. How they interrelate may vary. Empirical examples from the two surveys were selected to illustrate each of the five models, and reasons for failures of the models to explain some of the observed relationships between propensity and measurement error were discussed.

In all, we demonstrated that these survey errors do exist, and that they can be anticipated. First, nonresponse bias exists. We showed that nonresponse bias can be anticipated by using conceptually guided propensity models and careful thinking of how the causes for survey participation are related to the survey variables of interest. We also showed that classical statistical models of measurement error often fail in light of empirical data. We used conceptual guidance from cognitive psychology to anticipate when failures of a classical true score model will occur, and to link different functional forms of an error term to failures of the cognitive response process. Finally, we showed that there may be a relationship between response propensity and measurement error, but that it is more complicated than previously thought. Conceptual models were proposed to guide future work on the nexus of these error sources, and empirical examples of each were provided.

5.1 Future Work on Nonresponse Propensity and Nonresponse Bias

Many unexpected discoveries occurred in these investigations of nonresponse propensity and nonresponse bias. First, the idea of within-person variation in response propensities within a survey recruitment protocol became increasingly attractive. Traditional approaches to response propensity condition on the observed recruitment protocol, but generally fail to acknowledge this in the estimation of response propensities themselves. Legitimate reasons related to estimation based on potentially censored or endogenous variables justify not including features of the protocol in propensity models;

the unknown correlation of protocol features to the survey variables themselves may also account for this.

However, during a survey field period, any number of protocol decisions may be made that are deliberately designed to increase response propensities. A conceptual framework for understanding how and why these multiple protocol decisions affect survey participation was developed, rather unexpectedly, during the course of this dissertation. This conceptual framework reflects the dynamic nature of survey recruitment protocols in addition to characteristics of the respondents, their environment, and other influences. New estimation methods for response propensities are needed under a dynamic approach to survey participation, and the use of discrete time hazard models seems like a plausible approach (see discussion in the Appendix).

What intra-individual variation on response propensities means for understandings of nonresponse bias remains unclear. One obvious implication of a dynamic approach to response propensity is that the covariance between response propensity and the survey variables of interest is not fixed throughout a survey data collection, but instead changes over the course of a field period. In fact, design decisions can be implemented that deliberately change the nature of this covariance term. This is the basic idea behind a responsive design (Groves and Heeringa 2006), in which design features are successively implemented to augment cost and error properties of a survey recruitment protocol. How error properties of a survey are affected by successive decisions are largely unknown. More work is clearly needed to understand the implications of a dynamic approach to response propensities on estimation of these propensities and resultant effects on nonresponse bias.

Future work in nonresponse bias should also take a closer look at the error properties of a two-stage estimation approach for response propensities compared to a one-stage estimation approach. While the social science literature has had a long tradition of separating these two categories of survey nonresponse, systematic examination of their mean square error properties of two-stage postsurvey adjustment has not been evaluated statistically. Although this looks promising empirically from the data in these surveys, more work is needed analytically to understand the circumstances under which a two-stage procedure improves survey estimates.

Clear evidence of a change in the variability of the survey variables over the propensity distribution was observed. However, there is no social or psychological theory that clearly predicts differences in distributional properties as related to survey participation beyond that of the respondent mean. When will higher propensity cases be more variable on the survey characteristics being measured than lower propensity cases? When will they be less variable? Theoretical development from the social science side of survey methodology is needed to understand when changes in the full distribution of the Y variables with response propensity may arise.

To accomplish these goals, a better understanding of what leads people to participate in any particular surveys is needed. Further research on how components of the survey protocol are viewed by the sample unit and how changes in the protocol are influenced by what had happened previously clearly will bring greater understanding to why people participate in surveys. Linking these decisions to particular survey variables of interest will bring greater understanding to how participation decisions affect nonresponse bias of the final respondent pool.

5.2 Future Work on Measurement Error

Much research has investigated how and why measurement error occurs in survey reports. Other research has looked at how measurement error affects survey inference. However, the two traditions largely have not been linked. This dissertation took a first step in specifying the functional forms of the measurement error term for a few classes of items. However, more work in this area can clearly be done.

Although the cognitive response process predicts failures, and hence errors, on many types of items, a full understanding of how the direction and/or magnitude of the measurement error on particular survey questions may not be specified from the research on the cognitive response process. That is, while accuracy may be easy to predict from the cognitive response process, the degree of inaccuracy may be difficult. Purchase on the degree of inaccuracy usually arises by identifying moderators of the response effect. However, many of these moderators are unobservable or not available in surveys. More work is needed to understand how respondent attributes that are commonly available in surveys (e.g., demographics, other attitudes and behaviors) may be related to the presence and magnitude of measurement error. It is possible that heterogeneity in reporting biases exist that are not observed in laboratory or other settings and have not been previously investigated. Furthermore, cognitive theories for measurement error tend to focus on measurement error bias, rather than variance. Basic research on what leads to unreliability of answers versus biased answers is clearly needed.

More work is also needed to understand how errors on related behavioral items may interrelate. Items on similar topics may experience correlated errors. Design features that lead to correlated errors are well-studied, as are correlated errors on related attitudinal items. However, correlations of measurement errors on related behavioral items (such as the types of financial aid a student has received) have received less attention. When misclassification occurs, is the decision random as to where the misclassification occurs, or is it systematic? Is the amount of telescoping on one reported date related to the amount of telescoping on another reported date?

How can this be incorporated into survey estimates? In some instances, information from a "gold standard" is available, but only for a limited subset of respondents (Yucel and Zaslavsky 2005). Better imputation models of "truth" for the subset of the sample whose gold standard value is missing can be derived by using the cognitive response process to guide the impute model.

5.3 Future Work on Nonresponse Propensity and Measurement Error

Much work remains at the nexus of the two error sources. The conceptual models need to be evaluated on other surveys, for other types of variables, with additional propensity models. Other models, in addition to the simplified models examined here, need to be assessed. Failures of the conceptual models need to be explored in greater detail to understand how and why such failures arise empirically. More work is needed to understand what might lead to correlations between causes for measurement error and response propensity. Systematic joint review of the nonresponse and measurement error literatures for correlates of measurement error on classes of items and predictors of survey participation on surveys that measure those items is in order. This review would suggest a set of likely candidate variables for inducing correlations between the error sources. From these candidate variables, theoretical development on how the variable (or the construct that the variable proxies) is jointly related to both nonresponse and measurement errors can occur and be tested empirically.

The conceptual models will be strengthened to the extent that experimental studies can be mounted to explicitly test the models. The most likely candidate for testing would appear to be Model 5, the Measurement Process Model. This model suggests that the implementation of particular design features varies over the recruitment protocol, thereby inducing a relationship between propensity and measurement error. Systematic experimental implementation of these protocol features at varying points of the recruitment protocol can give light on the types of protocol features that are likely to affect this relationship.

Similarly, Model 3, the Common Cause Model, nicely lends itself to experimental manipulation. Again, if the Common Cause is a feature of the survey protocol (e.g., topic interest), then experimental manipulation of this cause should result in changes in the relationship between propensity and measurement error. One possible place to start is that of interviewer behavior. If interviewer behavior at the time of the recruitment request is correlated with behavior during the interview, then training or monitoring may be possible to break the relationship between the causes of propensity and measurement error.

Missing from Chapter Four was a discussion of the mean square error properties of estimates made from surveys across varying levels of response propensity. One reason for this was the lack of knowledge of measurement error among the nonrespondents. To answer the counterfactual "what would happen if we had brought in more low propensity cases" question, knowledge about the measurement error properties of the nonrespondents is needed. Future work could use the information from Chapters Three and Four to develop imputation models for the error-filled answers of the nonrespondents. These imputations could be used to simulate the effect of recruiting additional respondents on the mean square error of the survey estimate.

Following from this, a correlation between response propensity and measurement error implies that response propensities might be usefully included in imputation models for some variables, even when the goal is simply to have an analytic data set of the respondents. Future analytic and simulation work should investigate how incorporating response propensities in imputation models performs compared to or in addition to the variables in the propensity models themselves (e.g., when is a nonlinear transformation of a set of variables going to improve predictability?).

5.4 Future Work on Mixed Mode Surveys

Both of the studies considered here were mixed mode surveys, a feature that was largely ignored in the analysis. However, the mix of modes undoubtedly affects the nonresponse bias and measurement error properties of the respondent data pool. What would the error properties of the surveys be had only one mode been used? What if the order of the modes in the recruitment request been switched? Do respondents answer questions differently having received a request in one mode, followed by a request in a second mode? Nonresponse error and measurement error are likely to be affected by mode switches, but full theoretical understandings and empirical examples must be developed.

5.5 Conclusion

This dissertation provided a first look at a long-standing question – are reluctant respondents giving poor quality data. The answer is clearly that “it depends.” The conceptual models proposed in Chapter Four give some insights on what “it depends” on.

More work is needed to evaluate and test the conceptual models. To fully understand the nexus of error sources, each error source must be examined individually and in conjunction. This will provide a fertile area of research for many years to come.

Appendix A

This appendix contains detailed tables for the above analyses. It also contains a more extensive discussion of points that were not presented in the text. The appendix tables are ordered by chapter. Tables for Chapter Two are Table A.2 through Table A.110. The variables used in the analyses are in Table A.111 and Table A.112. Section A.1 provides a detailed discussion of the statistical evaluation of the propensity models. Section A.2 describes the model-building exercise using all possible interaction effects. Section A.3 describes the sensitivity in conclusions of the change in the mean over propensity strata for two illustrative statistics. Section A.4 describes a mini-simulation in which the sensitivity of the p-Y correlation is evaluated in light of two causes for p and Y. Section A.5 introduces the notion of dynamic response propensities. Table A.117 through Table A.132 comprise the tables for Chapter Three. The remaining tables are those for Chapter Four.

Table A.1: Summary of Common Indicators for Causes of Survey Participation

	Social/ Environmental Characteristics	Household / Respondent Characteristics	Survey Design Features	Most likely variables for NR bias
Fixed attribute models				
Social Integration / Isolation	Single person households, low education, minorities, foreign born, living in group quarters, children, owners	Education, income, receipt of government transfer payments, single-person households, age, employment status	None	Voting, civic participation, size of social networks, adoption of social norms
Social Cohesion	Urbanicity, Crime Rates, Population density, multi-unit structures, group structures, children or other young people, elderly, adult to child ratio, average household size, renters, housing values, minorities, foreign-born, non-mobile population, adults with professional/ managerial occupations, working adults, working males, working females, average commuting time, education, living below the poverty level	None	None	Fear of crime, attitudes towards neighborhood, attitudes toward local social services
Helping Tendencies / Altruism	Urbanicity	Reports of volunteer activity; gender	Altruistic messages; donations to charity	Volunteerism, willingness of donate to charity
Positive attitudes toward surveys	Percent college educated	Reports on surveys on surveys;	None	Attitudes towards surveys, attitudes toward value of research
Discretionary Time	Percent of workers, Household size, Commuting time, Income, House value	Employment, Income, Age, "I'm too busy" statements	Long surveys, burdensome surveys	Time use, employment variables, perceived busyness
Topic Interest	None	Survey variables, Membership in organization related to topic, Prior affiliation with topic	Survey topic	Statistics centrally related to avowed topic
Positive opinion of sponsor	Urbanicity	Education for university studies;	Sponsor	Statistic related to avowed sponsor

	Social/ Environmental Characteristics	Household / Respondent Characteristics	Survey Design Features	Most likely variables for NR bias
		measured prior affiliation with sponsor		
Decision-making models				
Social Exchange	None	SES, recipient of government transfer payments, renters, low income, high income	Incentives, TDM, respondent-friendly questionnaires, follow-up procedures	Receipt of services; Provision of funds
Social validation	None	None	Advance letters; interviewer introductions	Social networks, conformity measures
Scarcity	Surveying climate	None	Advance letters; interviewer introductions	Perceptions of oversurveying
Liking	None	Age, race, gender, religion, SES	Interviewer matching	Racial, gender attitudes; Attitudes toward similar others
Authority	Views of the president	Military, non-citizens	Sponsor; Advance letters; interviewer introductions	Trust in authority
Reciprocation	None	None	Incentives; Advance letters; interviewer introductions, door in the face, refusal conversion protocol changes	Topic interest-related variables, expectations of receiving rewards for services rendered
Consistency	None	Prior affiliation with topic or sponsor	Foot in the door appeals, Sponsor, topic	Items related to the trigger for consistency
Leverage-Saliency	None	Varies by design	Theoretically, all design features; Tested include Topic interest, incentives, follow-up procedures	Varies by leverage and saliency points

Table A.2: Means and Standard Errors for Respondent Characteristics, Overall, Noncontacts, Contacts, Contacted, no Interview, and Interviewed Cases, WDS

	Overall		Noncontacts		Contacts		Contacted, no interview		Interviews	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Female	51.3	1.8	50.4	4.2	51.5	2.1	39.1	5.9	53.2	2.2
Age	39.8	0.3	38.6	0.8	40.1	0.4	40.6	1.1	40.1	0.4
College degree or more	20.6	1.5	14.2	2.9	22.1	1.7	26.1	5.3	21.6	1.8
Some college	19.4	1.5	16.3	3.1	20.1	1.6	14.5	4.3	20.8	1.8
High school degree	46.1	1.8	50.4	4.2	45.1	2.0	52.2	6.1	44.2	2.2
Less than high school degree	9.3	1.1	14.9	3.0	7.9	1.1	2.9	2.0	8.6	1.2
Missing education	4.6	0.8	4.3	1.7	4.7	0.9	4.3	2.5	4.8	0.9
Married in Wisconsin	74.5	1.6	70.2	3.9	75.5	1.8	82.6	4.6	74.6	1.9
Divorce County Close to Sponsor	58.9	1.8	58.9	4.2	59.0	2.0	53.6	6.0	59.7	2.1
Live in Wisconsin	82.9	1.4	73.0	3.7	85.3	1.5	91.3	3.4	84.5	1.6
# children R granted custody	0.30	0.03	0.27	0.06	0.31	0.03	0.19	0.07	0.33	0.03
# children R and spouse granted joint custody	0.41	0.03	0.37	0.07	0.43	0.03	0.28	0.07	0.45	0.04
# children Spouse granted custody	0.24	0.02	0.28	0.06	0.23	0.03	0.16	0.06	0.24	0.03

Table A.3: Descriptive Statistics, Census Characteristics, by Outcome, WDS

	Overall		Noncontacts		Contacts		Contacted, no interview		Interviews	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Urban	56.1	1.7	63.1	3.7	54.5	1.9	57.0	5.5	54.1	2.0
Male	49.2	0.1	49.3	0.1	49.2	0.1	49.1	0.4	49.2	0.1
White, non-Hispanic	93.1	0.3	90.8	1.0	93.7	0.3	93.3	0.8	93.7	0.3
Hispanic	1.7	0.1	2.5	0.6	1.5	0.1	1.4	0.2	1.6	0.1
Black, non-Hispanic	3.3	0.2	4.2	0.6	3.1	0.2	3.3	0.6	3.1	0.3
Age 17 and below	25.2	0.2	24.3	0.5	25.4	0.2	24.8	0.5	25.5	0.2
Age 55+	19.6	0.2	19.5	0.6	19.6	0.2	20.8	0.7	19.5	0.3
Single person Households	24.2	0.3	25.0	0.8	24.0	0.3	24.2	0.9	23.9	0.3
Married	56.0	0.4	53.9	1.1	56.5	0.4	56.3	1.0	56.5	0.5
Drove alone to work	73.8	0.4	72.8	1.0	74.1	0.4	73.1	1.0	74.2	0.4
Commute is less than 15 minutes	38.3	0.4	37.3	0.9	38.5	0.4	40.2	1.3	38.3	0.5
Work at home	4.4	0.1	3.7	0.3	4.5	0.2	4.3	0.4	4.5	0.2
Lived in same house in 1990 as 1985	52.0	0.4	50.3	1.0	52.5	0.4	53.0	1.3	52.4	0.5
High School Graduate and higher	82.9	0.3	82.2	0.7	83.1	0.3	83.3	0.9	83.1	0.3
College graduate and higher	49.4	0.6	50.0	1.4	49.3	0.6	49.4	2.0	49.3	0.7
Managerial/Professional occupations	26.0	0.3	26.1	0.8	25.9	0.4	27.0	1.3	25.8	0.4
Households living below poverty level	19.3	0.6	20.9	1.6	19.0	0.7	20.8	2.2	18.7	0.7

Note: When the zip code in the Wisconsin Divorce Study file matched to more than one possible record in the Census data file, the most populous area was taken. This decision was made as the most likely place for the sampled unit to have lived. Of the 733 cases, 44 cases, or six percent, had more than one possible record in the Census data file.

Table A.4: Descriptive Statistics, Respondent Characteristics, by Outcome, NPSAS

	Overall		Noncontact		Contact		Contact, no Interview		Complete	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Gender										
Female	45.6	0.28	47.7	1.43	45.5	0.28	47.7	0.57	44.7	0.33
Male	54.4	0.28	52.3	1.43	54.5	0.28	52.3	0.57	55.3	0.33
Age										
Age 15-19	23.8	0.22	18.1	1.01	24.1	0.22	24.6	0.26	22.6	0.47
Age 20-21	24.8	0.24	17.8	1.09	25.1	0.25	25.1	0.29	25.0	0.49
Age 22-27	29.8	0.26	33.1	1.37	29.7	0.26	29.5	0.31	30.3	0.52
Age 28+	21.6	0.21	31.1	1.34	21.2	0.22	20.8	0.26	22.1	0.46
Has High School Diploma										
Has High School Diploma or Missing	98.7	0.06	95.8	0.46	98.8	0.06	99.0	0.06	98.2	0.13
No Diploma	1.3	0.06	4.2	0.46	1.2	0.06	1.0	0.06	1.8	0.13
Race/Ethnicity										
Hispanic	9.1	0.15	10.4	0.88	9.1	0.15	8.6	0.17	10.3	0.32
White	58.1	0.24	46.1	1.41	58.6	0.25	57.5	0.30	61.6	0.54
Black	11.3	0.17	17.3	1.02	11.1	0.18	10.7	0.20	12.2	0.41
Asian	5.2	0.12	5.4	0.65	5.2	0.12	5.4	0.15	4.9	0.23
Native Amer./Pac. Islander	1.2	0.06	2.9	0.47	1.2	0.06	1.1	0.06	1.4	0.12
Missing	14.9	0.15	17.9	1.05	14.8	0.15	16.7	0.19	9.6	0.30
Marital & Dependency Status										
Missing marital status, known independent	9.6	0.16	12.0	0.95	9.5	0.16	9.4	0.19	9.7	0.32
Married	10.0	0.17	10.2	0.88	10.0	0.17	10.2	0.20	9.6	0.33
Missing marital & dependent status	15.2	0.19	9.3	0.82	15.5	0.20	16.1	0.24	13.7	0.38
Single, divorced, widowed, or separated	65.2	0.26	68.6	1.34	65.0	0.26	64.3	0.31	67.0	0.52
Citizenship and Veteran status										
Citizen and veteran	2.7	0.10	5.9	0.78	2.6	0.10	2.6	0.11	2.7	0.20
Citizen, not veteran	85.2	0.19	78.2	1.25	85.5	0.19	85.0	0.23	86.7	0.37
Not veteran, unknown citizen	6.1	0.11	6.1	0.71	6.1	0.12	6.6	0.14	4.8	0.22
Nonresident alien	4.3	0.11	5.5	0.71	4.3	0.12	4.2	0.14	4.5	0.23
Foreign student	1.6	0.07	4.2	0.57	1.5	0.07	1.6	0.09	1.3	0.12
Year in School										
Unclassified Undergraduate	10.2	0.12	11.8	0.81	10.1	0.12	10.2	0.16	10.0	0.27
1st year	29.8	0.22	36.7	1.31	29.6	0.22	28.4	0.26	32.8	0.48
2nd year	22.7	0.24	23.1	1.24	22.6	0.24	22.7	0.28	22.5	0.51
3rd year	15.7	0.20	10.9	1.03	15.9	0.21	16.3	0.25	14.8	0.42
4th year	20.0	0.22	16.0	1.11	20.1	0.23	20.8	0.27	18.4	0.44
5th year	1.6	0.07	1.6	0.35	1.6	0.07	1.6	0.08	1.6	0.14
Spring Term Enrollment										
>1 month with full time enrollment	54.0	0.25	39.7	1.37	54.6	0.25	56.7	0.30	49.0	0.55
>1 month with part time enrollment	22.5	0.22	27.6	1.27	22.3	0.22	21.5	0.26	24.4	0.46
>1 month unknown enrollment	6.8	0.10	5.5	0.83	6.8	0.10	7.8	0.14	4.2	0.24
>1 month no enrollment, and no enrollment above	16.7	0.20	27.2	1.27	16.3	0.20	14.0	0.22	22.4	0.46

Table A.5: Descriptive Statistics, School Characteristics by Outcome, NPSAS

	Overall		Noncontact		Contact		Contact, no Interview		Complete	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
School Selectivity										
Most Selective	3.9	0.04	1.3	0.34	4.0	0.04	4.4	0.08	3.2	0.18
Very Selective	14.2	0.10	9.4	0.84	14.3	0.10	15.1	0.14	12.4	0.40
Moderately Selective	38.1	0.12	30.8	1.31	38.4	0.13	39.2	0.20	36.4	0.48
Minimally Selective	7.5	0.07	8.1	0.68	7.4	0.07	7.3	0.11	7.8	0.23
Open Admission or Not 4 year School	36.3	0.13	50.3	1.39	35.8	0.14	34.1	0.20	40.2	0.48
Region										
New England	4.5	0.04	2.6	0.40	4.6	0.05	4.4	0.08	5.1	0.19
Mid East	13.4	0.10	18.4	1.07	13.2	0.11	12.6	0.14	14.9	0.40
Great Lakes	18.4	0.09	16.3	1.08	18.5	0.10	17.9	0.17	20.0	0.40
Plains	7.2	0.05	2.8	0.43	7.4	0.06	8.5	0.10	4.5	0.19
Southeast	20.2	0.09	22.5	1.05	20.2	0.10	20.4	0.16	19.6	0.37
Southwest	16.6	0.09	19.8	1.25	16.5	0.11	15.6	0.17	18.9	0.41
Rocky Mountains	5.5	0.07	4.6	0.58	5.5	0.07	5.8	0.10	4.8	0.22
Far West	14.0	0.06	13.0	0.83	14.1	0.07	14.8	0.12	12.2	0.29
Historically Black College or University										
Not HBCU	98.4	0.08	97.0	0.35	98.5	0.08	98.6	0.05	98.3	0.28
HBCU	1.6	0.08	3.0	0.35	1.5	0.08	1.4	0.05	1.7	0.28
Hispanic Serving Institution										
Not Hispanic-Serving Institution	89.1	0.08	84.0	1.01	89.3	0.09	90.0	0.13	87.2	0.32
Hispanic-Serving Institution	10.9	0.08	16.0	1.01	10.7	0.09	10.0	0.13	12.8	0.32
Urbanicity										
Urbanicity missing	0.5	0.02	0.7	0.11	0.5	0.02	0.5	0.02	0.6	0.05
Central City	64.4	0.12	65.7	1.24	64.4	0.13	63.8	0.20	65.8	0.45
Urban Fringe	20.5	0.10	23.0	1.06	20.5	0.11	20.1	0.16	21.3	0.37
Town	12.4	0.08	8.3	0.69	12.6	0.09	13.4	0.14	10.3	0.29
Rural or Not Assigned	2.1	0.04	2.3	0.38	2.1	0.04	2.2	0.06	1.9	0.13
Proportion American Indian students										
0% American Indian	56.6	0.12	57.5	1.38	56.6	0.13	55.9	0.21	58.4	0.49
1% American Indian	35.4	0.12	34.7	1.36	35.4	0.13	36.1	0.20	33.6	0.47
>1% American Indian	8.0	0.07	7.8	0.66	8.0	0.07	8.0	0.12	8.0	0.26
Proportion Asian students										
0-1% Asian	22.8	0.11	25.3	1.12	22.7	0.12	22.7	0.18	22.8	0.39
2% Asian	17.0	0.11	17.1	1.10	17.0	0.12	16.7	0.16	17.9	0.43
3-5% Asian	31.1	0.12	27.6	1.27	31.2	0.13	30.8	0.20	32.4	0.46
6+ % Asian	29.1	0.10	30.0	1.28	29.1	0.12	29.9	0.19	26.9	0.44
Proportion Black Students										
0-3% Black	25.9	0.11	19.0	1.05	26.2	0.12	27.4	0.18	22.9	0.40
4-7% Black	27.0	0.12	19.5	1.09	27.3	0.12	27.7	0.19	26.1	0.44
8-18% Black	30.5	0.12	30.7	1.34	30.5	0.13	30.1	0.20	31.7	0.46
19% Black+	16.5	0.12	30.9	1.24	16.0	0.13	14.7	0.16	19.3	0.42
Proportion Hispanic Students										
0-1% Hispanic	16.9	0.11	15.7	0.89	17.0	0.12	17.3	0.16	16.0	0.41
2-3% Hispanic	29.2	0.12	21.2	1.15	29.5	0.12	30.9	0.19	25.8	0.43
4-11% Hispanic	28.0	0.11	27.3	1.28	28.0	0.12	27.4	0.19	29.8	0.45

	Overall		Noncontact		Contact		Contact, no Interview		Complete	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
12+% Hispanic	25.9	0.12	35.8	1.33	25.5	0.13	24.4	0.19	28.5	0.44
Level of School										
Less than 2 year	1.0	0.01	2.1	0.14	1.0	0.01	0.7	0.02	1.6	0.04
2 year	31.7	0.12	42.4	1.35	31.3	0.14	29.6	0.20	35.7	0.46
4 year non-doctorate granting	18.3	0.09	19.3	1.03	18.2	0.10	18.8	0.15	16.9	0.32
4 year doctorate granting	49.0	0.12	36.2	1.40	49.5	0.13	50.8	0.21	45.8	0.50
Number of Students										
<1483 Students	4.6	0.06	6.0	0.33	4.6	0.06	4.2	0.08	5.4	0.15
1484-5902 Students	17.0	0.10	16.9	0.88	17.0	0.10	17.3	0.15	16.2	0.31
5903-14296 students	29.4	0.12	30.1	1.25	29.3	0.13	29.0	0.19	30.2	0.47
14297+ students	49.1	0.12	47.0	1.41	49.1	0.14	49.5	0.21	48.1	0.50

Note: Students missing institution data placed in mean category.

Table A.6: Logistic Regression Coefficients and Standard Errors, Contact Propensity Models, WDS

	At-home patterns		Access Impediments		Combined	
	Coef.	SE	Coef.	SE	Coef.	SE
Intercept	-3.28 ***	1.02	0.86	0.75	-3.04*	1.24
At home patterns						
Female	0.02	0.21			0.01	0.21
Age	0.02	0.01			0.02	0.01
# Kids R. Sole Custody	0.11	0.15			0.11	0.15
# Kids R and Spouse Share Custody	0.04	0.13			0.03	0.13
# Kids Spouse Sole Custody	-0.03	0.15			-0.02	0.15
Educ. information missing	0.79	0.53			0.79	0.53
College vs. < HS	1.33 ***	0.38			1.32**	0.39
Some College vs. < HS	0.96 **	0.36			0.97**	0.37
HS vs. < HS	0.53 +	0.31			0.54+	0.31
Live in Wisconsin	0.71 **	0.24			0.61*	0.27
Prop. Drive to work alone	2.57 **	0.92			1.63	1.78
Prop. Commute <15 minutes	1.30	0.94			1.88	1.16
Prop. Work at home	10.17 **	3.45			8.25+	4.58
Access Impediments						
Prop. People live in urban areas			-0.09	0.30	-0.08	0.35
Prop. Nonwhite persons			-3.28 *	1.29	-0.72	1.62
Median Income			0.00	0.00	0.00	0.00
Prop. Married			-2.45	2.67	0.57	2.85
Prop. Age 17 and Younger			5.64	4.03	-0.08	5.09
Prop. Age 55 and Older			1.32	2.37	-0.71	2.61

+p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001

Table A.7: Logistic Regression Coefficients and Standard Errors, Contact Propensity Models, NPSAS

	At-home patterns		Access impediments		Combined main effects	
	Coef.	SE	Coef.	SE	Coef.	SE
Intercept	2.12 ****	0.12	1.87	0.35	0.84 *	0.37
At-home patterns						
Female	0.16 **	0.06			0.19 **	0.06
Age 15-19 vs. 28+	0.70 ****	0.10			0.46 ****	0.11
Age 20-21	0.62 ****	0.11			0.47 ****	0.11
Age 22-27	0.20 *	0.09			0.14	0.09
New England vs. Far west	0.28	0.17			0.02	0.20
Mid East	-0.50 ****	0.10			-0.43 ***	0.13
Great Lakes	0.00	0.10			-0.16	0.14
Plains	0.77 ****	0.18			0.50 *	0.20
Southeast	-0.24 *	0.09			-0.27 *	0.14
Southwest	-0.26 *	0.11			-0.15	0.12
Rocky Mountains	0.02	0.15			-0.20	0.18
No High School Diploma vs. HS Diploma or Diploma status unknown	-1.08 ****	0.13			-1.03 ****	0.14
Missing marital status, known independent vs. single	0.38 ***	0.11			0.38 ***	0.11
Married	0.42 ***	0.11			0.40 ***	0.12
Marital status and dependency unknown	0.56 ****	0.10			0.56 ****	0.12
>=1 month FT enrollment in Spring Term vs. Not enrolled	0.67 ****	0.08			0.65 ****	0.08
>=1 month PT enrollment	0.39 ****	0.08			0.42 ****	0.08
>=1 month enrollment level unknown	0.74 ****	0.17			0.92 ****	0.17
Year in School	0.13 ****	0.02			0.07 *	0.03
Access Impediments						
Hispanic vs. Race missing			0.23	0.13	0.25	0.13
White			0.23 *	0.09	0.25 **	0.09
Black			-0.02	0.10	0.07	0.11
Asian			0.17	0.15	0.15	0.15
Native Amer./Pac. Islander			-0.73 ***	0.19	-0.73 ***	0.19
Urbanicity missing vs. Rural			0.01	0.25	-0.06	0.26
Central City			0.05	0.18	0.00	0.19
Urban Fringe			-0.08	0.19	-0.14	0.19
Town			0.32	0.20	0.26	0.20
0% Amer. Indian vs. >1% Amer. Indian			0.15	0.10	0.13	0.11
1% American Indian			0.11	0.11	0.01	0.11
0%-1% Asian vs. >=6% Asian			-0.31 **	0.10	-0.23 *	0.12
2% Asian vs. >=6% Asian			-0.01	0.10	0.08	0.11
3-5% Asian vs. >=6% Asian			0.16	0.09	0.22 *	0.09
0-3% Black vs. >=19% Black			0.84 ****	0.10	0.60 ****	0.11
4-7% Black vs. >=19% Black			0.77 ****	0.09	0.61 ****	0.10
8-18% Black vs. >=19% Black			0.60 ****	0.08	0.47 ****	0.08
0-1% Hispanic vs. >12% Hispanic			0.36 ***	0.11	0.27 *	0.12
2-3% Hispanic vs. >12% Hispanic			0.40 ****	0.09	0.34 ***	0.10
4-11% Hispanic vs. >12% Hispanic			0.10	0.09	0.08	0.09
School Selectivity (1=Most Selective, 5=Open enrollment)			-0.21 ****	0.04	-0.20 ****	0.04
Citizenship missing			1.15 ****	0.20	1.08 ****	0.20

	At-home patterns		Access impediments		Combined main effects	
	Coef.	SE	Coef.	SE	Coef.	SE
Citizen vs. Foreign student			0.99 ****	0.16	1.08 ****	0.17
Non-resident Alien vs. Foreign student			0.97 ****	0.21	1.11 ****	0.21
<1483 vs. 14297+ students			0.12	0.12	0.19	0.13
1484-5902 vs. 14297+ students			0.19 *	0.10	0.20 *	0.10
5903-14296 vs. 14297+ students			0.12	0.08	0.14	0.08
< 2 year vs. 4 year doctoral granting			-0.15	0.16	0.07	0.17
2 year vs. 4 year doctoral granting			0.18	0.11	0.36 **	0.12
4 year non-doctoral granting vs. 4 year doctoral granting			-0.05	0.10	0.04	0.10
Public vs. For profit			0.04	0.16	0.15	0.16
Private vs. For profit			0.23	0.16	0.32 *	0.15

+p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001

Note: Many predictor variables in the NPSAS were categorized into quartiles. First, balance could be better obtained in the interaction models using quartiles (see Section A.2) Second, rather than impute for missing data on the records or further restrict the analytic data set, missingness indicators are included. For missing school characteristics (e.g., race/ethnicity composition, school size), the case is included in the category that corresponds to the sample mean school characteristic. Inclusion of an indicator for missingness on race/ethnicity composition of the school did not dramatically change the model parameters. Although missing data rates on the records were in the single digits in the NPSAS, record missing data positively predicts contact and cooperation.

Table A.8: Logistic Regression Coefficients and Standard Errors for Two Cooperation Models, Social Isolation and Social Environmental Factors Model, WDS

	Social Isolation		Social Environmental Factors	
	Coeff.	SE	Coeff.	SE
Intercept	-0.35	0.97	3.43	2.09
Social Isolation				
Respondent age	0.04*	0.02		
R=Female	4.47***	1.28		
R=Female * R age	-0.09**	0.03		
# of children whose custody given to R	0.30	0.24		
# of children whose custody given to both R and ex-spouse	0.46*	0.21		
# of children whose custody given to ex-spouse	0.56*	0.27		
Proportion single person HH	0.79	1.93		
Proportion HH below poverty status	-0.68	0.81		
Social Environmental Factors				
Prop. urban			-0.04	0.40
Prop. age 17 and younger			3.46	7.11
Prop. age 55 and older			-2.58	4.13
Prop. nonwhite			-1.41	2.14
Prop. lived in same house in 1985			-1.60	2.28
Prop. married			-1.11	3.61
Median income			0.00	0.00
Prop. some college or more			-0.98	1.71

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.9: Logistic Regression Coefficients and Standard Errors for Two Cooperation Models, Discretionary Time and Positive Affect Toward Sponsor, WDS

	Discretionary Time		Positive Affect Toward Sponsor	
	Coeff.	SE	Coeff.	SE
Intercept	3.25*	1.61	2.70 ****	0.50
Discretionary Time				
Education Missing	-0.97	0.95		
College graduate vs. no HS degree	-1.19	0.79		
Some college vs. no HS degree	-0.69	0.80		
High school grad vs. no HS degree	-1.25+	0.75		
Prop. drive alone to work	1.11	1.35		
Prop. commute 15 minutes or less to work	-1.85	1.28		
Prop. work at home	0.10	4.15		
Prop. managerial/professional occupations	-0.99	1.52		
Positive Affect Toward Sponsor				
Married in Wisconsin			-0.40	0.34
Divorce County = relevant to sponsor			0.22	0.26
Live in Wisconsin			-0.56	0.45

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.10: Logistic Regression Coefficients and Standard Errors for Combined Cooperation Model, WDS

	Combined	
	Coeff.	*SE*
Intercept	-4.73	4.15
Social Isolation		
Respondent age	0.05*	0.02
R=Female	4.70***	1.38
R=Female * R age	-0.10**	0.03
# of children whose custody given to R	0.27	0.25
# of children whose custody given to both R and ex-spouse	0.48*	0.21
# of children whose custody given to ex-spouse	0.54+	0.29
Proportion single person HH	9.67*	4.81
Proportion HH below poverty status	-0.61	0.87
Social Environmental Factors		
Prop. urban	0.10	0.51
Prop. age 17 and younger	16.27	10.29
Prop. age 55 and older	1.22	5.87
Prop. nonwhite	-1.83	3.23
Prop. lived in same house in 1985	-1.93	2.72
Prop. married	-0.95	5.20
Median income	0.00	0.00
Prop. some college or more	5.73	4.17
Discretionary Time		
Education Missing	-1.28	1.01
College graduate vs. no HS degree	-1.72+	0.85
Some college vs. no HS degree	-1.05	0.86
High school grad vs. no HS degree	-1.51+	0.80
Prop. drive alone to work	1.24	3.13
Prop. commute 15 minutes or less to work	-0.52	1.84
Prop. work at home	0.39	6.47
Prop. managerial/professional occupations	-11.13*	5.74
Positive Affect Toward Sponsor		
Married in Wisconsin	-0.52	0.38
Divorce County = relevant to sponsor	0.40	0.41
Live in Wisconsin	-0.81	0.56

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.11: Logistic Regression Coefficients and Standard Errors for Two Cooperation Models, Social Isolation Model and Social Environmental Factors Model, NPSAS

	Social Isolation		Social Environmental Factors	
	Coef.	SE	Coef.	SE
Intercept	0.68 ****	0.04	1.31 ****	0.13
Female	0.17 ****	0.03		
Age 15-19	0.22 ****	0.05		
Age 20-21	0.12 **	0.05		
Age 22-27	0.03	0.04		
No HS Diploma	-0.57 ****	0.10		
Hispanic vs. White	-0.09 *	0.04		
Black	-0.04	0.05		
Asian	0.18 **	0.06		
Native American/Pacific Islander	-0.15	0.11		
Race missing	0.65 ****	0.04		
Missing marital status, independent	0.13 **	0.05		
Married	0.19 ***	0.05		
Missing marital and dependent status	0.16 ****	0.04		
New England			-0.29 ***	0.07
Mid East			-0.28 ****	0.06
Great Lakes			-0.28 ****	0.06
Plains			0.32 ****	0.07
Southeast			-0.12	0.06
Southwest			-0.22 ****	0.06
Rocky Mountains			-0.05	0.08
Historically Black College or University			-0.07	0.17
Hispanic serving institution			-0.16 **	0.05
Urbanicity missing			0.05	0.15
Central City			-0.13	0.09
Urban Fringe			-0.14	0.09
Town			0.01	0.09
0% American Indian			0.02	0.05
1% American Indian			0.05	0.05
0%-1% Asian			-0.22 ****	0.05
2% Asian			-0.23 ****	0.05
3-5% Asian			-0.20 ****	0.04
0-3% Black			0.23 ****	0.05
4-7% Black			0.18 ****	0.05
8-18% Black			0.15 ***	0.04
0-1% Hispanic			0.12	0.06
2-3% Hispanic			0.19 ***	0.05
4-11% Hispanic			-0.05	0.04
Public			-0.07	0.05
Private for-profit			-0.10	0.08
Private, not-for-profit, no religious affiliation			-0.15 *	0.07
Less than 2 year			-0.64 ****	0.08
2 year			-0.17 ****	0.04
4 year non-doctorate granting			0.04	0.04
<1483 Students			-0.12	0.07
1484-5902 Students			0.07	0.05
5903-14296 students			-0.01	0.03

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.12: Logistic Regression Coefficients and Standard Errors for Two Cooperation Models, Discretionary Time and Positive Affect Toward Sponsor, NPSAS

Parameter	Discretionary Time Coef.	Discretionary Time SE	Positive Affect Toward Sponsor Coef.	Positive Affect Toward Sponsor SE
Intercept	0.41 ****	0.03	1.43 ****	0.04
Discretionary Time				
Year in School	0.05 ****	0.01		
>1 month with full time enrollment	0.60 ****	0.03		
>1 month with part time enrollment	0.35 ****	0.04		
>1 month unknown enrollment	1.12 ****	0.08		
Positive affect toward sponsor				
Citizen and veteran (vs. Citizen, not veteran)			0.04	0.09
Not veteran, unknown citizenship			0.42 ****	0.05
Nonresident alien			-0.01	0.06
Foreign student			0.24 *	0.11
School selectivity (1=Most Selective, 5=Open Enrollment)			-0.13 ****	0.01

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.13: Logistic Regression Coefficients and Standard Errors for One Cooperation Model, Combined, NPSAS

Parameter	Combined Coef.	Combined SE
Intercept	0.63 ****	0.15
Female	0.21 ****	0.03
Age 15-19 vs. 28+	0.06	0.05
Age 20-21	-0.05	0.05
Age 22-27	-0.08	0.04
No HS Diploma	-0.41 ****	0.10
Hispanic vs. White	0.12 *	0.05
Black	0.15 ***	0.05
Asian	0.19 **	0.06
Native American/Pacific Islander	-0.14	0.12
Race missing	0.64 ****	0.05
Missing marital status, independent vs. Single	0.19 ***	0.05
Married	0.21 ****	0.05
Missing marital and dependent status	0.14 **	0.04
Citizen and veteran vs. Citizen, not veteran	0.09	0.09
Not veteran, unknown citizenship	0.17 **	0.06
Nonresident alien	-0.06	0.07
Foreign student	0.04	0.11
School selectivity (1=Most Selective, 5=Open Enrollment)	-0.05 **	0.02
New England vs. Far West	-0.33 ****	0.08
Mid East	-0.31 ****	0.06
Great Lakes	-0.23 ***	0.06
Plains	0.32 ****	0.07
Southeast	-0.03	0.07
Southwest	-0.10	0.06
Rocky Mountains	0.07	0.08
Historically Black College or University	-0.09	0.17
Hispanic serving institution	-0.18 **	0.06

Parameter	Combined Coef.	SE
Urbanicity missing vs. Rural	0.03	0.15
Central City	-0.20 *	0.09
Urban Fringe	-0.17	0.09
Town	-0.04	0.10
0% American Indian	-0.03	0.05
1% American Indian	-0.01	0.05
0%-1% Asian	-0.17 **	0.06
2% Asian	-0.16 **	0.05
3-5% Asian	-0.14 ***	0.04
0-3% Black	0.25 ****	0.05
4-7% Black	0.23 ****	0.05
8-18% Black	0.17 ****	0.04
0-1% Hispanic	0.08	0.06
2-3% Hispanic	0.18 ***	0.05
4-11% Hispanic	-0.07	0.05
Public	-0.04	0.05
Private for-profit	-0.42 ****	0.08
Private, not-for-profit, no religious affiliation	-0.14 *	0.07
Less than 2 year	-0.44 ****	0.09
2 year	-0.02	0.05
4 year non-doctorate granting	0.08	0.04
<1483 Students	-0.03	0.07
1484-5902 Students	0.09	0.05
5903-14296 students	0.01	0.03
Discretionary Time		
Year in School	0.02	0.01
>1 month with full time enrollment	0.60 ****	0.04
>1 month with part time enrollment	0.38 ****	0.04
>1 month unknown enrollment	1.14 ****	0.08

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.14: Global tests for predictor variables, five cooperation models, NPSAS

	DF	Chi-Square	Combined Chi-Square
Social Isolation			
Female	1	37.30 ****	54.77 ****
Age	3	31.57 ****	12.61 **
High School Diploma	1	30.39 ****	15.33 ****
Race	5	269.51 ****	191.70 ****
Marital and Dependency Status	3	31.06 ****	30.06 ****
Positive Affect Toward Sponsor			
Citizenship and Veteran Status	4	62.64 ****	9.61 *
School Selectivity	1	138.93 ****	7.01 **
Social Environmental Factors			
Region	7	116.61 ****	116.36 ****
HBCU	1	0.16	0.30
Hispanic-Serving Institution	1	8.78 **	10.71 **
Urbanicity	4	13.84 *	17.10 **
% Native Americans	2	1.17	0.36
% Asians	3	31.16 ****	14.01 **
% Blacks	3	21.80 ****	26.54 ****
% Hispanics	3	38.75 ****	41.26 ****
Control and Religious Affiliation	3	5.57	29.43 ****
Level of school	3	99.74 ****	47.44 ****
Size of School	3	14.40 **	7.33
Discretionary Time			
Year in School	1	30.33 ****	3.58
Spring Enrollment Intensity	3	411.23 ****	371.50 ****

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.15: Coefficients and Standard Errors for Two Interview Models, WDS

	Main Effects Model			Interaction Model		
	Coeff.		SE	Coeff.		SE
Intercept	-6.470	*	2.550	-27.00	****	6.98
Respondent age	0.010		0.010	0.01		0.01
R=Female	0.260		0.183	-0.99		0.74
# children whose custody given to R	0.193		0.137	4.78	*	2.08
# children whose custody given to both R and ex-spouse	0.210	+	0.119	0.21	+	0.13
# children whose custody given to ex-spouse	0.154		0.140	2.06	*	0.97
Proportion single person HH	6.370	*	2.867	11.95	*	4.15
Prop. HH below poverty status	-0.394		0.525	7.34	*	3.63
Prop. Urban	0.017		0.312			
Prop. age 17 and younger	7.152		5.816	-50.70	+	27.81
Prop. age 55 and older	-0.386		3.248	49.25	+	29.12
Prop. Nonwhite	-0.962		1.632	3.98	+	2.05
Prop. lived in same house in 1985	-0.001		1.648	22.52		18.03
Prop. Married	0.938		2.896	13.67	+	6.98
Median income	0.000		0.000	0.00	***	0.00
Prop. some college or more	2.817		2.377	19.04	****	5.14
R educ. = missing vs. no HS degree	0.460		0.487	0.22		0.65
R educ. = college graduate vs. no HS degree	0.501		0.359	-0.83		0.58
R educ. = 1 to 3 years of college vs. no HS degree	0.556		0.349	0.11		0.52
R educ. = High school grad vs. no HS degree	0.063		0.297	-0.23		0.39
Prop. drive alone to work	1.576		1.761	25.67	****	6.16
Prop. commute 15 minutes or less to work	1.038		1.123	9.19		8.17
Prop. work at home	5.960		3.889	75.54	****	17.91
Prop. managerial/professional occupations	-5.729	+	3.070	-37.62	****	9.24
Married in Wisconsin	-0.116		0.210	-0.14		0.23
Divorce County close to sponsor	0.198		0.229	-1.95	+	1.04
Live in Wisconsin	0.230		0.268	0.53		0.31
R=Female* Prop. commute 15 minutes or less to work				3.47	+	1.86
R. age*# children whose custody given to ex-spouse				-0.05	*	0.02
# children custody given to R * Prop. Married				6.25	*	2.77
# children custody given to R * Prop. Drive alone to work				-9.65	*	3.67
# children custody given to R * Prop. work at home				-19.66	**	5.91
Prop. HH below poverty status * Prop. lived in same house				-13.33	*	6.09
Prop. age 17 and younger * Prop. drive alone to work				69.45	*	37.41
Prop. age 55 and older *Median income				0.00	**	0.00
Prop. age 55 and older * Prop. some college or more				-75.22	**	20.64
Prop. age 55 and older * Prop. drive alone to work				-61.83	+	34.88
Prop. age 55 and older * Prop. work at home				-253.40	***	71.57
Prop. lived in same house * Prop. drive alone to work				-47.17	+	24.62
Prop. lived in same house * Prop. Managerial /prof. occ.				59.36	**	17.69
R. Educ = missing* Divorce County close to sponsor				1.06		1.04
R. educ = College* Divorce County close to sponsor				2.63	**	0.80
R. educ. = Some College * Divorce County close to sponsor				1.52	*	0.77
R. educ = High School* Divorce County close to sponsor				1.15	+	0.67
Prop. commute <15 minutes to work * Divorce county close to sponsor				2.48		2.18
Prop. married *proportion. commute less than 15 minutes				-16.73		13.76

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.16: Logistic regression coefficients and standard errors, Interview Model, NPSAS

Parameter	Coef.	SE
Intercept	0.42 **	0.15
Female	0.21 ****	0.03
Age 15-19	0.11 *	0.05
Age 20-21	0.01	0.05
Age 22-27	-0.05	0.04
No HS Diploma	-0.56 ****	0.09
Hispanic vs. White	0.12 *	0.05
Black	0.12 **	0.04
Asian	0.17 **	0.06
Native American/Pacific Islander	-0.26 *	0.11
Race missing	0.55 ****	0.04
Missing marital status, independent	0.23 ****	0.05
Married	0.25 ****	0.05
missing marital and dependent status	0.19 ****	0.04
citizen and veteran	-0.01	0.08
not veteran, unknown citizenship	0.16 **	0.06
nonresident alien	-0.06	0.06
foreign student	-0.20 *	0.10
School selectivity (1=Most Selective, 5=Open Enrollment)	-0.08 ****	0.02
New England	-0.32 ****	0.08
Mid East	-0.35 ****	0.06
Great Lakes	-0.23 ****	0.06
Plains	0.34 ****	0.07
Southeast	-0.06	0.06
Southwest	-0.10	0.05
Rocky Mountains	0.05	0.08
Historically Black College or University	-0.12	0.14
Hispanic serving institution	-0.16 **	0.05
Urbanicity missing	0.00	0.14
Central City	-0.19 *	0.09
Urban Fringe	-0.18 *	0.09
Town	-0.02	0.09
0% American Indian	-0.01	0.05
1% American Indian	-0.01	0.05
0%-1% Asian	-0.18 ***	0.05
2% Asian	-0.13 **	0.05
3-5% Asian	-0.10 **	0.04
0-3% Black	0.30 ****	0.05
4-7% Black	0.30 ****	0.05
8-18% Black	0.23 ****	0.04
0-1% Hispanic	0.12 *	0.06
2-3% Hispanic	0.21 ****	0.05
4-11% Hispanic	-0.05	0.04
Public	-0.06	0.05
Private for-profit	-0.43 ****	0.08
Private, not-for-profit, no religious affiliation	-0.13 *	0.06
Less than 2 year	-0.40 ****	0.08
2 year	0.03	0.05
4 year non-doctorate granting	0.08	0.04

Parameter	Coef.	SE
<1483 Students	0.00	0.07
1484-5902 Students	0.11 *	0.04
5903-14296 students	0.02	0.03
Year in School	0.03 *	0.01
>1 month with full time enrollment	0.63 ****	0.04
>1 month with part time enrollment	0.40 ****	0.04
>1 month unknown enrollment	1.16 ****	0.07

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

A.1 Discussion of Statistical Evaluation of Propensity Models

The above discussion in Chapter Two evaluated the propensity models in terms of their fit with theoretical specification. We now turn to a statistical evaluation of the propensity model specification. Statistical evaluations of the efficacy of model specification procedures for nonresponse adjustments usually rely on model fit statistics and by evaluating the distribution of the predicted propensities (e.g., $1+cv^2$ of the nonresponse weights; Kish 1965; Little and Vartivarian 2005).

Table A.17: Fit Statistics, Contact Propensity Models, WDS and NPSAS

	d.f.	AIC	-2LL	Likelihood Ratio test	Percent Concordant
WDS					
Contact Models					
At-home patterns	13	704.8	676.8	41.0****	66.9
Access Impediments	6	703.7	717.7	14.1*	62.8
Combined	21	665.3	709.3	52.5****	69.2
Cooperation Models					
Social Isolation	8	418.6	400.6	25.7***	68.1
Discretionary Time	8	434.7	416.7	9.5	57.4
Positive affect toward sponsor	3	429.4	421.4	4.8	60.4
Social Environmental Factors	8	439.3	421.3	4.9	44.3
Combined	27	428.9	372.9	53.3**	75.8
NPSAS					
Contact Models					
At-home patterns	19	1929040	1929000	77063****	62.9
Access Impediments	32	1930302	1930236	75827****	63.7
Combined	51	1885669	1885565	120498****	67.0
Cooperation Models					
Social Isolation	13	7063993	7063965	79431****	54.8
Discretionary Time	4	7043914	7043904	99492****	53.3
Positive affect toward sponsor	5	7105858	7105846	37550****	42.3
Social Environmental Factors	33	7033060	7032992	110405****	59.0
Combined	55	6873028	6872916	270481****	64.0

Can a “better model” for reducing nonresponse bias be identified from the fit statistics alone? Table A.17 shows the fit statistics for the three contact models and five cooperation models estimated in each survey. The only clear story from the fit statistics is that the combined models perform better (lower AIC, higher percent concordant predictions) than the individual blocks of variables. For the blocks of covariates in the WDS, some indicators show that the model is a good one, while others provide a contradictory message (e.g., the WDS access impediments model has a slightly lower AIC than the at-home patterns model, but also has slightly lower percent concordant predictions, and a marginally significant likelihood ratio test). While there is variation in predictive power for the blocks of variables, the sample size in the NPSAS dictates that all models significantly predict contact and cooperation. The WDS models show variation in predictability (e.g., the access impediments variables do not significantly add to the model with the at-home patterns, likelihood ratio test=11.47, 8 d.f., p=.18). Other than this, there is no clear winner for model specification.

A second measure for distinguishing among the propensity models are the distributions of the predicted propensities from each model. To examine the distribution of the predicted contact and cooperation propensities, we create quintiles for each model. Although any number of discrete groups can be formed, quintiles of the predicted propensities are commonly used, and are found to be sufficient for removing up to 90 percent of the bias due to the variables in the propensity model when estimating treatment effects (Rosenbaum and Rubin 1984). Additionally, the discrete groups are designed to be illustrative rather than definitive, permitting easy identification of the trend in the change of the survey variables over the propensity strata.

Table A.18: Predicted Propensities by Propensity Strata, Contact Propensity and Cooperation Propensity, WDS and NPSAS

	Average Predicted Propensity: WDS					Average Predicted Propensity: NPSAS				
	Low	2	3	4	High	Low	2	3	4	High
Contact										
At-home patterns	0.66	0.78	0.83	0.86	0.91	0.92	0.95	0.97	0.97	0.98
Access Impediments	0.72	0.80	0.82	0.84	0.86	0.92	0.95	0.96	0.97	0.98
Combined	0.65	0.78	0.83	0.87	0.91	0.91	0.95	0.97	0.98	0.99
Cooperation										
Social Isolation	0.77	0.86	0.90	0.93	0.96	0.67	0.70	0.72	0.74	0.80
Social Environment	0.84	0.88	0.89	0.90	0.92	0.62	0.68	0.71	0.75	0.80
Discretionary Time	0.83	0.86	0.88	0.90	0.94	0.64	0.71	0.74	0.75	0.78
Positive affect toward the sponsor	0.85	0.88	0.90	0.93	--	0.68	0.69	0.71	0.74	0.77
Combined	0.72	0.86	0.91	0.95	0.98	0.56	0.66	0.72	0.77	0.85

Note: The mean propensities in the NPSAS are weighted. Due to the inclusion of only three dichotomous predictors, only four groups were created in the WDS Positive affect toward sponsor model.

Table A.18 shows the overall average predicted propensities for the eight propensity models estimated for each survey across propensity score quintiles.[36] Three comments can be made about the predicted propensities across propensity models. First, the average predicted propensity for each quintile across the three contact models is very similar, as are the predicted propensities for the five cooperation models. That is, while there is some variation across models, the conclusion about the average response propensity for high versus low propensity people does not differ greatly according to model specification. Second, the predicted propensities for the combined models are more variable than those from the individual models. That is, combining all variables in the same model stretches the predicted propensity distribution in both studies.

Third, predicted propensities for the contacted vs. uncontacted groups and cooperators vs. noncooperators within each model are very similar (Appendix Table A.30

[36] Sample sizes for each propensity strata are in Appendix Table A.29 and Table A.31; distribution of the propensities for the contacted vs. noncontacted cases across the five quintiles given in Appendix Table A.30; distribution of the predicted propensities for the cooperators vs. noncooperators across the five quintiles given in Appendix Table A.32.

and Table A.32). That is, there are generally overlapping regions of common support for the units who respond and do not respond; however, the lowest predicted propensity for the nonrespondents cases is lower than the lowest predicted propensity for the respondents in each of the models. This corresponds to the largest discrepancies between contacted and noncontacted / cooperators and noncooperators in the lowest propensity quintile for all models. Unlike a causal inference paradigm, however, we cannot discard cases in which there is no common support for those who participated and those who did not participate.

A.1.1 Statistical Evaluation of Interview Model Propensity

The combined interview models fit the data in both surveys (WDS: likelihood ratio test=42.2, 26 d.f., $p<.03$, 65.8 percent concordant predictions, NPSAS: likelihood ratio test=318238, 55 d.f., $p<.0001$; 64.4 percent concordant predictions). The real question is not model fit, but whether we end up in the same place estimating two separate models for contact and cooperation versus one model for interview directly? One way to look at this is by examining the relationship between the product of the predicted probabilities from the contact and cooperation models (the two-step prediction) and the predicted probabilities from the interview model (the one-step prediction). Since the interview model is fit on all cases, we apply the coefficients from the cooperation model to the noncontacted cases to obtain an overall two-step probability of interview for all cases (Appendix Figure 7 and Figure 8).

Using the predicted probabilities from the final contact, cooperation and interview models, including interaction effects, a strong (WDS: $r=0.65$, $p<.0001$; NPSAS: $r=0.861$, $p<.0001$), although not perfect, relationship between the predicted probabilities from the two-step prediction and the one-step prediction for the contacted cases is found. Virtually identical correlations are found true whether the noncontacted cases are included (WDS: $r=0.646$, $p<.0001$; NPSAS: $r=0.859$, $p<.0001$) or not (WDS: $r=0.648$, $p<.0001$; NPSAS $r=0.861$, $p<.0001$). Thus, there is a strong relationship between the probabilities estimated using the two-step method and those estimated using the one-step method.

A.2 Sensitivity Analysis for Main Effects Specification

The analyses in Chapter Two show that carefully specified propensity models with a priori specification of the anticipated relationship between propensity and the survey variables can lead to insights for the risk of nonresponse bias. However, as with any model-based analyses, conclusions drawn from the analyses will be sensitive to the form of the model.

There are two problems with the previous approach. First, the theories are imprecise. While the use of theory to guide variable selection limits the choice of variables to likely candidates, the actual meaning of any of the theories can be disputed. Second, indicators of the theories are weak. Given these two weaknesses, we now use the variables included in the above models for testing interaction effects. The goal for this section is to uncover possibly overlooked complexities in the pattern of propensity across the population and examine their effect on anticipating nonresponse bias.

Since we do not have clear hypotheses for particular interaction effects, this set of model building tested all possible two-way interactions among the variables included in each of the main effects models. Because of dimensionality issues, interaction effects were tested in blocks (e.g., all possible interactions with gender, with age, etc.).

For example, in the WDS Contact Model, approximately 160 interaction effects were tested. Of these, 15 were statistically significant at a $p<.10$ level, approximately the number that would be expected by chance. After identifying the significant interaction effects, all fifteen interaction effects were entered into a model. Interaction effects not significant at a $p<.10$ level were eliminated. To avoid unnecessary variability in the predicted propensities, main effects that were not significant at a $p<.10$ level and did not have an interaction effect that remained in the model were also eliminated, providing the final interaction model (Table A.71).

From this model, we then tested for balance on the covariates across quintiles of the predicted propensity score on variables included and excluded from the model by examining the interaction effect in a two-way ANOVA of the propensity score quintile and contactability (Rosenbaum and Rubin 1984). This revealed one variable without balance across the propensity score quintiles when excluded from the model. This variable was included and balance was once again restored for that variable.

This procedure was followed for all of the other models. Due to the large sample size in the NPSAS, the power for detecting significant interaction effects was high; thus, $p<.05$ was used as the retention criterion. As many of the variables are categorical, over 500 parameters were added to each of the models. The number of interaction terms were reduced, with over 200 parameters added to the NPSAS contact model, and over 300 parameters identified in both the cooperation and interview model. The NPSAS models used sample design-adjusted ANOVAs for testing for balance (Dolton, Azevedo and Smith 2006; Zanutto 2006). Appendix Table A.19 through Table A.21 show parameter estimates for the final interaction models and a summary of the tests for balance for each of these models (Table A.22). Balance was better achieved in the NPSAS main effects models than in the interaction models. There is not a clear interpretation for the interaction effects. The range for the predicted propensities for the interaction models is much wider than the main effects only model in both surveys (Table A.73).

The real question is whether including the interaction effects changes the understanding of the relationship between propensity and nonresponse bias. In every instance except for one, the answer is no (Table A.23). Conclusions on the sign of the relationship between p and Y are identical in both the main effects model and the interaction model, with most of the correlations between p and Y attenuated by including the interaction terms in the propensity model. The only instance in which there is a noticeable difference – applying for financial aid with the NPSAS cooperation model – the main effects model specification yields a correlation that is approximately zero. The inclusion of the interaction effects for this variable improves the prediction, such that the relationship between predicted propensity and the survey variable is in the direction of the observed difference between interviews and contacted, not interviewed. Thus, for this variable, a more complex relationship with cooperation propensity exists than captured by the main effects models.

Table A.19: Contact Model with Interaction Effects, NPSAS

	Coeff.		SE
Intercept	7.47	****	1.61
Female	-0.39		0.25
Age 15-19 vs. 28+	-2.46	**	0.78
Age 20-21	-1.76	*	0.77
Age 22-27	-1.02		0.67
New England vs. Far west	-0.92		0.58
Mid East	-1.92	****	0.46
Great Lakes	-1.25	*	0.55
Plains	0.83		1.00
Southeast	-1.28	*	0.52
Southwest	-0.27		0.62
Rocky Mountains	-0.82		0.92
No High School Diploma	-0.78	****	0.15
Missing marital status, known independent vs. single	0.32		0.63
Married	1.78	*	0.77
missing marital and dependent status	0.53		0.41
At least one month with full time enrollment in Spring Term vs. Not enrolled	1.11	*	0.47
At least one month with part time enrollment	0.82		0.54
At least one month unknown enrollment	3.99	**	1.16
Year in School	0.07	*	0.03
Hispanic vs. Race missing	0.62	*	0.31
White	0.23		0.23
Black	-0.10		0.31
Asian	0.18		0.30
Native American/Pacific Islander	-1.26	**	0.39
Urbanicity missing vs. Rural	-1.99	*	0.92
Central City	-1.53		0.90
Urban Fringe	-1.17		0.94
Town	0.97		1.17
0% American Indian vs. >1% American Indian	-1.60	*	0.63
1% American Indian	-0.40		0.63
0%-1% Asian vs. >=6% Asian	-0.62	****	0.14
2% Asian	-0.19		0.13
3-5% Asian	0.04		0.10
0-3% Black vs. >=19% Black	-0.46		0.57
4-7% Black	-0.09		0.53
8-18% Black	0.45		0.51
0-1% Hispanic vs. >12% Hispanic	-1.82	*	0.72
2-3% Hispanic	-2.40	**	0.70
4-11% Hispanic	-2.02	**	0.65
School Selectivity (1=Most Selective, 5=Open enrollment)	-0.51	***	0.14
Citizenship missing vs. Foreign student	-1.36		1.05
Citizen	-1.59		0.94
Non-resident Alien	-1.68		1.01
<1483 Students vs. 14297+ students	-0.49		0.61
1484-5902 Students	-0.02		0.63
5903-14296 students	-0.02		0.68
Less than 2 year vs. 4 year doctoral granting	-0.64		0.61
2 year	-0.56		0.61
4 year non-doctoral granting	-0.07		0.58

	Coeff.	SE
Public vs. For profit	-0.99	0.95
Private	-0.81	1.01
Female*Public vs. For profit	0.66 *	0.26
Female*Private	0.50	0.30
Age 15-19 vs. 28+*At least one month with FT enrollment vs. Not enrolled	0.66 **	0.25
Age 15-19 vs. 28+*At least one month with PT enrollment	0.42	0.25
Age 15-19 vs. 28+*At least one month unknown enrollment	0.31	0.21
Age 20-21*At least one month with full time enrollment vs. Not enrolled	-0.33	0.26
Age 20-21*At least one month with part time enrollment	-0.04	0.27
Age 20-21*At least one month unknown enrollment	0.04	0.21
Age 22-27*At least one month with full time enrollment vs. Not enrolled	0.14	0.62
Age 22-27*At least one month with part time enrollment	-1.02	0.78
Age 22-27*At least one month unknown enrollment	-0.30	0.43
Age 15-19 vs. 28+*Citizenship missing vs. Foreign student	1.00	0.89
Age 15-19 vs. 28+*Citizen	1.57	0.94
Age 15-19 vs. 28+*Non-resident Alien	0.84	0.77
Age 20-21*Citizenship missing vs. Foreign student	2.90 ***	0.78
Age 20-21*Citizen	2.23 **	0.77
Age 20-21*Non-resident Alien	1.06	0.67
Age 22-27*Citizenship missing vs. Foreign student	2.67 **	0.87
Age 22-27*Citizen	2.42 **	0.87
Age 22-27*Non-resident Alien	1.48 *	0.75
New England vs. Far west*Hispanic vs. Race missing	0.68	0.61
New England vs. Far west*White	0.89	0.46
New England vs. Far west*Black	0.49	0.57
New England vs. Far west*Asian	0.73	0.81
New England vs. Far west*Native American/Pacific Islander	-1.01	1.09
Mid East *Hispanic vs. Race missing	0.30	0.39
Mid East *White	1.25 ****	0.29
Mid East *Black	1.23 **	0.39
Mid East *Asian	1.23 **	0.44
Mid East *Native American/Pacific Islander	2.51 *	1.13
Great Lakes *Hispanic vs. Race missing	0.00	0.47
Great Lakes *White	0.89 *	0.36
Great Lakes *Black	0.95 *	0.46
Great Lakes *Asian	1.39 *	0.64
Great Lakes *Native American/Pacific Islander	1.40	0.98
Plains *Hispanic vs. Race missing	-2.53 *	1.10
Plains *White	-2.06 *	0.94
Plains *Black	-1.07	0.99
Plains *Asian	-3.22 **	1.22
Plains *Native American/Pacific Islander	-1.79	1.10
Southeast *Hispanic vs. Race missing	0.06	0.50
Southeast *White	0.19	0.34
Southeast *Black	0.58	0.43
Southeast *Asian	0.71	0.58
Southeast *Native American/Pacific Islander	0.63	0.78
Southwest *Hispanic vs. Race missing	-0.72	0.54
Southwest *White	-0.54	0.47
Southwest *Black	-0.31	0.54
Southwest *Asian	-0.69	0.59

	Coeff.		SE
Southwest *Native American/Pacific Islander	-0.66		0.63
Rocky Mountains *Hispanic vs. Race missing	-0.54		0.82
Rocky Mountains *White	0.37		0.50
Rocky Mountains *Black	0.42		1.04
Rocky Mountains *Asian	1.54		0.94
Rocky Mountains *Native American/Pacific Islander	-0.33		0.84
New England vs. Far west*0-3% Black vs. >=19% Black	0.64		0.67
New England vs. Far west*4-7% Black	1.46	*	0.64
New England vs. Far west*8-18% Black	0.28		0.65
Mid East *0-3% Black vs. >=19% Black	1.78	**	0.53
Mid East *4-7% Black	1.49	**	0.49
Mid East *8-18% Black	0.00		0.45
Great Lakes *0-3% Black vs. >=19% Black	1.29	*	0.54
Great Lakes *4-7% Black	1.64	**	0.51
Great Lakes *8-18% Black	-0.71		0.48
Plains *0-3% Black vs. >=19% Black	2.12	**	0.64
Plains *4-7% Black	2.97	****	0.70
Plains *8-18% Black	0.72		0.69
Southeast *0-3% Black vs. >=19% Black	1.19	*	0.52
Southeast *4-7% Black	2.08	***	0.54
Southeast *8-18% Black	0.20		0.47
Southwest *0-3% Black vs. >=19% Black	1.10	*	0.48
Southwest *4-7% Black	1.36	**	0.47
Southwest *8-18% Black	-0.05		0.48
Rocky Mountains *0-3% Black vs. >=19% Black	1.49		0.85
Rocky Mountains *4-7% Black	0.14		0.87
Rocky Mountains *8-18% Black	2.46	*	1.06
Missing marital status, known independent vs. single*Citizenship missing	0.22		0.78
Missing marital status, known independent vs. single*Citizen	0.03		0.63
Missing marital status, known independent vs. single*Non-resident Alien	0.13		0.84
Married *Citizenship missing vs. Foreign student	-1.79	*	0.89
Married *Citizen	-1.65	*	0.77
Married *Non-resident Alien	-1.18		0.86
missing marital and dependent status *Citizenship missing vs. Foreign student	2.32	***	0.60
missing marital and dependent status *Citizen	-0.31		0.38
missing marital and dependent status *Non-resident Alien	-0.62		0.68
Citizenship missing *>1 month with FT enrollment vs. Not enrolled	-1.30	*	0.55
Citizenship missing *>1 month with PT enrollment	0.47		0.69
Citizenship missing vs. Foreign student*>1 month unknown enrollment	-3.89	***	1.02
Citizen*At least one month with FT enrollment vs. Not enrolled	-0.80		0.43
Citizen*At least one month with PT enrollment	-0.49		0.51
Citizen*At least one month unknown enrollment	-2.48	*	1.01
Non-resident Alien*At least one month with FT enrollment vs. Not enrolled	-0.69		0.55
Non-resident Alien*At least one month with part time enrollment	-0.10		0.64
Non-resident Alien*At least one month unknown enrollment	-1.79		1.28
Hispanic vs. Race missing*0-1% Hispanic vs. >12% Hispanic	-0.83		0.63
Hispanic vs. Race missing*2-3% Hispanic	-0.05		0.56
Hispanic vs. Race missing*4-11% Hispanic	-1.37	****	0.35
White*0-1% Hispanic vs. >12% Hispanic	-0.10		0.34
White*2-3% Hispanic	-0.24		0.28
White*4-11% Hispanic	-1.08	****	0.26

	Coeff.	SE
Black*0-1% Hispanic vs. >12% Hispanic	-0.54	0.36
Black*2-3% Hispanic	-0.51	0.35
Black*4-11% Hispanic	-0.95 **	0.32
Asian*0-1% Hispanic vs. >12% Hispanic	1.47	1.06
Asian*2-3% Hispanic	-0.56	0.50
Asian*4-11% Hispanic	-1.28 **	0.38
Native American/Pacific Islander*0-1% Hispanic vs. >12% Hispanic	0.86	0.66
Native American/Pacific Islander*2-3% Hispanic	0.91	0.71
Native American/Pacific Islander*4-11% Hispanic	-0.18	0.50
Urbanicity missing vs. Rural*<1483 Students vs. 14297+ students	1.98 **	0.64
Urbanicity missing vs. Rural*1484-5902 Students	0.00	.
Urbanicity missing vs. Rural*5903-14296 students	0.00	.
Central City*<1483 Students vs. 14297+ students	1.54 *	0.61
Central City*1484-5902 Students	0.59	0.61
Central City*5903-14296 students	0.31	0.67
Urban Fringe*<1483 Students vs. 14297+ students	1.15	0.64
Urban Fringe*1484-5902 Students	0.22	0.62
Urban Fringe*5903-14296 students	0.17	0.68
Town*<1483 Students vs. 14297+ students	-0.85	0.66
Town*1484-5902 Students	-0.81	0.70
Town*5903-14296 students	-0.70	0.76
Urbanicity missing vs. Rural*Public vs. For profit	2.52 *	1.03
Urbanicity missing vs. Rural*Private	1.41	1.30
Central City*Public vs. For profit	1.27	0.74
Central City*Private	1.04	0.78
Urban Fringe*Public vs. For profit	0.62	0.78
Urban Fringe*Private	1.65 *	0.83
Town*Public vs. For profit	0.05	1.00
Town*Private	0.98	1.08
School Selectivity (1=Most Selective, 5=Open enrollment)*0% American Indian vs. >1% American Indian	0.41 **	0.14
School Selectivity *1% American Indian	0.11	0.14
0-3% Black vs. >=19% Black*<1483 Students vs. 14297+ students	0.00	0.35
0-3% Black vs. >=19% Black*1484-5902 Students	0.08	0.30
0-3% Black vs. >=19% Black*5903-14296 students	-0.18	0.25
4-7% Black*<1483 Students vs. 14297+ students	-1.10 **	0.32
4-7% Black*1484-5902 Students	-0.45	0.27
4-7% Black*5903-14296 students	0.10	0.25
8-18% Black*<1483 Students vs. 14297+ students	-0.60	0.31
8-18% Black*1484-5902 Students	-0.46	0.26
8-18% Black*5903-14296 students	-0.13	0.22
Public vs. For profit*0-3% Black vs. >=19% Black	0.32	0.35
Public vs. For profit*4-7% Black	-0.59	0.35
Public vs. For profit*8-18% Black	0.10	0.30
Private*0-3% Black vs. >=19% Black	-0.79	0.43
Private*4-7% Black	-1.27 **	0.37
Private*8-18% Black	0.13	0.37
Citizenship missing vs. Foreign student*0-1% Hispanic vs. >12% Hispanic	2.43 ***	0.69
Citizenship missing vs. Foreign student*2-3% Hispanic	1.63 *	0.64
Citizenship missing vs. Foreign student*4-11% Hispanic	3.75 ****	0.64
Citizen*0-1% Hispanic vs. >12% Hispanic	2.14 ***	0.58

	Coeff.		SE
Citizen*2-3% Hispanic	1.92	**	0.55
Citizen*4-11% Hispanic	2.55	****	0.51
Non-resident Alien*0-1% Hispanic vs. >12% Hispanic	2.24	*	0.89
Non-resident Alien*2-3% Hispanic	1.77	*	0.75
Non-resident Alien*4-11% Hispanic	2.00	***	0.58
Less than 2 year vs. 4 year doctoral granting*0-1% Hispanic	0.20		0.42
Less than 2 year vs. 4 year doctoral granting*2-3% Hispanic	1.73	****	0.42
Less than 2 year vs. 4 year doctoral granting*4-11% Hispanic	1.06	**	0.40
2 year*0-1% Hispanic vs. >12% Hispanic	0.73	**	0.27
2 year*2-3% Hispanic	0.81	**	0.27
2 year*4-11% Hispanic	1.02	***	0.26
4 year non-doctoral granting*0-1% Hispanic vs. >12% Hispanic	0.98	**	0.32
4 year non-doctoral granting*2-3% Hispanic	0.41		0.30
4 year non-doctoral granting*4-11% Hispanic	0.87	***	0.30
Public vs. For profit*0-1% Hispanic vs. >12% Hispanic	-0.33		0.37
Public vs. For profit*2-3% Hispanic	0.66		0.37
Public vs. For profit*4-11% Hispanic	-0.11		0.28
Private*0-1% Hispanic vs. >12% Hispanic	0.50		0.47
Private*2-3% Hispanic	1.93	****	0.47
Private*4-11% Hispanic	0.20		0.36
Missing marital status, known independent*> 1 month with FT enrollment	-0.23		0.30
Missing marital status, known independent *>1 month with PT enrollment	-0.20		0.24
Missing marital status, known independent *>1 month unknown enrollment	0.11		0.64
Married *>1 month with full time enrollment in Spring Term vs. Not enrolled	0.34		0.26
Married *At least one month with part time enrollment	0.35		0.28
Married *At least one month unknown enrollment	1.07		0.62
Missing marital and dependent status *>1 month with FT enrollment	-0.13		0.26
Missing marital and dependent status *>1 month with PT enrollment	0.05		0.29
Missing marital and dependent status *>1 month unknown enrollment	2.35	*	0.98
0-3% Black vs. >=19% Black*0-1% Hispanic vs. >12% Hispanic	-0.65		0.41
0-3% Black vs. >=19% Black*2-3% Hispanic	-1.19	**	0.35
0-3% Black vs. >=19% Black*4-11% Hispanic	-0.23		0.30
4-7% Black*0-1% Hispanic vs. >12% Hispanic	-0.12		0.39
4-7% Black*2-3% Hispanic	-0.36		0.37
4-7% Black*4-11% Hispanic	0.04		0.30
8-18% Black*0-1% Hispanic vs. >12% Hispanic	0.17		0.29
8-18% Black*2-3% Hispanic	0.21		0.29
8-18% Black*4-11% Hispanic	-0.12		0.27
Less than 2 year vs. 4 year doctoral granting*Public vs. For profit	0.50		0.61
Less than 2 year vs. 4 year doctoral granting*Private	0.09		0.69
2 year*Public vs. For profit	0.40		0.60
2 year*Private	-0.27		0.63
4 year non-doctoral granting*Public vs. For profit	-0.38		0.54
4 year non-doctoral granting*Private	-0.61		0.56

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.20: Cooperation Model with Interaction Effects, NPSAS

	Coeff.	SE
Intercept	-0.35	1.13
Female	0.11 *	0.05
Age 15-19	0.04	0.14
Age 20-21	-0.09	0.14
Age 22-27	0.06	0.13
No HS Diploma	-0.78 ***	0.22
Hispanic vs. White	-0.06	0.11
Black	0.06	0.10
Asian	-0.03	0.16
Native American/Pacific Islander	0.06	0.26
missing	0.31 **	0.10
Missing marital status, independent	1.09 **	0.35
Married	-0.01	0.33
missing marital and dependent status	0.01	0.28
citizen and veteran	0.09	0.22
not veteran, unknown citizenship	-0.28	0.19
nonresident alien	0.18	0.17
foreign student	-0.82 *	0.32
School selectivity (1=Most Selective, 5=Open Enrollment)	-0.06 *	0.03
New England	-1.15	0.66
Mid East	-1.51 *	0.75
Great Lakes	0.13	0.53
Plains	-2.78 **	0.86
Southeast	-0.42	0.45
Southwest	-1.08 *	0.45
Rocky Mountains	-1.58	0.82
Historically Black College or University	0.02	0.14
Hispanic serving institution	0.50 ****	0.12
Urbanicity missing	1.88	1.44
Central City	0.78	1.04
Urban Fringe	0.51	1.06
Town	1.99	1.09
0% American Indian	-0.05	0.21
1% American Indian	-0.09	0.18
0%-1% Asian	-0.27 ****	0.07
2% Asian	-0.24 ***	0.06
3-5% Asian	-0.16 **	0.05
0-3% Black	1.09 **	0.41
4-7% Black	0.45	0.44
8-18% Black	1.40 **	0.44
0-1% Hispanic	2.97 **	1.12
2-3% Hispanic	0.95	0.66
4-11% Hispanic	0.91	0.62
Public	0.35	0.47
Private for-profit	-0.79	0.73
Private, not-for-profit, no religious affiliation	0.90	0.85
Less than 2 year	-2.79 **	0.98
2 year	0.05	0.24
4 year non-doctorate granting	-0.14	0.17

	Coeff.	SE
<1483 Students	-0.36	0.49
1484-5902 Students	-0.17	0.42
5903-14296 students	0.59	0.60
Year in School	-0.18 *	0.09
At least one month with full time enrollment	0.56	0.33
At least one month with part time enrollment	0.72 *	0.36
At least one month unknown enrollment	2.37 *	1.20
Female*Year in school	0.05 *	0.02
New England*Age 15-19	-0.10	0.22
New England*Age 20-21	0.00	0.22
New England*Age 22-27	0.24	0.20
Mid East*Age 15-19	-0.02	0.16
Mid East*Age 20-21	-0.03	0.16
Mid East*Age 22-27	-0.13	0.15
Great Lakes*Age 15-19	0.08	0.15
Great Lakes*Age 20-21	0.20	0.15
Great Lakes*Age 22-27	-0.11	0.14
Plains*Age 15-19	0.41	0.22
Plains*Age 20-21	0.37	0.21
Plains*Age 22-27	0.35	0.20
Southeast*Age 15-19	-0.30 *	0.14
Southeast*Age 20-21	0.00	0.14
Southeast*Age 22-27	-0.21	0.13
Southwest*Age 15-19	0.09	0.16
Southwest*Age 20-21	0.20	0.15
Southwest*Age 22-27	0.07	0.14
Rocky Mountains*Age 15-19	-0.25	0.25
Rocky Mountains*Age 20-21	0.03	0.24
Rocky Mountains*Age 22-27	0.07	0.22
Age 15-19*At least one month with full time enrollment	0.18	0.13
Age 15-19*At least one month with part time enrollment	-0.30 *	0.14
Age 15-19*At least one month unknown enrollment	-0.18	0.29
Age 20-21*At least one month with full time enrollment	0.04	0.13
Age 20-21*At least one month with part time enrollment	-0.25	0.14
Age 20-21*At least one month unknown enrollment	-0.28	0.31
Age 22-27*At least one month with full time enrollment	-0.14	0.11
Age 22-27*At least one month with part time enrollment	-0.23 *	0.11
Age 22-27*At least one month unknown enrollment	-0.40	0.25
No HS Diploma*Hispanic vs. White	-0.56 *	0.27
No HS Diploma*Black	0.21	0.36
No HS Diploma*Asian	1.32 *	0.51
No HS Diploma*Native American/Pacific Islander	0.64	0.78
No HS Diploma*missing	-0.05	0.37
No HS Diploma*Missing marital status, independent	1.29 ***	0.28
No HS Diploma*Married	-0.06	0.38
No HS Diploma*missing marital and dependent status	0.53	0.30
Hispanic vs. White*At least one month with full time enrollment	0.20	0.13
Hispanic vs. White*At least one month with part time enrollment	0.46 **	0.14
Hispanic vs. White*At least one month unknown enrollment	-0.24	0.27
Black*At least one month with full time enrollment	0.02	0.12
Black*At least one month with part time enrollment	0.06	0.13

	Coeff.		SE
Black*At least one month unknown enrollment	0.61		0.31
Asian*At least one month with full time enrollment	0.38	*	0.18
Asian*At least one month with part time enrollment	-0.01		0.21
Asian*At least one month unknown enrollment	-0.10		0.37
Native American/Pacific Islander*>1 month with full time enrollment	-0.38		0.31
Native American/Pacific Islander*>1 month with part time enrollment	-0.05		0.34
Native American/Pacific Islander*>1 month unknown enrollment	-0.76		0.64
missing*At least one month with full time enrollment	0.15		0.12
missing*At least one month with part time enrollment	0.24		0.14
missing*At least one month unknown enrollment	0.48		0.32
Missing marital status, independent *citizen and veteran	-0.22		0.25
Missing marital status, independent *not veteran, unknown citizenship	0.87	****	0.19
Missing marital status, independent *nonresident alien	0.00		0.26
Missing marital status, independent *foreign student	0.63	*	0.32
Married *citizen and veteran	-0.25		0.22
Married *not veteran, unknown citizenship	-0.02		0.26
Married *nonresident alien	-0.08		0.19
Married *foreign student	0.40		0.56
missing marital and dependent status *citizen and veteran	1.10		0.69
missing marital and dependent status *not veteran, unknown citizenship	1.82	****	0.19
missing marital and dependent status *nonresident alien	1.03	**	0.33
missing marital and dependent status *foreign student	1.26	****	0.30
HBCU*Missing marital status, independent	0.97	**	0.35
HBCU*Married	0.01		0.36
HBCU*missing marital and dependent status	1.06		0.70
Urbanicity missing*Missing marital status, independent	-1.25	*	0.49
Urbanicity missing*Married	0.17		0.41
Urbanicity missing*missing marital and dependent status	1.41	*	0.67
Central City*Missing marital status, independent	-0.86	*	0.35
Central City*Married	0.29		0.32
Central City*missing marital and dependent status	-0.04		0.28
Urban Fringe*Missing marital status, independent	-0.72	*	0.35
Urban Fringe*Married	0.15		0.33
Urban Fringe*missing marital and dependent status	-0.08		0.28
Town*Missing marital status, independent	-1.19	**	0.37
Town*Married	0.38		0.34
Town*missing marital and dependent status	-0.09		0.30
Missing marital status, independent *>1 month with full time enrollment	-0.32	*	0.15
Missing marital status, independent *>1 month with part time enrollment	-0.22		0.13
Missing marital status, independent *>1 month unknown enrollment	-0.50		0.31
Married *At least one month with full time enrollment	0.13		0.14
Married *At least one month with part time enrollment	0.06		0.14
Married *At least one month unknown enrollment	-0.36		0.30
Missing marital and dependent status *>1 month with FT enrollment	-0.16		0.11
Missing marital and dependent status *>1 month with part time enrollment	0.14		0.13
Missing marital and dependent status *>1 month unknown enrollment	1.18	**	0.39
Citizen and veteran *At least one month with full time enrollment	0.30		0.24
Citizen and veteran *At least one month with part time enrollment	0.12		0.25
Citizen and veteran *At least one month unknown enrollment	-0.57		0.46
Not veteran, unknown citizenship *>1 month with full time enrollment	0.15		0.19
Not veteran, unknown citizenship *>1 month with part time enrollment	0.06		0.19

	Coeff.		SE
Not veteran, unknown citizenship *>1 month unknown enrollment	-1.48	****	0.26
Nonresident alien *At least one month with full time enrollment	-0.26		0.19
Nonresident alien *At least one month with part time enrollment	-0.53	*	0.21
Nonresident alien *At least one month unknown enrollment	0.17		0.39
Foreign student *At least one month with full time enrollment	0.59		0.32
Foreign student *At least one month with part time enrollment	0.40		0.39
Foreign student *At least one month unknown enrollment	3.73	**	1.17
Hispanic Serving Institution*New England	0.00		.
Hispanic Serving Institution*Mid East	-0.45	*	0.20
Hispanic Serving Institution*Great Lakes	-1.53	****	0.26
Hispanic Serving Institution*Plains	0.39		0.80
Hispanic Serving Institution*Southeast	-0.46		0.32
Hispanic Serving Institution*Southwest	-0.47	**	0.16
Hispanic Serving Institution*Rocky Mountains	0.00		.
New England*0% American Indian	0.42		0.37
New England*1% American Indian	0.28		0.39
Mid East*0% American Indian	0.72		0.64
Mid East*1% American Indian	0.96		0.64
Great Lakes*0% American Indian	-0.61		0.35
Great Lakes*1% American Indian	-0.75	*	0.35
Plains*0% American Indian	-0.40		0.31
Plains*1% American Indian	0.07		0.29
Southeast*0% American Indian	0.35		0.22
Southeast*1% American Indian	0.44	*	0.20
Southwest*0% American Indian	0.47	*	0.20
Southwest*1% American Indian	0.33		0.17
Rocky Mountains*0% American Indian	0.49		0.50
Rocky Mountains*1% American Indian	0.11		0.46
New England*0-3% Black	-0.59		0.38
New England*4-7% Black	-0.68		0.35
New England*8-18% Black	-0.62		0.33
Mid East*0-3% Black	-0.28		0.30
Mid East*4-7% Black	-0.07		0.26
Mid East*8-18% Black	-0.21		0.24
Great Lakes*0-3% Black	0.06		0.25
Great Lakes*4-7% Black	-0.13		0.24
Great Lakes*8-18% Black	-0.27		0.24
Plains*0-3% Black	-0.54		0.36
Plains*4-7% Black	-0.65		0.36
Plains*8-18% Black	-1.12	**	0.36
Southeast*0-3% Black	-0.38		0.26
Southeast*4-7% Black	-0.08		0.23
Southeast*8-18% Black	-0.39		0.23
Southwest*0-3% Black	0.03		0.25
Southwest*4-7% Black	-0.07		0.25
Southwest*8-18% Black	-0.02		0.25
Rocky Mountains*0-3% Black	1.49	**	0.56
Rocky Mountains*4-7% Black	1.14	*	0.57
Rocky Mountains*8-18% Black	3.45	****	0.80
New England*0-1% Hispanic	-1.16		1.02
New England*2-3% Hispanic	0.44		0.34

	Coeff.	SE
New England*4-11% Hispanic	0.22	0.28
Mid East*0-1% Hispanic	-1.28	0.89
Mid East*2-3% Hispanic	0.53 **	0.20
Mid East*4-11% Hispanic	-0.02	0.15
Great Lakes*0-1% Hispanic	-1.78 *	0.86
Great Lakes*2-3% Hispanic	0.22	0.22
Great Lakes*4-11% Hispanic	-0.13	0.20
Plains*0-1% Hispanic	0.67	0.99
Plains*2-3% Hispanic	2.09 ***	0.54
Plains*4-11% Hispanic	0.73	0.55
Southeast*0-1% Hispanic	-1.59	0.86
Southeast*2-3% Hispanic	0.43 *	0.21
Southeast*4-11% Hispanic	-0.01	0.18
Southwest*0-1% Hispanic	-1.46	0.89
Southwest*2-3% Hispanic	0.26	0.24
Southwest*4-11% Hispanic	0.00	0.16
Rocky Mountains*0-1% Hispanic	-2.22 *	1.04
Rocky Mountains*2-3% Hispanic	0.36	0.49
Rocky Mountains*4-11% Hispanic	-0.15	0.41
New England*Public	0.23	0.31
New England*Private for-profit	0.63	1.10
New England*Private, not-for-profit, no religious affiliation	0.58	0.34
Mid East*Public	0.13	0.25
Mid East*Private for-profit	0.45	0.32
Mid East*Private, not-for-profit, no religious affiliation	0.54	0.31
Great Lakes*Public	0.06	0.24
Great Lakes*Private for-profit	0.21	0.31
Great Lakes*Private, not-for-profit, no religious affiliation	0.29	0.32
Plains*Public	0.96 ***	0.29
Plains*Private for-profit	1.36 **	0.42
Plains*Private, not-for-profit, no religious affiliation	1.73 ****	0.40
Southeast*Public	0.18	0.25
Southeast*Private for-profit	-0.14	0.28
Southeast*Private, not-for-profit, no religious affiliation	0.27	0.34
Southwest*Public	0.12	0.25
Southwest*Private for-profit	0.18	0.34
Southwest*Private, not-for-profit, no religious affiliation	1.14	1.13
Rocky Mountains*Public	-0.35	0.31
Rocky Mountains*Private for-profit	-0.61	0.43
Rocky Mountains*Private, not-for-profit, no religious affiliation	0.00	.
New England*Less than 2 year	1.29	1.11
New England*2 year	0.40	0.29
New England*4 year non-doctorate granting	0.59 *	0.25
Mid East*Less than 2 year	0.53	0.35
Mid East*2 year	0.29	0.19
Mid East*4 year non-doctorate granting	0.37 *	0.18
Great Lakes*Less than 2 year	1.06 **	0.34
Great Lakes*2 year	0.28	0.17
Great Lakes*4 year non-doctorate granting	0.49 **	0.19
Plains*Less than 2 year	1.91 ***	0.52
Plains*2 year	1.74 ****	0.27

	Coeff.	SE
Plains*4 year non-doctorate granting	1.07 ****	0.21
Southeast*Less than 2 year	1.03 ***	0.28
Southeast*2 year	-0.10	0.17
Southeast*4 year non-doctorate granting	0.23	0.17
Southwest*Less than 2 year	0.87 *	0.35
Southwest*2 year	0.26	0.18
Southwest*4 year non-doctorate granting	0.17	0.20
Rocky Mountains*Less than 2 year	0.70	0.56
Rocky Mountains*2 year	0.02	0.47
Rocky Mountains*4 year non-doctorate granting	-0.20	0.28
New England*<1483 Students	-0.87 *	0.38
New England*1484-5902 Students	-0.49	0.28
New England*5903-14296 students	-0.17	0.22
Mid East*<1483 Students	-0.26	0.31
Mid East*1484-5902 Students	-0.15	0.21
Mid East*5903-14296 students	-0.19	0.15
Great Lakes*<1483 Students	-0.49	0.33
Great Lakes*1484-5902 Students	-0.27	0.22
Great Lakes*5903-14296 students	0.16	0.16
Plains*<1483 Students	-0.36	0.38
Plains*1484-5902 Students	-0.52	0.30
Plains*5903-14296 students	-0.53 *	0.22
Southeast*<1483 Students	-0.38	0.28
Southeast*1484-5902 Students	-0.13	0.20
Southeast*5903-14296 students	-0.02	0.15
Southwest*<1483 Students	0.09	0.33
Southwest*1484-5902 Students	0.15	0.21
Southwest*5903-14296 students	-0.17	0.14
Rocky Mountains*<1483 Students	-0.44	0.58
Rocky Mountains*1484-5902 Students	0.49	0.48
Rocky Mountains*5903-14296 students	-0.19	0.24
Year in school*New England	0.03	0.06
Year in school*Mid East	0.08	0.05
Year in school*Great Lakes	0.17 ***	0.05
Year in school*Plains	0.24 ***	0.06
Year in school*Southeast	0.04	0.04
Year in school*Southwest	0.16 **	0.05
Year in school*Rocky Mountains	0.24 ***	0.07
New England*At least one month with full time enrollment	0.75 ***	0.23
New England*At least one month with part time enrollment	0.79 **	0.24
New England*At least one month unknown enrollment	1.29	0.78
Mid East*At least one month with full time enrollment	0.40 *	0.16
Mid East*At least one month with part time enrollment	0.33	0.17
Mid East*At least one month unknown enrollment	2.31 ****	0.57
Great Lakes*At least one month with full time enrollment	0.43 **	0.15
Great Lakes*At least one month with part time enrollment	0.33 *	0.16
Great Lakes*At least one month unknown enrollment	0.37	0.29
Plains*At least one month with full time enrollment	0.49 **	0.18
Plains*At least one month with part time enrollment	0.29	0.21
Plains*At least one month unknown enrollment	3.31 ***	0.86
Southeast*At least one month with full time enrollment	0.45 **	0.14

	Coeff.		SE
Southeast*At least one month with part time enrollment	0.42	**	0.15
Southeast*At least one month unknown enrollment	-0.14		0.32
Southwest*At least one month with full time enrollment	0.18		0.15
Southwest*At least one month with part time enrollment	-0.05		0.15
Southwest*At least one month unknown enrollment	0.49		0.38
Rocky Mountains*At least one month with full time enrollment	0.28		0.20
Rocky Mountains*At least one month with part time enrollment	0.25		0.23
Rocky Mountains*At least one month unknown enrollment	0.85		0.71
Hispanic Serving Institution*<1483 Students	-1.02	****	0.25
Hispanic Serving Institution*1484-5902 Students	-0.56	***	0.16
Hispanic Serving Institution*5903-14296 students	-0.25	*	0.12
Urbanicity missing*0-3% Black	0.70		0.64
Urbanicity missing*4-7% Black	2.75	***	0.78
Urbanicity missing*8-18% Black	-0.65		0.51
Central City*0-3% Black	-0.25		0.30
Central City*4-7% Black	0.01		0.34
Central City*8-18% Black	-0.74	*	0.35
Urban Fringe*0-3% Black	-0.50		0.32
Urban Fringe*4-7% Black	0.14		0.36
Urban Fringe*8-18% Black	-0.79	*	0.37
Town*0-3% Black	-0.52		0.33
Town*4-7% Black	-0.17		0.37
Town*8-18% Black	-1.07	**	0.38
Urbanicity missing*0-1% Hispanic	-0.10		0.96
Urbanicity missing*2-3% Hispanic	-1.72	*	0.74
Urbanicity missing*4-11% Hispanic	-0.49		0.70
Central City*0-1% Hispanic	-1.51	*	0.73
Central City*2-3% Hispanic	-1.21		0.64
Central City*4-11% Hispanic	-1.01		0.62
Urban Fringe*0-1% Hispanic	-1.48	*	0.73
Urban Fringe*2-3% Hispanic	-1.37	*	0.64
Urban Fringe*4-11% Hispanic	-1.06		0.62
Town*0-1% Hispanic	-1.97	*	0.78
Town*2-3% Hispanic	-1.76	*	0.70
Town*4-11% Hispanic	-1.15		0.69
Urbanicity missing*Public	-2.72	**	0.88
Urbanicity missing*Private for-profit	-1.69		1.09
Urbanicity missing*Private, not-for-profit, no religious affiliation	0.00		.
Central City*Public	0.03		0.37
Central City*Private for-profit	0.19		0.58
Central City*Private, not-for-profit, no religious affiliation	-1.30	*	0.59
Urban Fringe*Public	0.14		0.38
Urban Fringe*Private for-profit	0.00		0.58
Urban Fringe*Private, not-for-profit, no religious affiliation	-1.15		0.61
Town*Public	-0.17		0.39
Town*Private for-profit	0.01		0.68
Town*Private, not-for-profit, no religious affiliation	-0.73		0.63
Urbanicity missing*<1483 Students	0.80		0.50
Urbanicity missing*1484-5902 Students	0.00		.
Urbanicity missing*5903-14296 students	0.00		.
Central City*<1483 Students	0.70		0.42

	Coeff.	SE
Central City*1484-5902 Students	0.02	0.37
Central City*5903-14296 students	-0.29	0.58
Urban Fringe*<1483 Students	1.01 *	0.44
Urban Fringe*1484-5902 Students	0.28	0.38
Urban Fringe*5903-14296 students	-0.03	0.58
Town*<1483 Students	0.45	0.43
Town*1484-5902 Students	-0.30	0.39
Town*5903-14296 students	-0.60	0.60
Year in school*Urbanicity missing	-0.45 *	0.19
Year in school*Central City	0.09	0.08
Year in school*Urban Fringe	0.09	0.09
Year in school*Town	0.01	0.09
Urbanicity missing*At least one month with full time enrollment	0.83	0.55
Urbanicity missing*At least one month with part time enrollment	1.58 **	0.53
Urbanicity missing*At least one month unknown enrollment	0.64	1.23
Central City*At least one month with full time enrollment	0.11	0.25
Central City*At least one month with part time enrollment	0.33	0.28
Central City*At least one month unknown enrollment	-0.48	1.08
Urban Fringe*At least one month with full time enrollment	0.24	0.26
Urban Fringe*At least one month with part time enrollment	0.42	0.29
Urban Fringe*At least one month unknown enrollment	-0.09	1.10
Town*At least one month with full time enrollment	0.41	0.26
Town*At least one month with part time enrollment	0.57	0.30
Town*At least one month unknown enrollment	-1.04	1.08
0% American Indian*<1483 Students	0.03	0.20
0% American Indian*1484-5902 Students	0.55 **	0.18
0% American Indian*5903-14296 students	-0.14	0.16
1% American Indian*<1483 Students	0.08	0.21
1% American Indian*1484-5902 Students	0.27	0.18
1% American Indian*5903-14296 students	-0.33 *	0.16
At least one month with full time enrollment*0% American Indian	-0.34 *	0.15
At least one month with full time enrollment*1% American Indian	-0.13	0.15
At least one month with part time enrollment*0% American Indian	-0.60 ***	0.16
At least one month with part time enrollment*1% American Indian	-0.39 *	0.16
At least one month unknown enrollment *0% American Indian	0.52	0.53
At least one month unknown enrollment *1% American Indian	1.16 *	0.54
0-3% Black*Public	-0.46 *	0.21
4-7% Black*Private for-profit	-1.06 ****	0.26
8-18% Black*Private, not-for-profit, no religious affiliation	0.14	0.40
0-3% Black*Public	-0.09	0.20
4-7% Black*Private for-profit	-0.87 **	0.28
8-18% Black*Private, not-for-profit, no religious affiliation	0.24	0.37
0-3% Black*Public	-0.20	0.19
4-7% Black*Private for-profit	-0.70 **	0.24
8-18% Black*Private, not-for-profit, no religious affiliation	0.17	0.35
Less than 2 year*Public	1.27	0.96
Less than 2 year*Private for-profit	2.57 *	1.00
Less than 2 year*Private, not-for-profit, no religious affiliation	0.55	0.99
2 year*Public	-0.31	0.21
2 year*Private for-profit	0.97 *	0.41
2 year*Private, not-for-profit, no religious affiliation	-0.35	0.36

	Coeff.	SE
4 year non-doctorate granting*Public	-0.05	0.13
4 year non-doctorate granting*Private for-profit	0.98 **	0.36
4 year non-doctorate granting*Private, not-for-profit, no religious affiliation	-0.12	0.18
>1 month with FT enrollment*Public	-0.26 *	0.13
>1 month with FT enrollment*Private for-profit	-0.29	0.19
>1 month with FT enrollment*Private, not-for-profit, no religious affiliation	-0.25	0.19
>1 month with PT enrollment*Public	-0.39 *	0.17
>1 month with PT enrollment*Private for-profit	-0.74 **	0.24
>1 month with PT enrollment*Private, not-for-profit, no religious affiliation	-0.59 *	0.24
>1 month unknown enrollment *Public	-1.04	1.16
>1 month unknown enrollment *Private for-profit	-1.09	1.22
>1 month unknown enrollment *Private, not-for-profit, no religious affiliation	-2.34	1.26

Table A.21: Interview Model with Interaction Effects, NPSAS

	Coeff.		SE
Intercept	-2.27		1.64
Female	-0.13		0.09
Age 15-19	0.46	*	0.19
Age 20-21	-0.10		0.19
Age 22-27	-0.09		0.18
No HS Diploma	-1.04	****	0.21
Hispanic vs. White	0.08		0.07
Black	0.00		0.07
Asian	0.19	*	0.09
Native American/Pacific Islander	-0.33	*	0.17
missing	0.75	****	0.07
Missing marital status, independent	1.41	***	0.36
Married	-0.24		0.37
missing marital and dependent status	0.84	**	0.32
citizen and veteran	0.06		0.09
not veteran, unknown citizenship	0.50	****	0.09
nonresident alien	-0.16	*	0.08
foreign student	-0.40	***	0.12
School selectivity (1=Most Selective, 5=Open Enrollment)	-0.09	*	0.04
New England	1.32		1.04
Mid East	2.54		1.39
Great Lakes	2.11		1.10
Plains	0.93		1.31
Southeast	2.44	*	1.02
Southwest	-2.22	****	0.52
Rocky Mountains	0.63		0.91
Historically Black College or University	-1.41	**	0.44
Hispanic serving institution	-0.24		0.73
Urbanicity missing	8.27	****	1.88
Central City	3.76	*	1.60
Urban Fringe	3.49	*	1.61
Town	5.52	***	1.64
0% American Indian	-0.97	****	0.23
1% American Indian	-0.85	****	0.22
0%-1% Asian	-0.28		0.17
2% Asian	-0.41		0.22
3-5% Asian	-0.15		0.13
0-3% Black	0.33		0.39
4-7% Black	-0.41		0.41
8-18% Black	0.63		0.41
0-1% Hispanic	4.01	**	1.25
2-3% Hispanic	1.05		0.79
4-11% Hispanic	-0.73		0.76
Public	0.06		0.43
Private for-profit	-1.69		0.89
Private, not-for-profit, no religious affiliation	1.79		0.56
Less than 2 year	-1.73	****	0.22
2 year	-0.15		0.14
4 year non-doctorate granting	-0.26		0.15

	Coeff.		SE
<1483 Students	-1.06	*	0.50
1484-5902 Students	-0.49		0.45
5903-14296 students	2.51	****	0.64
Year in School	-0.15		0.09
At least one month with full time enrollment	0.72	****	0.05
At least one month with part time enrollment	0.39	****	0.05
At least one month unknown enrollment	1.47	****	0.11
Female*Year in School	0.04	*	0.02
Female*Hispanic vs. White	0.05		0.09
Female*Black	0.15		0.09
Female*Asian	-0.04		0.12
Female*Native American/Pacific Islander	0.11		0.22
Female*missing	-0.51	****	0.09
Female*No HS diploma	0.44	*	0.21
Female*Citizen	0.20	****	0.05
Female*New England	-0.05		0.13
Female*Mid East	0.10		0.10
Female*Great Lakes	0.12		0.09
Female*Plains	0.00		0.13
Female*Southeast	0.08		0.09
Female*Southwest	0.13		0.10
Female*Rocky Mountains	0.26		0.14
New England*Age 15-19	-0.16		0.23
New England*Age 20-21	-0.02		0.23
New England*Age 22-27	0.23		0.21
Mid East*Age 15-19	-0.04		0.16
Mid East*Age 20-21	-0.02		0.16
Mid East*Age 22-27	-0.05		0.15
Great Lakes*Age 15-19	0.11		0.15
Great Lakes*Age 20-21	0.21		0.15
Great Lakes*Age 22-27	-0.11		0.14
Plains*Age 15-19	0.35		0.24
Plains*Age 20-21	0.26		0.23
Plains*Age 22-27	0.24		0.21
Southeast*Age 15-19	-0.36	*	0.14
Southeast*Age 20-21	-0.05		0.14
Southeast*Age 22-27	-0.22		0.12
Southwest*Age 15-19	0.10		0.16
Southwest*Age 20-21	0.19		0.16
Southwest*Age 22-27	0.09		0.14
Rocky Mountains*Age 15-19	-0.26		0.26
Rocky Mountains*Age 20-21	-0.01		0.25
Rocky Mountains*Age 22-27	0.13		0.21
School selectivity (1=Most Selective, 5=Open Enrollment)*Age 15-19	-0.09	*	0.04
School selectivity (1=Most Selective, 5=Open Enrollment)*Age 20-21	0.01		0.04
School selectivity (1=Most Selective, 5=Open Enrollment)*Age 22-27	0.00		0.04
No HS Diploma*Missing marital status, independent	1.14	****	0.25
No HS Diploma*Married	-0.16		0.38
No HS Diploma*missing marital and dependent status	0.39		0.27
New England*Missing marital status, independent	-0.35		0.26
New England*Married	-0.29		0.29

	Coeff.		SE
New England*missing marital and dependent status	-0.42	*	0.20
Mid East*Missing marital status, independent	-0.11		0.20
Mid East*Married	-0.03		0.20
Mid East*missing marital and dependent status	-0.22		0.16
Great Lakes*Missing marital status, independent	-0.50	**	0.17
Great Lakes*Married	0.05		0.19
Great Lakes*missing marital and dependent status	-0.57	***	0.16
Plains*Missing marital status, independent	-0.58		0.28
Plains*Married	-0.04		0.25
Plains*missing marital and dependent status	-0.51	**	0.19
Southeast*Missing marital status, independent	-0.56	**	0.17
Southeast*Married	0.12		0.18
Southeast*missing marital and dependent status	-0.65	****	0.16
Southwest*Missing marital status, independent	-0.37	*	0.18
Southwest*Married	0.23		0.18
Southwest*missing marital and dependent status	-0.61	****	0.15
Rocky Mountains*Missing marital status, independent	-0.44		0.26
Rocky Mountains*Married	0.24		0.24
Rocky Mountains*missing marital and dependent status	-0.25		0.22
Hispanic Serving Institution*Missing marital status, independent	0.66	****	0.16
Hispanic Serving Institution*Married	-0.13		0.14
Hispanic Serving Institution*missing marital and dependent status	0.96	****	0.18
Urbanicity missing*Missing marital status, independent	-1.22	**	0.45
Urbanicity missing*Married	0.25		0.42
Urbanicity missing*missing marital and dependent status	1.23	*	0.60
Central City*Missing marital status, independent	-0.95	**	0.32
Central City*Married	0.35		0.32
Central City*missing marital and dependent status	-0.04		0.27
Urban Fringe*Missing marital status, independent	-0.88	**	0.33
Urban Fringe*Married	0.22		0.33
Urban Fringe*missing marital and dependent status	-0.22		0.27
Town*Missing marital status, independent	-1.11	**	0.35
Town*Married	0.49		0.34
Town*missing marital and dependent status	0.04		0.29
Missing marital status, independent *0-3% Black	0.00		0.16
Missing marital status, independent *4-7% Black	0.35	*	0.15
Missing marital status, independent *8-18% Black	0.29	*	0.13
Married *0-3% Black	-0.09		0.16
Married *4-7% Black	0.21		0.15
Married *8-18% Black	0.07		0.13
Missing marital and dependent status *0-3% Black	-0.45	**	0.16
Missing marital and dependent status *4-7% Black	-0.22		0.14
Missing marital and dependent status *8-18% Black	-0.03		0.13
Missing marital status, independent *At least one month with full time enrollment	-0.42	**	0.13
Missing marital status, independent *At least one month with part time enrollment	-0.19		0.11
Missing marital status, independent *At least one month unknown enrollment	-0.33		0.23
Married *At least one month with full time enrollment	0.11		0.12
Married *At least one month with part time enrollment	0.18		0.12
Married *At least one month unknown enrollment	-0.26		0.23
Missing marital and dependent status *At least one month with full time enrollment	-0.21	*	0.10
Missing marital and dependent status *At least one month with part time enrollment	0.06		0.12

	Coeff.		SE
Missing marital and dependent status *At least one month unknown enrollment	1.33	****	0.33
Hispanic Serving Institution*citizen and veteran	-0.23		0.26
Hispanic Serving Institution*not veteran, unknown citizenship	-1.36	****	0.17
Hispanic Serving Institution*nonresident alien	0.02		0.15
Hispanic Serving Institution*foreign student	-0.05		0.36
Urbanicity missing*New England	-2.63		1.41
Urbanicity missing*Mid East	-3.49	**	1.31
Urbanicity missing*Great Lakes	-0.62		1.31
Urbanicity missing*Plains	-1.99		1.40
Urbanicity missing*Southeast	-1.75		1.07
Urbanicity missing*Southwest	0.84		0.52
Urbanicity missing*Rocky Mountains	2.23		1.47
Central City*New England	-1.57		0.94
Central City*Mid East	-3.56	**	1.18
Central City*Great Lakes	-2.16	*	0.93
Central City*Plains	-2.00		1.07
Central City*Southeast	-2.19	*	0.89
Central City*Southwest	0.37		0.23
Central City*Rocky Mountains	-0.76	*	0.35
Urban Fringe*New England	-0.93		0.94
Urban Fringe*Mid East	-3.10	**	1.19
Urban Fringe*Great Lakes	-1.79		0.94
Urban Fringe*Plains	-1.28		1.08
Urban Fringe*Southeast	-1.93	*	0.89
Urban Fringe*Southwest	-0.15		0.26
Urban Fringe*Rocky Mountains	-0.65		0.61
Town*New England	-1.15		0.98
Town*Mid East	-3.65	**	1.21
Town*Great Lakes	-2.11	*	0.93
Town*Plains	-2.28	*	1.06
Town*Southeast	-2.04	*	0.90
Town*Southwest	0.00		.
Town*Rocky Mountains	0.00		.
New England*0% American Indian	0.20		0.38
New England*1% American Indian	0.17		0.39
Mid East*0% American Indian	0.43		0.54
Mid East*1% American Indian	0.69		0.53
Great Lakes*0% American Indian	-0.59		0.40
Great Lakes*1% American Indian	-0.76		0.39
Plains*0% American Indian	-1.07	**	0.33
Plains*1% American Indian	-0.78	*	0.31
Southeast*0% American Indian	-0.11		0.26
Southeast*1% American Indian	-0.07		0.23
Southwest*0% American Indian	0.42	*	0.21
Southwest*1% American Indian	0.22		0.18
Rocky Mountains*0% American Indian	-0.51		0.51
Rocky Mountains*1% American Indian	-0.72		0.46
New England*0-3% Black	-0.26		0.35
New England*4-7% Black	-0.43		0.33
New England*8-18% Black	-0.21		0.32
Mid East*0-3% Black	0.00		0.30

	Coeff.		SE
Mid East*4-7% Black	0.24		0.25
Mid East*8-18% Black	0.10		0.24
Great Lakes*0-3% Black	0.25		0.26
Great Lakes*4-7% Black	0.27		0.24
Great Lakes*8-18% Black	0.03		0.24
Plains*0-3% Black	-0.10		0.33
Plains*4-7% Black	-0.24		0.33
Plains*8-18% Black	-0.72	*	0.33
Southeast*0-3% Black	-0.12		0.27
Southeast*4-7% Black	0.46		0.24
Southeast*8-18% Black	0.04		0.23
Southwest*0-3% Black	0.50		0.26
Southwest*4-7% Black	0.45		0.26
Southwest*8-18% Black	0.46		0.26
Rocky Mountains*0-3% Black	1.26	*	0.55
Rocky Mountains*4-7% Black	0.85		0.60
Rocky Mountains*8-18% Black	2.70	****	0.63
New England*0-1% Hispanic	-3.39	**	1.10
New England*2-3% Hispanic	0.51		0.37
New England*4-11% Hispanic	0.23		0.29
Mid East*0-1% Hispanic	-2.34	*	1.02
Mid East*2-3% Hispanic	0.71	**	0.24
Mid East*4-11% Hispanic	0.13		0.18
Great Lakes*0-1% Hispanic	-2.42	*	1.00
Great Lakes*2-3% Hispanic	0.81	***	0.23
Great Lakes*4-11% Hispanic	0.63	***	0.19
Plains*0-1% Hispanic	-1.42		1.09
Plains*2-3% Hispanic	1.42	**	0.46
Plains*4-11% Hispanic	0.33		0.44
Southeast*0-1% Hispanic	-2.98	**	1.00
Southeast*2-3% Hispanic	0.34		0.23
Southeast*4-11% Hispanic	0.07		0.19
Southwest*0-1% Hispanic	-2.00	*	1.02
Southwest*2-3% Hispanic	1.28	****	0.30
Southwest*4-11% Hispanic	0.36	*	0.14
Rocky Mountains*0-1% Hispanic	-3.95	***	1.12
Rocky Mountains*2-3% Hispanic	0.03		0.50
Rocky Mountains*4-11% Hispanic	0.29		0.42
New England*Public	0.22		0.30
New England*Private for-profit	2.91	**	1.02
New England*Private, not-for-profit, no religious affiliation	0.43		0.32
Mid East*Public	-0.03		0.24
Mid East*Private for-profit	0.29		0.29
Mid East*Private, not-for-profit, no religious affiliation	0.19		0.27
Great Lakes*Public	-0.12		0.24
Great Lakes*Private for-profit	0.51		0.29
Great Lakes*Private, not-for-profit, no religious affiliation	-0.04		0.28
Plains*Public	0.89	**	0.30
Plains*Private for-profit	0.31		0.39
Plains*Private, not-for-profit, no religious affiliation	0.98	**	0.36
Southeast*Public	0.27		0.22

	Coeff.		SE
Southeast*Private for-profit	-0.16		0.26
Southeast*Private, not-for-profit, no religious affiliation	-0.16		0.27
Southwest*Public	0.51	*	0.24
Southwest*Private for-profit	-0.07		0.31
Southwest*Private, not-for-profit, no religious affiliation	1.01		1.10
Rocky Mountains*Public	-0.76	*	0.31
Rocky Mountains*Private for-profit	-1.23	*	0.50
Rocky Mountains*Private, not-for-profit, no religious affiliation	0.00		.
New England*Less than 2 year	-1.24		1.04
New England*2 year	0.24		0.28
New England*4 year non-doctorate granting	0.52	*	0.24
Mid East*Less than 2 year	0.56		0.33
Mid East*2 year	0.04		0.18
Mid East*4 year non-doctorate granting	0.16		0.17
Great Lakes*Less than 2 year	0.85	*	0.34
Great Lakes*2 year	0.07		0.18
Great Lakes*4 year non-doctorate granting	0.38	*	0.19
Plains*Less than 2 year	1.62	***	0.47
Plains*2 year	1.45	****	0.28
Plains*4 year non-doctorate granting	1.14	****	0.23
Southeast*Less than 2 year	0.80	**	0.30
Southeast*2 year	-0.44	*	0.17
Southeast*4 year non-doctorate granting	0.08		0.17
Southwest*Less than 2 year	0.35		0.34
Southwest*2 year	0.23		0.17
Southwest*4 year non-doctorate granting	0.36		0.20
Rocky Mountains*Less than 2 year	0.17		0.63
Rocky Mountains*2 year	0.07		0.51
Rocky Mountains*4 year non-doctorate granting	-0.15		0.29
New England*<1483 Students	-1.10	**	0.38
New England*1484-5902 Students	-0.72	*	0.28
New England*5903-14296 students	-0.48	*	0.21
Mid East*<1483 Students	-0.34		0.28
Mid East*1484-5902 Students	-0.34		0.20
Mid East*5903-14296 students	-0.47	**	0.14
Great Lakes*<1483 Students	-0.97	**	0.32
Great Lakes*1484-5902 Students	-0.60	**	0.22
Great Lakes*5903-14296 students	-0.28		0.15
Plains*<1483 Students	-0.30		0.38
Plains*1484-5902 Students	-0.60		0.31
Plains*5903-14296 students	-0.78	**	0.23
Southeast*<1483 Students	-0.48		0.27
Southeast*1484-5902 Students	-0.29		0.21
Southeast*5903-14296 students	-0.25		0.15
Southwest*<1483 Students	0.61	*	0.30
Southwest*1484-5902 Students	0.25		0.22
Southwest*5903-14296 students	-0.08		0.14
Rocky Mountains*<1483 Students	-1.35	*	0.59
Rocky Mountains*1484-5902 Students	0.32		0.47
Rocky Mountains*5903-14296 students	-0.81	**	0.27
Year in School*New England	-0.01		0.06

	Coeff.		SE
Year in School*Mid East	0.03		0.05
Year in School*Great Lakes	0.14	**	0.04
Year in School*Plains	0.23	***	0.06
Year in School*Southeast	0.02		0.04
Year in School*Southwest	0.16	**	0.05
Year in School*Rocky Mountains	0.23	***	0.07
HBCU*Urbanicity missing	0.00		.
HBCU*Central City	1.15	**	0.36
HBCU*Urban Fringe	0.26		0.43
HBCU*Town	1.13	*	0.49
HBCU*<1483 Students	1.07	**	0.40
HBCU*1484-5902 Students	0.71	**	0.27
HBCU*5903-14296 students	0.00		.
Hispanic Serving Institution*Urbanicity missing	-2.43	**	0.86
Hispanic Serving Institution*Central City	-0.66		0.71
Hispanic Serving Institution*Urban Fringe	-0.32		0.72
Hispanic Serving Institution*Town	0.00		.
Hispanic Serving Institution*0% American Indian	1.08	****	0.23
Hispanic Serving Institution*1% American Indian	1.14	****	0.24
Hispanic Serving Institution*<1483 Students	-0.90	****	0.22
Hispanic Serving Institution*1484-5902 Students	-0.71	****	0.16
Hispanic Serving Institution*5903-14296 students	-0.61	****	0.12
Urbanicity missing*0-3% Black	-1.20		0.89
Urbanicity missing*4-7% Black	1.63	*	0.80
Urbanicity missing*8-18% Black	-1.19	*	0.48
Central City*0-3% Black	-0.23		0.33
Central City*4-7% Black	0.35		0.36
Central City*8-18% Black	-0.61		0.35
Urban Fringe*0-3% Black	-0.45		0.34
Urban Fringe*4-7% Black	0.53		0.37
Urban Fringe*8-18% Black	-0.58		0.36
Town*0-3% Black	-0.31		0.36
Town*4-7% Black	0.21		0.38
Town*8-18% Black	-0.90	*	0.38
Urbanicity missing*0-1% Hispanic	-3.46	***	0.97
Urbanicity missing*2-3% Hispanic	-4.20	****	0.92
Urbanicity missing*4-11% Hispanic	-0.49		0.84
Central City*0-1% Hispanic	-2.62	**	0.80
Central City*2-3% Hispanic	-2.78	***	0.75
Central City*4-11% Hispanic	-0.28		0.73
Urban Fringe*0-1% Hispanic	-2.76	***	0.80
Urban Fringe*2-3% Hispanic	-3.13	****	0.75
Urban Fringe*4-11% Hispanic	-0.38		0.73
Town*0-1% Hispanic	-3.20	***	0.86
Town*2-3% Hispanic	-3.36	****	0.82
Town*4-11% Hispanic	-0.49		0.79
Urbanicity missing*Public	-2.52	**	0.86
Urbanicity missing*Private for-profit	-1.86		1.34
Urbanicity missing*Private, not-for-profit, no religious affiliation	0.00		.
Central City*Public	-0.06		0.39
Central City*Private for-profit	1.60		0.88

	Coeff.		SE
Central City*Private, not-for-profit, no religious affiliation	-2.00	****	0.51
Urban Fringe*Public	-0.02		0.40
Urban Fringe*Private for-profit	1.15		0.88
Urban Fringe*Private, not-for-profit, no religious affiliation	-2.05	****	0.53
Town*Public	-0.49		0.41
Town*Private for-profit	0.80		0.97
Town*Private, not-for-profit, no religious affiliation	-1.60	**	0.57
Urbanicity missing*<1483 Students	0.96	*	0.41
Urbanicity missing*1484-5902 Students	0.00		.
Urbanicity missing*5903-14296 students	0.00		.
Central City*<1483 Students	1.17	**	0.43
Central City*1484-5902 Students	0.40		0.41
Central City*5903-14296 students	-1.95	**	0.63
Urban Fringe*<1483 Students	1.56	**	0.45
Urban Fringe*1484-5902 Students	0.74		0.41
Urban Fringe*5903-14296 students	-1.65	**	0.63
Town*<1483 Students	0.68		0.45
Town*1484-5902 Students	0.00		0.43
Town*5903-14296 students	-2.34	***	0.64
Year in School*Urbanicity missing	-0.33		0.17
Year in School*Central City	0.11		0.08
Year in School*Urban Fringe	0.09		0.08
Year in School*Town	-0.01		0.09
0% American Indian*0-1% Hispanic	1.02	***	0.30
0% American Indian*2-3% Hispanic	1.25	****	0.28
0% American Indian*4-11% Hispanic	0.60	**	0.22
1% American Indian*0-1% Hispanic	1.32	****	0.30
1% American Indian*2-3% Hispanic	1.47	****	0.25
1% American Indian*4-11% Hispanic	0.63	**	0.19
0% American Indian*<1483 Students	0.44	*	0.21
0% American Indian*1484-5902 Students	0.73	****	0.18
0% American Indian*5903-14296 students	-0.08		0.17
1% American Indian*<1483 Students	0.43	*	0.21
1% American Indian*1484-5902 Students	0.21		0.17
1% American Indian*5903-14296 students	-0.29		0.16
Less than 2 year*0-1% Hispanic	0.63	**	0.20
Less than 2 year*2-3% Hispanic	1.12	****	0.18
Less than 2 year*4-11% Hispanic	0.51	**	0.17
2 year*0-1% Hispanic	0.43	**	0.15
2 year*2-3% Hispanic	0.15		0.13
2 year*4-11% Hispanic	0.19		0.11
4 year non-doctorate granting*0-1% Hispanic	0.41	*	0.17
4 year non-doctorate granting*2-3% Hispanic	0.16		0.15
4 year non-doctorate granting*4-11% Hispanic	0.12		0.13
School selectivity (1=Most Selective, 5=Open Enrollment)*0%-1% Asian	0.00		0.04
School selectivity (1=Most Selective, 5=Open Enrollment)*2% Asian	0.06		0.05
School selectivity (1=Most Selective, 5=Open Enrollment)*3-5% Asian	0.02		0.03

Note: +p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001.

Table A.22: Summary of p-values on Interaction Effect in Two-way ANOVA, with Outcome and Five Propensity Strata, Testing Balance on All Covariates in Model, WDS and NPSAS

	WDS				NPSAS			
	p>.05	.01<p<.05	.001<p <.01	p<.001	p>.05	.01<p<.05	.001< p <.01	p<.001
Contact								
At home patterns	16	0	0	0	17	1	1	1
Access impediments	16	0	0	0	6	3	5	6
Combined	16	0	0	0	11	3	2	4
Interaction	15	1	0	0	12	5	1	2
Cooperation								
Social Isolation	22	1	0	0	6	1	3	10
Social Cohesion	23	0	0	0	4	3	4	9
Discretionary Time	22	1	0	0	11	2	3	4
I like the sponsor	21	2	0	0	7	3	1	9
Combined	21	1	1	0	11	2	3	4
Interaction	23	0	0	0	8	1	2	9
Interview								
Combined	23	0	0	0	10	3	3	4
Interaction	23	0	0	0	8	1	3	8

Table A.23: Correlation Between Predicted Propensity and Survey Variables, Contact, Cooperation, and Interview Interaction Models, and Contact*Cooperation Interaction Model, WDS and NPSAS

	Contact	Coop.	Contact * Coop.	Interview
	Corr(p,Y)	Corr(p,Y)	Corr(p,Y)	Corr(p,Y)
WDS				
Length of marriage	0.196	0.020[a]	0.171	0.140
Months between divorce and interview	-0.012[a]	0.038[a]	-0.009[a]	-0.003[a]
Number of marriages	0.010[a]	-0.007[a]	0.002[a]	-0.026[a]
Age at marriage	0.071[a]	-0.095[a]	-0.012[a]	-0.034[a]
Age at divorce	0.237	-0.057[a]	0.149	0.112
NPSAS				
Applied for financial aid	-0.013	0.024	0.017	0.002
Received financial aid	0.023	0.067	0.064	0.052
Received Stafford loan	0.089	0.073	0.081	0.075
Amount of Stafford loan	0.063	0.073	0.075	0.072
Received Pell Grant	-0.088	-0.010	-0.029	-0.039
Amount of Pell Grant	-0.054	0.017	0.001	-0.001
Received Work Study	0.088	0.079	0.090	0.090
Amount of Work Study	0.070	0.060	0.069	0.070
Received State Aid	0.013	0.058	0.054	0.048
Amount of State Aid	0.055	0.093	0.095	0.093
Received Institutional Aid	0.134	0.111	0.128	0.129
Amount of Institutional Aid	0.122	0.077	0.095	0.090
GPA	0.080	0.125	0.130	0.129
Did not take ACT/SAT	-0.207	-0.266	-0.243	-0.231

Note: Product of contact and cooperation applied the cooperation model to the noncontacted cases.
[a] indicates that the estimated correlation is not significantly different from zero.

Table A.24: Percentage Difference in Unadjusted Estimate from Target and Adjusted Estimate from Target, WDS and NPSAS

	Interview	Main Effects		Interaction Effects	
	Unadj.	Two-Stage	One Stage	Two-Stage	One Stage
	%	%	%	%	%
WDS					
Length of marriage (months)	2.96	1.07	1.10	0.19	0.41
Months between divorce and interview	1.43	1.46	1.60	1.43	0.64
Number of marriages	-1.64	-2.37	-2.18	-2.46	-1.64
Age at marriage (years)	-0.52	-0.70	-0.62	-0.48	-0.16
Age at divorce (years)	0.47	-0.22	-0.18	-0.31	-0.11
NPSAS					
Applied for Financial Aid	1.17	1.31	1.33	1.17	1.37
Received Financial Aid	2.29	1.75	1.78	1.49	1.71
Received Stafford Loan	4.41	3.53	3.57	2.68	3.15
Amount of Stafford Loan	4.39	3.08	3.12	2.43	2.79
Received Pell Grant	-0.21	0.98	1.08	0.62	1.03
Amount of Pell Grant	1.42	1.93	2.06	1.56	1.84
Received Work Study	12.32	6.87	6.77	5.51	5.93
Amount of Work Study	14.06	8.41	8.29	7.03	7.41
Received State Aid	4.33	3.00	3.05	2.40	2.73
Amount of State Aid Received	8.42	4.27	4.30	3.46	3.73
Received Institutional Aid	7.37	3.41	3.32	2.72	2.83
Amount of Institutional Aid	9.54	4.32	4.16	3.42	4.11
GPA	2.06	1.52	1.52	1.37	1.49
Did not take SAT or ACT	-5.31	0.41	0.50	0.41	-0.01

Table A.25: Correlation Between Propensity Predictors and Survey Variables of Interest, WDS

	Length of marriage	Months between divorce and interview	Number of marriages	Age at marriage	Age at divorce
Respondent age	0.686****	0.173****	0.247****	0.449****	0.973****
R=Female	0.010	-0.010	0.015	-0.174****	-0.126***
# of children whose custody given to R	-0.002	0.065+	-0.010	-0.149****	-0.104**
# of children whose custody given to both R and ex-spouse	0.128***	-0.076*	-0.106**	-0.146****	0.012
# of children whose custody given to ex-spouse	0.022	0.004	-0.049	-0.115**	-0.065+
Prop. single person HH	-0.019	0.005	-0.013	0.012	0.001
Prop. HH below poverty status	0.030	-0.145****	0.018	-0.044	-0.011
Prop. urban	0.009	0.053	0.020	0.056	0.053
Prop. age 17 and younger	0.018	-0.016	0.079*	-0.016	-0.007
Prop. age 55 and older	-0.023	-0.013	0.032	-0.020	-0.031
Prop. nonwhite	0.014	0.037	0.025	-0.038	-0.014
Prop. lived in same house in 1985	-0.009	-0.036	0.034	-0.041	-0.047
Prop. married	0.008	-0.022	0.025	-0.009	-0.007
Median income	0.035	0.043	-0.059	0.032	0.052
% of people with some college or more	0.017	0.019	-0.096**	0.064+	0.068
Resp. education (less than high school=1, college=4)	0.120**	-0.008	-0.083*	0.090*	0.183****
Resp. education missing	-0.054	0.013	0.024	0.023	-0.026
Prop. drive alone to work	-0.018	-0.014	0.090*	0.027	-0.003
Prop. commute 15 minutes or less to work	-0.003	0.001	0.069	0.007	0.006
Prop. work at home	0.013	-0.013	-0.050	-0.075*	-0.039
Prop. with managerial/ professional occupations	0.026	0.015	-0.067*	0.058	0.069*
Married in Wisconsin	-0.114**	0.029	-0.054	-0.027	-0.134***
Divorce county close to sponsor	0.039	-0.015	-0.138***	0.049	0.077*
Live in Wisconsin	0.066+	-0.088*	-0.007	0.051	0.087*

Table A.26: Distribution of Applying for Financial Aid, Receiving Financial Aid, Receiving Stafford Loans, and the Amount of the Stafford Loan, by Propensity Predictors, NPSAS

	Applied for Financial Aid		Received Financial Aid		Received Stafford Loan		Amount of Stafford Loan	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Gender								
Female	76.7	0.3	67.6	0.4	38.1	0.4	1807.6	21.3
Male	67.8	0.4	59.0	0.4	33.0	0.4	1540.9	23.3
Age								
Age 15-19	79.2	0.4	71.4	0.5	36.1	0.5	1117.4	23.6
Age 20-21	75.2	0.5	68.6	0.5	39.6	0.6	1765.2	28.7
Age 22-27	69.5	0.5	59.3	0.5	36.8	0.5	1987.3	32.9
Age 28+	66.8	0.6	55.4	0.6	29.7	0.6	1806.9	39.3
Has HS Diploma								
Has HS diploma or status missing	73.1	0.2	64.1	0.3	36.2	0.3	1703.7	15.5
No Diploma	37.3	2.1	28.5	1.8	8.0	1.0	368.5	62.7
Race/Ethnicity								
Hispanic	78.2	0.8	65.1	0.9	31.7	0.8	1491.9	47.9
White	69.6	0.3	61.6	0.4	36.3	0.3	1693.9	20.1
Black	86.4	0.6	76.3	0.7	44.3	0.9	2241.6	57.9
Asian	68.4	1.2	57.8	1.2	28.1	1.1	1247.7	58.6
Native Amer. /Pacific Islander	73.5	2.1	64.9	2.3	32.8	2.2	1577.9	128.8
Race missing	72.1	0.6	63.2	0.7	32.9	0.6	1514.7	37.4
Marital & Dependency Status								
Missing marital status, independent	29.5	0.8	16.8	0.6	2.8	0.3	170.7	18.6
Married	83.6	0.7	72.0	0.8	41.4	0.9	2516.5	65.9
Missing marital and dependent status	23.5	0.6	20.4	0.6	0.4	0.1	14.9	3.3
Single, divorced, widowed, separated	88.8	0.2	79.4	0.3	48.1	0.3	2172.5	19.6
Citizenship and Veteran status								
Citizen and veteran	85.3	1.2	74.4	1.6	37.6	1.8	2186.9	123.7
Citizen, not veteran	75.7	0.3	66.6	0.3	38.9	0.3	1820.2	17.0
Not veteran, unknown citizenship	25.8	1.0	19.0	0.8	1.9	0.3	69.3	13.4
Nonresident alien	84.8	1.0	73.2	1.2	32.7	1.3	1587.8	77.4
Foreign student	34.2	2.0	30.3	2.0	2.9	0.8	135.9	40.5
School Selectivity								
Most Selective	70.3	1.3	65.2	1.3	33.9	1.3	1459.1	65.3
Very Selective	76.8	0.7	71.3	0.7	43.0	0.8	2020.5	49.3
Moderately Selective	76.9	0.4	69.9	0.4	44.8	0.5	2166.5	27.4
Minimally Selective	77.9	0.8	68.7	0.8	47.3	0.9	2250.1	51.8
Open Admission or Not 4 year	65.7	0.4	52.9	0.4	21.3	0.4	959.0	20.0
Region								
New England	71.5	1.0	63.7	1.1	41.0	1.1	1727.9	55.7
Mid East	76.0	0.6	68.3	0.7	37.6	0.7	1689.4	45.8
Great Lakes	71.4	0.6	62.3	0.6	36.9	0.6	1693.0	35.1
Plains	78.0	0.8	73.3	0.8	51.6	1.0	2346.5	56.5
Southeast	78.4	0.5	69.7	0.5	36.9	0.6	1757.6	32.4
Southwest	68.8	0.7	57.6	0.8	31.3	0.7	1621.1	44.4
Rocky Mountains	68.5	1.2	61.0	1.2	31.7	1.1	1458.5	62.3

	Applied for Financial Aid		Received Financial Aid		Received Stafford Loan		Amount of Stafford Loan	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Far West	66.6	0.6	55.4	0.6	28.1	0.6	1381.7	34.6
Historically Black College or University								
Not HBCU	72.4	0.2	63.4	0.3	35.5	0.3	1662.9	15.0
HBCU	89.2	1.2	80.9	1.7	55.7	2.7	3132.6	217.4
Hispanic Serving Institution								
Not Hispanic-Serving Institution	73.0	0.3	64.5	0.3	37.5	0.3	1761.4	16.6
Hispanic-Serving Institution	69.6	0.7	56.5	0.8	21.9	0.7	1071.9	38.2
Urbanicity								
Urbanicity missing	76.3	2.4	64.4	2.5	40.1	2.4	1957.5	136.1
Central City	72.9	0.3	63.8	0.3	35.3	0.3	1675.4	20.2
Urban Fringe	68.2	0.5	58.3	0.5	32.3	0.5	1547.6	28.8
Town	78.5	0.6	71.4	0.7	43.7	0.7	1927.4	41.6
Rural or Not Assigned	73.1	1.6	65.4	1.7	38.0	1.7	1867.4	107.9
% American Indian students								
0% American Indian	75.3	0.3	66.4	0.3	36.8	0.3	1691.3	20.2
1% American Indian	69.5	0.4	60.2	0.5	34.6	0.4	1678.7	26.3
>1% American Indian	67.9	0.9	59.3	0.9	34.2	0.9	1680.5	53.7
% Asian students								
0-1% Asian	79.7	0.5	71.4	0.5	41.4	0.5	1877.4	29.4
2% Asian	74.1	0.6	64.8	0.7	37.3	0.7	1761.7	44.6
3-5% Asian	70.6	0.5	61.7	0.5	35.2	0.5	1707.4	27.4
6+% Asian	68.5	0.5	58.9	0.5	31.2	0.5	1468.9	27.0
% Black Students								
0-3% Black	72.5	0.5	64.8	0.5	37.6	0.5	1701.2	28.6
4-7 % Black	72.4	0.5	65.1	0.5	38.6	0.5	1746.2	28.2
8-18% Black	70.0	0.5	59.3	0.5	34.8	0.5	1740.4	29.8
19% Black+	78.1	0.5	67.5	0.6	30.2	0.6	1463.1	39.3
% Hispanic Students								
0-1% Hispanic	80.7	0.5	73.0	0.6	43.4	0.7	2015.3	42.0
2-3% Hispanic	74.1	0.5	67.2	0.5	40.0	0.5	1835.7	28.2
4-11% Hispanic	71.4	0.5	62.4	0.5	37.8	0.5	1813.8	30.6
12+% Hispanic	67.0	0.5	54.9	0.5	24.0	0.4	1163.6	25.1
Control / Religious Affiliation								
Public	70.5	0.3	60.5	0.3	32.0	0.3	1470.5	16.3
Private for-profit	83.3	1.3	75.0	1.4	57.7	1.5	3247.6	103.8
Private, not-for-profit, not religious	79.7	0.7	75.1	0.8	49.5	1.0	2366.6	67.5
Private, not-for-profit, religious affiliation	82.8	0.7	78.8	0.7	49.8	0.8	2416.4	50.2
Level of School								
Less than 2 year	87.2	0.9	80.2	0.9	43.9	0.8	1919.6	39.8
2 year	63.7	0.4	50.2	0.5	17.4	0.3	673.3	16.4
4 year non-doctorate granting	79.5	0.5	71.8	0.5	45.3	0.5	2223.8	32.2
4 year doctorate granting	75.6	0.4	69.0	0.4	43.9	0.4	2135.7	26.5
Number of Students								
<1483 Students	84.0	0.9	78.8	0.9	46.6	0.8	2164.5	41.2
1484-5902 Students	78.8	0.4	71.1	0.5	39.9	0.5	1905.8	30.8
5903-14296 students	71.1	0.4	61.1	0.5	35.4	0.5	1642.4	29.3
14297+ students	70.4	0.4	61.2	0.4	33.6	0.4	1591.0	23.4

	Applied for Financial Aid		Received Financial Aid		Received Stafford Loan		Amount of Stafford Loan	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Year in School								
Unclassified Undergraduate	47.3	0.8	34.9	0.7	14.6	0.5	658.1	29.2
1st year	75.9	0.4	65.1	0.4	30.4	0.4	1036.5	16.3
2nd year	74.6	0.5	65.8	0.6	35.6	0.6	1447.7	31.1
3rd year	76.8	0.7	70.1	0.7	47.0	0.8	2561.2	50.0
4th year	74.7	0.6	68.0	0.6	45.0	0.7	2674.3	46.3
5th year	78.1	1.9	69.5	2.0	48.2	2.2	2739.7	149.8
Spring Term Enrollment								
>1 month with FT enrollment	80.5	0.3	75.0	0.3	44.3	0.4	2089.2	22.1
>1 month with PT enrollment	64.1	0.6	50.2	0.6	24.2	0.5	1249.0	30.3
>1 month unknown enrollment	54.2	1.2	44.9	1.2	25.9	1.1	1405.5	70.7
At least one month no enrollment	66.4	0.7	52.5	0.7	27.8	0.6	1082.7	29.7

Note: All estimates are weighted by the student base weight. Standard errors calculated using a Taylor Series approximation, assuming a stratified random sample of students from universities.

Table A.27: Distribution of Receiving Pell Grant, Amount of Pell Grant, Receiving State Aid, and Amount of State Aid by Propensity Predictors, NPSAS

	Received Pell Grant		Amount of Pell Grant		Received State Aid		Amount of State Aid	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Gender								
Female	33.5	0.3	816.0	10.1	23.2	0.3	510.8	9.1
Male	23.7	0.3	574.1	9.8	17.9	0.3	406.6	8.9
Age								
Age 15-19	27.4	0.4	703.6	13.1	27.7	0.4	698.4	14.5
Age 20-21	25.5	0.5	642.1	14.7	23.3	0.5	603.8	16.3
Age 22-27	30.7	0.5	734.1	13.8	16.5	0.4	317.9	10.3
Age 28+	32.5	0.6	741.8	15.4	16.2	0.4	242.8	8.7
Has HS Diploma								
Has HS diploma or status missing	29.2	0.2	709.8	7.1	21.0	0.2	467.4	6.2
No Diploma	15.9	1.4	404.8	42.7	8.4	1.1	156.2	24.2
Race/Ethnicity								
Hispanic	41.3	0.9	1030.2	26.5	24.7	0.8	592.7	25.0
White	21.6	0.3	505.5	8.2	18.1	0.3	393.6	7.6
Black	50.1	0.9	1293.3	26.6	25.9	0.7	493.1	18.5
Asian	30.8	1.1	831.2	35.7	22.6	1.0	703.4	39.7
Native Amer. /Pacific Islander	33.5	2.2	801.4	61.1	19.4	1.8	453.8	60.5
Race missing	33.4	0.6	789.0	18.4	24.3	0.6	549.3	17.4
Marital & Dependency Status								
Missing marital status, independent	3.8	0.3	58.7	6.8	4.6	0.3	59.1	7.0
Married	39.6	0.9	862.2	23.4	18.4	0.7	282.6	15.3
Missing marital and dependent status	0.8	0.1	6.6	1.8	6.5	0.3	169.3	11.5
Single, divorced, widowed, or separated	37.7	0.3	940.5	9.7	26.9	0.3	620.0	8.8
Citizenship and Veteran status								
Citizen and veteran	32.3	1.7	784.2	48.9	15.5	1.2	264.9	27.2
Citizen, not veteran	30.0	0.3	725.4	7.6	21.9	0.2	487.3	6.9
Not veteran, unknown citizenship	3.4	0.4	35.2	7.3	3.4	0.4	35.8	8.0
Nonresident alien	53.5	1.4	1434.0	44.7	33.4	1.3	860.2	42.8
Foreign student	4.7	0.9	116.8	24.8	4.6	0.9	62.9	17.1
School Selectivity								
Most Selective	17.0	1.1	362.9	29.5	14.7	1.0	456.2	37.5
Very Selective	23.7	0.6	618.0	19.2	25.6	0.6	757.2	22.4
Moderately Selective	28.4	0.4	718.4	12.1	22.6	0.4	585.0	11.8
Minimally Selective	36.3	0.8	906.3	25.0	22.0	0.7	535.4	21.5
Open Admission or Not 4 year	31.6	0.4	722.7	10.9	17.4	0.3	205.5	4.8
Region								
New England	21.4	0.9	492.4	24.8	13.8	0.8	280.3	22.8
Mid East	34.4	0.7	885.3	20.9	31.2	0.6	668.5	18.3
Great Lakes	25.2	0.6	588.3	15.8	20.1	0.5	434.6	14.7
Plains	27.8	0.8	603.5	23.1	18.9	0.7	489.4	22.9
Southeast	32.3	0.5	794.8	15.5	27.0	0.5	587.0	13.7
Southwest	28.4	0.7	697.1	18.8	14.0	0.5	276.8	12.4
Rocky Mountains	27.7	1.1	696.8	32.5	6.5	0.6	110.9	16.1

	Received Pell Grant		Amount of Pell Grant		Received State Aid		Amount of State Aid	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Far West	28.6	0.6	695.2	17.6	19.7	0.5	529.4	20.3
Historically Black College or University								
Not HBCU	28.6	0.2	693.4	7.1	20.9	0.2	465.9	6.2
HBCU	52.3	2.9	1476.7	89.2	15.1	1.4	300.0	30.1
Hispanic Serving Institution								
Not Hispanic-Serving Institution	27.7	0.3	669.9	7.3	20.2	0.2	456.1	6.5
Hispanic-Serving Institution	39.8	0.8	997.5	23.8	25.9	0.7	521.2	18.4
Urbanicity								
Urbanicity missing	42.0	2.5	952.9	60.1	5.2	1.7	91.6	34.0
Central City	29.4	0.3	716.5	9.1	21.1	0.3	487.0	8.0
Urban Fringe	25.8	0.5	615.4	13.4	19.7	0.4	419.0	12.3
Town	31.3	0.7	776.3	20.1	21.0	0.6	439.0	17.1
Rural or Not Assigned	31.0	1.6	776.7	48.0	23.6	1.4	404.6	30.5
% American Indian students								
0% American Indian	30.5	0.3	740.8	9.5	24.3	0.3	548.5	8.6
1% American Indian	27.0	0.4	654.4	11.5	16.8	0.3	369.8	9.7
>1% American Indian	27.8	0.8	684.4	25.1	13.9	0.6	270.1	18.5
% Asian students								
0-1% Asian	36.5	0.5	911.8	15.0	23.5	0.4	445.2	11.3
2% Asian	29.0	0.6	691.6	16.7	18.3	0.5	357.9	11.9
3-5% Asian	25.7	0.4	609.8	12.3	18.2	0.4	433.0	11.3
6+% Asian	26.6	0.5	655.1	13.3	22.9	0.4	571.1	13.3
% Black Students								
0-3% Black	28.5	0.5	691.5	13.6	17.0	0.4	402.1	11.9
4-7 % Black	24.0	0.4	588.6	13.1	22.1	0.4	543.4	13.2
8-18% Black	27.4	0.5	666.5	13.0	20.3	0.4	443.9	11.3
19% Black+	41.0	0.6	991.8	18.1	25.4	0.5	464.2	12.3
% Hispanic Students								
0-1% Hispanic	32.9	0.6	816.3	17.3	24.4	0.5	531.0	15.9
2-3% Hispanic	26.4	0.4	629.3	12.8	19.9	0.4	436.6	11.0
4-11% Hispanic	25.2	0.4	623.0	12.8	18.3	0.4	433.6	11.6
12+% Hispanic	33.6	0.5	809.2	14.4	22.1	0.4	481.3	12.2
Control / Religious Affiliation								
Public	29.1	0.3	703.4	8.1	21.1	0.2	423.1	6.5
Private for-profit	42.3	1.2	994.9	29.9	9.3	0.5	283.0	20.2
Private, not-for-profit, not religious	23.5	0.7	598.0	21.8	19.9	0.7	596.9	27.0
Private, not-for-profit, religious affiliation	26.6	0.7	677.6	21.1	24.6	0.7	849.9	30.9
Level of School								
Less than 2 year	61.3	0.9	1409.3	25.9	3.6	0.4	55.7	6.7
2 year	31.6	0.4	711.9	11.6	18.3	0.3	204.7	4.9
4 year non-doctorate granting	33.4	0.5	847.4	15.3	26.7	0.5	702.9	15.8
4 year doctorate granting	25.0	0.4	634.1	10.8	20.6	0.3	549.6	10.6
Number of Students								
<1483 Students	43.8	0.8	1010.0	22.5	19.7	0.6	414.7	18.7
1484-5902 Students	33.9	0.5	807.3	14.7	25.4	0.4	559.0	14.5
5903-14296 students	29.0	0.4	730.0	12.9	20.4	0.4	457.1	11.7
14297+ students	26.0	0.4	627.4	10.7	19.5	0.3	438.3	9.0
Year in School								

	Received Pell Grant		Amount of Pell Grant		Received State Aid		Amount of State Aid	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Unclassified Undergraduate	19.2	0.6	426.0	16.0	10.2	0.4	118.9	9.1
1st year	33.6	0.4	784.8	11.3	22.4	0.3	450.2	9.1
2nd year	30.3	0.5	778.9	16.6	23.4	0.5	505.4	14.5
3rd year	27.4	0.7	685.3	19.9	20.6	0.6	570.0	20.6
4th year	27.0	0.6	662.4	17.1	21.3	0.5	536.6	17.4
5th year	28.2	2.0	715.9	59.7	17.6	1.7	333.4	39.4
Spring Term Enrollment								
>1 month with FT enrollment	32.0	0.3	886.5	10.7	27.1	0.3	682.1	10.1
>1 month with PT enrollment	26.7	0.5	552.5	12.7	14.0	0.4	182.0	7.3
>1 month unknown enrollment	20.3	0.9	405.1	23.7	8.7	0.6	249.6	20.6
At least one month no enrollment	26.0	0.6	448.8	12.8	14.4	0.5	220.1	10.8

Note: All estimates are weighted by the student base weight. Standard errors calculated using a Taylor Series approximation, assuming a stratified random sample of students from universities.

Table A.28: Average Receiving Institutional Aid, Amount of Institutional Aid, Receiving Work Study and Amount of Work Study by Propensity Predictors, NPSAS

	Received Institutional Aid		Amount of Institutional Aid		Received Work Study		Amount of Work Study	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Gender								
Female	22.5	0.3	1101.8	22.3	6.6	0.2	135.7	5.0
Male	20.7	0.3	1122.1	36.5	5.7	0.2	117.7	4.7
Age								
Age 15-19	33.2	0.5	1954.2	60.6	9.9	0.3	179.5	6.1
Age 20-21	29.0	0.5	1758.5	49.5	9.1	0.3	202.4	10.2
Age 22-27	15.7	0.4	591.0	24.2	4.1	0.2	86.6	5.4
Age 28+	8.7	0.3	154.5	10.3	1.7	0.1	40.6	4.5
Has HS Diploma								
Has HS diploma or status missing	21.9	0.2	1124.3	19.8	6.2	0.1	128.9	3.4
No Diploma	5.4	0.9	127.0	37.7	1.0	0.3	22.3	12.2
Race/Ethnicity								
Hispanic	17.8	0.7	816.4	51.8	5.6	0.4	120.7	10.8
White	23.4	0.3	1209.4	21.7	6.0	0.2	121.7	4.1
Black	21.1	0.8	1232.4	122.0	7.9	0.4	168.6	15.6
Asian	25.1	1.0	1586.1	101.0	8.9	0.7	172.5	15.8
Native Amer. /Pacific Islander	21.9	1.9	857.6	125.3	4.8	1.0	83.0	22.8
Race missing	16.8	0.5	666.7	32.2	5.0	0.3	111.1	7.7
Marital & Dependency Status								
Missing marital status, independent	4.9	0.4	99.1	15.1	0.5	0.1	9.2	2.4
Married	11.9	0.6	263.0	21.5	1.9	0.2	47.6	7.2
Missing marital and dependent status	10.8	0.4	530.9	34.7	0.4	0.1	12.4	3.7
Single, divorced, widowed, or separated	28.2	0.3	1527.8	28.8	9.0	0.2	184.2	5.0
Citizenship and Veteran status								
Citizen and veteran	6.6	0.8	184.4	43.7	1.7	0.5	36.8	13.0
Citizen, not veteran	23.3	0.2	1199.8	22.4	6.7	0.1	137.2	3.8
Not veteran, unknown citizenship	6.6	0.5	297.9	33.4	1.2	0.2	21.0	4.6
Nonresident alien	21.9	1.1	866.0	79.7	7.3	0.7	153.1	18.2
Foreign student	21.0	1.7	1699.0	196.5	4.3	0.8	100.6	23.7
School Selectivity								
Most Selective	42.5	1.3	4730.4	206.2	19.1	1.0	375.9	25.2
Very Selective	37.7	0.7	2506.0	95.4	9.8	0.4	191.7	10.1
Moderately Selective	28.4	0.4	1268.5	25.9	7.8	0.2	159.2	6.6
Minimally Selective	19.7	0.6	619.8	31.7	5.3	0.4	120.6	11.7
Open Admission or Not 4 year	6.5	0.2	104.8	5.7	1.8	0.1	43.6	3.2
Region								
New England	38.5	1.1	3398.8	149.4	12.4	0.7	258.8	20.9
Mid East	26.4	0.7	1693.7	98.5	7.4	0.3	163.2	9.9
Great Lakes	22.8	0.5	1166.5	39.9	6.5	0.3	128.2	10.0
Plains	30.8	0.8	1425.9	54.7	10.4	0.5	216.9	13.4
Southeast	21.0	0.4	996.5	34.1	6.1	0.3	111.4	6.9
Southwest	14.3	0.4	492.5	22.6	3.1	0.2	74.0	6.8
Rocky Mountains	17.6	0.9	406.9	30.4	2.6	0.4	69.5	11.8

	Received Institutional Aid		Amount of Institutional Aid		Received Work Study		Amount of Work Study	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Far West	16.9	0.5	748.6	29.6	5.5	0.3	112.8	6.9
Historically Black College or University								
Not HBCU	21.7	0.2	1099.9	15.7	6.1	0.1	127.3	3.4
HBCU	22.6	3.8	1819.9	739.6	8.2	1.1	138.4	20.2
Hispanic Serving Institution								
Not Hispanic-Serving Institution	23.0	0.2	1222.2	21.8	6.7	0.1	137.5	3.8
Hispanic-Serving Institution	10.8	0.5	205.7	15.4	2.2	0.2	46.2	5.6
Urbanicity								
Urbanicity missing	6.4	1.0	217.0	35.6	1.7	0.5	31.0	10.7
Central City	21.9	0.3	1111.1	26.7	5.5	0.1	116.3	4.3
Urban Fringe	18.3	0.4	1136.1	35.6	6.1	0.2	131.7	6.9
Town	26.0	0.6	1109.8	42.9	9.5	0.4	176.3	10.0
Rural or Not Assigned	26.4	1.6	1105.5	126.4	8.5	0.9	170.1	21.5
% American Indian students								
0% American Indian	24.7	0.3	1368.9	31.1	6.9	0.2	138.1	4.9
1% American Indian	17.6	0.3	797.4	20.8	5.2	0.2	113.7	5.1
>1% American Indian	18.6	0.7	670.6	48.9	5.4	0.4	113.2	10.8
% Asian students								
0-1% Asian	20.3	0.4	812.3	24.3	6.4	0.2	119.1	5.7
2% Asian	20.2	0.5	1050.6	76.3	6.2	0.3	132.4	8.1
3-5% Asian	22.0	0.4	1089.2	29.1	5.6	0.2	118.8	6.9
6+% Asian	23.3	0.4	1402.1	35.1	6.6	0.2	140.5	6.3
% Black Students								
0-3% Black	24.8	0.4	1229.3	29.6	7.4	0.2	148.4	6.0
4-7 % Black	27.3	0.4	1623.0	37.4	7.9	0.3	163.3	7.2
8-18% Black	19.4	0.4	919.4	27.9	5.4	0.2	116.6	7.1
19% Black+	11.9	0.5	439.7	77.2	2.8	0.2	56.3	5.0
% Hispanic Students								
0-1% Hispanic	22.2	0.6	1165.8	80.9	8.2	0.3	160.4	10.7
2-3% Hispanic	26.9	0.4	1313.0	29.4	7.5	0.2	152.9	6.5
4-11% Hispanic	24.4	0.4	1537.7	36.7	7.0	0.2	149.3	6.6
12+% Hispanic	12.5	0.3	386.3	16.0	2.5	0.2	53.8	4.4
Control / Religious Affiliation								
Public	15.8	0.2	473.1	12.3	4.0	0.1	85.2	3.5
Private for-profit	8.2	0.4	136.3	14.5	1.3	0.2	41.6	8.7
Private, not-for-profit, not religious	54.6	1.0	5168.4	171.0	17.5	0.7	365.9	19.1
Private, not-for-profit, religious affiliation	58.3	0.8	4319.4	94.0	20.3	0.6	382.4	14.5
Level of School								
Less than 2 year	9.3	0.5	105.4	8.5	1.2	0.2	16.3	3.3
2 year	5.3	0.2	61.4	4.8	1.6	0.1	37.7	3.4
4 year non-doctorate granting	25.6	0.4	1317.0	29.5	8.8	0.3	167.3	6.6
4 year doctorate granting	31.1	0.4	1734.8	37.6	8.3	0.2	173.1	6.1
Number of Students								
<1483 Students	27.4	0.6	1528.0	49.2	8.5	0.4	128.7	7.1
1484-5902 Students	25.9	0.4	1683.0	40.5	9.5	0.3	180.9	7.3
5903-14296 students	21.0	0.4	1181.4	50.4	6.8	0.2	148.3	6.2
14297+ students	20.1	0.3	832.5	21.6	4.5	0.2	96.5	5.2

	Received Institutional Aid		Amount of Institutional Aid		Received Work Study		Amount of Work Study	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Year in School								
Unclassified Undergraduate	6.5	0.4	131.6	16.0	1.1	0.2	22.6	4.9
1st year	19.0	0.3	937.1	20.6	5.6	0.2	101.4	3.9
2nd year	21.3	0.5	1167.4	65.6	7.0	0.3	145.0	7.2
3rd year	26.7	0.6	1579.5	60.6	7.6	0.4	175.3	13.2
4th year	29.5	0.6	1455.8	46.7	7.3	0.3	161.6	9.2
5th year	26.9	2.0	877.6	99.5	7.7	1.2	137.5	26.6
Spring Term Enrollment								
>1 month with FT enrollment	31.7	0.3	1829.2	34.8	9.7	0.2	202.4	5.9
>1 month with PT enrollment	8.3	0.3	191.6	14.5	1.4	0.1	36.8	4.3
>1 month unknown enrollment	9.4	0.5	316.7	29.3	1.6	0.3	25.1	4.8
At least one month no enrollment	12.4	0.4	355.6	19.8	2.9	0.2	49.1	4.6

Note: All estimates are weighted by the student base weight. Standard errors calculated using a Taylor Series approximation, assuming a stratified random sample of students from universities.

Table A.29: Sample Sizes, Contact Propensity Strata, Four Contact Models, Overall, Noncontacted and Contacted, WDS and NPSAS

	WDS					NPSAS				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
At-home patterns										
Overall	146	147	147	147	146	13820	13690	13800	13760	13760
Noncontacted	48	37	28	16	12	1100	670	520	390	280
Contacted	98	110	119	131	134	12730	13020	13270	13370	13490
Access Impediments										
Overall	154	134	152	147	146	13750	13790	13770	13710	13810
Noncontacted	43	29	22	28	19	1010	820	510	370	240
Contacted	111	105	130	119	127	12740	12970	13260	13340	13570
Main Effects Model										
Overall	146	147	146	148	146	13770	13770	13770	13770	13760
Noncontacted	51	34	25	18	13	1140	790	520	310	200
Contacted	95	113	121	130	133	12630	12980	13240	13460	13570
Interaction Model										
Overall	146	147	147	147	146	13770	13770	13770	13760	13770
Noncontacted	57	30	27	17	10	1370	720	430	260	170
Contacted	89	117	120	130	136	12400	13050	13330	13500	13600

Note: In order to maintain the level of confidentiality required of NCES data, all NPSAS sample sizes have been rounded.

Table A.30: Predicted Contact Propensities by Contact Propensity Strata, Overall, Noncontacted and Contacted, WDS and NPSAS

	Average Predicted Propensity: WDS					Average Predicted Propensity: NPSAS				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
At-home patterns										
Overall	0.66	0.78	0.83	0.86	0.91	0.92	0.95	0.97	0.97	0.98
Noncontacted	0.64	0.77	0.83	0.87	0.91	0.92	0.95	0.97	0.97	0.98
Contacted	0.67	0.78	0.83	0.86	0.91	0.92	0.95	0.97	0.97	0.98
Observed	67%	75%	81%	89%	92%	92%	95%	96%	97%	98%
Access Impediments										
Overall	0.72	0.80	0.82	0.84	0.86	0.92	0.95	0.96	0.97	0.98
Noncontacted	0.71	0.80	0.82	0.84	0.86	0.91	0.95	0.96	0.97	0.98
Contacted	0.73	0.80	0.82	0.84	0.86	0.92	0.95	0.96	0.97	0.98
Observed	72%	78%	86%	81%	87%	91%	94%	96%	97%	98%
Main Effects Model										
Overall	0.65	0.78	0.83	0.87	0.91	0.91	0.95	0.97	0.98	0.99
Noncontacted	0.64	0.77	0.83	0.87	0.91	0.90	0.95	0.97	0.98	0.99
Contacted	0.66	0.78	0.83	0.87	0.91	0.91	0.95	0.97	0.98	0.99
Observed	65%	77%	83%	88%	91%	91%	94%	96%	98%	99%

Note: The observed in the NPSAS is a weighted contact rate. The mean propensities in the NPSAS are weighted mean propensities. All observed contact rates are calculated using AAPOR CON2.

Table A.31: Sample Size for Five Cooperation Propensity Strata for Five Models, WDS and NPSAS

	N: WDS Cooperation Strata					N: NPSAS Cooperation Strata				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	118	119	118	119	118	13520	12160	13810	13050	13330
Noninterview	25	19	13	8	4	4970	3900	4070	3590	2970
Interview	93	100	105	111	114	8560	8260	9740	9460	10370
Social Environmental Factors										
Overall	119	103	132	119	119	13170	13180	13180	13170	13170
Noninterview	19	16	16	8	10	5380	4240	3800	3360	2720
Interview	100	87	116	111	109	7800	8940	9380	9810	10450
Discretionary Time										
Overall	116	117	122	118	119	13060	11240	21560	6900	13120
Noninterview	24	14	11	11	9	5070	3610	6470	1610	2740
Interview	92	103	111	107	110	7990	7630	15090	5300	10380
Positive affect toward the sponsor										
Overall	168	231	64	129	0	1740	25320	8960	17140	12710
Noninterview	26	28	5	10	0	770	8280	2920	4580	2950
Interview	142	203	59	119	0	970	17040	6030	12570	9770
Main Effects model										
Overall	119	118	118	119	118	13170	13180	13180	13170	13180
Noninterview	36	17	11	2	3	6030	4520	3660	3220	2070
Interview	83	101	107	117	115	7140	8660	9520	9950	11110
Interaction Model										
Overall	118	119	118	119	118	13170	13170	13180	13180	13170
Noninterview	33	22	12	1	1	6270	4710	3820	2970	1730
Interview	85	97	106	118	117	6910	8460	9360	10210	11440

Note: In order to maintain the level of confidentiality required of NCES data, all NPSAS sample sizes have been rounded.

Table A.32: Average Predicted Propensities for Four Cooperation Models and Combined Model, Overall, Noncooperators and Cooperators, WDS and NPSAS

	Average Predicted Cooperation Propensities: WDS					Average Predicted Cooperation Propensities: NPSAS				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	0.77	0.86	0.90	0.93	0.96	0.67	0.70	0.72	0.74	0.80
Noninterview	0.76	0.85	0.90	0.93	0.96	0.67	0.70	0.72	0.74	0.80
Interview	0.77	0.86	0.90	0.93	0.96	0.67	0.70	0.72	0.74	0.81
Observed	79%	84%	89%	93%	97%	66%	69%	72%	73%	79%
Social Environmental Factors										
Overall	0.84	0.88	0.89	0.90	0.92	0.62	0.68	0.71	0.75	0.80
Noninterview	0.83	0.88	0.88	0.90	0.92	0.62	0.68	0.71	0.75	0.80
Interview	0.84	0.88	0.89	0.90	0.92	0.62	0.68	0.71	0.75	0.81
Observed	84%	84%	88%	93%	92%	59%	66%	71%	74%	79%
Discretionary Time										
Overall	0.83	0.86	0.88	0.90	0.94	0.64	0.71	0.74	0.75	0.78
Noninterview	0.83	0.86	0.88	0.90	0.93	0.63	0.70	0.74	0.75	0.78
Interview	0.83	0.86	0.88	0.90	0.94	0.64	0.71	0.74	0.75	0.78
Observed	79%	88%	91%	91%	92%	63%	69%	73%	75%	77%
Positive affect toward the sponsor										
Overall	0.85	0.88	0.90	0.93	--	0.68	0.69	0.71	0.74	0.77
Noninterview	0.85	0.88	0.90	0.92	--	0.68	0.69	0.71	0.74	0.77
Interview	0.85	0.88	0.90	0.93	--	0.68	0.69	0.71	0.74	0.77
Observed	85%	88%	92%	92%		62%	69%	69%	73%	76%
Main Effects model										
Overall	0.72	0.86	0.91	0.95	0.98	0.56	0.66	0.72	0.77	0.85
Noninterview	0.70	0.86	0.92	0.96	0.98	0.55	0.66	0.72	0.77	0.83
Interview	0.72	0.86	0.91	0.95	0.98	0.56	0.66	0.72	0.77	0.85
Observed	70%	86%	91%	98%	97%	55%	65%	71%	75%	83%

Note: Due to the inclusion of only three dichotomous predictors, only four groups were created in the WDS Positive affect toward sponsor model. The observed cooperation rates in the NPSAS are weighted.

Table A.33: Mean Length of Marriage Across Five Contact Propensity Strata, Four Contact Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	102.4	111.0	125.0	140.1	173.4	6.9	7.1	7.9	7.6	9.2
Noncontacted	100.3	95.8	107.4	154.6	189.6	10.4	10.6	15.1	23.1	41.4
Contacted	103.5	116.1	129.1	138.3	171.9	9.0	8.8	9.0	8.0	9.4
Access impediments										
Overall	134.8	123.4	130.7	127.3	134.6	7.9	8.6	8.0	7.7	8.2
Noncontacted	118.9	118.8	91.5	107.6	133.0	13.6	14.8	14.1	17.4	23.3
Contacted	141.0	124.7	137.3	131.9	134.9	9.5	10.3	8.9	8.5	8.7
Combined										
Overall	105.9	110.7	121.4	144.3	169.4	7.0	7.1	7.7	7.8	9.3
Noncontacted	105.5	91.2	106.6	151.8	171.8	10.1	10.9	16.2	23.3	38.1
Contacted	106.1	116.6	124.4	143.2	169.2	9.3	8.6	8.6	8.2	9.6
Interaction										
Overall	114.8	103.7	121.1	139.2	173.0	7.2	6.8	8.0	7.6	9.2
Noncontacted	108.9	103.0	112.3	119.9	174.3	9.4	15.3	19.7	22.1	34.1
Contacted	118.6	103.9	123.1	141.7	172.9	10.1	7.6	8.7	8.1	9.6

Table A.34. Mean Months Between Divorce and Interview Across Five Contact Propensity Strata, Four Contact Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	51.49	46.77	51.02	52.88	46.30	2.02	1.99	2.01	1.99	2.01
Noncontacted	52.81	41.24	51.86	45.06	49.33	3.65	3.78	4.80	6.57	7.20
Contacted	50.84	48.63	50.82	53.83	46.03	2.43	2.32	2.22	2.07	2.10
Access impediments										
Overall	51.43	44.76	50.28	50.28	51.18	1.98	2.03	1.98	2.02	2.02
Noncontacted	51.49	45.59	53.00	48.64	40.11	3.89	4.59	5.39	4.74	5.36
Contacted	51.41	44.53	49.82	50.66	52.84	2.31	2.27	2.13	2.24	2.15
Both										
Overall	50.18	47.23	52.44	50.69	47.93	2.03	1.98	2.01	1.99	2.04
Noncontacted	52.27	42.56	46.72	53.89	44.23	3.53	4.04	5.09	6.14	6.77
Contacted	49.05	48.64	53.62	50.25	48.29	2.49	2.27	2.18	2.11	2.14
Interaction										
Overall	51.01	48.22	48.22	51.84	49.17	2.05	1.99	2.00	2.01	2.02
Noncontacted	49.28	51.00	43.81	55.53	36.00	3.31	4.53	4.82	6.22	6.76
Contacted	52.12	47.50	49.22	51.36	50.14	2.61	2.22	2.19	2.13	2.09

Table A.35: Mean Number of Marriages Across Five Contact Propensity Strata, Four Contact Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	1.20	1.18	1.22	1.29	1.20	0.03	0.03	0.04	0.04	0.03
Noncontacted	1.27	1.32	1.29	1.13	1.25	0.06	0.08	0.10	0.09	0.13
Contacted	1.16	1.14	1.20	1.31	1.19	0.04	0.03	0.04	0.05	0.03
Access impediments										
Overall	1.23	1.20	1.24	1.22	1.18	0.03	0.03	0.04	0.03	0.03
Noncontacted	1.33	1.17	1.23	1.36	1.21	0.07	0.07	0.11	0.09	0.10
Contacted	1.20	1.21	1.25	1.19	1.17	0.04	0.04	0.05	0.04	0.03
Combined										
Overall	1.19	1.21	1.24	1.24	1.20	0.03	0.03	0.04	0.04	0.03
Noncontacted	1.25	1.38	1.32	1.06	1.23	0.06	0.08	0.11	0.06	0.12
Contacted	1.16	1.16	1.22	1.27	1.20	0.04	0.03	0.04	0.05	0.03
Interaction										
Overall	1.21	1.20	1.28	1.18	1.21	0.03	0.03	0.04	0.03	0.04
Noncontacted	1.28	1.27	1.30	1.24	1.20	0.06	0.08	0.10	0.11	0.13
Contacted	1.16	1.19	1.28	1.18	1.21	0.04	0.04	0.04	0.03	0.04

Table A.36: Mean Age at Marriage Across Five Contact Propensity Strata, Four Contact Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	24.13	24.05	24.73	26.47	25.73	0.44	0.45	0.45	0.64	0.50
Noncontacted	24.96	25.46	25.50	24.38	25.58	0.95	0.99	1.04	1.36	1.76
Contacted	23.72	23.56	24.55	26.73	25.75	0.46	0.50	0.50	0.70	0.53
Access impediments										
Overall	24.38	26.23	24.71	25.30	24.66	0.42	0.56	0.49	0.59	0.48
Noncontacted	25.16	25.00	24.18	26.57	24.63	0.82	1.05	1.35	1.40	1.22
Contacted	24.07	26.58	24.80	25.00	24.66	0.49	0.65	0.52	0.65	0.52
Combined										
Overall	23.73	24.59	24.91	26.17	25.70	0.41	0.46	0.52	0.61	0.51
Noncontacted	24.37	26.50	25.60	24.33	25.31	0.80	1.19	1.17	1.19	1.68
Contacted	23.38	24.01	24.77	26.42	25.74	0.45	0.47	0.58	0.67	0.54
Interaction										
Overall	23.99	25.35	25.34	24.90	25.54	0.50	0.53	0.51	0.46	0.54
Noncontacted	24.93	25.77	24.52	25.41	26.30	0.90	0.94	0.96	1.13	2.62
Contacted	23.39	25.24	25.53	24.84	25.49	0.58	0.62	0.58	0.50	0.55

Table A.37: Mean Age at Divorce Across Five Contact Propensity Strata, Four Contact Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	32.74	32.91	35.16	38.13	40.20	0.65	0.59	0.63	0.71	0.77
Noncontacted	33.33	33.46	34.46	37.25	41.33	1.19	1.20	1.44	2.41	3.31
Contacted	32.45	32.73	35.33	38.24	40.10	0.78	0.68	0.70	0.74	0.79
Access impediments										
Overall	35.47	36.64	35.61	35.90	35.64	0.69	0.70	0.69	0.80	0.68
Noncontacted	35.12	34.86	31.86	35.54	35.68	1.38	1.35	1.26	2.04	1.94
Contacted	35.60	37.13	36.24	35.99	35.64	0.79	0.81	0.77	0.87	0.73
Combined										
Overall	32.63	33.41	35.08	38.18	39.83	0.65	0.57	0.66	0.73	0.76
Noncontacted	33.20	34.12	34.44	37.00	39.62	1.11	1.32	1.56	2.33	3.17
Contacted	32.32	33.19	35.21	38.35	39.85	0.79	0.64	0.73	0.77	0.78
Interaction										
Overall	33.60	33.79	35.30	36.51	39.96	0.70	0.67	0.68	0.67	0.73
Noncontacted	34.00	34.33	33.93	35.41	40.90	1.09	1.50	1.65	1.97	3.60
Contacted	33.34	33.66	35.61	36.65	39.89	0.91	0.75	0.74	0.71	0.75

Table A.38: Means for Length of Marriage Across Five Cooperation Propensity Strata, Five Cooperation Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	110.6	141.7	170.3	126.3	122.0	10.8	8.5	9.8	8.5	6.8
Noninterview	93.8	166.6	154.5	107.8	219.0	22.0	21.7	35.3	24.8	51.2
Interview	115.1	136.9	172.3	127.6	118.6	12.4	9.3	10.1	8.9	6.6
Social Environmental Factors										
Overall	128.2	123.2	143.0	137.9	136.3	8.8	10.3	8.5	8.8	9.5
Noninterview	148.5	94.3	152.4	140.4	136.7	29.9	22.6	30.8	33.7	25.3
Interview	124.3	128.5	141.7	137.7	136.2	8.9	11.4	8.7	9.2	10.1
Discretionary Time										
Overall	138.9	140.2	130.4	146.9	114.8	9.4	10.6	8.1	9.4	7.9
Noninterview	133.2	128.6	119.9	170.5	118.6	21.8	38.3	22.7	35.2	31.5
Interview	140.5	141.8	131.4	144.5	114.5	10.4	11.0	8.7	9.7	8.2
Positive affect toward sponsor										
Overall	127.1	131.5	137.7	146.4	--	7.7	6.4	12.6	9.0	--
Noninterview	118.0	126.8	135.0	196.6	--	21.5	16.4	44.8	49.8	--
Interview	128.8	132.1	137.9	142.2	--	8.3	6.9	13.2	8.9	--
Combined										
Overall	119.3	149.9	137.9	148.9	114.9	10.4	9.3	8.8	9.0	7.5
Noninterview	104.6	180.5	158.0	175.0	112.3	16.1	25.8	40.8	96.0	65.7
Interview	125.7	144.7	135.8	148.5	115.0	13.2	10.0	8.8	9.1	7.6
Interaction										
Overall	129.6	134.3	151.2	132.3	123.4	10.1	9.3	9.3	8.3	8.5
Noninterview	131.4	105.1	207.1	112.0	14.0	18.7	18.9	37.2	a	a
Interview	129.0	140.9	144.8	132.5	124.3	12.0	10.5	9.4	8.4	8.5

Note: -- indicates that only four groups could be created using the Positive Affect Toward Sponsor model in the WDS. a indicates that there was only one noninterviewed case in this stratum.

Table A.39: Means for Months Between Divorce and Interview Across Five Cooperation Propensity Strata, Five Cooperation Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	48.66	49.85	50.08	51.70	49.69	2.18	2.20	2.30	2.23	2.24
Noninterview	40.40	49.89	47.31	56.00	50.00	4.46	5.78	7.54	8.52	15.12
Interview	50.88	49.84	50.42	51.39	49.68	2.46	2.39	2.42	2.32	2.28
Social Environmental Factors										
Overall	48.48	45.87	49.81	54.29	51.00	2.25	2.30	2.11	2.20	2.24
Noninterview	41.21	43.88	51.00	65.00	40.00	5.56	5.34	6.39	8.00	8.21
Interview	49.86	46.24	49.65	53.52	52.01	2.45	2.55	2.25	2.28	2.31
Discretionary Time										
Overall	53.19	49.38	48.68	48.21	50.61	2.27	2.26	2.20	2.19	2.21
Noninterview	46.88	44.57	39.27	50.18	54.22	5.13	6.45	7.18	7.72	8.60
Interview	54.84	50.04	49.61	48.01	50.32	2.51	2.42	2.30	2.30	2.30
Positive affect toward sponsor										
Overall	49.54	50.17	50.22	50.17	--	1.89	1.58	3.09	2.13	--
Noninterview	42.23	44.61	77.20	48.80	--	4.51	4.67	2.31	8.04	--
Interview	50.88	50.94	47.93	50.29	--	2.07	1.68	3.17	2.22	--
Combined										
Overall	47.45	54.95	49.47	48.65	49.52	2.20	2.20	2.24	2.25	2.21
Noninterview	42.81	49.47	45.82	52.50	76.67	4.01	5.89	7.79	24.50	1.33
Interview	49.46	55.87	49.84	48.58	48.81	2.62	2.37	2.34	2.26	2.23
Interaction										
Overall	50.19	49.17	49.28	48.66	52.71	2.22	2.26	2.23	2.24	2.19
Noninterview	43.85	48.55	46.08	75.00	78.00	4.16	5.33	7.51	a	a
Interview	52.65	49.31	49.64	48.44	52.50	2.59	2.51	2.34	2.25	2.20

Note: -- indicates that only four groups could be created using the Positive Affect Toward Sponsor model in the WDS. a indicates that there was only one noninterviewed case in this stratum.

Table A.40: Means for Number of Marriages Across Five Cooperation Propensity Strata, Five Cooperation Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	1.14	1.36	1.23	1.15	1.14	0.03	0.05	0.04	0.03	0.03
Noninterview	1.16	1.53	1.23	1.25	1.00	0.07	0.22	0.12	0.16	0.00
Interview	1.14	1.33	1.23	1.14	1.14	0.04	0.05	0.04	0.03	0.03
Social Environmental Factors										
Overall	1.16	1.18	1.30	1.17	1.19	0.03	0.04	0.05	0.03	0.04
Noninterview	1.26	1.31	1.44	1.13	1.10	0.10	0.12	0.26	0.13	0.10
Interview	1.14	1.16	1.28	1.17	1.20	0.03	0.04	0.04	0.04	0.04
Discretionary Time										
Overall	1.21	1.27	1.16	1.15	1.24	0.04	0.05	0.03	0.03	0.04
Noninterview	1.25	1.43	1.18	1.18	1.33	0.09	0.29	0.12	0.12	0.17
Interview	1.20	1.25	1.15	1.15	1.23	0.04	0.04	0.03	0.03	0.04
Positive affect toward sponsor										
Overall	1.25	1.15	1.31	1.19	--	0.04	0.02	0.06	0.03	--
Noninterview	1.42	1.07	1.20	1.50	--	0.17	0.05	0.20	0.17	--
Interview	1.22	1.16	1.32	1.16	--	0.03	0.03	0.06	0.03	--
Combined										
Overall	1.26	1.19	1.19	1.13	1.25	0.05	0.04	0.04	0.03	0.04
Noninterview	1.36	1.18	1.09	1.00	1.67	0.13	0.10	0.09	0.00	0.33
Interview	1.22	1.19	1.21	1.14	1.23	0.05	0.04	0.04	0.03	0.04
Interaction										
Overall	1.20	1.27	1.21	1.14	1.19	0.04	0.05	0.04	0.03	0.04
Noninterview	1.27	1.27	1.25	1.00	2.00	0.08	0.19	0.13	a	a
Interview	1.18	1.27	1.21	1.14	1.19	0.04	0.05	0.04	0.03	0.04

Note: -- indicates that only four groups could be created using the Positive Affect Toward Sponsor model in the WDS. a indicates that there was only one noninterviewed case in this stratum.

Table A.41: Means for Age at Marriage Across Five Cooperation Propensity Strata, Five Cooperation Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	25.32	27.72	25.02	25.05	21.79	0.52	0.67	0.56	0.54	0.39
Noninterview	25.80	26.84	25.46	25.13	20.00	1.13	1.62	1.91	1.30	0.82
Interview	25.18	27.89	24.96	25.05	21.85	0.59	0.74	0.59	0.57	0.40
Social Environmental Factors										
Overall	24.45	26.19	24.75	24.82	24.92	0.48	0.67	0.54	0.57	0.60
Noninterview	25.32	25.88	25.94	26.50	24.50	1.08	1.84	1.85	2.20	1.38
Interview	24.29	26.25	24.58	24.69	24.95	0.54	0.73	0.56	0.59	0.65
Discretionary Time										
Overall	25.32	25.18	25.10	24.15	25.18	0.59	0.59	0.58	0.51	0.57
Noninterview	26.63	25.64	25.36	22.73	26.67	1.41	1.72	1.65	1.27	1.91
Interview	24.98	25.12	25.07	24.30	25.06	0.65	0.64	0.62	0.55	0.60
Positive affect toward sponsor										
Overall	24.49	25.47	24.91	24.81	--	0.50	0.40	0.81	0.52	--
Noninterview	26.92	24.57	24.00	25.90	--	1.54	0.88	1.92	1.53	--
Interview	24.04	25.60	24.98	24.72	--	0.51	0.44	0.87	0.55	--
Combined										
Overall	25.95	25.54	25.68	23.98	23.78	0.59	0.56	0.57	0.54	0.56
Noninterview	26.33	24.35	25.64	22.50	26.00	1.06	1.53	1.70	0.50	3.06
Interview	25.78	25.74	25.68	24.01	23.72	0.71	0.60	0.61	0.55	0.57
Interactions										
Overall	26.16	25.48	25.23	23.94	24.13	0.58	0.54	0.59	0.51	0.61
Noninterview	25.55	25.59	25.75	24.00	28.00	1.06	1.44	1.61	a	a
Interview	26.40	25.45	25.17	23.94	24.09	0.70	0.58	0.64	0.51	0.61

Note: -- indicates that only four groups could be created using the Positive Affect Toward Sponsor model in the WDS. a indicates that there was only one noninterviewed case in this stratum.

Table A.42: Means for Age at Divorce Across Five Cooperation Propensity Strata, Five Cooperation Propensity Models, WDS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	34.63	39.56	39.22	35.40	31.64	0.91	0.61	0.78	0.77	0.64
Noninterview	33.64	40.79	38.31	34.13	38.25	2.06	1.05	2.46	2.35	4.87
Interview	34.90	39.33	39.33	35.50	31.40	1.02	0.69	0.82	0.81	0.63
Social Environmental Factors										
Overall	35.18	36.46	36.50	36.31	36.04	0.76	0.86	0.72	0.84	0.80
Noninterview	37.84	33.69	38.50	38.38	35.90	2.02	2.29	2.58	2.26	1.90
Interview	34.68	36.97	36.23	36.16	36.06	0.82	0.93	0.73	0.89	0.86
Discretionary Time										
Overall	36.66	36.91	36.02	36.20	34.73	0.77	0.91	0.70	0.82	0.75
Noninterview	37.67	36.21	35.45	37.09	36.78	2.02	2.89	1.87	2.45	1.86
Interview	36.40	37.01	36.07	36.10	34.56	0.82	0.96	0.75	0.88	0.80
Positive affect toward sponsor										
Overall	34.89	36.32	36.36	37.16	--	0.67	0.54	1.21	0.78	--
Noninterview	36.77	35.18	35.40	42.20	--	1.83	1.35	3.75	3.16	--
Interview	34.55	36.47	36.44	36.73	--	0.71	0.58	1.28	0.79	--
Combined										
Overall	35.91	37.85	37.19	36.19	33.36	0.85	0.71	0.79	0.77	0.78
Noninterview	35.06	39.47	38.64	37.50	35.67	1.52	1.81	2.80	7.50	2.96
Interview	36.28	37.57	37.04	36.16	33.30	1.04	0.77	0.83	0.78	0.80
Interactions										
Overall	36.99	36.76	37.69	34.65	34.42	0.81	0.76	0.73	0.76	0.87
Noninterview	36.58	34.27	43.00	33.00	30.00	1.61	1.59	2.00	a	a
Interview	37.15	37.32	37.09	34.66	34.46	0.95	0.85	0.76	0.77	0.87

Note: -- indicates that only four groups could be created using the Positive Affect Toward Sponsor model in the WDS. a indicates that there was only one noninterviewed case in this stratum.

Table A.43: Means and Standard Errors, Percent Applied for Financial Aid, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	72.4	72.1	77.4	77.8	64.4	0.6	0.6	0.5	0.5	0.5
Noncontacts	77.6	72.5	78.1	67.9	53.5	2.0	2.7	3.0	3.9	4.5
Contacts	72.0	72.1	77.4	78.1	64.6	0.6	0.6	0.6	0.5	0.5
Access Impediments										
Overall	74.3	72.7	66.9	73.5	76.1	0.7	0.6	0.6	0.5	0.5
Noncontacts	79.5	73.9	67.0	70.9	66.9	2.3	2.6	2.9	3.4	4.2
Contacts	73.8	72.7	66.9	73.6	76.2	0.7	0.6	0.6	0.5	0.5
Combined										
Overall	75.2	72.6	73.5	75.4	67.4	0.6	0.6	0.6	0.5	0.5
Noncontacts	80.4	71.7	68.8	71.2	53.6	1.9	2.5	3.2	3.9	5.2
Contacts	74.8	72.7	73.7	75.5	67.6	0.7	0.6	0.6	0.5	0.5
Interaction Model										
Overall	74.4	72.2	74.0	75.8	67.0	0.6	0.6	0.5	0.5	0.6
Noncontacts	74.6	69.4	76.4	69.3	60.8	1.9	2.8	2.9	4.6	6.8
Contacts	74.4	72.4	73.9	75.8	67.0	0.6	0.6	0.5	0.5	0.6

Table A.44: Percent And Standard Error, Received Financial Aid, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	57.9	59.8	68.4	70.5	60.4	0.7	0.6	0.6	0.5	0.6
Noncontacts	67.1	58.5	69.4	63.0	49.6	2.2	3.0	3.2	3.9	4.4
Contacts	57.1	59.9	68.3	70.7	60.5	0.7	0.7	0.6	0.6	0.6
Access Impediments										
Overall	63.6	60.2	55.7	66.2	70.8	0.8	0.6	0.6	0.5	0.5
Noncontacts	71.8	62.0	54.1	61.8	64.7	2.5	2.8	3.1	3.6	4.2
Contacts	62.8	60.1	55.8	66.3	70.9	0.8	0.6	0.6	0.5	0.5
Combined										
Overall	60.9	60.7	63.5	68.0	63.6	0.7	0.6	0.6	0.5	0.5
Noncontacts	69.2	62.3	58.3	63.2	50.9	2.2	2.7	3.3	4.1	5.2
Contacts	60.1	60.6	63.7	68.1	63.8	0.7	0.7	0.6	0.5	0.6
Interaction Model										
Overall	62.4	59.6	64.4	68.5	62.0	0.7	0.6	0.6	0.6	0.6
Noncontacts	63.4	58.9	70.1	62.2	59.3	2.1	2.8	3.2	4.8	6.8
Contacts	62.2	59.6	64.3	68.6	62.0	0.7	0.6	0.6	0.6	0.6

Table A.45: Percent and Standard Error, Received Stafford Loan, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	27.2	33.5	41.4	41.7	33.5	0.6	0.6	0.6	0.6	0.5
Noncontacts	22.5	27.8	39.6	33.0	22.3	2.0	2.7	3.3	3.5	3.5
Contacts	27.6	33.8	41.5	41.9	33.7	0.6	0.6	0.7	0.6	0.5
Access Impediments										
Overall	25.5	29.2	31.8	41.5	43.7	0.6	0.6	0.6	0.6	0.5
Noncontacts	21.5	25.7	26.8	41.7	34.9	2.1	2.5	2.8	3.6	4.1
Contacts	25.9	29.4	32.0	41.5	43.8	0.7	0.6	0.6	0.6	0.5
Combined										
Overall	26.6	32.7	38.1	41.9	36.0	0.6	0.6	0.6	0.6	0.5
Noncontacts	21.3	31.5	30.4	38.3	26.2	1.9	2.6	3.0	4.1	4.4
Contacts	27.1	32.8	38.4	41.9	36.1	0.6	0.6	0.6	0.6	0.5
Interaction Model										
Overall	27.3	32.3	38.2	40.5	37.0	0.6	0.6	0.6	0.6	0.6
Noncontacts	21.3	33.5	39.3	28.0	33.7	1.7	2.7	3.4	4.2	6.2
Contacts	28.1	32.3	38.1	40.7	37.0	0.7	0.6	0.6	0.6	0.6

Table A.46: Mean Amount of Stafford Loan, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	1221	1646	2052	1887	1552	31.9	38.5	41.3	33.9	28.9
Noncontacts	920	1345	2155	1590	1138	96.0	156.3	213.8	211.4	185.1
Contacts	1245	1661	2048	1895	1559	33.6	39.7	42.1	34.4	29.2
Access Impediments										
Overall	1217	1461	1495	1983	1960	36.4	35.2	36.4	33.6	30.2
Noncontacts	1041	1171	1335	2000	1725	113.6	128.8	167.7	208.3	262.9
Contacts	1233	1476	1501	1983	1964	38.8	36.5	37.4	34.0	30.4
Combined										
Overall	1250	1582	1887	1952	1598	34.2	35.9	39.9	33.7	28.5
Noncontacts	935	1494	1546	1975	1295	103.9	135.8	175.7	277.4	232.9
Contacts	1279	1588	1899	1951	1601	36.2	37.3	40.8	33.9	28.7
Interaction Model										
Overall	1332	1597	1841	1888	1620	36.3	34.8	35.7	35.9	30.8
Noncontacts	1032	1622	1770	1462	1679	94.3	162.4	184.3	260.7	355.1
Contacts	1373	1596	1843	1894	1620	39.5	35.7	36.4	36.2	30.9

Table A.47: Percent Received Pell Grant, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	34.8	32.9	33.3	28.8	18.4	0.6	0.6	0.6	0.5	0.4
Noncontacts	39.4	34.2	41.3	31.3	17.3	2.3	2.8	3.3	3.4	3.2
Contacts	34.4	32.9	33.0	28.8	18.4	0.6	0.6	0.6	0.5	0.4
Access Impediments										
Overall	41.3	36.1	27.6	25.9	22.0	0.7	0.6	0.5	0.5	0.5
Noncontacts	44.1	41.3	29.9	25.4	22.7	2.6	2.7	2.8	3.1	3.6
Contacts	41.1	35.8	27.5	25.9	22.0	0.8	0.6	0.5	0.5	0.5
Combined										
Overall	38.2	35.3	31.5	26.5	18.1	0.7	0.6	0.6	0.5	0.4
Noncontacts	42.4	38.2	30.8	24.2	18.8	2.4	2.6	2.9	3.5	3.7
Contacts	37.8	35.1	31.5	26.5	18.1	0.7	0.6	0.6	0.5	0.4
Interaction Model										
Overall	37.6	32.9	30.7	26.5	20.7	0.7	0.6	0.5	0.5	0.5
Noncontacts	37.7	31.3	35.4	34.0	28.9	2.0	2.5	3.3	4.4	6.5
Contacts	37.6	33.0	30.5	26.4	20.7	0.7	0.6	0.5	0.5	0.5

Table A.48: Mean Amount of Pell Grant, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	702	795	871	759	449	15.4	17.7	18.1	15.9	12.5
Noncontacts	790	773	1209	980	547	55.8	75.0	107.7	118.8	114.4
Contacts	695	796	859	754	447	16.1	18.2	18.3	16.1	12.5
Access Impediments										
Overall	987	880	675	649	521	20.6	17.4	15.5	14.5	13.0
Noncontacts	1051	1003	714	687	610	74.1	80.9	77.9	94.4	114.9
Contacts	982	873	673	648	520	21.7	17.9	15.9	14.7	13.1
Combined										
Overall	816	849	817	682	434	17.2	17.4	17.1	15.5	12.0
Noncontacts	864	989	901	666	572	58.5	77.0	97.0	114.4	128.8
Contacts	811	841	814	682	433	18.2	18.0	17.4	15.6	12.0
Interaction Model										
Overall	855	780	782	673	494	18.3	16.5	16.0	15.3	13.4
Noncontacts	847	777	951	1042	851	53.9	71.2	101.6	156.0	240.1
Contacts	856	781	777	668	492	19.8	17.0	16.2	15.4	13.4

Table A.49: Percent Students Received Work Study, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	2.4	3.3	6.1	8.5	8.9	0.2	0.2	0.3	0.3	0.3
Noncontacts	2.4	1.5	4.6	5.5	5.5	0.8	0.6	1.3	1.6	1.7
Contacts	2.4	3.4	6.2	8.6	9.0	0.2	0.2	0.3	0.3	0.3
Access Impediments										
Overall	2.6	2.7	3.7	6.3	12.6	0.2	0.2	0.2	0.3	0.3
Noncontacts	1.5	2.4	3.0	6.1	6.8	0.5	0.8	1.2	1.7	1.7
Contacts	2.6	2.7	3.7	6.4	12.7	0.2	0.2	0.2	0.3	0.3
Combined										
Overall	1.6	3.0	5.0	8.2	10.9	0.2	0.2	0.3	0.3	0.3
Noncontacts	1.9	2.8	3.2	6.4	7.6	0.7	0.9	1.0	1.8	2.2
Contacts	1.6	3.0	5.1	8.2	10.9	0.2	0.2	0.3	0.3	0.3
Interaction Model										
Overall	2.2	3.4	5.4	7.7	10.5	0.2	0.2	0.2	0.3	0.3
Noncontacts	2.0	2.3	8.3	2.8	5.8	0.5	0.8	1.9	1.1	2.1
Contacts	2.2	3.5	5.4	7.7	10.5	0.2	0.2	0.2	0.3	0.3

Table A.50: Mean Amount of Work Study, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	48	70	129	165	194	5.2	5.8	7.7	7.6	9.6
Noncontacts	57	43	76	79	101	24.9	21.2	22.6	25.5	34.8
Contacts	47	71	131	167	195	5.2	6.0	7.9	7.7	9.7
Access Impediments										
Overall	56	55	87	134	247	6.2	4.5	6.4	8.9	8.2
Noncontacts	23	43	73	101	155	9.9	13.2	37.3	30.9	54.5
Contacts	58	55	87	135	248	6.7	4.7	6.5	9.1	8.3
Combined										
Overall	32	61	105	181	212	4.3	5.1	6.9	10.3	7.7
Noncontacts	30	60	65	127	142	11.3	28.3	27.1	38.7	48.8
Contacts	32	61	107	182	213	4.6	5.1	7.0	10.5	7.8
Interaction Model										
Overall	42	71	121	159	207	4.6	5.7	8.9	7.9	8.3
Noncontacts	33	50	186	41	77	9.3	17.4	59.3	19.7	27.5
Contacts	43	72	120	161	208	5.1	5.9	9.0	8.0	8.3

Table A.51: Percent Received State Aid, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	16.8	19.3	25.4	24.5	17.5	0.5	0.5	0.5	0.5	0.4
Noncontacts	22.6	25.0	26.0	24.3	9.8	1.9	2.5	2.9	3.2	2.9
Contacts	16.3	19.0	25.4	24.5	17.6	0.5	0.5	0.5	0.5	0.4
Access Impediments										
Overall	20.9	22.0	19.7	22.5	19.1	0.6	0.5	0.5	0.4	0.4
Noncontacts	28.9	23.7	19.7	18.9	16.3	2.3	2.3	2.5	2.8	3.3
Contacts	20.2	21.9	19.8	22.6	19.2	0.6	0.5	0.5	0.4	0.4
Combined										
Overall	18.9	19.8	22.6	24.0	18.0	0.5	0.5	0.5	0.5	0.4
Noncontacts	26.2	21.2	23.2	23.2	10.6	2.1	2.1	2.7	3.6	3.1
Contacts	18.2	19.7	22.6	24.1	18.1	0.5	0.5	0.5	0.5	0.4
Interaction Model										
Overall	20.0	19.2	20.9	24.3	18.8	0.5	0.5	0.5	0.5	0.4
Noncontacts	22.5	18.7	25.8	30.5	20.3	1.7	2.0	3.1	4.6	6.2
Contacts	19.7	19.2	20.8	24.2	18.8	0.6	0.5	0.5	0.5	0.4

Table A.52: Mean Amount of State Aid, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	213	329	564	624	512	7.8	11.5	15.7	16.1	15.3
Noncontacts	332	466	564	586	269	38.0	63.4	83.8	102.2	93.4
Contacts	203	322	564	625	516	7.9	11.7	16.0	16.3	15.5
Access Impediments										
Overall	358	357	397	560	556	12.6	11.1	11.8	14.8	15.0
Noncontacts	549	370	379	441	390	61.9	51.9	62.0	80.1	101.5
Contacts	341	357	397	563	559	13.0	11.4	12.1	15.1	15.2
Combined										
Overall	271	345	467	603	542	9.6	11.8	13.6	15.8	15.6
Noncontacts	432	407	428	575	326	47.8	54.6	69.4	113.7	105.7
Contacts	256	341	468	603	545	9.7	12.1	13.9	15.9	15.7
Interaction Model										
Overall	337	351	461	601	498	12.3	12.4	13.6	15.2	15.2
Noncontacts	416	299	528	728	450	42.2	47.0	83.9	137.4	176.9
Contacts	326	354	460	599	498	13.1	12.8	13.8	15.3	15.3

Table A.53: Percent Received Institutional Aid, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	9.7	12.2	21.5	28.5	31.4	0.4	0.4	0.6	0.5	0.5
Noncontacts	10.5	6.5	13.3	16.9	25.8	1.5	1.4	2.0	2.8	3.8
Contacts	9.7	12.5	21.8	28.8	31.5	0.4	0.4	0.6	0.5	0.5
Access Impediments										
Overall	10.8	10.8	11.8	26.0	39.7	0.4	0.4	0.5	0.5	0.5
Noncontacts	12.8	8.7	5.9	16.3	29.3	1.8	1.5	1.3	2.7	4.0
Contacts	10.6	10.9	12.0	26.2	39.9	0.4	0.4	0.5	0.5	0.5
Combined										
Overall	9.8	10.5	17.3	27.7	36.8	0.4	0.4	0.5	0.5	0.5
Noncontacts	10.9	9.3	10.7	19.6	26.0	1.5	1.5	2.0	3.2	4.3
Contacts	9.6	10.6	17.5	27.9	36.9	0.4	0.4	0.5	0.5	0.5
Interaction Model										
Overall	10.6	12.8	20.2	28.3	31.4	0.4	0.4	0.5	0.5	0.5
Noncontacts	8.4	12.5	21.2	13.1	25.2	1.1	1.8	2.8	3.2	5.9
Contacts	10.9	12.8	20.2	28.5	31.4	0.4	0.4	0.5	0.5	0.5

Table A.54: Mean Amount of Institutional Aid, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	214	477	1136	1488	1872	14.9	23.8	70.0	42.8	45.9
Noncontacts	121	246	569	802	1605	29.1	109.6	147.1	191.1	386.3
Contacts	222	489	1156	1504	1876	15.9	24.4	72.2	43.7	46.3
Access Impediments										
Overall	277	317	431	1160	2670	22.2	19.0	61.0	35.4	48.8
Noncontacts	379	222	132	700	1756	121.2	48.8	47.8	235.1	313.1
Contacts	268	322	442	1171	2685	21.6	19.9	63.3	35.9	49.5
Combined										
Overall	218	263	692	1454	2438	19.1	14.5	64.5	41.3	50.2
Noncontacts	262	223	352	1062	1862	90.7	53.9	88.9	306.7	441.2
Contacts	214	265	704	1462	2445	19.1	15.0	66.7	41.7	50.6
Interaction Model										
Overall	262	470	958	1534	1948	18.5	28.2	33.2	64.4	45.9
Noncontacts	230	306	1219	562	1335	69.4	57.4	231.0	336.2	444.3
Contacts	267	478	950	1547	1951	18.9	29.6	33.7	65.1	46.2

Table A.55: Mean GPA Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	2.81	2.83	2.86	2.94	3.04	0.01	0.01	0.01	0.01	0.01
Noncontacts	2.66	2.76	2.72	2.80	2.90	0.04	0.06	0.05	0.06	0.05
Contacts	2.83	2.83	2.87	2.94	3.04	0.01	0.01	0.01	0.01	0.01
Access Impediments										
Overall	2.80	2.83	2.85	2.94	3.03	0.01	0.01	0.01	0.01	0.01
Noncontacts	2.68	2.81	2.66	2.76	2.87	0.05	0.05	0.05	0.06	0.06
Contacts	2.81	2.83	2.86	2.94	3.04	0.01	0.01	0.01	0.01	0.01
Combined										
Overall	2.76	2.83	2.85	2.95	3.07	0.01	0.01	0.01	0.01	0.01
Noncontacts	2.69	2.67	2.78	2.82	2.95	0.04	0.04	0.06	0.06	0.05
Contacts	2.76	2.84	2.85	2.95	3.07	0.01	0.01	0.01	0.01	0.01
Interaction Model										
Overall	2.79	2.84	2.87	2.94	3.05	0.01	0.01	0.01	0.01	0.01
Noncontacts	2.72	2.74	2.72	2.82	2.88	0.04	0.05	0.05	0.07	0.11
Contacts	2.80	2.84	2.88	2.94	3.05	0.01	0.01	0.01	0.01	0.01

Table A.56: Percent Did Not take SAT or ACT, Across Five Contact Propensity Strata, Four Contact Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home patterns										
Overall	72.6	59.6	41.0	27.8	21.3	0.7	0.7	0.7	0.6	0.5
Noncontacts	73.4	65.4	58.3	42.5	38.1	2.7	3.4	3.7	4.4	4.5
Contacts	72.5	59.3	40.4	27.5	21.0	0.7	0.7	0.7	0.6	0.5
Access Impediments										
Overall	76.1	65.0	49.7	30.3	18.8	0.6	0.6	0.7	0.5	0.4
Noncontacts	72.9	68.1	66.1	42.2	35.5	2.8	3.2	3.7	3.9	4.3
Contacts	76.5	64.9	49.2	30.1	18.6	0.6	0.7	0.7	0.5	0.4
Combined										
Overall	76.3	62.2	46.4	28.1	16.5	0.7	0.7	0.7	0.5	0.4
Noncontacts	73.7	64.2	60.3	39.5	29.4	2.6	3.1	3.8	4.4	4.8
Contacts	76.5	62.1	46.0	27.9	16.4	0.7	0.7	0.7	0.6	0.4
Interaction Model										
Overall	69.2	59.4	41.7	28.8	22.5	0.7	0.7	0.6	0.5	0.5
Noncontacts	69.9	64.7	46.0	40.3	38.1	2.4	3.2	3.9	5.1	7.0
Contacts	69.2	59.1	41.6	28.6	22.4	0.8	0.7	0.6	0.5	0.5

Table A.57: Percent Applied for Financial Aid Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	76.9	77.9	73.6	72.9	63.2	0.5	0.6	0.5	0.6	0.6
Noninterview	73.4	73.9	68.7	64.9	68.7	1.0	1.2	1.1	1.3	1.2
Interview	78.7	79.6	75.4	75.7	61.8	0.6	0.7	0.6	0.7	0.6
Positive affect toward sponsor										
Overall	75.4	81.2	74.6	77.8	62.6	0.5	1.1	0.5	0.5	0.5
Noninterview	83.1	69.4	77.4	73.5	61.6	2.8	0.9	1.3	0.9	1.3
Interview	77.4	70.2	79.9	80.3	65.1	2.1	0.6	0.8	0.5	0.6
Social Environmental Factors										
Overall	72.6	68.2	72.8	73.5	75.2	0.8	0.6	0.5	0.5	0.5
Noninterview	72.6	65.7	71.3	70.9	72.5	1.4	1.1	1.0	1.1	1.1
Interview	72.7	69.4	73.3	74.3	75.8	1.0	0.8	0.6	0.6	0.5
Discretionary Time										
Overall	62.6	66.9	81.8	80.0	73.9	0.6	0.6	0.4	0.7	0.5
Noninterview	64.2	66.2	80.5	75.7	70.6	1.0	1.2	0.9	1.5	1.1
Interview	61.8	67.3	82.2	81.3	74.9	0.8	0.8	0.5	0.7	0.5
Combined										
Overall	70.5	73.5	73.8	74.0	70.5	0.7	0.6	0.5	0.5	0.5
Noninterview	70.4	69.0	71.6	68.8	73.3	1.2	1.1	1.1	1.1	1.4
Interview	73.5	72.5	76.3	75.3	70.0	1.0	0.7	0.6	0.6	0.6
Interaction										
Overall	66.0	70.2	75.9	78.5	68.8	0.8	0.6	0.5	0.5	0.5
Noninterview	62.4	67.5	72.8	77.8	77.5	1.2	1.0	1.0	1.1	1.5
Interview	68.0	70.9	76.9	80.0	67.9	1.0	0.7	0.6	0.5	0.6

Table A.58: Percent Received Financial Aid Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	66.6	68.2	65.1	63.9	55.6	0.6	0.7	0.6	0.6	0.6
Noninterview	61.9	62.7	59.4	55.0	58.3	1.1	1.4	1.2	1.3	1.3
Interview	69.0	70.5	67.3	67.0	54.9	0.7	0.8	0.7	0.7	0.7
Positive affect toward sponsor										
Overall	62.0	71.6	66.7	70.1	54.6	0.6	1.2	0.5	0.5	0.5
Noninterview	64.8	53.5	65.3	66.0	55.8	3.3	0.9	1.5	0.9	1.3
Interview	65.6	57.4	70.9	73.7	59.2	2.4	0.6	0.9	0.5	0.6
Social Environmental Factors										
Overall	61.0	56.3	63.0	65.4	69.2	0.9	0.7	0.5	0.5	0.5
Noninterview	59.0	53.0	61.1	61.4	65.3	1.6	1.2	1.1	1.1	1.2
Interview	62.3	57.9	63.8	66.8	70.2	1.1	0.8	0.6	0.6	0.6
Discretionary Time										
Overall	48.3	53.3	74.1	74.8	68.8	0.6	0.7	0.5	0.7	0.5
Noninterview	49.3	52.2	70.5	70.6	64.7	1.1	1.2	1.0	1.7	1.2
Interview	47.8	53.8	75.4	76.1	69.9	0.8	0.8	0.6	0.8	0.6
Combined										
Overall	56.1	61.9	65.1	66.9	64.3	0.8	0.6	0.6	0.6	0.6
Noninterview	55.5	56.9	61.7	61.6	65.5	1.2	1.2	1.1	1.2	1.5
Interview	58.7	61.0	67.8	69.1	63.9	1.1	0.8	0.7	0.6	0.6
Interaction										
Overall	51.8	60.1	67.5	71.1	61.6	0.8	0.6	0.6	0.5	0.6
Noninterview	49.9	55.4	63.4	69.6	68.5	1.3	1.1	1.1	1.2	1.6
Interview	54.1	60.6	68.7	72.8	61.2	1.1	0.8	0.7	0.6	0.6

Table A.59: Percent Received Stafford Loan Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	41.4	42.2	36.8	34.7	26.2	0.6	0.7	0.6	0.6	0.5
Noninterview	36.2	35.8	32.9	29.0	26.2	1.0	1.5	1.1	1.2	1.1
Interview	44.0	44.8	38.2	36.8	26.3	0.7	0.8	0.7	0.7	0.6
Positive affect toward sponsor										
Overall	22.8	49.4	40.5	47.9	27.9	0.5	1.3	0.5	0.6	0.5
Noninterview	16.9	20.8	37.1	43.6	32.3	2.4	0.8	1.5	1.0	1.4
Interview	21.2	26.0	46.1	48.1	32.5	2.2	0.5	1.0	0.6	0.6
Social Environmental Factors										
Overall	22.9	28.9	37.9	38.2	43.1	0.9	0.6	0.5	0.5	0.5
Noninterview	20.1	26.4	37.1	35.3	40.7	1.9	1.0	1.1	1.1	1.3
Interview	24.6	30.0	38.1	39.2	43.6	1.0	0.7	0.6	0.6	0.6
Discretionary Time										
Overall	25.6	26.1	38.0	42.7	44.9	0.6	0.6	0.5	0.8	0.5
Noninterview	22.7	23.0	35.5	39.1	45.8	0.9	1.0	1.0	2.1	1.2
Interview	27.2	27.4	38.9	43.8	44.6	0.7	0.7	0.6	0.9	0.6
Combined										
Overall	27.9	33.7	38.4	38.9	37.1	0.7	0.7	0.6	0.6	0.6
Noninterview	25.7	28.9	34.2	36.6	40.4	1.0	1.3	1.1	1.2	1.5
Interview	33.1	33.8	40.2	39.2	37.0	1.0	0.7	0.7	0.7	0.6
Interaction										
Overall	24.9	33.1	39.6	42.2	34.8	0.8	0.6	0.6	0.6	0.6
Noninterview	21.9	28.2	36.3	42.4	43.0	1.3	1.0	1.1	1.3	1.8
Interview	27.6	34.4	39.0	43.4	35.4	0.9	0.7	0.7	0.7	0.6

Table A.60: Mean Amount of Stafford Loan Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	2077	2339	1529	1435	1179	35.9	49.7	29.3	34.6	28.5
Noninterview	1806	1932	1361	1175	1202	60.8	103.4	55.5	62.1	65.4
Interview	2211	2508	1591	1525	1173	44.9	57.8	34.7	41.3	32.1
Positive affect toward sponsor										
Overall	922	2305	1777	2426	1378	25.3	83.9	29.8	38.0	29.7
Noninterview	860	873	1746	2106	1575	153.5	39.2	89.4	57.2	90.7
Interview	1062	1174	2233	2297	1509	135.0	30.8	60.3	34.3	35.4
Social Environmental Factors										
Overall	966	1345	1829	1825	2009	56.9	34.3	32.9	31.8	32.5
Noninterview	900	1169	1798	1729	1881	125.4	57.1	63.0	65.8	73.0
Interview	1008	1429	1841	1857	2040	57.2	44.3	39.1	36.7	36.7
Discretionary Time										
Overall	1006	1362	1339	1684	2566	27.1	35.5	23.1	44.9	36.6
Noninterview	887	1151	1310	1632	2634	43.8	59.2	47.8	138.2	79.2
Interview	1073	1453	1349	1701	2547	34.7	44.2	26.6	40.5	41.6
Combined										
Overall	1124	1551	1827	1904	1782	32.9	39.2	34.7	34.5	33.7
Noninterview	1055	1299	1667	1838	1957	51.8	79.0	63.9	72.0	93.7
Interview	1388	1555	1910	1890	1774	49.7	43.6	41.5	39.0	36.9
Interaction										
Overall	1071	1537	1921	1994	1652	45.9	32.7	36.0	34.6	34.1
Noninterview	969	1302	1669	2108	2119	80.4	53.4	60.9	78.4	115.1
Interview	1202	1574	1878	2052	1685	57.3	41.6	41.9	38.5	36.5

Table A.61: Percent Received Pell Grant Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Percent					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	30.6	39.4	23.4	25.6	26.3	0.6	0.7	0.5	0.6	0.5
Noninterview	29.7	36.1	21.6	23.6	30.5	1.0	1.3	0.9	1.1	1.2
Interview	31.1	40.7	24.0	26.3	25.2	0.7	0.8	0.6	0.7	0.6
Positive affect toward sponsor										
Overall	39.6	38.3	27.4	27.8	21.6	0.6	1.2	0.5	0.5	0.5
Noninterview	52.6	34.2	33.9	26.5	16.6	3.3	0.9	1.4	0.8	0.9
Interview	48.8	34.6	37.3	28.8	18.8	2.5	0.6	1.0	0.5	0.5
Social Environmental Factors										
Overall	41.5	30.0	26.9	25.7	27.8	0.9	0.6	0.5	0.5	0.5
Noninterview	39.6	28.4	25.9	25.8	26.0	1.5	1.0	0.9	1.0	1.1
Interview	42.7	30.8	27.4	25.7	28.2	1.1	0.7	0.6	0.6	0.6
Discretionary Time										
Overall	24.0	28.5	35.9	31.0	26.8	0.5	0.6	0.5	0.7	0.5
Noninterview	26.8	29.4	36.8	29.1	22.7	0.9	1.1	1.0	1.6	1.0
Interview	22.4	28.1	35.7	31.6	28.0	0.7	0.7	0.6	0.8	0.6
Combined										
Overall	31.5	30.6	29.0	27.9	26.6	0.7	0.6	0.5	0.5	0.5
Noninterview	32.5	29.5	26.4	26.7	25.9	1.1	1.0	1.0	1.0	1.3
Interview	31.4	30.2	30.2	28.3	26.8	1.0	0.7	0.6	0.6	0.6
Interaction										
Overall	28.3	29.3	30.3	29.5	26.3	0.7	0.6	0.5	0.5	0.5
Noninterview	27.4	27.4	28.8	30.7	27.0	1.0	0.9	1.0	1.2	1.6
Interview	28.5	28.3	30.6	31.1	26.0	0.9	0.7	0.6	0.6	0.6

Table A.62: Mean Amount of Pell Grant Received, Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	745	970	573	607	635	16.3	20.4	14.4	15.7	14.4
Noninterview	682	831	491	527	744	27.0	36.5	25.4	27.9	34.1
Interview	776	1028	604	634	607	20.4	24.5	17.4	18.8	16.1
Positive affect toward sponsor										
Overall	914	929	678	717	510	16.2	32.6	14.2	15.6	13.2
Noninterview	1269	734	769	644	420	97.6	23.3	38.6	24.0	27.4
Interview	1260	807	970	737	462	76.4	15.9	29.1	15.3	14.7
Social Environmental Factors										
Overall	972	719	661	643	673	24.6	16.5	14.6	14.5	14.7
Noninterview	862	657	607	624	595	39.0	28.7	26.4	29.0	31.4
Interview	1043	749	682	650	692	32.4	20.6	17.6	16.8	16.7
Discretionary Time										
Overall	420	594	951	899	708	11.7	14.8	15.8	24.2	14.8
Noninterview	427	612	972	835	622	18.8	27.2	32.3	51.5	31.0
Interview	416	586	944	919	732	14.9	17.8	18.2	27.4	16.9
Combined										
Overall	619	712	734	737	660	16.6	16.3	16.1	15.7	15.2
Noninterview	607	643	648	701	686	25.6	27.2	28.6	32.1	40.4
Interview	649	710	769	760	657	23.3	19.5	19.2	18.4	16.5
Interaction										
Overall	585	682	757	774	640	16.9	15.6	16.0	16.1	15.3
Noninterview	541	606	704	775	704	23.7	25.3	28.7	35.1	48.6
Interview	600	674	777	820	631	23.0	19.2	19.2	18.8	16.0

Table A.63: Percent Received Work Study Aid, Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Percent					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	6.4	4.3	8.5	7.2	4.8	0.3	0.3	0.3	0.3	0.2
Noninterview	4.7	3.7	6.2	4.3	3.6	0.4	0.5	0.5	0.5	0.5
Interview	7.3	4.6	9.4	8.2	5.1	0.4	0.3	0.4	0.4	0.3
Positive affect toward sponsor										
Overall	2.4	5.1	7.8	8.1	6.2	0.2	0.4	0.3	0.3	0.2
Noninterview	1.6	1.3	3.9	6.0	7.7	0.6	0.2	0.6	0.4	0.6
Interview	4.4	2.3	5.4	8.9	9.7	1.0	0.2	0.4	0.3	0.3
Social Environmental Factors										
Overall	1.3	2.7	6.9	8.0	8.6	0.2	0.2	0.3	0.3	0.3
Noninterview	0.8	2.6	5.2	6.3	6.7	0.2	0.3	0.5	0.5	0.6
Interview	1.6	2.8	7.6	8.6	9.1	0.2	0.2	0.3	0.3	0.3
Discretionary Time										
Overall	2.6	1.6	8.5	10.6	8.4	0.2	0.2	0.3	0.5	0.3
Noninterview	1.7	1.5	5.9	7.1	7.9	0.2	0.3	0.5	0.8	0.6
Interview	3.1	1.6	9.4	11.7	8.5	0.3	0.2	0.3	0.6	0.3
Combined										
Overall	2.2	4.6	6.8	7.8	7.7	0.2	0.3	0.3	0.3	0.3
Noninterview	1.5	3.4	5.2	6.3	7.4	0.2	0.4	0.5	0.6	0.7
Interview	2.5	4.4	7.3	8.6	8.3	0.3	0.3	0.3	0.3	0.3
Interaction										
Overall	1.9	4.3	6.8	8.8	7.3	0.2	0.2	0.3	0.3	0.3
Noninterview	1.4	3.4	5.9	7.3	7.0	0.2	0.4	0.5	0.6	0.9
Interview	2.2	5.2	6.5	8.9	8.0	0.3	0.3	0.3	0.3	0.3

Table A.64: Mean Amount of Work Study Received, Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	136	92	181	131	104	8.0	7.6	10.3	6.7	6.1
Noninterview	91	72	118	83	65	10.4	11.1	12.4	12.0	11.5
Interview	158	100	205	148	113	10.9	9.7	13.4	8.0	7.2
Positive affect toward sponsor										
Overall	58	105	159	163	128	5.2	10.8	9.0	7.4	6.6
Noninterview	39	29	81	111	145	18.5	4.4	15.9	10.1	14.6
Interview	142	54	120	188	192	39.7	4.8	12.0	9.4	8.9
Social Environmental Factors										
Overall	31	56	148	168	170	6.5	5.1	9.4	7.6	7.0
Noninterview	18	52	99	125	123	5.5	9.7	10.1	13.3	14.1
Interview	40	58	167	182	182	10.2	6.0	12.5	9.3	8.1
Discretionary Time										
Overall	45	40	153	215	189	4.4	4.7	6.1	11.4	9.1
Noninterview	28	39	108	137	152	6.3	8.7	10.4	19.1	14.3
Interview	54	40	168	240	200	6.0	5.6	7.4	13.7	11.0
Combined										
Overall	42	97	147	160	155	5.2	7.2	9.7	7.7	6.8
Noninterview	26	78	92	125	131	4.5	11.4	10.2	14.2	15.2
Interview	52	87	167	177	170	9.4	8.0	12.8	9.3	7.9
Interaction										
Overall	37	93	152	177	143	5.1	6.8	9.9	7.8	6.7
Noninterview	28	59	126	136	124	5.7	7.5	13.8	14.8	18.6
Interview	36	115	148	189	159	5.6	9.7	9.6	11.8	7.5

Table A.65: Percent Received State Aid Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Percent					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	18.7	20.4	22.0	21.8	21.0	0.5	0.5	0.5	0.5	0.5
Noninterview	15.4	16.9	18.3	18.5	23.7	0.7	1.0	0.9	1.0	1.1
Interview	20.3	21.8	23.4	23.0	20.3	0.6	0.7	0.6	0.6	0.5
Positive affect toward sponsor										
Overall	21.1	20.2	21.9	21.6	18.7	0.4	0.8	0.4	0.5	0.4
Noninterview	25.0	17.3	19.5	19.6	15.5	2.8	0.7	1.2	0.7	0.9
Interview	24.3	19.5	24.2	24.4	19.2	2.0	0.4	0.8	0.5	0.5
Social Environmental Factors										
Overall	18.4	19.7	20.1	23.8	19.9	0.7	0.5	0.4	0.4	0.4
Noninterview	16.1	17.9	18.6	20.5	16.3	1.1	0.8	0.8	0.9	0.9
Interview	19.8	20.5	20.7	24.9	20.7	0.9	0.6	0.5	0.5	0.5
Discretionary Time										
Overall	13.1	15.1	27.1	28.0	22.1	0.4	0.5	0.5	0.7	0.4
Noninterview	12.7	14.3	24.5	23.3	20.3	0.7	0.8	0.9	1.5	0.9
Interview	13.3	15.4	28.0	29.5	22.7	0.5	0.6	0.5	0.8	0.5
Combined										
Overall	13.6	19.5	22.7	23.4	20.8	0.5	0.5	0.5	0.5	0.5
Noninterview	12.9	16.3	20.4	21.4	20.1	0.8	0.8	0.9	0.9	1.2
Interview	15.7	19.4	23.9	25.4	19.8	0.8	0.6	0.6	0.6	0.5
Interaction										
Overall	12.7	18.3	23.3	25.7	19.4	0.5	0.5	0.5	0.5	0.5
Noninterview	11.7	15.5	20.0	27.5	17.9	0.7	0.7	0.9	1.1	1.4
Interview	13.9	19.2	23.4	27.0	19.4	0.7	0.6	0.6	0.6	0.5

Table A.66: Mean Amount of State Aid Received Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	388	380	548	476	517	13.1	14.2	15.9	15.4	15.1
Noninterview	287	306	413	383	479	18.1	25.9	25.6	29.0	30.7
Interview	438	411	599	508	526	17.5	17.1	19.7	18.3	17.5
Positive affect toward sponsor										
Overall	254	514	532	555	457	7.3	25.7	14.1	14.8	13.7
Noninterview	368	184	429	480	413	53.0	9.5	33.3	23.0	29.1
Interview	396	230	594	640	565	44.6	7.2	25.3	15.6	17.5
Social Environmental Factors										
Overall	283	345	414	583	554	12.6	11.0	12.9	13.7	15.4
Noninterview	238	312	323	482	433	19.1	20.1	20.0	27.6	32.9
Interview	312	362	449	617	583	17.9	13.8	16.4	16.4	17.8
Discretionary Time										
Overall	194	203	619	687	609	9.5	8.8	13.8	22.5	15.1
Noninterview	165	185	533	540	521	15.3	14.6	27.6	41.8	29.6
Interview	210	210	648	733	634	12.5	11.0	16.2	26.4	17.7
Combined										
Overall	178	343	499	587	553	9.8	12.0	14.3	15.5	15.4
Noninterview	164	260	404	529	520	15.3	17.3	23.9	30.3	40.5
Interview	221	334	539	640	548	14.8	14.3	17.9	18.1	17.1
Interaction										
Overall	182	322	501	649	518	10.4	11.8	14.0	16.1	15.5
Noninterview	159	277	380	668	473	13.4	19.1	21.4	36.2	45.6
Interview	206	362	505	667	529	15.1	16.2	16.6	18.5	16.6

Table A.67: Percent Received Institutional Aid Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Percent					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	21.5	16.5	28.4	25.9	17.9	0.5	0.6	0.5	0.5	0.4
Noninterview	18.1	14.5	23.4	18.3	18.0	0.8	1.5	1.0	1.0	1.0
Interview	23.2	17.4	30.2	28.6	17.8	0.6	0.6	0.6	0.7	0.5
Positive affect toward sponsor										
Overall	7.4	17.7	26.3	30.4	21.5	0.3	0.8	0.5	0.5	0.4
Noninterview	11.1	6.3	14.3	25.9	28.2	1.9	0.4	0.9	0.8	1.4
Interview	10.1	7.1	19.5	31.4	31.4	1.4	0.3	0.7	0.5	0.6
Social Environmental Factors										
Overall	8.3	13.9	22.9	25.9	29.0	0.8	0.4	0.4	0.5	0.5
Noninterview	8.4	12.8	20.1	23.5	25.5	1.9	0.7	0.9	1.0	1.1
Interview	8.2	14.5	24.1	26.7	29.9	0.5	0.5	0.5	0.5	0.5
Discretionary Time										
Overall	11.3	8.8	27.3	30.8	30.1	0.4	0.4	0.4	0.8	0.5
Noninterview	11.2	9.0	21.8	29.3	27.0	0.6	0.7	0.9	2.2	1.0
Interview	11.4	8.7	29.2	31.3	31.0	0.5	0.4	0.5	0.8	0.5
Combined										
Overall	10.6	17.3	24.1	25.8	26.1	0.4	0.6	0.5	0.5	0.5
Noninterview	9.2	15.3	22.3	22.5	25.7	0.6	1.2	0.9	1.0	1.3
Interview	10.8	16.0	25.1	28.1	26.6	0.6	0.5	0.6	0.6	0.5
Interaction										
Overall	9.8	17.1	23.8	29.0	24.2	0.7	0.5	0.5	0.5	0.5
Noninterview	10.3	15.3	21.4	25.1	28.5	1.2	0.7	0.9	1.1	1.6
Interview	10.2	18.0	24.0	29.6	24.7	0.6	0.6	0.6	0.6	0.5

Table A.68: Mean Amount of Institutional Aid Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	1124	681	1647	1345	848	42.9	79.4	47.0	41.5	32.2
Noninterview	904	733	1225	906	753	70.6	252.4	86.8	68.6	69.3
Interview	1235	660	1803	1498	872	54.8	39.6	56.8	51.2	36.9
Positive affect toward sponsor										
Overall	125	601	1269	1553	1433	8.5	39.2	32.5	60.8	41.8
Noninterview	55	101	413	1100	2184	10.6	12.3	38.2	58.4	227.7
Interview	130	131	620	1419	2350	36.3	9.1	34.8	34.0	58.1
Social Environmental Factors										
Overall	346	498	1567	1299	1362	137.7	22.7	44.6	33.7	32.8
Noninterview	506	466	1269	1063	1138	346.2	46.9	86.7	70.6	84.0
Interview	242	513	1685	1378	1417	28.2	26.9	56.2	40.7	37.3
Discretionary Time										
Overall	312	212	1473	1896	1699	16.9	17.5	33.9	111.2	42.6
Noninterview	250	243	1089	1799	1634	23.4	41.1	63.8	397.3	97.6
Interview	346	199	1607	1927	1717	23.5	18.0	41.2	78.1	48.6
Combined										
Overall	315	960	1285	1397	1293	25.0	75.8	42.9	38.6	36.4
Noninterview	220	799	1207	1194	1201	27.1	200.3	88.5	81.2	91.9
Interview	314	803	1459	1508	1326	28.3	42.3	54.7	46.0	39.0
Interaction										
Overall	405	809	1258	1601	1219	105.5	37.3	41.3	42.5	35.3
Noninterview	477	681	1116	1290	1438	206.4	56.9	79.1	90.2	128.7
Interview	326	923	1311	1602	1259	32.1	46.4	50.3	49.3	37.9

Table A.69: Mean GPA Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	2.83	2.87	2.94	2.98	2.97	0.01	0.01	0.01	0.01	0.01
Noninterview	2.72	2.75	2.80	2.83	2.84	0.02	0.02	0.02	0.02	0.02
Interview	2.89	2.92	2.99	3.03	3.01	0.01	0.01	0.01	0.01	0.01
Positive affect toward sponsor										
Overall	2.80	2.87	2.88	2.98	2.99	0.01	0.02	0.01	0.01	0.01
Noninterview	2.85	2.70	2.80	2.76	2.90	0.06	0.02	0.03	0.01	0.02
Interview	2.92	2.91	2.94	2.95	3.06	0.04	0.01	0.02	0.01	0.01
Social Environmental Factors										
Overall	2.81	2.85	2.91	2.93	2.99	0.02	0.01	0.01	0.01	0.01
Noninterview	2.73	2.75	2.76	2.82	2.82	0.03	0.02	0.02	0.02	0.02
Interview	2.86	2.90	2.96	2.97	3.03	0.02	0.01	0.01	0.01	0.01
Discretionary Time										
Overall	2.82	2.88	2.77	2.93	3.08	0.01	0.01	0.01	0.01	0.01
Noninterview	2.67	2.79	2.64	2.79	2.96	0.02	0.02	0.02	0.03	0.02
Interview	2.89	2.92	2.82	2.97	3.11	0.01	0.01	0.01	0.01	0.01
Combined										
Overall	2.75	2.82	2.91	2.96	3.05	0.02	0.01	0.01	0.01	0.01
Noninterview	2.64	2.70	2.79	2.90	2.91	0.03	0.02	0.02	0.02	0.02
Interview	2.82	2.87	2.95	3.00	3.07	0.02	0.01	0.01	0.01	0.01
Interaction										
Overall	2.75	2.82	2.91	2.99	3.03	0.02	0.01	0.01	0.01	0.01
Noninterview	2.66	2.72	2.80	2.89	2.94	0.02	0.02	0.02	0.02	0.03
Interview	2.83	2.89	2.94	3.01	3.04	0.02	0.01	0.01	0.01	0.01

Table A.70: Percent Did Not Take SAT or ACT Across Five Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Mean					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
Overall	45.6	56.9	30.5	35.2	36.1	0.65	0.83	0.56	0.65	0.61
Noninterview	50.4	56.3	34.9	39.8	38.5	1.19	1.76	1.15	1.38	1.46
Interview	43.3	57.1	28.9	33.7	35.4	0.80	0.92	0.66	0.76	0.71
Positive affect toward sponsor										
Overall	78.4	35.9	28.5	31.7	37.9	0.52	1.09	0.50	0.54	0.54
Noninterview	91.2	76.3	55.7	26.2	26.7	2.31	0.92	1.70	0.87	1.19
Interview	85.3	76.6	48.0	24.3	25.2	2.42	0.57	1.05	0.48	0.58
Social Environmental Factors										
Overall	81.2	58.9	40.0	30.1	24.9	1.07	0.61	0.50	0.45	0.47
Noninterview	80.7	58.9	39.8	31.5	27.9	2.46	1.28	1.09	1.08	1.23
Interview	81.5	58.9	40.1	29.6	24.2	0.91	0.80	0.63	0.56	0.53
Discretionary Time										
Overall	57.2	65.7	33.9	25.5	26.6	0.69	0.72	0.51	0.72	0.50
Noninterview	57.7	65.1	40.7	29.4	25.2	1.21	1.34	1.10	1.72	1.10
Interview	56.9	65.9	31.5	24.2	27.0	0.88	0.88	0.60	0.79	0.58
Combined										
Overall	67.5	51.8	37.6	30.6	27.7	0.82	0.72	0.60	0.56	0.54
Noninterview	67.7	54.2	37.2	31.2	26.0	1.32	1.43	1.17	1.19	1.47
Interview	68.8	54.7	37.9	28.7	26.0	1.10	0.85	0.72	0.63	0.59
Interaction										
Overall	65.3	49.1	38.3	29.5	32.1	0.97	0.66	0.59	0.55	0.60
Noninterview	61.5	48.8	37.8	35.4	30.5	1.63	1.18	1.14	1.27	1.74
Interview	64.6	49.1	36.3	32.4	31.0	1.14	0.85	0.70	0.65	0.64

Table A.71: Contact Model with Interaction Effects, WDS

	Contact Model with Interaction Effects	
	Coeff.	SE
Intercept	-5.012**	1.662
At home patterns		
Female	-3.517**	1.241
Age	-0.010	0.016
# Kids R. Sole Custody	3.948+	2.126
# Kids R and Spouse Share Custody		
# Kids Spouse Sole Custody	-0.079	0.150
Education information missing	0.801	0.537
Education= College (vs. lt HS)	1.378**	0.398
Education= Some College (vs. lt HS)	0.875*	0.372
Education= HS (vs. lt HS)	0.449	0.310
Live in Wisconsin	0.606*	0.260
Prop. Drive to work alone	3.614*	1.699
Prop. Commute <15 minutes	0.670	1.501
Prop. Work at home	16.323***	5.579
Access Impediments		
Prop. People live in urban areas	2.709*	1.156
Prop. Nonwhite persons		
Median Income	0.00008***	0.00003
Prop. Married	-0.660	1.986
Prop. Age 17 and Younger		
Prop. Age 55 and Older		
Interaction Effects		
Female * Age	0.050*	0.024
Female* Prop. Commute <15 minutes	4.104*	1.929
# Kids R. Sole Custody* Prop. Drive to work alone	-9.265*	3.782
# Kids R. Sole Custody* Prop. Work at home	-15.534**	5.953
# Kids R. Sole Custody* Prop. Married	6.804*	2.796
Median Income * Prop. live in urban areas	-0.00008*	0.00003

Note: *p<.05, **p<.01, ***p<.001, ****p<.0001

Table A.72: Cooperation Model with Interaction Effects, WDS

	Coeff.		*SE*
Intercept	-13.27	*	*6.15*
Social Isolation			
Respondent age	0.07	*	*0.03*
R=Female	5.78	**	*1.50*
R=Female * R age	-0.12	***	*0.04*
# of children whose custody given to R	0.34		*0.26*
# of children whose custody given to both R and ex-spouse	7.57	*	*3.41*
# of children whose custody given to ex-spouse	2.76		*2.31*
Proportion single person HH	10.45	*	*4.24*
Proportion HH below poverty status	37.17	**	*12.74*
Social Environmental Factors			
Prop. age 17 and younger	12.22		*13.38*
Prop. age 55 and older	13.78		*11.18*
Prop. lived in same house in 1985	3.71		*3.92*
Prop. some college or more	12.46	**	*4.06*
Discretionary Time			
Respondent education = missing vs. no HS degree	-8.02	+	*4.13*
R. education = college graduate vs. no HS degree	-2.57		*2.76*
R. education = 1 to 3 years of college vs. no HS degree	0.29		*3.02*
R. education = High school grad vs. no HS degree	0.90		*2.67*
Prop. managerial/professional occupations	-10.23	+	*5.81*
Positive Affect Toward Sponsor			
Live in Wisconsin	-8.02	*	*3.45*
# of children whose custody given to ex-spouse * R. age	-0.10	*	*0.05*
# of children whose custody given to both R and ex-spouse * Proportion single person HH	-10.46	+	*5.56*
# of children whose custody given to both R and ex-spouse * Prop. age 17 and younger	-17.86	*	*9.06*
# of children whose custody given to ex-spouse * Prop. managerial/professional occupations	8.02		*5.78*
Proportion HH below poverty status * Prop. lived in same house in 1985	-48.63		*16.52*
Proportion HH below poverty status * Prop. managerial/professional occupations	-42.00	**	*15.11*
Prop. age 17 and younger * Live in Wisconsin	27.90	**	*13.35*
Prop. age 55 and older * R. educ. = missing vs. no HS degree	36.22	*	*21.23*
Prop. age 55 and older * R. educ. = college graduate vs. no HS degree	6.15		*11.72*
Prop. age 55 and older * R. educ. = 1 to 3 years of college vs. no HS degree	-5.57		*12.78*
Prop. age 55 and older * R. educ. = High school grad vs. no HS degree	-11.30		*10.90*

Note: *p<.05, **p<.01, ***p<.001, ****p<.0001

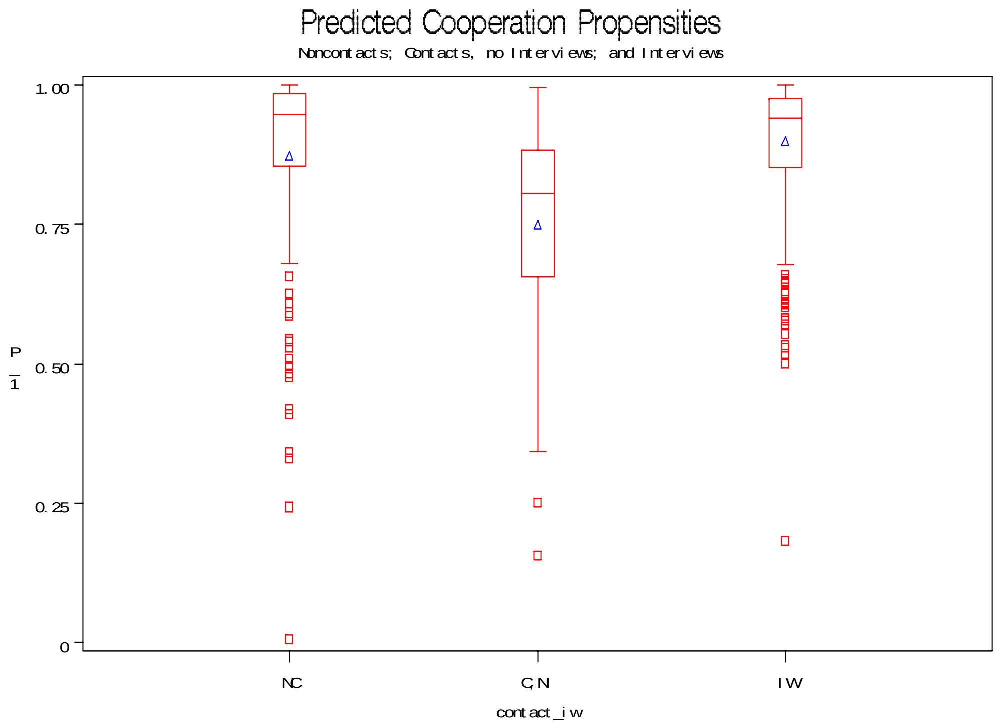

Figure 7: Boxplot of Predicted Cooperation Propensities for Noncontacted, Contacted, No Interview, and Interviewed Cases, Using Interaction Models, WDS

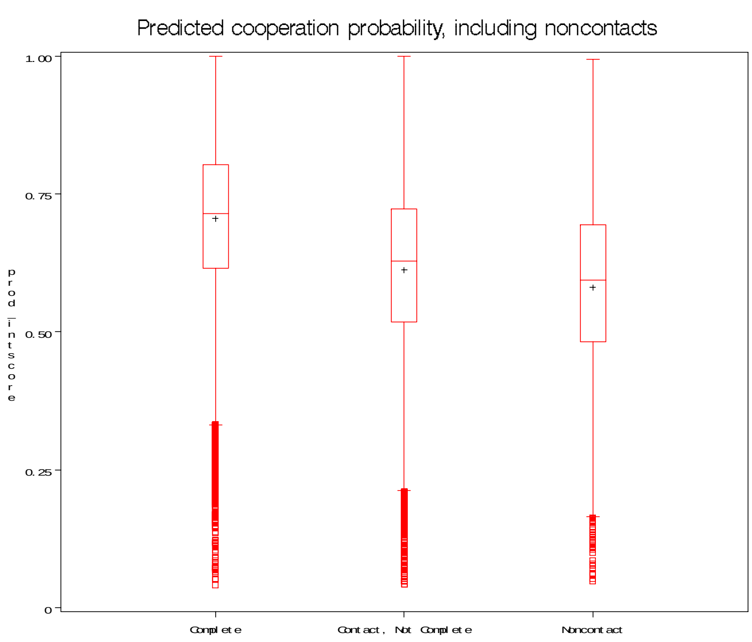

Figure 8: Predicted Cooperation Propensities, Complete, Contacted, No Interview, and Noncontacts, Using Interaction Models, NPSAS

Table A.73: Predicted Contact and Cooperation Propensities, Interaction Models, WDS and NPSAS

	Average Predicted Propensity: WDS					Average Predicted Propensity: NPSAS				
	Low	2	3	4	High	Low	2	3	4	High
Contact Interaction										
Overall	0.63	0.77	0.83	0.88	0.94	0.88	0.95	0.97	0.99	0.99
Noncontacted	0.60	0.77	0.83	0.88	0.92	0.85	0.95	0.97	0.98	0.99
Contacted	0.65	0.77	0.83	0.88	0.94	0.88	0.95	0.97	0.99	0.99
Observed	61%	80%	82%	88%	93%	87%	95%	97%	98%	99%
Cooperation Interaction										
Overall	0.68	0.85	0.93	0.96	0.99	0.51	0.64	0.72	0.79	0.89
Noninterview	0.61	0.85	0.92	0.97	1.00	0.49	0.64	0.72	0.78	0.87
Interview	0.71	0.85	0.93	0.96	0.99	0.52	0.64	0.72	0.79	0.89
Observed	72%	82%	90%	99%	99%	49%	63%	70%	78%	88%

Note: Observed in NPSAS are weighted contact and cooperation rates.

Table A.74: Percentage Difference from Target in Unadjusted and Adjusted Contact and Cooperator Means for Four Adjustment Models, WDS and NPSAS

	Contact			Cooperation		
	Unadj.	Main Effects	Interaction Effects	Unadj.	Main Effects	Interaction Effects
	%	%	%	%	%	%
WDS						
Length of marriage (months)	2.96	1.24	1.01	0.00	-0.19	-0.79
Months between divorce and interview	0.62	0.62	0.72	0.80	0.85	0.88
Number of marriages	-1.64	-1.54	-1.64	0.00	-0.47	-0.83
Age at marriage (years)	-0.16	-0.64	-0.48	-0.36	-0.03	0.04
Age at divorce (years)	0.75	-0.10	-0.08	-0.28	-0.10	-0.22
NPSAS						
Applied for Financial Aid	0.00	0.02	0.02	1.17	1.32	1.15
Received Financial Aid	0.03	-0.07	-0.06	2.26	1.85	1.58
Received Stafford Loan	0.81	0.47	0.30	3.58	3.03	2.35
Amount of Stafford Loan Received	0.77	0.43	0.32	3.59	2.58	2.04
Received Pell Grant	-0.83	-0.29	-0.21	0.63	1.34	0.90
Amount of Pell Grant Received	-0.85	-0.53	-0.43	2.29	2.44	1.96
Received Work Study	1.78	0.52	0.25	10.35	6.36	5.23
Amount of Work Study Received	1.56	0.25	-0.06	12.31	8.07	7.08
Received State Aid	-0.48	-0.48	-0.51	4.83	3.69	3.07
Amount of State Aid Received	0.22	-0.34	-0.42	8.19	4.76	4.03
Received Institutional Aid	1.38	0.52	0.42	5.91	3.12	2.52
Amount of Institutional Aid Received	2.16	0.56	0.45	7.22	3.80	2.99
GPA	0.34	0.16	0.16	1.71	1.25	1.19
Did not take SAT or ACT	-1.61	-0.31	-0.33	0.69	0.70	0.66

Table A.75: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Length of Marriage, by Contact Propensity Strata, Four Contact Models, WDS

	Quartile					95% Confidence Interval: (LL UL)									
	Low	2	3	4	High	Low		2		3		4		High	
At-home Patterns															
25	37	54	48	73	84	(30	46)	(40	63)	(41	60)	(63	81)	(67	97)
50	75	88	95	114	154	(60	88)	(80	101)	(74	130)	(100	139)	(127	175)
75	146	138	188	210	248	(115	178)	(116	168)	(154	208)	(163	236)	(224	275)
Access Impediments															
25	63	52	51	63	58	(48	79)	(41	60)	(38	63)	(47	68)	(44	73)
50	106	85	111	96	107	(93	128)	(73	110)	(87	135)	(81	123)	(92	130)
75	198	177	192	175	187	(160	227)	(144	216)	(156	220)	(152	211)	(161	230)
Combined															
25	37	50	51	69	82	(33	48)	(39	63)	(39	58)	(62	81)	(67	96)
50	79	89	89	115	141	(65	92)	(80	103)	(73	127)	(104	143)	(125	165)
75	159	144	176	213	245	(128	181)	(122	182)	(151	216)	(181	238)	(224	275)
Contact Interaction															
25	46	41	57	63	81	(37	54)	(34	50)	(41	67)	(53	80)	(68	96)
50	85.5	87	86	117	152	(74	107)	(63	101)	(75	103)	(104	143)	(127	175)
75	172	148	159	213	255	(143	205)	(115	166)	(136	202)	(161	238)	(224	281)

Table A.76: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Time Since Divorce, by Contact Propensity Strata, Four Contact Models, WDS

	Quartile					95% Confidence Interval: (LL UL)									
	Low	2	3	4	High	Low		2		3		4		High	
At-home Patterns															
25	27	25	26	27	24	(25	27)	(23	27)	(24	28)	(25	29)	(23	26)
50	69	30	69	69	30	(30	71)	(29	68)	(30	70)	(31	71)	(29	68)
75	74	72	74	74	73	(73	77)	(70	75)	(73	76)	(73	76)	(71	75)
Access Impediments															
25	26	26	26	26	25	(24	27)	(23	28)	(25	27)	(24	28)	(24	28)
50	69	30	68	68	68	(30	71)	(28	31)	(29	70)	(30	70)	(31	70)
75	74	72	74	74	74	(73	75)	(70	75)	(73	76)	(73	76)	(73	76)
Combined															
25	26	25	27	26	24	(24	27)	(23	27)	(25	29)	(24	28)	(23	26)
50	50	31	69	68	31	(30	71)	(29	69)	(31	71)	(30	70)	(29	69)
75	74	72	75	74	73	(73	76)	(70	75)	(73	76)	(72	75)	(72	76)
Contact Interaction															
25	26	26	26	27	25	(24	27)	(24	27)	(24	28)	(24	28)	(24	27)
50	69	31	32	69	31.5	(29	71)	(29	69)	(29	69)	(30	71)	(29	70)
75	74	73	74	74	73	(73	77)	(71	75)	(71	75)	(73	75)	(72	75)

Table A.77: First Quartile, Median, and Third Quartile with 95% Confidence Limits, Age at Marriage, by Contact Propensity Strata, Four Contact Models, WDS

	Quartile					95% Confidence Interval: (LL UL)				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	20	20	21	20	22	(20 21)	(19 21)	(20 22)	(20 22)	(21 22)
50	23	22	23	24	24	(22 24)	(22 24)	(22 24)	(23 25)	(23 25)
75	27	27	28	30	28	(26 28)	(25 28)	(26 29)	(27 33)	(27 30)
Access Impediments										
25	21	22	21	20	21	(20 21)	(20 22)	(20 22)	(20 21)	(20 22)
50	23	25	23	23	23	(22 24)	(24 27)	(23 24)	(22 24)	(22 24)
75	28	30	27	27	27	(26 29)	(28 32)	(26 29)	(26 31)	(26 29)
Combined										
25	20	21	21	21	22	(20 21)	(20 21)	(20 21)	(20 22)	(21 22)
50	23	23	23	24	24	(22 23)	(22 24)	(22 24)	(23 25)	(23 25)
75	27	28	27	29.5	28	(25 28)	(26 30)	(26 30)	(27 33)	(27 30)
Contact Interaction										
25	20	21	21	21	21	(20 21)	(20 22)	(20 22)	(20 22)	(20 22)
50	22	24	24	23	23	(22 23)	(23 25)	(23 25)	(23 24)	(23 24)
75	26	28	27	27	28	(24 29)	(27 30)	(26 30)	(26 30)	(26 31)

Table A.78: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Age at Divorce, by Contact Propensity Strata, Four Contact Models, WDS

	Quartile					95% Confidence Interval: (LL UL)				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	27	27	29	31	33	(26 28)	(26 28)	(28 30)	(30 33)	(31 36)
50	31	31	35	38	39	(29 34)	(30 33)	(33 36)	(36 40)	(38 43)
75	38	38	41	43	46	(36 40)	(36 40)	(38 42)	(41 44)	(45 49)
Access Impediments										
25	29	29	29	28	29	(27 30)	(27 32)	(27 30)	(27 30)	(28 30)
50	35	36	35	35	35	(33 37)	(35 39)	(33 37)	(32 36)	(33 37)
75	41	42	41	42	41	(39 43)	(41 44)	(40 42)	(39 46)	(39 44)
Combined										
25	27	28	29	31	33	(26 28)	(27 29)	(27 30)	(29 33)	(31 34)
50	30	33	34	38	38.5	(29 34)	(31 34)	(32 36)	(37 40)	(37 42)
75	37	38	41	43	46	(35 40)	(36 40)	(39 42)	(42 45)	(44 48)
Contact Interaction										
25	27	28	29	29	33	(25 27)	(27 29)	(28 30)	(28 31)	(31 35)
50	32.5	33	34	37	39.5	(30 35)	(30 34)	(32 36)	(36 38)	(38 42)
75	39	38	41	42	46	(37 41)	(36 42)	(38 42)	(41 44)	(44 47)

Table A.79: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Length of Marriage, by Cooperation Propensity Strata, Six Cooperation Models, WDS

	Quartile					95% Confidence Interval: (LL UL)									
	Low	2	3	4	High	Low		2		3		4		High	
Social Isolation															
25	38	66	83	49	64	(33	45)	(58	79)	(68	103)	(38	68)	(43	84)
50	68.5	115	150	98	116	(51	81)	(95	144)	(121	177)	(80	134)	(99	134)
75	130	236	255	201	163	(97	191)	(161	255)	(215	288)	(159	218)	(146	198)
Social Cohesion															
25	57	45	64	64	51	(45	68)	(36	60)	(49	84)	(47	79)	(44	74)
50	100	92	124	115	103	(83	134)	(68	116)	(103	150)	(86	139)	(86	126)
75	169	185	209	208	211	(146	203)	(132	224)	(181	239)	(167	241)	(160	248)
Discretionary Time															
25	66	45	63	65	51	(49	86)	(36	64)	(46	75)	(45	79)	(44	60)
50	108	102	112	128	80	(95	139)	(84	134)	(97	131)	(96	165)	(68	103)
75	190	208	170	225	169	(150	234)	(155	249)	(159	227)	(194	250)	(134	195)
Positive affect toward sponsor															
25	48.5	60	64	57	44	(41	63)	(50	68)	(38	81)	(46	77)	(35	57)
50	98.5	104	103	125	86	(86	117)	(91	122)	(84	161)	(103	146)	(67	97)
75	189	182	207	215	143	(150	218)	(157	213)	(166	248)	(186	249)	(110	195)
Combined															
25	66	63	64	52	49	(54	79)	(48	74)	(44	87)	(38	68)	(36	63)
50	113	117	139	94	87.5	(96	151)	(97	144)	(110	155)	(79	117)	(74	106)
75	231	187	222	161	186	(196	270)	(168	239)	(198	243)	(136	193)	(143	218)
Interaction															
25	50	57	64	64	53	(37	61)	(44	69)	(52	84)	(45	74)	(37	68)
50	91	100	141	108	102	(76	111)	(81	123)	(120	160)	(81	139)	(86	127)
75	194	212	213	193	166	(143	236)	(151	239)	(176	255)	(161	224)	(139	211)

Table A.80: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Time Since Divorce, by Cooperation Propensity Strata, Six Cooperation Models, WDS

	Quartile					95% Confidence Interval: (LL UL)									
	Low	2	3	4	High	Low		2		3		4		High	
Social Isolation															
25	27	26	24	27	25	(25	28)	(25	29)	(23	26)	(25	29)	(23	28)
50	31	32	68	68	68	(29	69)	(30	69)	(29	70)	(30	71)	(30	70)
75	73	74	73	75	74	(71	74)	(72	75)	(72	77)	(73	77)	(71	76)
Social Cohesion															
25	25	26	26	28	26	(24	27)	(24	28)	(23	28)	(24	29)	(24	29)
50	31	30	68	70	68	(28	69)	(29	68)	(30	69)	(68	71)	(30	70)
75	74	72	73	75	74	(72	75)	(70	74)	(72	75)	(73	77)	(72	77)
Discretionary Time															
25	26	26	26	27	27	(24	29)	(23	29)	(24	27)	(24	28)	(24	28)
50	69	31	31	31	68	(31	71)	(29	70)	(29	70)	(29	69)	(30	69)
75	74	74	74	73	73	(73	76)	(72	76)	(72	75)	(71	74)	(72	76)
Positive affect toward sponsor															
25	25	27	26	27	25	(24	27)	(25	28)	(23	29)	(24	29)	(24	27)
50	49.5	68	50	68	31	(30	70)	(30	69)	(29	71)	(30	70)	(29	69)
75	73.5	74	75	74	72	(72	75)	(72	75)	(71	78)	(73	75)	(70	74)
Combined															
25	28	26	26	26	27	(26	30)	(23	27)	(23	28)	(24	28)	(24	28)
50	71	50	31	32	68	(68	73)	(29	69)	(29	69)	(30	70)	(30	71)
75	75	73	74	73	74	(74	77)	(71	75)	(71	76)	(71	76)	(72	75)
Interaction															
25	27	26	26	24	27	(25	27)	(23	28)	(24	28)	(23	27)	(25	29)
50	68	31	32	32	69	(29	70)	(30	70)	(29	70)	(29	69)	(31	71)
75	74	74	73	72	74	(72	75)	(73	76)	(72	75)	(70	76)	(73	76)

Table A.81: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Age at Marriage, by Cooperation Propensity Strata, Six Cooperation Models, WDS

	Quartile					95% Confidence Interval: (LL UL)									
	Low	2	3	4	High	Low		2		3		4		High	
Social Isolation															
25	22	22	21	22	19	(21	22)	(20	23)	(20	22)	(21	22)	(18	20)
50	24	26	23	24	21	(23	25)	(24	28)	(23	24)	(23	25)	(20	22)
75	27	34	28	28	23	(26	31)	(30	36)	(26	29)	(26	29)	(23	25)
Social Cohesion															
25	21	21	20	21	21	(20	21)	(20	22)	(20	22)	(20	22)	(20	22)
50	23	24	23	23	23	(22	24)	(23	26)	(22	24)	(23	24)	(22	24)
75	28	32	27	27	27	(26	29)	(27	33)	(26	29)	(25	29)	(25	30)
Discretionary Time															
25	20	21	21	20	21	(20	22)	(20	22)	(20	22)	(20	21)	(20	22)
50	24	24	23	23	23	(22	25)	(23	24)	(22	24)	(22	24)	(23	25)
75	28	27	27	26	27	(27	31)	(26	29)	(25	30)	(25	29)	(26	31)
Positive affect toward sponsor															
25	20	21	21	21	21	(19	21)	(20	22)	(19	22)	(20	22)	(20	22)
50	23	24	23	23	24	(22	23)	(23	24)	(22	25)	(22	24)	(23	26)
75	27	28	27	28	29	(26	29)	(27	30)	(25	30)	(26	30)	(27	32)
Combined															
25	21	21	20	20	21	(20	22)	(20	22)	(20	21)	(19	21)	(20	22)
50	24	24	23	23	24	(23	25)	(23	26)	(22	23)	(22	23)	(23	26)
75	29	28	25	26	29	(27	32)	(27	32)	(24	28)	(25	28)	(27	30)
Interaction															
25	22	21	21	20	20	(20	22)	(20	22)	(20	22)	(20	21)	(19	21)
50	24	24	23	23	23	(24	27)	(23	25)	(22	24)	(22	24)	(22	23)
75	30	28	28	26	25	(28	32)	(26	31)	(25	31)	(25	28)	(24	28)

Table A.82: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Age at Divorce, by Cooperation Propensity Strata, Six Cooperation Models, WDS

	Quartile					95% Confidence Interval: (LL UL)									
	Low	2	3	4	High	Low		2		3		4		High	
Social Isolation															
25	27	36	33	28	27	(26	28)	(33	37)	(30	35)	(27	31)	(25	28)
50	32	41	38	33	31	(29	35)	(39	42)	(36	40)	(32	37)	(29	33)
75	39	44	44	41	36	(36	46)	(43	46)	(42	48)	(39	42)	(34	38)
Social Cohesion															
25	28	29	30	29	29	(27	30)	(27	32)	(29	33)	(28	30)	(27	30)
50	34	36	36	36	35	(32	37)	(34	39)	(34	37)	(33	38)	(33	37)
75	41	42	42	42	42	(38	43)	(41	44)	(39	43)	(40	46)	(39	44)
Discretionary Time															
25	30	29	30	29	27	(28	33)	(27	31)	(28	31)	(27	30)	(27	30)
50	36	35	36	36	35	(34	38)	(33	37)	(33	38)	(32	38)	(32	37)
75	42	42	42	42	40	(40	46)	(41	46)	(40	44)	(41	44)	(38	42)
Positive affect toward sponsor															
25	28	30	28	30	29	(27	30)	(29	31)	(26	31)	(28	32)	(27	30)
50	34	36	36	37	35	(33	36)	(34	38)	(33	40)	(35	39)	(32	37)
75	40.5	42	43	42	42	(38	42)	(40	44)	(41	46)	(41	45)	(39	45)
Combined															
25	33	30	30	27	29	(28	34)	(29	32)	(27	31)	(26	28)	(27	31)
50	38	36	36	31.5	36	(36	41)	(34	39)	(33	38)	(30	35)	(33	38)
75	43	43	41	38	42	(42	47)	(41	46)	(40	44)	(37	40)	(40	46)
Interaction															
25	29	30	32	28	27	(28	32)	(28	32)	(29	34)	(27	30)	(26	29)
50	36	36	38	33	32	(35	38)	(34	39)	(36	40)	(32	36)	(30	35)
75	43	42	43	38	39	(40	46)	(41	45)	(42	45)	(37	41)	(37	42)

Table A.83: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Length of Marriage, by Interview Propensity Strata, Two Interview Models, WDS

	Quartile					95% Confidence Interval: (LL UL)				
	Low	2	3	4	High	Low	2	3	4	High
Combined										
25	41	47	50	73	82	(33 52)	(37 57)	(41 63)	(55 86)	(65 104)
50	80	85	87	132	140	(65 92)	(72 106)	(77 106)	(104 152)	(122 161)
75	137	170	182	208	226	(111 170)	(139 203)	(132 226)	(176 231)	(202 246)
Interaction										
25	45	50	52	66	68	(37 53)	(39 60)	(37 65)	(51 76)	(58 83)
50	86	86	98	127	130	(70 100)	(80 103)	(79 115)	(93 150)	(109 151)
75	151	163	208	205	210	(129 195)	(136 205)	(147 239)	(166 236)	(172 241)

Table A.84: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Time Since Divorce, by Interview Propensity Strata, Two Interview Models, WDS

	Quartile					95% Confidence Interval: (LL UL)				
	Low	2	3	4	High	Low	2	3	4	High
Combined										
25	26	25	24	26	26	(25 27)	(24 28)	(23 27)	(25 28)	(24 28)
50	31.5	69	30	68	68	(29 69)	(31 71)	(29 69)	(30 69)	(31 70)
75	73	74	73	74	74	(72 76)	(73 75)	(72 74)	(72 76)	(73 76)
Interaction										
25	26	27	26	26	26	(24 27)	(25 28)	(23 27)	(24 27)	(24 29)
50	31.5	69	30	31	68	(29 70)	(31 71)	(29 69)	(28 70)	(31 70)
75	74	75	73	74	73	(72 75)	(74 77)	(71 75)	(72 76)	(72 75)

Table A.85: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Age at marriage, by Interview Propensity Strata, Two Interview Models, WDS

	Quartile					95% Confidence Interval (LL UL)				
	Low	2	3	4	High	Low	2	3	4	High
Combined										
25	21	21	21	21	21	(20 22)	(20 22)	(20 22)	(20 22)	(20 21)
50	23	24	23	23	23	(22 25)	(23 25)	(23 25)	(23 24)	(22 23)
75	28	28	28	29	26	(27 30)	(27 29)	(27 32)	(27 32)	(24 27)
Interaction										
25	22	21	20	21	21	(20 22)	(20 21)	(20 21)	(20 22)	(20 22)
50	24	23	23	24	23	(23 26)	(22 24)	(22 24)	(23 25)	(22 24)
75	28	28	26	29	26	(28 30)	(26 29)	(25 28)	(27 33)	(25 28)

Table A.86: First Quartile, Median, and Third Quartile, with 95% Confidence Limits, Age at Divorce, by Interview Propensity Strata Two Interview Models, WDS

	Quartile					95% Confidence Interval (LL UL)				
	Low	2	3	4	High	Low	2	3	4	High
Combined										
25	27	28	28	32	31	(26 28)	(27 30)	(27 30)	(30 33)	(29 32)
50	33	34	34	38	37	(31 35)	(31 36)	(31 37)	(36 39)	(35 38)
75	38	41	42	43	42	(36 40)	(39 43)	(41 44)	(42 45)	(40 44)
Interaction										
25	28	29	28	30	30	(27 30)	(27 29)	(27 30)	(29 32)	(28 32)
50	34	34	33	38	36	(33 36)	(32 36)	(31 36)	(36 41)	(34 38)
75	39	41	41	44	42	(38 41)	(38 43)	(39 43)	(42 45)	(40 44)

Table A.87: First Quartile, Median, and Third Quartile, Nonzero Amount of Stafford Loan, by Contact Propensity Strata, Four Contact Models, NPSAS

	Quartiles					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	2624	2625	2625	2625	2625	0.02	0.03	0.02	0	51.9
50	3749	4554	5045	3500	4487	83.5	244.9	192.8	14.3	282.1
75	6504	6624	6495	5498	5500	121.5	0.02	86.45	0.01	0
Access Impediments										
25	2625	2625	2625	2625	2625	0.04	0	0.01	0	0
50	4416	4876	3750	4453	3501	231.0	181.5	159.0	103.5	123.1
75	6624	6625	6294	5498	5500	0.02	69.82	198.5	0.1	0
Combined										
25	2625	2625	2625	2625	2625	0.07	0.04	7.69	0.01	0.0
50	4275	4373	5000	3820	3500	176.9	198.6	172.0	143.2	74.5
75	6624	6624	6624	5500	5500	0.01	0.02	198.5	0.0	0.0
Contact Interaction										
25	2625	2694	2625	2625	2625	49.6	58.9	0.02	0.01	0.01
50	4625	5051	4958	3750	3488	228.4	164.3	191.2	136.8	0.3
75	6625	6625	5500	5500	5500	0.01	0.0	192.5	0.0	0.01

Table A.88: First Quartile, Median, and Third Quartile, Nonzero Amount of Pell Grants, by Contact Propensity Strata, Four Contact Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	1012	1299	1496	1519	1199	14.04	49.95	.	.	.
50	2011	2399	2841	2888	2595	31.22	90.63	73.07	61.59	59.38
75	3037	3938	.	.	3996	35.13	.	.	.	11.91
Access Impediments										
25	1348	1300	1299	1381	1129	33.23	45.27	42.42	42.73	.
50	2200	2437	2475	2592	2394	99.79	65.41	88.82	59.01	62.02
75	3893	3933	3993	3990	3889	.	.	.	.	.
Combined										
25	1013	1298	1497	1488	1189	29.61	46.69	.	47.05	.
50	2024	2399	2784	2698	2598	0.01	72.93	58.57	56.56	49.75
75	3324	3935	.	3998	3896	60.94	.	.	.	.
Contact Interaction										
25	1199	1222	1397	1397	1100	70.03	47.4	36.39	54.23	.
50	2025	2320	2597	2695	2499	0.03	79.75	55.35	79.94	87.41
75	3587	3885	4000	3997	3898	.	.	.	.	.

Note: . indicates that SUDAAN could not calculate a quantile or its standard error.

Table A.89: First Quartile, Median, and Third Quartile, Nonzero Amount of Work Study, by Contact Propensity Strata, Four Contact Models, NPSAS

	Quartiles					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	953	1058	1214	1097	1298	122.69	48.85	65.91	43.39	62.14
50	1763	1710	1865	1786	1966	122.64	100.72	78.51	27.2	30.64
75	2479	2779	2494	2398	2492	258.92	139.38	67.58	73.2	70.69
Access Impediments										
25	1017	998	1209	1043	1216	95.03	114.98	108.29	48.95	39.15
50	1789	1994	2017	1789	1797	111.82	111.58	90.33	42.91	20.25
75	2816	2864	2997	2494	2299	355.19	107.23	118.41	59.13	44.02
Combined										
25	978	994	1056	1197	1287	96.71	102.84	56.03	62.98	39.95
50	1597	1917	1783	1934	1800	193.06	99.1	101.35	45.63	34.07
75	2883	2597	2794	2591	2273	455.46	106.68	123.19	71.24	37.58
Contact Interaction										
25	993	1198	1116	1220	1197	129.86	85.7	53.98	68.24	32.31
50	1774	1995	1879	1798	1792	144.27	42.76	79.3	55.76	13.36
75	2480	2600	2774	2484	2338	168.69	89.61	118.85	62.45	45.87

Table A.90: First Quartile, Median, and Third Quartile, Nonzero Amount of State Aid, by Contact Propensity Strata, Four Contact Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	488	576	909	1150	1296	13.51	18.54	32.59	29.32	46.41
50	954	1269	1898	2150	2487	34.63	39.24	59.35	53.11	96.09
75	1786	2395	3148	3652	4371	65.99	90.24	40.43	56.4	66.06
Access Impediments										
25	618	525	804	1045	1216	31.86	20.92	43.55	35.6	43.61
50	1350	1209	1735	2000	2690	29.54	35.42	63.68	35.21	95.42
75	2448	2377	2994	3352	4079	109.54	82.17	80.13	91.68	51.42
Combined										
25	494	625	900	1080	1349	19.75	26.42	33.31	34.65	50.41
50	1108	1249	1749	2125	2548	46.08	40.79	59.76	51.34	104.66
75	1993	2419	3078	3591	4379	71.49	90.06	50.59	63.1	33.79
Contact Interaction										
25	588	635	902	1022	1099	29.64	21.27	38.85	38.99	35.61
50	1349	1293	1784	2045	2205	41.27	39.61	69.61	28.37	51.13
75	2592	2506	3159	3499	3997	120.56	91.45	63.73	68.08	104.36

Table A.91: First Quartile, Median, and Third Quartile, Nonzero Amount of Institutional Aid, by Contact Propensity Strata, Four Contact Models, NPSAS

	Quartiles					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	398	698	1000	1081	1498	41.2	52.7	10.7	40.5	38.3
50	999	1797	2994	3008	3838	71.1	100.4	150.3	136.4	141.2
75	2822	4999	7499	7298	8436	267.4	328.6	478.5	226.7	193.8
Access Impediments										
25	409	496	716	996	1783	58.3	23.3	90.7	0.6	53.3
50	1000	1266	1810	2492	4598	42.5	94.4	147.2	65.3	90.6
75	2997	3941	4502	5998	9582	388.3	335.6	637.3	167.6	192.3
Combined										
25	307	551	926	1201	1649	32.2	35.2	54.1	63.8	60.8
50	899	1248	1997	3082	4500	70.5	108.4	83.7	122.5	90.1
75	2166	2993	5297	7302	9498	212.9	208.9	391.2	225.1	180.4
Contact Interaction										
25	397	747	996	1185	1575	45.1	53.8	20.1	57.1	79.1
50	1000	1783	2399	2995	4197	59.3	101.1	144.5	64.8	116.9
75	3313	5214	6713	7169	8997	356.3	356.4	453.2	214.6	154.1

Table A.92: First Quartile, Median, Third Quartile, GPA, by Contact Propensity Strata, Four Contact Models, NPSAS

	Quartiles					SE				
	Low	2	3	4	High	Low	2	3	4	High
At-home Patterns										
25	2.29	2.32	2.4	2.5	2.66	0.02	0.02	0.02	0.01	.
50	2.95	2.93	2.95	3	3.1	0.02	0.02	0.02	0.01	0.01
75	3.47	3.44	3.41	3.48	3.51	0.02	0.01	0.02	0.01	0.01
Access Impediments										
25	2.25	2.33	2.37	2.5	2.65	0.03	0.02	0.02	0.01	.
50	2.97	2.95	2.93	3	3.11	0.03	0.02	0.02	0.01	0.01
75	3.4	3.44	3.43	3.47	3.51	0.02	0.02	0.01	0.01	0.01
Combined										
25	2.15	2.32	2.39	2.52	2.7	0.03	0.02	0.02	0.01	.
50	2.89	2.93	2.92	3.01	3.15	0.03	0.02	0.02	0.01	0.01
75	3.39	3.43	3.42	3.48	3.53	0.02	0.01	0.02	0.01	0.01
Contact Interaction										
25	2.24	2.35	2.4	2.52	2.66	0.03	0.02	0.01	0.01	0.01
50	2.93	2.94	2.93	3.02	3.12	0.03	0.02	0.01	0.01	0.01
75	3.38	3.43	3.44	3.48	3.53	0.02	0.01	0.01	0.01	0.01

Note: . indicates that SUDAAN could not calculate a quantile or its standard error.

Table A.93: First Quartile, Median, and Third Quartile, Nonzero Amount of Stafford Loan, by Cooperation Propensity Strata, Six Cooperation Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
25	3311	3499	2625	2624	2625	132.0	38.7	0.0	0.0	0.0
50	5499	5499	3496	3066	3500	9.3	0.0	0.1	205.0	40.5
75	5500	7000	5500	5499	5495	0.0	158.1	0.0	64.7	0.4
Positive Affect Toward Sponsor										
25	3310	2624	2625	2625	2625	222.7	0.0	0.0	0.0	48.3
50	4673	3500	4180	4699	4305	447.6	1.6	222.9	182.3	171.7
75	6613	6497	6624	5500	5500	.	93.2	0.0	0.0	0.0
Social Environmental Factors										
25	2624	2625	2624	2625	2625	34.8	0.0	0.0	0.0	0.0
50	3499	3984	4625	4625	3986	125.0	135.2	207.8	238.9	125.7
75	6332	5499	5846	5500	5500	348.7	137.5	164.4	0.0	0.0
Discretionary Time										
25	2500	2748	2624	2625	4049	85.0	47.3	0.0	0.0	155.1
50	3428	5310	2625	3499	5499	59.5	118.7	0.0	0.0	0.0
75	5499	6625	4416	4313	6297	9.9	213.5	211.2	475.6	289.9
Combined										
25	2624	2625	2625	2625	2625	31.8	0.0	0.0	0.0	0.0
50	3499	3891	4595	4747	4496	0.0	132.2	241.2	228.4	95.2
75	5500	5499	5500	5500	5500	0.0	2.8	0.0	138.7	52.9
Interaction										
25	2624	2625	2625	2625	2625	13.7	0.0	0.0	0.0	0.0
50	3500	4115	4173	4497	4389	131.5	142.8	140.7	180.9	150.2
75	5922	5500	5500	5500	5500	271.8	0.0	0.0	0.0	79.2

Note: . indicates that SUDAAN could not calculate a quantile or its standard error.

Table A.94: First Quartile, Median, and Third Quartile, Nonzero Amount of Pell Grant, by Cooperation Propensity Strata, Six Cooperation Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
25	1295	1394	1296	1210	1274	52.8	46.9	61.8	54.9	.
50	2496	2498	2498	2299	2446	63.9	66.2	50.2	68.3	61.8
75	3931	3999	3992	3798	3996	.	.	.	.	.
Positive Affect Toward Sponsor										
25	1428	1175	1348	1393	1196	118.6	44.5	.	32.5	.
50	2531	2025	2593	2599	2686	191.1	34.1	79.3	35.4	68.7
75	3909	3544	.	3999	3997	.	.	.	.	.
Social Environmental Factors										
25	1310	1298	1298	1339	1197	51.1	53.4	45.5	53.7	.
50	2086	2290	2498	2599	2528	52.3	69.0	55.0	66.1	57.2
75	3713	3798	3952	3995	3996	.	.	.	19.6	18.7
Discretionary Time										
25	825	1013	1600	2002	1489	33.7	34.9	.	.	.
50	1519	2024	2749	3380	2995	33.2	0.0	54.7	64.6	.
75	2394	3037	.	.	.	76.2	.	.	.	.
Combined										
25	986	1275	1348	1594	1299	30.5	41.9	42.1	.	.
50	1945	2025	2649	2954	2699	60.9	53.5	.	69.6	45.3
75	3037	3543	3993	.	4000	71.7	25.6	.	.	.
Interaction										
25	1011	1265	1347	1495	1300	33.9	50.3	35.6	.	.
50	2024	2092	2596	2800	2533	20.6	62.2	.	52.2	66.9
75	3052	3694	3998	.	3992	72.9	.	.	.	29.3

Note: . indicates that SUDAAN could not calculate a quantile or its standard error.

Table A.95: First Quartile, Median, and Third Quartile, Nonzero Amount of Work Study, by Cooperation Propensity Strata, Six Cooperation Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
25	1189	1137	1199	1170	1202	73.8	68.1	58.2	55.9	64.9
50	1798	1901	1867	1785	1951	50.8	95.0	49.9	40.7	62.6
75	2492	2605	2411	2245	2660	86.7	117.1	57.6	55.5	143.9
Positive Affect Toward Sponsor										
25	1713	1366	1007	1138	1213	360.1	86.0	68.2	34.5	52.0
50	2788	2061	1809	1797	1796	456.6	89.5	113.9	18.9	41.6
75	3731	2873	2933	2496	2278	.	135.5	207.5	45.8	56.1
Social Environmental Factors										
25	1004	1059	1188	1186	1200	150.0	106.6	71.6	41.3	44.0
50	1793	1696	1998	1854	1789	205.5	57.1	28.9	46.7	41.1
75	3012	2407	2463	2497	2482	437.1	167.2	53.3	65.6	63.9
Discretionary Time										
25	780	1498	1080	1250	1272	67.1	100.4	35.8	78.0	57.3
50	1391	2363	1700	1921	1972	141.6	150.4	51.7	41.0	38.4
75	2038	3294	2198	2400	2599	122.2	265.0	42.9	76.3	43.5
Combined										
25	992	1126	1198	1186	1202	101.9	121.6	49.7	56.5	51.7
50	1784	1896	1798	1798	1832	152.8	60.7	61.6	41.3	63.5
75	2472	2443	2464	2496	2496	301.6	126.5	51.1	71.4	42.7
Interaction										
25	730	1134	1320	1138	1200	103.9	75.8	77.2	44.0	40.8
50	1583	1943	1999	1793	1798	183.6	48.1	31.6	27.1	55.6
75	2482	2467	2599	2398	2395	172.3	105.6	72.7	56.5	84.8

Table A.96: First Quartile, Median, and Third Quartile, Nonzero Amount of State Aid, by Cooperation Propensity Strata, Six Cooperation Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
25	832	718	999	828	944	45.7	33.2	26.3	45.3	41.6
50	1602	1396	1998	1752	2044	78.2	39.2	43.5	64.1	39.3
75	3000	2600	3591	3138	3800	66.6	105.4	66.5	65.6	84.2
Positive Affect Toward Sponsor										
25	528	492	989	1160	1438	75.8	9.2	27.9	24.4	73.6
50	1296	895	1968	2101	2862	42.0	25.2	84.6	40.8	74.8
75	2058	1448	3340	3590	4199	224.6	36.2	99.6	38.9	45.1
Social Environmental Factors										
25	525	655	687	1002	1151	34.3	36.3	43.3	35.1	38.7
50	1161	1300	1473	2074	2345	60.1	34.8	51.5	47.4	49.9
75	2170	2508	3129	3498	4070	131.7	75.8	85.8	69.1	63.6
Discretionary Time										
25	470	500	998	1037	1292	20.4	15.6	15.6	37.4	42.0
50	969	999	1824	2043	2499	38.2	22.2	48.4	50.2	59.3
75	1939	1807	3258	3484	3899	93.4	88.9	54.3	96.3	69.1
Combined										
25	488	621	909	1148	1099	23.9	21.6	32.8	32.1	45.1
50	872	1249	1698	2159	2249	54.2	35.6	59.8	46.5	69.1
75	1773	2323	3139	3508	4066	114.9	85.8	42.4	68.1	70.0
Interaction										
25	499	637	847	1076	1045	21.8	28.5	42.2	32.5	40.7
50	999	1299	1597	2049	2234	48.7	38.0	58.8	45.4	62.7
75	1928	2515	3086	3499	4072	119.5	91.9	59.7	68.3	76.8

Table A.97: First Quartile, Median, and Third Quartile, Nonzero Amount of Institutional Aid, by Cooperation Propensity Strata, Six Cooperation Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
25	1096	775	1291	1150	998	40.1	58.3	48.2	67.0	28.0
50	2993	1997	3824	3146	2499	105.4	100.9	140.2	165.4	111.1
75	7286	4982	8430	7529	6820	312.5	535.8	250.3	253.5	304.6
Positive Affect Toward Sponsor										
25	202	396	784	1000	1949	31.0	22.9	83.4	19.2	72.8
50	455	798	1750	2778	4989	97.5	62.3	123.1	81.7	104.0
75	964	1997	4403	6499	11270	233.5	64.1	284.1	113.3	385.3
Social Environmental Factors										
25	442	705	1499	999	1000	72.8	26.2	56.0	15.6	27.9
50	1265	1794	4497	2989	2865	450.9	97.9	169.6	60.1	95.8
75	5995	4790	9995	7198	6395	4375	231.6	231.9	213.0	166.7
Discretionary Time										
25	672	473	1000	1387	1289	29.9	42.3	47.2	90.4	39.5
50	1573	1016	3145	3993	3483	101.9	58.5	131.8	187.1	91.6
75	3654	2530	7972	8991	7999	196.7	301.6	176.9	381.8	151.8
Combined										
25	601	995	1198	1000	1000	45.5	34.9	68.7	38.9	26.1
50	1497	2540	3181	2999	2996	123.5	252.8	154.5	108.1	87.2
75	3737	7492	8000	7601	6999	267.1	782.8	208.1	227.2	161.3
Interaction										
25	670	999	999	1028	1000	88.1	9.1	39.4	38.9	57.5
50	1795	2800	2996	2985	3182	213.6	178.7	104.5	64.3	148.8
75	4720	6999	7991	7554	7295	1197	279.1	313.7	224.1	216.1

Table A.98: First Quartile, Median and Third Quartile, GPA, by Cooperation Propensity Strata, Six Cooperation Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Social Isolation										
25	2.37	2.41	2.50	2.56	2.54	0.01	0.02	0.01	0.02	0.02
50	2.88	2.94	3.02	3.09	3.01	0.01	0.02	0.01	0.02	0.01
75	3.39	3.42	3.50	3.54	3.51	0.01	0.02	0.01	0.01	0.01
Positive Affect Toward Sponsor										
25	2.37	2.33	2.43	2.47	2.62	0.07	0.02	0.02	0.01	0.01
50	2.99	2.99	2.99	2.99	3.09	0.01	0.01	0.00	0.01	0.01
75	3.50	3.49	3.50	3.43	3.51	0.04	0.01	0.01	0.01	0.01
Social Environmental Factors										
25	2.27	2.36	2.46	2.49	2.59	0.04	0.02	0.01	0.01	0.01
50	2.97	2.97	3.00	3.00	3.05	0.03	0.02	0.00	0	0.01
75	3.42	3.44	3.48	3.49	3.49	0.02	0.02	0.01	0.01	0.01
Discretionary Time										
25	2.30	2.39	2.25	2.49	2.68	0.02	0.01	0.01	0.02	.
50	2.93	2.99	2.92	2.99	3.12	0.02	0.01	0.02	0.01	0.01
75	3.48	3.46	3.41	3.42	3.53	0.02	0.01	0.01	0.02	0.01
Combined										
25	2.20	2.32	2.46	2.55	2.65	0.03	0.02	0.01	0.01	0.01
50	2.85	2.89	2.99	3.03	3.11	0.02	0.02	0.00	0.01	0.01
75	3.40	3.38	3.45	3.50	3.55	0.02	0.02	0.01	0.01	0.01
Interaction										
25	2.21	2.37	2.45	2.56	2.63	0.04	0.02	0.01	0.01	0.02
50	2.85	2.92	2.98	3.05	3.11	0.03	0.02	0.01	0.01	0.01
75	3.38	3.39	3.44	3.52	3.55	0.02	0.01	0.01	0.01	0.01

Table A.99: First Quartile, Median and Third Quartile, Nonzero Amounts of Stafford Loan, by Interview Propensity Strata, Two Interview Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Main Effects										
25	2624	2625	2625	2625	2625	33.7	0.0	0.0	0.0	0.0
50	3500	3937	4651	4625	4440	0.0	133.8	241.2	247.5	100.3
75	5500	5500	5500	5500	5500	79.7	223.0	0.0	51.6	0.0
Interaction										
25	2624	2625	2625	2625	2625	9.7	0.0	0.0	0.0	0.0
50	3500	3795	4470	4652	4141	142.3	144.0	185.9	222.2	139.4
75	5999	5500	5500	5500	5500	253.3	0.0	134.6	86.1	0.0

Table A.100: First Quartile, Median, and Third Quartile, Nonzero Amounts of Pell Grant, by Interview Propensity Strata, Two Interview Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Main Effects										
25	1000	1299	1348	1624	1299	28.6	40.2	.	.	.
50	1994	2025	2690	2983	2600	40.9	27.0	48.6	45.6	67.1
75	3037	3543	.	.	3999	67.8	.	.	.	.
Interaction										
25	1011	1299	1345	1519	1273	26.4	58.6	42.9	.	.
50	1946	2192	2595	2889	2599	45.8	55.4	.	63.6	73.1
75	2999	3678	3998	.	3974	96.2	.	.	.	.

Note: . indicates that SUDAAN could not calculate a quantile or its standard error.

Table A.101: First Quartile, Median, and Third Quartile, Nonzero Amount of Work Study Aid, by Interview Propensity Strata, Two Interview Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Main Effects										
25	891	1034	1195	1196	1210	93.1	107.5	67.1	57.8	46.8
50	1600	1949	1794	1800	1853	204.9	66.6	71.7	46.6	54.8
75	2204	2633	2494	2492	2459	286.7	158.2	76.4	32.1	69.0
Interaction	1	2	3	4	5	1	2	3	4	5
25	960	1102	1403	1108	1198	111.5	83.1	71.4	41.4	34.1
50	1666	1977	1996	1780	1795	152.2	33.6	22.3	33.6	24.4
75	2498	2382	2598	2425	2390	269.6	75.9	61.7	93.2	82.8

Note: . indicates that SUDAAN could not calculate a quantile or its standard error.

Table A.102: First Quartile, Median, and Third Quartile, Nonzero Amount of State Aid, by Interview Propensity Strata, Two Interview Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Main Effects										
25	489	593	863	1153	1206	24.9	18.5	37.4	33.6	49.3
50	927	1225	1537	2156	2430	53.2	40.5	55.5	47.4	93.7
75	1877	2256	3042	3534	4093	110.7	72.8	61.5	55.6	61.2
Interaction										
25	488	636	880	1079	1094	16.0	25.1	40.7	33.7	33.5
50	984	1291	1600	2062	2189	48.2	35.6	59.3	41.6	54.6
75	1906	2573	3138	3406	4003	115.4	83.7	44.8	62.0	76.4

Table A.103: First Quartile, Median, and Third Quartile, Nonzero Amount of Institutional Aid, by Interview Propensity Strata, Two Interview Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Main Effects										
25	481	751	1095	1189	1015	40.7	83.6	53.8	51.7	42.5
50	1096	2245	2998	3303	2999	71.2	178.5	105.8	146.4	87.4
75	2979	6608	7826	8000	7183	260.6	713.9	286.1	186.4	195.5
Interaction										
25	497	898	1033	1049	1140	59.7	69.0	51.4	51.8	56.7
50	1390	2500	2992	2999	3097	218.2	149.8	109.1	83.2	136.1
75	4420	7233	7853	7896	6936	1163	318.7	271.3	250.9	203.3

Table A.104: First Quartile, Median, and Third Quartile, GPA, by Interview Propensity Strata, Two Interview Models, NPSAS

	Quartile					SE				
	Low	2	3	4	High	Low	2	3	4	High
Main Effects										
25	2.17	2.30	2.44	2.54	2.66	0.03	0.02	0.01	0.02	0.01
50	2.84	2.89	2.98	3.02	3.13	0.02	0.02	0.01	0.01	0.01
75	3.39	3.37	3.43	3.50	3.54	0.02	0.02	0.01	0.01	0.01
Interaction										
25	2.17	2.36	2.45	2.52	2.64	0.03	0.02	0.01	0.01	0.01
50	2.83	2.94	2.99	3.04	3.10	0.02	0.02	0.01	0.01	0.01
75	3.32	3.41	3.44	3.51	3.53	0.02	0.01	0.01	0.01	0.01

Table A.105: Correlations between Length of Marriage, Number of Marriages, and Age over Contact Propensity Strata, Four Contact Models, WDS

	Correlation				
	Low	2	3	4	High
Length of marriage and # of marriages					
At home patterns	-0.14	-0.09	-0.27	-0.20	-0.23
Access Impediments	-0.14	-0.24	-0.23	-0.09	-0.18
Combined	-0.11	-0.11	-0.26	-0.18	-0.25
Interaction	-0.16	-0.11	-0.17	-0.08	-0.31
Length of marriage and age					
At home patterns	0.72	0.58	0.70	0.51	0.77
Access Impediments	0.75	0.66	0.72	0.66	0.66
Combined	0.76	0.55	0.64	0.58	0.76
Interaction	0.68	0.54	0.63	0.74	0.71
# of marriages and age					
At home patterns	0.27	0.32	0.19	0.28	0.21
Access Impediments	0.21	0.25	0.20	0.35	0.24
Combined	0.26	0.34	0.27	0.24	0.19
Interaction	0.31	0.31	0.30	0.22	0.18

Table A.106: Correlations between Length of Marriage, Number of Marriages, and Age over Cooperation Propensity Strata, Six Cooperation Models, WDS

	Correlation				
	Low	2	3	4	High
Length of marriage and # of marriages					
Social Isolation	-0.09	-0.35	-0.32	-0.09	-0.05
Social Cohesion	-0.16	-0.12	-0.24	-0.21	-0.14
Discretionary Time	-0.13	-0.23	-0.28	-0.06	-0.13
Positive Affect Toward Sponsor	-0.18	-0.18	-0.14	-0.19	--
Combined	-0.17	-0.17	-0.18	-0.12	-0.16
Interaction	-0.16	-0.15	-0.27	-0.24	-0.07
Length of marriage and age					
Social Isolation	0.81	0.44	0.70	0.68	0.69
Social Cohesion	0.80	0.65	0.63	0.73	0.62
Discretionary Time	0.65	0.74	0.63	0.72	0.64
Positive Affect Toward Sponsor	0.65	0.65	0.73	0.76	--
Combined	0.76	0.62	0.69	0.66	0.66
Interaction	0.74	0.72	0.58	0.68	0.71
# of marriages and age					
Social Isolation	0.26	0.27	0.10	0.25	0.30
Social Cohesion	0.18	0.24	0.27	0.21	0.39
Discretionary Time	0.29	0.20	0.14	0.36	0.32
Positive Affect Toward Sponsor	0.30	0.28	0.31	0.17	--
Combined	0.26	0.21	0.31	0.25	0.35
Interaction	0.24	0.24	0.28	0.15	0.35

Note: -- indicates that only four groups could be created out of the Positive Affect Toward Sponsor model in the WDS.

Table A.107: Correlations between Length of Marriage, Number of Marriages, and Age over Interview Propensity Strata, Two Interview Models, WDS

	Correlation				
	Low	2	3	4	High
Length of marriage and # of marriages					
Combined	-0.13	-0.14	-0.19	-0.31	-0.11
Interaction	-0.10	-0.17	-0.21	-0.26	-0.11
Length of marriage and age					
Combined	0.61	0.77	0.62	0.58	0.79
Interaction	0.66	0.68	0.70	0.64	0.75
# of marriages and age					
Combined	0.30	0.21	0.32	0.25	0.18
Interaction	0.30	0.23	0.20	0.27	0.26

Table A.108: Correlation, Stafford Loan, Pell Grant, State Aid, Institutional Aid, and Year in School, by Contact Propensity Strata, Four Contact Models, NPSAS

	Correlation				
	Low	2	3	4	High
Stafford loan amount and Pell Grant amount					
At home patterns	0.294	0.274	0.225	0.215	0.276
Access Impediments	0.271	0.258	0.257	0.287	0.272
Combined	0.292	0.252	0.252	0.224	0.293
Interaction	0.313	0.268	0.239	0.234	0.251
State Aid and Institutional Aid Amount					
At home patterns	0.043	0.093	0.104	0.098	0.065
Access Impediments	0.028	0.119	0.099	0.083	0.095
Combined	0.019	0.130	0.090	0.100	0.079
Interaction	0.077	0.088	0.128	0.044	0.115
Year in School and Institutional Aid amount					
At home patterns	0.128	0.091	0.052	0.043	0.033
Access Impediments	0.103	0.112	0.059	0.031	0.005
Combined	0.093	0.081	0.068	0.070	0.004
Interaction	0.087	0.091	0.081	0.054	0.090
Year in School and Pell Grant amount					
At home patterns	-0.007	0.035	0.043	0.022	0.031
Access Impediments	-0.005	0.031	0.096	0.016	0.034
Combined	-0.005	0.030	0.054	0.045	0.025
Interaction	0.042	0.021	0.004	0.003	0.033
Year in School and Stafford loan amount					
At home patterns	0.161	0.287	0.347	0.304	0.220
Access Impediments	0.234	0.298	0.285	0.231	0.230
Combined	0.176	0.262	0.332	0.308	0.213
Interaction	0.226	0.226	0.281	0.257	0.263
Year in School and State Aid Amount					
At home patterns	0.039	0.044	0.056	0.025	0.058
Access Impediments	0.050	0.084	0.118	0.026	0.013
Combined	0.036	0.065	0.071	0.046	0.030
Interaction	0.064	0.081	0.066	0.037	0.056

Table A.109: Correlation Stafford Loan, Pell Grant, State Aid, Institutional Aid, and Year in School by Cooperation Propensity Strata, Six Cooperation Propensity Models, NPSAS

	Correlation				
	Low	2	3	4	High
Stafford loan amount and Pell Grant amount					
Social Isolation	0.258	0.273	0.227	0.225	0.226
Positive Affect Toward Sponsor	0.046	0.221	0.257	0.277	0.311
Social Environmental Factors	0.210	0.213	0.310	0.267	0.276
Discretionary Time	0.335	0.247	0.216	0.201	0.285
Combined	0.311	0.221	0.225	0.268	0.268
Interaction	0.314	0.238	0.246	0.240	0.249
State Aid and Institutional Aid Amount					
Social Isolation	0.104	0.091	0.114	0.106	0.071
Positive Affect Toward Sponsor	0.199	0.091	0.115	0.098	0.071
Social Environmental Factors	0.032	0.124	0.097	0.088	0.103
Discretionary Time	0.147	0.066	0.063	0.040	0.081
Combined	0.105	0.067	0.099	0.091	0.090
Interaction	0.077	0.108	0.068	0.087	0.105
Year in School and Institutional Aid amount					
Social Isolation	0.169	0.096	0.140	-0.015	0.085
Positive Affect Toward Sponsor	0.149	0.097	0.101	-0.024	0.058
Social Environmental Factors	0.154	0.122	0.101	0.037	0.032
Discretionary Time	0.133	0.114	0.022	--	0.118
Combined	0.138	0.113	0.102	0.036	0.066
Interaction	0.128	0.144	0.082	0.036	0.072
Year in School and Pell Grant amount					
Social Isolation	0.027	-0.058	0.000	-0.022	0.026
Positive Affect Toward Sponsor	-0.032	0.053	0.030	-0.007	0.089
Social Environmental Factors	0.028	0.046	0.009	0.007	0.052
Discretionary Time	0.021	-0.014	-0.035	--	0.097
Combined	-0.047	-0.027	-0.006	0.007	0.062
Interaction	-0.034	-0.056	-0.009	-0.007	0.077
Year in School and Stafford loan amount					
Social Isolation	0.319	0.261	0.250	0.181	0.225
Positive Affect Toward Sponsor	0.290	0.262	0.255	0.192	0.266
Social Environmental Factors	0.129	0.336	0.239	0.241	0.241
Discretionary Time	0.175	0.269	0.069	--	0.252
Combined	0.120	0.272	0.294	0.264	0.275
Interaction	0.172	0.232	0.247	0.261	0.322
Year in School and State Aid Amount					
Social Isolation	0.117	0.087	0.076	-0.013	0.100
Positive Affect Toward Sponsor	0.047	0.049	0.087	-0.032	0.075
Social Environmental Factors	0.106	0.107	0.051	0.032	0.025
Discretionary Time	0.095	0.036	-0.002	--	0.106
Combined	0.058	0.053	0.059	0.037	0.055
Interaction	0.044	0.074	0.043	0.044	0.055

Note: -- indicates that only four groups were created out of the Positive Affect Toward Sponsor model in the WDS.

Table A.110: Correlation of Stafford Loan, Pell Grant, State Aid, Institutional Aid, and Year in School, by Interview Propensity Strata, Two Interview Propensity Models, NPSAS

	Correlation				
	Low	2	3	4	High
Stafford loan amount and Pell Grant amount					
Main Effects	0.324	0.219	0.229	0.269	0.267
Interaction Model	0.315	0.220	0.242	0.256	0.256
State Aid and Institutional Aid Amount					
Main Effects	0.103	0.058	0.084	0.115	0.072
Interaction Model	0.068	0.081	0.105	0.089	0.089
Year in School and Institutional Aid amount					
Main Effects	0.115	0.115	0.095	0.041	0.063
Interaction Model	0.123	0.132	0.088	0.040	0.068
Year in School and Pell Grant amount					
Main Effects	-0.053	-0.013	0.007	0.003	0.056
Interaction Model	-0.025	-0.059	-0.018	-0.005	0.083
Year in School and Stafford loan amount					
Main Effects	0.111	0.262	0.311	0.265	0.267
Interaction Model	0.151	0.242	0.262	0.260	0.313
Year in School and State Aid Amount					
Main Effects	0.045	0.046	0.058	0.035	0.054
Interaction Model	0.060	0.059	0.052	0.037	0.056

Table A.111: Census Variables Used in the WDS Analyses

Created Variable	Census Variable
Proportion urban	P0060001/P0010001
Proportion male	P0070001/P0010001
Proportion White, non-Hispanic	P0120001/P0010001
Total number of people	Sum(P0130001, P0130002, P0130003, P0130004, P0130005, P0130006, P0130007, P0130008, P0130009, P0130010, P0130011, P0130012, P0130013, P0130014, P0130015, P0130016, P0130017, P0130018, P0130019, P0130020, P0130021, P0130022, P0130023, P0130024, P0130025, P0130026, P0130027, P0130028, P0130029, P0130030, P0130031)
Proportion under age 18	sum(P0130001, P0130002, P0130003, P0130004, P0130005, P0130006, P0130007, P0130008, P0130009, P0130010, P0130011, P0130012) / Total # of People
Proportion age 18-54	sum(P0130013, P0130014, P0130015, P0130016, P0130017, P0130018, P0130019, P0130020, P0130021, P0130022, P0130023) / Total # of People
Proportion age 55+	sum(P0130024, P0130025, P0130026, P0130027, P0130028, P0130029, P0130030, P0130031) / Total # of People
Number of persons age 15+	Sum(P0270001, P0270002, P0270003, P0270004, P0270005, P0270006, P0270007, P0270008, P0270009, P0270010, P0270011, P0270012)
Proportion of people age 15+ married	Sum(P0270002, P0270008)/ # of persons age 15+
Proportion whose means of transportation to work is driving alone to work, out of workers 16 years and older	P0490001/ sum(P0490001--P0490013)
Proportion whose commute is less than 15 minutes long, out of workers 16 years and older	sum(P0500001--P0500003)/ sum(P0500001--P0500013)
Proportion who work at home, out of workers 16 years and older	P0500013/sum(P0500001--P0500013)
Proportion of people age 18+ whose highest educational attainment is high school graduate+	sum(P0600003, P0600004, P0600005, P0600006, P0600007) / sum(P0600001, P0600002, P0600003, P0600004, P0600005, P0600006, P0600007)
Median income	P080A001

Note: Source: Census of Population and Housing, 1990: Summary Tape File 3 on CD-ROM [machine-readable data files] Prepared by the Bureau of the Census, Washington, DC: The Bureau, 1992. Files downloaded October 2006 from http://ftp.census.gov/census_1990.

Table A.112: Variables Used for Creating Record and Interview Variables, NPSAS

Variable	Record Variables		Interview Variables
Type of student	INCPS	LEVEL	N4STAT
	C04058	FPOPPER	N4DUG
	C04037	C04175	N4DGPR
	C04035	BENLAWA	N4DGD
	C04034	BENLALVL	N4DGMS
	CADESTYP	BENADVDG	
	BENLADEG	STTYPE	
	CFAGRAID	GRADAID	
	HLOFFER		
Type of Degree	BENLADEG	BENLALVL	N4STAT
	BENLAWA	C04034	TSTAT
	HLOFFER	C04058	N4DGUG
	CADESTYP	C04035	N4DGGR
Gender	ASGENDER	C05024	N4GENDR
	C04032		
Age	C04014	DOBPELL	N4DOBMY
	C05012	DOBNSLDS	N4LT30
	ASTHDOB	DOBNSLDSA	
Marital Status	C04020	C05019	N4MARR
	AMARITAL	C05102	
	C05020		
High School Diploma	AHIGHSCH	C05028	TSTAT
	C04036	C05102	N4DIPL
	ASHIGHYR		
Citizenship	ACITIZEN	C05017	N4CITZN
	C04018	C05102	
Veteran Status	C04063	CFATDVET	N4MILA
	AVETERAN	AGE_REC	N4MILN
SAT or ACT Test Taker	ASTSATAV	ADMCON7	N4ACTSAT
	TYPEOFSTUD_REC		N4BPSELG
July 2003 Enrollment – August 2004 Enrollment	YENROLL	BTMST06	
	E01—E12	BTMBEG07	
	ZENROLL	BTMEND07	
	BTMBEG01	BTMST07	
	BTMEND01	BTMBEG08	
	BTMST01	BTMEND08	
	BTMBEG02	BTMST08	
	BTMEND02	BTMBEG09	
	BTMST02	BTMEND09	
	BTMBEG03	BTMST09	
	BTMEND03	BTMBEG10	
	BTMST03	BTMEND10	
	BTMBEG04	BTMST10	
	BTMEND04	BTMBEG11	
	BTMST04	BTMEND11	
	BTMBEG05	BTMST11	
	BTMEND05	BTMBEG12	
	BTMST05	BTMEND12	
	BTMBEG06	BTMST12	
	BTMEND06		
GPA	BENNFGPA		N4GPA1
Applied for Financial Aid	CFACVANS	CFADPELL	N4APPAID

Variable	Record Variables		Interview Variables
	CFFEDAID	TOTWKST	
	CFSTATAID	ZTOTWKST	
	CFAUGAID	PELLAMT	
	CFAGRAID	ZPELL	
	CFATDOTH	STATEAMT	
	C04163	ZSTATEAM	
	INNSLDS	PERKAMT	
	INPELL	ZPERK	
	INCPS	PLUSAMT	
	CPSMAT2	ZPLUS	
	DOBPEL	CFACVANS	
	SEOGAMT	CFSTATAID	
	ZSEOG	CFAUGAID	
	STAFSUB	CFAGRAID	
	ZSTAFS	CFFEDAID	
	STAFUNSB	INNSLDS	
	ZSTAFU	INPELL	
	STAFFAMT	INCPS	
	ZSTAF		
Received Financial Aid	C01STATE	CFTEAASS	N4RCVAID
	C02STATE	CFGRDASS	
	C03STATE	CFAGRFEL	
	C04STATE	CFA1AMT	
	C05STATE	CFA2AMT	
	C06STATE	CFA3AMT	
	C07STATE	CFA4AMT	
	C08STATE	CFA5AMT	
	C09STATE	CFFEDAID	
	C10STATE	CFSTATAID	
	C11STATE	CFAUGAID	
	C12STATE	CFAGRAID	
	CFAINS01	CFATDOTH	
	CFAINS02	INNSLDS	
	CFAINS03	INPELL	
	CFAINS04	STATEWKST	
	CFAINS05	INSTWKST	
	CFAINS06	OTHWKST	
	CFAINS07	OTHSTTOT	
	CFAINS08	PELLAMT	
	CFAINS09	ZPELL	
	CFAINS10	SEOGAMT	
	CFAINS11	ZSEOG	
	CFAINS12	PERKAMT	
	CFADNEED	ZPERK	
	CFADBOTH	STAFSUB	
	CFATHSCH	ZSTAFS	
	CFAMERIT	STAFUNSB	
	CFEMPWAI	ZSTAFU	
	CFWAIDIS	STAFFAMT	
	CFAGRWAI	ZSTAF	
	CFTUIWAI	TOTWKST	
	CFAUGLON	ZTOTWKST	
	CFAGRLON	STATEAMT	
	CFADUGWS	ZSTATEAM	
	CFAUGASS	CFACVANS	

Variable	Record Variables		Interview Variables
Received Federal Loans (Specifically Stafford Loans)	CFADGRWS STAFSUB ZSTAFS STAFUNSB ZSTAFU	 STAFFAMT ZSTAF CFFEDAID	 NFEDLN N4CRVAID
Received Pell Grant	CFADPELL PELLYRS PELLAMT	ZPELL INPELL	N4PELL
Work Study Job	CFATDFWS CFADUGWS CFADUGRWS CFAUGASS	STATEWKST INSTWKST OTHWKST	N4WKST N4ASST N4WAERNT N4WAAMT N4WAERNS
Received any State Aid	OTHSTTOT CSTATAID STATEAMTTOT		N4STGRT N4STAMT N4STNONE N4RCVAID SUMSTFLG
Received and Institution Aid	INSTAMTTOT OTHINSTTOT CFAUGAID		N4INGRT N4INAMT N4STNONE N4RCVAID SUMSTFLG
Dependency Status	C04175 CNDEPEND AGE_REC VETERAN_REC	TYPEOFSTUD_REC MARITAL_REC C04062	N4DEP03
Urbanicity	LOCALE		
Number of students	ENRLSIZE		
Hispanic Serving Institution	OCRHSI		
Historically Black College or University	HBCU		
Region	OBEREG		
Percent Enrolled American Indian/ Alaskan Native	PCTMIN2		
Percent Enrolled Asian/ Pacific Islander	PCTMIN3		
Percent Enrolled Black, non-Hispanic	PCTMIN1		
Percent Enrolled Hispanic	PCTMIN4		
School Selectivity	SELECTIV		
Public, private, and not-for-profit	SECTOR		
Less than two year, two year, and four year institution	LEVEL		

A.3 Discussion of Two Illustrative Statistics

Two illustrative statistics are shown here.

Figure 9 shows the deviation from the overall mean for length of marriage in the WDS for six models. Bars on the left side (negative side) of the y-axis show that the stratum mean is lower than the overall mean. Bars on the right side (positive side) of the y-axis show that the stratum mean is higher than the overall mean. The bottom black bar in each set is the lowest propensity stratum. The dotted gray bar at the top is the highest propensity strata. If the bars move consistently from left to right, then the relationship between propensity and the survey outcome is relatively consistent over the propensity distribution. We can see for this statistic, the mean length of marriage, the at-home patterns model consistently orders the mean length of marriage, such that people in the lowest propensity stratum have shorter marriages and people in the highest propensity stratum have longer marriages. Only the positive affect toward sponsor model shows a similar ordering, although the magnitude of the difference across strata is much less. The rest of the models show inconsistent ordering of the mean length of marriage across strata. Thus, a statistic that is designed to measure a linear relationship between p and Y will not detect these differences.

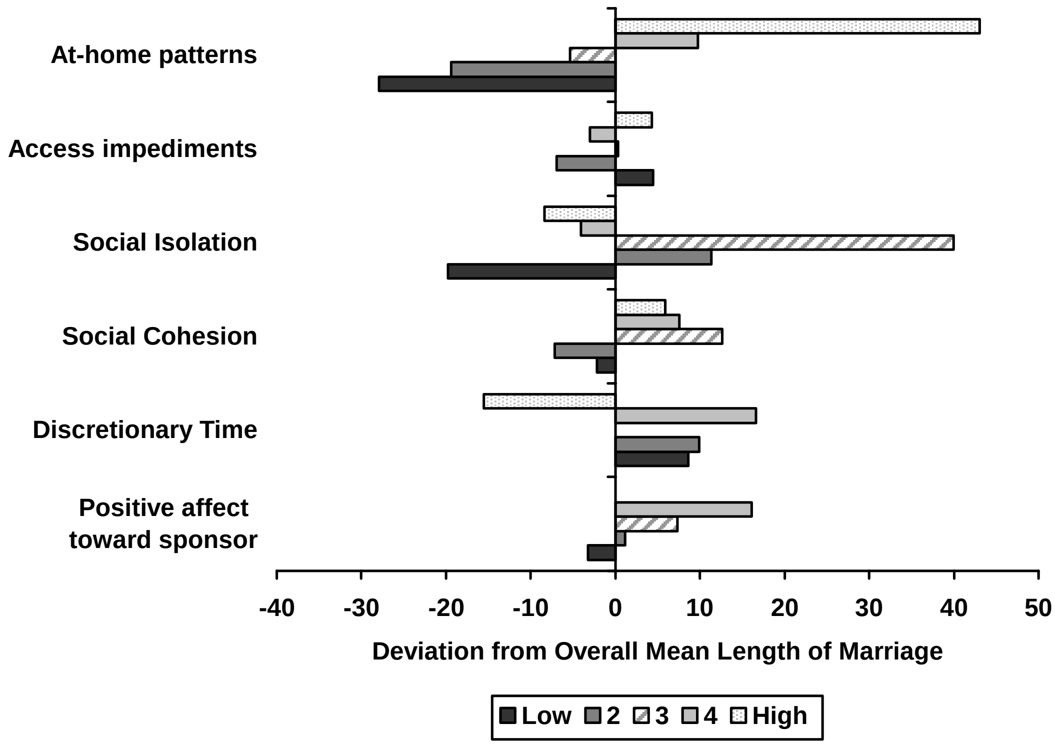

Figure 9: Deviation of Stratum Mean Length of Marriage around Overall Mean, Two Contact Models and Four Cooperation Models, WDS

In Figure 10, we see a more consistent ordering of the percent of students who received institutional aid in the NPSAS in both contact models and in the Social Environmental Factors propensity model. The social isolation model shows no clear relationship between the proportion of students who received institutional aid and propensity. The discretionary time model and positive affect toward sponsor show some ordering, although the positive affect toward sponsor model is not consistent at the highest stratum.

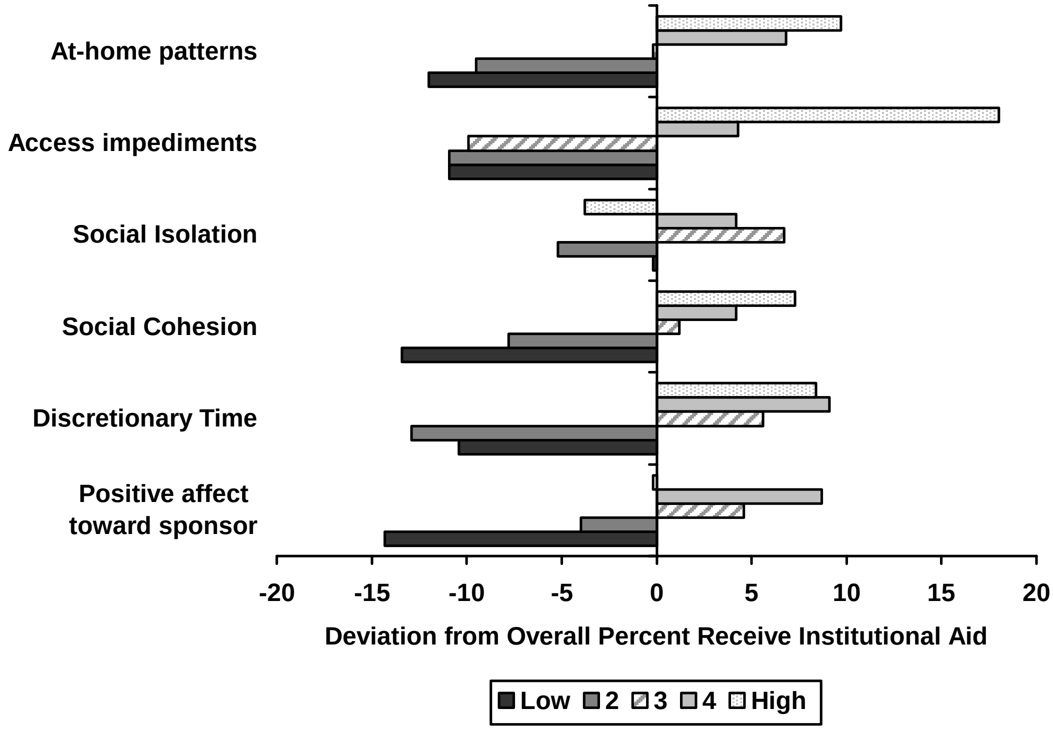

Figure 10: Deviation from Overall Percent Receive Institutional Aid, Two Contact Models and Four Cooperation Models, NPSAS

As is clear in Table 2.4 and the above figures, the direction and strength of the correlation between the predicted propensity and the survey variables varies, especially for the financial aid variables. We anticipated this. This indicates that the multiple competing influences on nonresponse propensity vary in their effects on nonresponse bias.

A.4 Simulation of Two Causes for p and Y

Call an auxiliary variable used in a propensity model a Z variable. In a series of papers on weighting for nonresponse, Little and Vartivarian (Little and Vartivarian 2004; Vartivarian and Little 2002) show that (1) propensity model adjustments for nonresponse are better (i.e., reduced variance and bias of the adjusted mean) when Z variables included in a propensity model that are related both to propensity and to the survey outcome of interest, (2) in absence of good predictors of propensity, including Z variables that predict the survey variables in a propensity model lead to variance reductions in the adjusted mean, although not bias reductions in the mean, (3) if the Z variable is not strongly related to the survey outcome, but is related to propensity, including that Z variable will not reduce bias, but will increase in variability in the adjusted mean. In general, Little and Vartivarian consider the case where there is only one common correlate for nonresponse and for the survey variables (although there may be other variables predicting both response propensity and the survey variables). For example, imagine that older people both have longer lengths of marriage and are less likely to participate in surveys than younger people. In this case, the mean length of marriage will be underestimated, the observed correlation between response propensity and the survey variable will be negative, and adjustment models that include age should decrease nonresponse bias and variance due to weighting.

What about in the case of multiple Z variables? Having Z variables that are related to both Y and p is not sufficient for observing a strong relationship between Y and p in the case of multiple Z's. What does this mean? Imagine that there are two independent groups – for example, people with children and older people – who vary in their values of a survey variable – for example, length of marriage. Suppose that people with children have longer marriages than people without children and that older people have longer marriages than younger people. Also suppose that the difference between older people and younger people's length of marriage is greater than the difference in the length of marriage for people with and without children. Now, imagine – as is commonly found – that people with children are more likely to participate in a survey than people without children, that older people are less likely to participate in a survey than younger people, and that the response rate for people with children is much greater than that for older people. Will there be nonresponse bias on the estimate for the mean length of marriage? Not necessarily. If enough of the people with children participate to compensate for the older people who do not, then there will not be nonresponse bias on the mean length of marriage – that is, the distribution of Y will be represented. When there is only one driver of nonresponse, conclusions are simple. When there are two or more drivers of nonresponse, each of which is related to the survey outcome, conclusions depend on the relative strength of the relationship of the correlates of nonresponse with the survey variables and the direction of relative response rates for the two groups.

To see a strong correlation between p and Y, the relative ordering of the variables that are related to Y must be consistent across all of p. Let's say that there are only two variables available, Z1 and Z2, that they are uncorrelated, and that they both predict p and Y. Intuitively, if Z1 and Z2 are positively related to both p and Y, then the relative ordering of Y across p is maintained and p will be positively related to Y. The strength of the relationship will depend on the relative strength of Z1 and Z2 in the p model versus the Y model. Similarly, if Z1 and Z2 are both negatively related to p and both positively related to Y (or vice versa), then the relative ordering of Y across p is maintained and p will be negatively related to Y. Complications arise when the relationship between Z1 and Z2 and p is different from their relationship with Y, in particular, when the relationship in one model has mixed coefficients.

To illustrate this point, 1000 bivariate normal random numbers were generated under a very simple scenario, $(z_1, z_2) \sim N(0,I)$. Then, the following models were used to generate values of p and y, where $(e_p, e_y) \sim N(0,I)$.

$$\text{logit}(p) = 1 + \beta_{1p} z_1 + \beta_{2p} z_2 + \varepsilon_p$$
$$p = \exp(\text{logit}(p)) / (1 + \exp(\text{logit}(p)))$$
$$y = 2 + \beta_{1y} z_1 + \beta_{2y} z_2 + \varepsilon_y$$

Under each of these scenarios, the average p is approximately 0.6, and the average y is approximately 2. That is, if this was a survey, the observed response rate is identical across all of the scenarios. The intuition described above is maintained. When both Z variables have the coefficients in the same direction for both the p and Y models, then significant correlations between p and Y are observed, with the strength of the correlation depending on whether the variable that has a stronger relationship in the p model (e.g., the variable with the .6 or -.6 coefficient) also has the stronger relationship in the Y model.

The scenarios in which no observed relationship is found between the p and Y variables, - even though both are predicted by the same variables – are those in which the coefficients for one model have mixed signs and the other does not. This is not enough to negate the relationship between p and Y, however. What appears to be necessary from Table X is that the stronger predictor for each model differs (e.g., Z1 is a stronger predictor of p, Z2 is a stronger predictor of Y) *and* that one of the four coefficients has an opposite sign, then no observed relationship is found. In Table A.113, these cells are denoted with a superscript a, where p and Y have no significant relationship.

Table A.113: Correlation Between p and Y from Mini-simulation, Varying Values of the Relationship Between z1, z2, p and Y

	(β_{1y}, β_{2y})							
	Both positive		Mixed				Both Negative	
	ya	yb	yc	yd	ye	yf	yg	yh
(β_{1p}, β_{2p})	(.2,.6)	(.6,.2)	(-.2,.6)	(.2,-.6)	(-.6,.2)	(.6,-.2)	(-.2,-.6)	(-.6,-.2)
Both positive								
Pa (.2,.6)	0.258	0.148	0.177	-0.235	0.029[a]	-0.009[a]	-0.259	-0.180
Pb (.6,.2)	0.204	0.292	0.032[a]	-0.007[a]	-0.224	0.210	-0.153	-0.308
Mixed								
Pc (-.2,.6)	0.258	0.029[a]	0.264	-0.272	0.157	-0.157	-0.256	-0.060[a]
Pd (.2,-.6)	-0.233	-0.008[a]	-0.239	0.269	-0.168	0.136	0.220	0.022[a]
Pe (-.6,.2)	-0.009[a]	-0.251	0.166	-0.170	0.268	-0.245	-0.005[a]	0.216
Pf (.6,-.2)	-0.063[a]	0.196	-0.127	0.148	-0.267	0.245	0.029[a]	-0.183
Both negative								
Pg (-.2,-.6)	-0.295	-0.164	-0.262	0.228	-0.025[a]	0.002[a]	0.245	0.164
Ph (-.6,-.2)	-0.205	-0.265	-0.031[a]	-0.022[a]	0.216	-0.218	0.178	0.259

[a] indicates that the correlation is not significant at a p<.0001 level. Most [a] values are p>.30.

A.5 Dynamic Response Propensities

The above discussion has looked at survey participation as a function of respondent and ecological factors. However, the survey recruitment protocol is a driving force in survey participation.

Lessler and Kalsbeek (p. 134) state that “a key feature of the stochastic view of nonresponse is the relationship between characteristics of the survey and the collective size of response probabilities.” Kish (1965, p. 548), employing a stochastic model for nonresponse, posits that respondents brought in on the first call are more likely to be persons with higher response propensities, whereas those brought in on subsequent calls are those with lower response propensities. On the other hand, Thomson and Siring (1983) describe how different events during recruitment can change response probabilities. Although statisticians acknowledge that the missing data mechanism (Little and Rubin 2002) must be specified correctly for full adjustment of nonresponse bias to take place, the specific features of recruitment protocol that lead to the missingness are usually ignored.

A.5.1 What is a Survey Recruitment Protocol?

At the simplest level, a survey recruitment protocol is the set of methods, rules and decisions implemented by a survey organization in an attempt to contact sample units and solicit their participation in a survey. A recruitment protocol is bounded by the amount of time allocated to the field period and by the survey’s budget. Survey recruitment protocols have multiple dimensions, some of which are applied to all sample units (e.g., the survey topic, sponsor, sending of an advance letter), while others are applied to only a subset of sample units (e.g., use of persuasion letters, changes in interviewers, mode switch, change in respondent rules). Dimensions that are applied to a subset of sample units are often implemented after the occurrence of an event, as long as time remains during the field period. For instance, failure to contact a sample unit on the first call attempt almost always generates a second call attempt. A contact without an interview generates a set of decisions by the survey organization on when to call the case again and whether other measures, in addition to more calls, should be taken to encourage that sample unit's participation. Each dimension of a recruitment protocol is intended to affect the likelihood of contacting and of obtaining an interview with a sample unit. However, not all sample units receive all dimensions of a recruitment protocol.

The importance of the recruitment protocol in influencing response propensities has been documented in countless experimental and observational analyses. Examples of recruitment protocol components that have shown importance in influencing response propensities are the number of call attempts, call timing, the interviewer, rules for selecting the respondent, mode and mode switches, incentives, survey topic, sponsorship, and advance letters.

Many survey features vary across sample units and across calls. For example, a frequently replicated finding is that additional call attempts (Groves and Couper 1998; Keeter et al. 2000; Kennickell 1999a; McCarty et al. 2006) or follow-up mailings (Heberlein and Baumgartner 1978) increase response rates. However, the same average number of call attempts does not guarantee the same response rate across surveys within the same organization (McCarty et al. 2006) or for the same survey over repeated administrations (Curtin, Presser and Singer 2000; Curtin, Presser and Singer 2005). Thus, there is not a simple correspondence between number of call attempts and response propensity. One reason for the number of call attempts being different from response propensity is that characteristics of call attempts themselves have also been shown to have a dramatic impact on response propensities. A replicated finding is that timing of the calls matters, with weekend days and weekday evenings being more productive for making contact with a household than other time slots (Bates 2003; Brick et al. 1996; Hoagland, Warde and Payton 1988; Piazza 1993; Purdon, Campanelli and Sturgis 1999; Weeks, Kulka and Pierson 1987). However, the findings on call timing for obtaining an interview are less clear (Purdon, Campanelli and Sturgis 1999; Weeks, Kulka and Pierson 1987).

Another feature of a recruitment protocol that may vary across calls is the interviewer and her interpersonal skills. Interviewers have been shown to both vary in nonresponse rates, both in terms of ability to contact a household and gain their cooperation (Groves and Couper 1998; Morton-Williams 1993; O'Muircheartaigh and Campanelli 1999). Survey organizations may change interviewers for a sample unit deliberately in an attempt to persuade a refusing household to participate, haphazardly based on shifts in a telephone call center, because of interviewer attrition, or to equalize workloads across interviewers. When done deliberately, the intention on the part of the survey organization is to increase the sample unit's propensity to be contacted and to participate. When done haphazardly, an effect may be observed, although the direction is less clear.

In an attempt to increase response rates, perhaps at the price of added measurement error, survey organizations often permit someone other than a selected sample person to complete the survey interview. This can manifest in two types of respondent rules, although both allow response by proxy. First, the survey can decide to do away with a selected sample person altogether and take only a household informant, usually the household member who is the most knowledgeable about the survey topic. Second, the survey organization can select a sampled person from the household, but permit another knowledgeable household member to answer for the sampled person when the selected respondent is not able, available, or willing.

Although many people think of surveys having only one mode, survey organizations are increasingly turning to mixed mode designs for cost savings and nonresponse rate reduction (de Leeuw 2005). The implementation of multiple modes may be concurrent (e.g., telephone survey for those who have telephone numbers, in-person survey for those who have addresses but no telephone number) or sequential (e.g., mail survey followed by telephone attempts). As with permitting proxy responses, the survey organization may be trading nonresponse reduction for an increase (or change) in measurement error.

Incentives have consistently been shown to increase response rates (Singer 2002). Prepaid incentives are more effective than promised incentives, and cash is more effective than gifts or promises for charitable donations. Recent experimental findings show that the increase in response propensity for an incentive is not uniform for all sample units (Groves, Presser and Dipko 2004; Groves, Singer and Corning 2000). Although many organizations will send the same incentive to all sample units at the beginning of the survey, the incentive structure often changes during the course of the survey as a method of refusal conversion.

The number and outcome of calls may generate decisions or be tied to rules by the survey organization for that recruitment protocol. For instance, many organizations have rules about the call on which to leave an answering machine message or a “Sorry I missed you” card. Other rules that may be present include the number of days to take the case out of the field after obtaining a refusal or persistent noncontact or whether to send a persuasion letter to these cases, procedures to follow after an interviewer sets soft or hard appointments, and the number of attempts that have to be made in any given time slot before taking the case out of the field for a rest. These rules may be followed strictly or not at all; this also varies across organizations and sample management systems.

Despite the degree to which these factors have been studied separately, recent theoretical development and empirical findings show that recruitment protocol and respondent characteristics cannot be separated when studying survey participation. Groves and Couper (1998) demonstrated across multiple surveys that both factors under the researcher’s control and those not under the researcher’s control influence survey participation. Ignoring the protocol assumes that there is no information contained in the protocol as to the causes of survey contact and cooperation. This does not mean, however, that response propensity is solely determined by the levels of effort exerted in the protocol. The probability of participation still depends on the respondent, as described in Chapters One and Two. Thus, the protocol, how it evolved for a specific respondent, and characteristics of the respondent must be taken jointly into account to understand survey participation.

A.5.2 Recruitment Protocol and Dynamic Response Propensities

The above discussion illustrates how different components of the protocol may change response propensities. As the protocol differs across respondents, then variations in response propensity will be observed across respondents.

However, in field data collection, application of a recruitment protocol not only varies across sample units but within sample units. The application of a new feature of the protocol increase or decrease the person's response propensity. For example, sample units receive additional calls at different times of the day and days of the week, receive incentives as a refusal conversion tactic, have different interviewers approach the household, have interviewers who keep or do not keep appointments, and are approached with a shortened survey or with a different mode from the initial request, among other changes in design features.

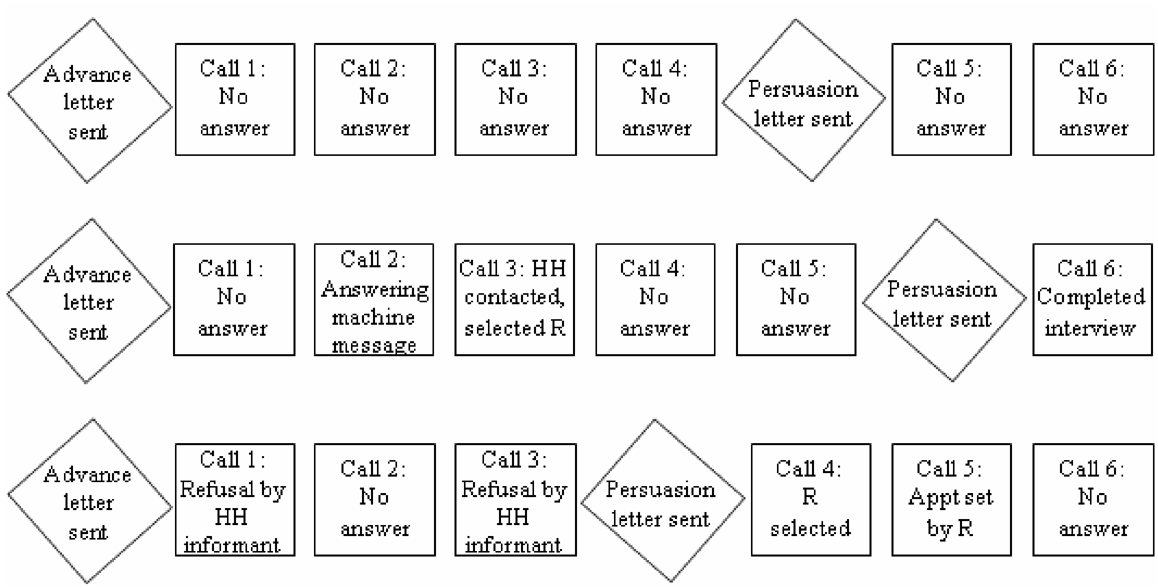

Figure 11: Three Example Cases, Six Call Protocol with Advance Letter and Persuasion Letter

To illustrate this, Figure 11 shows three cases that each receive six call attempts, an advance letter, and a persuasion letter. The character and outcome of these call attempts varies dramatically. The first case is called six times but never contacted. Here, the use of the persuasion letter is to try to increase contact propensity. The second case is contacted on the third call, following an answering machine message, not contacted for two more calls, and an interview completed on the sixth call. Here, the persuasion letter attempts to increase the cooperation propensity, but not because of a respondent refusal. The final case is contacted and refuses on the first and third call, receives a persuasion letter to convert the household refusal, is followed by two contacts that do not yield an interview, and the field period ends before the interview can be obtained.

Thus, not only is the participation decision stochastic, but a sample unit's likelihood of participation is dynamic, changing as the protocol evolves. What does this mean? Sample units have more than one response propensity to any single survey, all conditional on the prior observed features of the recruitment protocol. In fact, sample units have a vector of response propensities, changing with successive implementations of the protocol. As new design features are introduced, as more effort is exerted to obtain a contact or interview, the probability of response, p_i, changes. We call this a *dynamic* view of response propensities. As the protocol evolves, so does response propensity. Any careful discussion of the stochastic model for survey nonresponse acknowledges that the observed participation or nonparticipation is conditional on the protocol used to obtain contact and cooperation, as is a sample unit's response propensity (Lessler and Kalsbeek 1992). However, often overlooked in discussion of the stochastic model is that the implementation of a protocol varies both across and within sample units. At any given point in the field period, the sample unit's propensity to respond is conditional on the protocol to which it previously has been exposed, and can change as new protocol elements are introduced. Had the sample unit been exposed to other combinations of protocol components, not only could its final response propensity be different, but the propensity observed throughout data collection could have been different.

Further, it is convenient to view any observed evolved protocol as only one realization from all possible realizations of the protocol. Even though the decision rules and decision makers may be constant over realizations of the protocol, the actual evolution of the protocol will differ over repeated implementations. For example, for any given case, the first call attempt may be made at a different time or on a different day, the respondent's own life situation will vary, and the survey taking environment may change. The outcome of the first call will lead to decisions on subsequent calls that may or may not be made in other implementations. That is, not only are response propensities stochastic (random) and dynamic (changing), but protocols are also stochastic and dynamic. However, without repeated observations of the same protocol and randomization in implementation of the protocol, this effect cannot be disentangled.

A comprehensive framework for estimating evolving response propensities is needed. This framework should reflect the underlying phenomenon while staying as close to the observed data as possible. The student of response propensity is interested in understanding the mechanism for response propensity as it occurs. A modeling approach that permits a prospective look at response propensity is thus needed.

A.5.3 Estimating Dynamic Response Propensities

The ideal data set would contain the instantaneous propensity for each sample unit i to be contacted, $p_{ij,c}$, and cooperate given contact, $p_{ij,r|c}$, at all times j for all possible evolutions of a recruitment protocol and the causes of changes in propensity. These causes would include time invariant characteristics of the sample unit and of the recruitment protocol, as well as time varying characteristics of both. Since the ideal data set does not exist, dynamic response propensities must be estimated, conditional on an observed protocol.

We propose the following guiding principles when estimating evolving response propensities. (1) Estimation must include information on both respondents and nonrespondents, not on respondents alone. (2) Inclusion of auxiliary background characteristics on the respondents or ecological variables should be included when available and theoretically justified. (3) Information about different protocol features and how they change over the field period should be included when their implementation is not fully predictive of the final outcome (e.g., when the protocol feature is not endogenous). (4) A relevant measure for the 'time' of data collection should be selected. (5) Noncontact and refusal nonresponse should be disentangled, where possible.

With these guiding principles in mind, a method is needed to estimate dynamic response propensities. The method involves discrete time hazard models. In a discrete time hazard model, a time dimension must be specified. Here, each successive effort intended to contact or gain cooperation from the sample unit (e.g., call attempt, follow-up mailing) will be used as the metric of time. The levels of effort may occur in an in-person survey, telephone survey, mail survey, or web survey; for convenience, we will call any level of effort a "call."

Discrete time hazard models estimate the conditional probability $\mathrm{h}(\mathrm{t}_{\mathrm{ij}}) = \Pr[T_i = j \mid T_i \geq j]$ as a function of covariates, where T_i=j indicates that the event of interest occurred at time period j, given that it has not occurred during any time period prior to time j (Powers and Xie 2000; Singer and Willett 2003). We choose a discrete time hazard model over other forms of survival analysis because discrete time hazard models easily accommodate "ties" (e.g., contact or cooperation occurring at the same call for two sample units). Other methods for estimating survival models experience problems when the event of interest occurs for more than one unit at any given time (Singer and Willett 2003). We also choose a discrete time hazard model over a series of logistic regressions estimated on the sample units that received each call. As the number of calls becomes large, the number of cases to estimate a logistic regression becomes small. Hazard models borrow strength across time periods for parameter estimates, making a proportional odds assumption that the effects of covariates are constant over calls. This assumption can be formally tested in a hazard model framework, and relaxed as needed.

To obtain estimated dynamic response propensities, covariates reflecting the contact and cooperation mechanisms must be specified. Protocol characteristics can be entered as call-varying covariates and respondent and ecological characteristics can be entered as call-invariant covariates. The exact protocol, respondent, and ecological characteristics to include in the models will vary across surveys.

More formally, denote the vector of call indicators as T, the vector of call-varying protocol characteristics at call j as C_j and the vector of call-invariant respondent and ecological characteristics as R. Call-invariant protocol characteristics can be included in a model only when they vary over sample units (e.g., random assignment of incentives or an advance letter). We want to estimate

$p_{ij,c} = pr(\text{Contact at } T = j \mid \text{no contact at } T < j) = f(T, C_1, C_2, ..., C_{j-1}, C_j, R)$ and

$p_{ij,r|c} = pr(\text{Cooperation at } T = j \mid \text{no cooperation at } T < j) = g(T, C_1, C_2, ..., C_{j-1}, C_j, R)$.

These are the within-call dynamic response propensities. The vectors of protocol characteristics C_j and time invariant respondent characteristics *R* may differ between contact and cooperation models.

We are also interested in the cumulative probability of participation across calls. This is the unconditional probability that the sample unit will be contacted and will cooperate at time J, $p_{i,c} = p_{iJ,c}\prod_{j=1}^{J-1}(1-p_{ij,c})$ and $p_{i,r|c} = p_{iJ,r|c}\prod_{j=1}^{J-1}(1-p_{ij,r|c})$ (Powers and Xie 2000). To do this, we adopt a sequential approach so that the probabilities are both forward looking and are cumulative over time (Brand and Xie 2006). At the first call, the estimated within and across call dynamic response propensities are identical. At the second call, sample units from call one that were contacted or gave an interview (depending on the process of interest) are no longer part of the active sample. Sample units that were not contacted or not interviewed but only received one call are also no longer part of the active sample. These two groups of sample units were exposed to only one call’s worth of protocol components. Thus, their vector of dynamic propensities is only one value long. Had these sample units been exposed to additional protocol components, contrary to fact, they would have more than one dynamic response propensity. Thus, the best estimate that we have of their across-call response propensity is that estimated from the first call.

Sample units that received at least two calls have at least two within-call dynamic response propensities, and correspondingly, at leas two across-call dynamic response propensities. To reach the second call, the sample unit needed to not have achieved the outcome of interest or be censored at the first call, with the estimated probability of

$\hat{q}_{i1} = 1 - \hat{p}_{i1}$. The estimated across-call probability of having the outcome of interest at the second call is $\hat{p}_{i2}\hat{q}_{i1}$ for those who receive the second call, and $\hat{p}_{i1}$ for those who receive only the first call. Generally, at call *t*, the estimated across-call dynamic response propensity is $\hat{p}_{it}\prod_{j=1}^{t-1}\hat{q}_{ij}$ for those sample units who received call *t* and $\hat{p}_{ik}\prod_{j=1}^{k-1}\hat{q}_{ij}$ for sample units whose last call was *k =1,…,t-1*.

Estimation of the hazard in each time period is made easy given modern computing abilities and electronic sample management systems that record successive efforts made on sample cases. The simplest dynamic response propensities are simply call-level response rates. For example, imagine a sample with 1000 units and a two call recruitment protocol. At the first call, 300 sample units respond. Of the remaining 700 sample units, 150 respond at the second call. Thus, the estimated within-call dynamic response propensities are 300/1000=0.30 for call one and 150/700=0.21 for call two. The estimated across-call dynamic response propensities are 0.30 for all people on call one, 0.30 for sample units who received only call one, and (1-0.30)*0.21=0.15 for all people who received call two. This kind of model specification assumes that the only predictor of response propensity is the call number. However, as discussed above, this ignores a great deal of information about the sample units and the protocol.

A case-call level data set is used to estimate dynamic response propensities, with different case bases for contact and cooperation. Logistic regression procedures available in most standard statistical packages run on the appropriate case base will give appropriate parameter estimates for a discrete time hazard model. First, contact probabilities are estimated with first contact as the event of interest. Although many cases experience repeated contacts, as soon as the case experiences its first contact, the type of nonresponse shifts from noncontact nonresponse to noncooperation nonresponse. Second, cooperation probabilities are estimated with interview as the event of interest, among the contacted cases. For the rare occasions where interviews are spread across multiple call attempts, the first call on which a completed interview (or partial interview) is recorded will be the event of interest.

This is different from estimating response propensities *post hoc* for adjustment purposes. Adjustment methods take a retrospective look at response propensity, treating response as a sampling step where the sampling probabilities are unknown, often called a quasi-randomization approach (Oh and Scheuren 1983). Further, adjustments implicitly condition on the realized evolved state of the recruitment protocol. The goal of adjustment methods is to create subclasses based on observed variables such that response propensities are homogeneous within class but heterogeneous across classes (Bethlehem 2002). Many methods have been used for this type of adjustment, including poststratification, raking, sample-based weighting classes, and response propensity models using covariates in a logistic regression (Little 1982; Little 1986; Little and Rubin 2002).

Each adjustment method assumes that response propensities are constant across the classes or values formed by the variables used in the adjustment purposes, but generally tends to ignore paradata (Couper 2000) from the data collection process. In essence, ignoring process data assumes that there is no information about response propensity contained in paradata or that response propensities are constant over levels of effort. For instance, many typical weighting schemes use age, race and sex distributions.

The use of only these characteristics assumes that the response propensity for a 30 year old white male is constant, regardless of the number or timing of contact attempts or types of persuasive tactics used for this individual.

One reason for the lack of use of paradata in adjustment models could be problems of censoring and endogeneity in the estimation. “Censoring” is a term borrowed from survival analysis in which the time until an event’s occurrence is unknown for persons for whom the event does not occur, that is, it is censored (Singer and Willett, 2003, p.318). For example, the number of calls until contact is unknown and thus censored for sampled units who were never contacted. The term censoring is usually used for events that may occur to a sampled unit (e.g., death, divorce), but does not occur during the time of observation.

“Endogeneity” is a term used in econometrics with many meanings and gradations (e.g., weak, strong and super exogeneity in Engle, Hendry and Richard, 1983), but is usually tied to the specification of a causal model. Endogenous variables are those for whom the outcome is fully determined after the occurrence of a particular event or those whose values are internal to the causal system being measured by the model. In every instance, an endogeneity claim centers around a theoretical argument for what is exogenous and what is endogenous in a set of variables predicting a given outcome. Use of process data puts the analyst at risk of endogeneity when estimating hazard models.

An advantage of hazard models is that the method was developed to account for the censoring problem, and can facilitate ridding oneself of the endogeneity problem. In the context of a hazard model, a censored case is any case for which the event of interest does not occur (Singer and Willett 2003). For the models considered here, censoring in a contact model indicates that the effort stopped and the case was not contacted during the field period; censoring in a cooperation model indicates that effort stopped and the case did not complete an interview. The term “censoring” implies that there is a probability that a case would have been contacted or cooperated had the field effort been extended. The mechanisms for censoring in survey data collection are threefold: the field period ends, a field supervisor or interviewer decides to no longer make an attempt on a case, or a sample unit itself asks to no longer be contacted. A field supervisor or interviewer may decide to limit contact or persuasion attempts to a case because a double sample of the nonrespondents is implemented, the number of outstanding cases remaining in a primary sampling unit is too small to warrant additional cost extended to the case, the case is overlooked or inadvertently omitted from receipt of call attempts, the case has indicated excessive difficulty in ability to be contacted or strong reluctance against cooperation, or protocol limits on numbers of contact attempts or calls with resistance have been achieved. Most of these reasons for censoring are noninformative. Unfortunately, decisions about the reason for censoring are often not recorded, especially when the decision is made by field personnel. Thus, in most call record data sets, one cannot disentangle an end of field period or inadvertent limit on the number of field attempts from a decision made to limit call attempts because of the interviewer’s judgment of success with the case.

As with any modeling problem, care must be taken to account for endogeneity concerns. The term “endogeneity” can be ambiguous and difficult to apply. The analyst must recognize that analytic variables derived from paradata are fully protocol dependent. An analytic variable may be free from these concerns in one protocol, but are not in another protocol. As the process data necessarily reflect the protocol that was used for making contact and gaining cooperation, the protocol must be articulated before informed decisions about analytic variables can be made. Survival models permit the analyst to appropriately incorporate the protocol into the estimation of response propensities. For instance, outcomes from previous calls (such as appointments or refusals) can be incorporated as lagged variables, ensuring that there was some possibility for the outcome to have changed on a subsequent call. When creating variables, we suggest that the analyst ask the following questions.

1. What was the protocol, as designed, for contacting housing units? For gaining cooperation once contact was established? For refusal conversion? How well did the survey organization maintain the protocol over the field period?
2. Does the analytic variable reveal a stable trait of the sampled unit that is likely to be observed in other realizations of the survey protocol, a protocol decision by the survey organization, or both?
3. Were there survey organization or protocol decisions that restricted the distribution of particular analytic variables?
4. Did survey organization or protocol decisions play a role in restricting outcomes after a certain value of the analytic variable was reached?
5. Is it possible for all persons with the characteristic measured by the analytic variable to cooperate or not cooperate/be contacted or not be contacted?
6. Is it possible for all persons, either contacted or not contacted, or cooperative or uncooperative, to have any value measured by the analytic variable?

A.5.4 Example: Contact in the Wisconsin Divorce Study

The process for dynamic propensity model fitting was the following: First, an appropriate model for the level of effort/call variables (the "time" intercepts in the traditional survival model framework) in the discrete time hazard model was identified. Second, available candidate respondent characteristics were identified in the frame data and possible theoretical mechanisms were identified. These include characteristics that are not a focal statistic of interest, but are available for all or most sample members. Variables were selected that have theoretical justification as discussed above.

Model Building: Dynamic Propensity Models. Identifying a parsimonious representation of time is the first step in the dynamic propensity model analysis. Discrete time hazard models typically include an indicator variable for each time period – here call number – as an intercept. To define calls in the contact and cooperation models, calls are separated by the call at first contact. The contact model predicts the probability of first contact at call C. For the contacted cases, the cooperation model starts with the call at first contact, C, and continues through the end of data collection. The probability estimated is thus cooperation at call K after first contact. The first call in the cooperation model is the call of first contact. Including both phone and mail attempts, there were up to 103 calls made on any sample unit.

For each model, we fit a general model with the number of intercepts equal to the total number of calls (103 for the contact and interview models, 68 for the cooperation model) and a constant model, assuming that there was no change in the probability of obtaining a contact or interview over the data collection period. These models provided bounds on what we might expect. Then, both parametric and non-parametric models were specified and compared to a general model with no restrictions on the call parameters.

Then, parametric models using linear, quadratic, cubic, and log, and log-quadratic functions of calls were fit. Additionally, models in which the hazards were set to be equal for successive calls were fit, starting at 50 calls and moving backwards until 6 calls. Groups of calls were also set equal to test changing hazards, but were not significantly better than the models presented. The goal is to identify the most parsimonious representation of time that is not significantly different from the full model while imposing as little structure on the time dimension as possible.

Table A.114 presents the results from these models. Selection of the appropriate time parameters was based on finding no significant difference from the general model, low AIC, and high likelihood ratio chi-square statistics. A cubic term was selected as the most parsimonious representation of time.

Table A.114: Model Building: Selecting Time

	-2 Log likelihood (model)	AIC	Likelihood Ratio Chi-Square	# parameters	Difference in deviance compared to General Model	P value
General	2853.45	3059.45	352.79	103	--	--
Constant	3206.24	--	--		352.79	0.00
Linear	2994.37	2998.37	211.87	1	140.919	0.01
Quadratic	2952.23	2958.23	254.01	2	98.775	0.52
Cubic	2934.07	2942.07	272.17	3	80.618	0.91
Log	2958.83	2962.83	247.41	1	105.379	0.36
Quadratic Log	2948.33	2954.33	257.91	2	94.879	0.63
Hazard unchanging after call …						
6	2958.74	2970.74	247.50	6	105.29	0.27
10	2938.04	2958.04	268.20	10	84.59	0.72
13	2923.77	2949.77	282.48	13	70.31	0.94
16	2920.63	2952.63	285.62	16	67.17	0.94
30	2899.51	2959.51	306.73	30	46.06	0.99
50	2878.04	2978.04	328.21	50	24.58	1.00

Call Invariant Covariates: Contact Model. We now fit dynamic propensity models, starting with call-invariant covariates Interactions with time or other variables will be examined in a later section.

Table A.115: Coefficients and Standard Errors for Three Dynamic Response Propensity Models

	At-home patterns			Access impediments			Both		
	Coeff.		SE	Coeff.		SE	Coeff.		SE
Intercept	-2.08	****	0.53	-3.32		3.60	-3.62		3.67
Call	-0.19	****	0.02	-0.19	****	0.02	-0.19	****	0.02
Call*Call	0.0043	****	0.00	0.0044	****	0.00	0.0043	****	0.00
Call*Call*Call	$-3x10^{-5}$	***	0.00	$-3x10^{-5}$	***	0.00	$-3x10^{-5}$	***	0.00
R. age	0.00		0.01				0.01		0.01
# children R given custody	0.18	*	0.07				0.17	*	0.07
# children R and spouse given joint custody	0.11		0.06				0.12		0.06
# children spouse given custody	0.06		0.08				0.05		0.08
Currently live in Wisconsin	-0.03		0.14				0.01		0.16
Prop. drive alone to work	0.86		0.51				1.30		1.20
Prop. commute < 15 minutes	0.73		0.47				0.88		0.63
Prop. work at home	4.15	***	1.42				6.25	*	2.27
0-50% of HH in urban area				-0.18		0.16	-0.34	*	0.17
50-89% of HH in urban area				-0.20		0.16	-0.31		0.17
Education information missing				0.14		0.29	0.23		0.29
College degree or more				-0.13		0.21	-0.09		0.21
Some college				-0.02		0.21	0.01		0.21
High school degree				-0.11		0.19	-0.12		0.19
Prop. HH income <15K				-4.56		2.62	-4.00		2.66
Prop. HH income 15K-30K				-6.20	*	3.11	-6.55	*	3.19
Prop. HH income 30K-60K				-4.53	*	2.15	-3.38		2.30
Prop. HH income 60K-100K				-6.87		3.63	-6.33		3.72
Prop. White, non-Hispanic				7.94	*	3.29	5.52		3.55
Prop. Black, non-Hispanic				6.42		3.40	3.66		3.74
Prop. Hispanic				7.75		4.27	6.04		4.56
Prop. Never Married				-0.76		0.65	0.10		0.97
Prop. Divorced				-1.05		3.03	-1.68		3.16
Prop. Separated				11.05		11.71	19.44		12.43

In the at-home patterns model, age and living in Wisconsin are not significant (Table A.115). However, children in the respondent's custody or respondent and the ex-spouse's joint custody increase contactability. Both models show significant relationships for the proportion of persons who drive alone to work and the proportion in the zip code who work at home.

In the access impediments model, the education variables are not significant, but the income variables are, all with negative relationships with contactability (the proportion with incomes over $100,000 is omitted). Concentrations of whites, blacks, and Hispanics increase the likelihood of contactability; the proportion of whites and blacks were significant in the stochastic model, whereas the proportion Hispanics was not.

When the at-home patterns and access impediments variables are combined, two of the income groups (proportion household income between $15,000 and $30,000 and proportion between $60,000 and $100,000) are negatively related to contactability, but the others are not. The proportion driving alone to work is not significant after combining the two sets of variables; the race variables also fall out of significance. When the two groups are combined, persons living in urban zip codes are more likely to be contacted than persons living in zip codes with lower concentrations of urban households.

Call Varying Covariates: Contact. We now add call-varying indicators of at home patterns and access impediments from the call record data. First, an indicator for the call being the mail survey is included as that is expected to bypass both at-home patterns and access impediments. We expect it to have diminishing returns, however, if prior attempts to have reached the household by telephone have failed. We also include indicators for the time of day that the phone call was made – Sunday through Thursday after 5 PM, Saturday and Sunday during the day, and Friday and Saturday evenings, with Monday through Friday days as the reference category. We expect higher contactability during weekday days and weekends, but do not necessarily expect differences in Friday and Saturday evenings from Monday through Friday days. The mail survey is considered in the reference category. We also include a count total number of calls made during each of these time slots on all prior calls. We believe that individuals who received more "peak hour" calls on prior calls without being contacted are more likely to have different at-home patterns than other individuals.

Then, we include the time in between calls. Although not directly related to at home patterns or access impediments, we believe that calls made the same day are informative about a person's at home patterns that day. For instance, we anticipate that calls made a very short time after the previous call, that is, five minutes or less, are an indication that the interviewer obtained a busy signal on the previous call and is trying again. Calls made within an hour of the previous call are unlikely to be fruitful, especially if they were both made during the day. It is unclear how calls made later that day will behave. It is unclear how calls made later will behave. Some people believe that waiting a few days before a next contact attempt is more fruitful.

Table A.116: Coefficients and Standard Errors for Two Dynamic Contact Propensity Models, WDS

	Time-varying covariates (1)		Time-varying covariates (2)	
	Coeff.	SE	Coeff.	SE
Intercept	-5.11	3.79	-4.73	3.82
Call	-0.17***	0.04	-0.14***	0.05
Call*Call	0.0043****	0.00	0.0035***	0.00
Call*Call*Call	-0.00002***	0.00	-0.00002*	0.00
R. age	0.01	0.01	0.01	0.01
# children R given custody	0.17*	0.07	0.16*	0.07
# children R and spouse given joint custody	0.11	0.07	0.12	0.07
# children spouse given custody	0.02	0.08	0.03	0.09
Currently live in Wisconsin	0.09	0.17	0.14	0.17
Prop. drive alone to work	1.06	1.25	0.83	1.26
Prop. commute less than 15 minutes	1.00	0.65	0.91	0.65
Proportion in zip code work at home	6.51*	2.35	6.32*	2.36
0-50% of HH in zip code in urban area	-0.21	0.18	-0.19	0.18
50-89% of HH in zip code in urban area	-0.24	0.17	-0.20	0.17
Education information missing	0.32	0.30	0.33	0.30
College degree or more	0.04	0.22	0.03	0.22
Some college	0.09	0.22	0.07	0.22
High school degree	-0.02	0.20	-0.04	0.20
Prop. HH income less than 15K	-5.31	2.77	-5.51*	2.79
Prop. HH income between 15K-30K	-7.77*	3.33	-7.90*	3.35
Prop. HH income between 30K-60K	-4.22	2.41	-4.37	2.42
Prop. HH income between 60K-100K	-7.49*	3.85	-7.63*	3.88
Proportion White, non-Hispanic	7.11*	3.63	6.98	3.67
Proportion Black, non-Hispanic	5.09	3.81	4.97	3.84
Proportion Hispanic	7.59	4.62	7.50	4.67

	Time-varying covariates (1)		Time-varying covariates (2)	
	Coeff.	SE	Coeff.	SE
Proportion Never Married	0.14	1.00	-0.05	1.01
Proportion Divorced	-1.36	3.25	-0.58	3.28
Proportion Separated	25.46*	12.79	25.86*	12.89
Mail Survey	1.17****	0.23	1.13****	0.26
Mail Survey*Call	0.19****	0.04	0.17****	0.04
Mail Survey*Call*Call	-0.0019*	0.0008	-0.0017*	0.00
Call made Su-Th after 5 PM	0.81****	0.14	0.82****	0.15
Call made Weekend 9AM – 5 PM	0.57***	0.16	0.59***	0.16
Call made F-Sa after 5 PM	0.47	0.27	0.41	0.28
# of prior calls made Su-Th after 5 PM	-0.12	0.07	-0.11	0.07
# of prior calls made Weekend 9AM – 5 PM	0.05	0.07	0.08	0.07
# of prior calls made F-Sa after 5 PM	-0.02	0.11	-0.04	0.11
Prior call made same day, 0-5min. before			0.89*	0.35
Prior call made same day, 6-30min before			-0.74	0.55
Prior call made same day, 31-60min before			-1.11*	0.46
Prior call made same day, 1 hr before			-0.30	0.27
Prior call made same day, 2-4 hr before			-0.35	0.20
Prior call made same day, 5-10 hr before			0.03	0.28
Prior call made yesterday			-0.31	0.17
Prior call made between yesterday and 7 days ago			0.11	0.20
Prior call made between 8 and 14 days ago			0.09	0.42
Prior call made between 15 and 21 days ago			-0.19	0.64
Prior call made between 22 and 28 days ago			0.70	0.41
Prior call made 29 to 60 days ago			0.02	0.23
Prior call made 61 days ago or earlier			--	--

Sending a mail survey at the end of the telephone survey increases response propensity (Table A.116). As expected, its efficacy has diminishing returns for cases that have already received more telephone calls. Not surprisingly, calls made during weekday evenings and weekday days are more productive than calls made during weekday days or Friday and Saturday evenings. Persons who have received more calls during weekday evenings are marginally less likely to be contacted, confirming our hypothesis that being away from home during the evening on multiple occasions is indicative of noncontactability. Calls made immediately after the prior call do appear to reveal a busy signal; calls made any time during the day after a prior noncontact are not likely to yield a complete. Nothing conclusive can be said about other time lags.

A.5.5 Summary

This appendix has introduced a different approach to response propensity, one in which there is within-person variation in response propensity. It presented a modeling approach to estimate dynamic response propensities. Future work using this approach should focus on its implications of this approach for nonresponse bias.

Table A.117: Expert Reviewer Coding Form

Question	Question Wording	Response options	Population	Burdensome	Sensitive	Socially undesirable	Any failure ?	Comprehension	Retrieval	Judgment	Editing
Q1	<text>	<text>	<text>	Yes No	Yes No	Yes No	Yes No	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
Q2				Yes No	Yes No	Yes No	Yes No	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3

Note: Coding form was displayed in landscape layout for purposes of the expert review. Coding form displayed in portrait layout here. Each survey had its own form.

Table A.118: Question wording, response options, and population for questions, WDS

Question	Question Wording	Response Options	Population
vq6	Have you ever been married?	1 Yes 2 No	All Respondents
vq7	How many times have you been married?	________ (number of times)	All respondents who report being married
vq8aa / vq8ab	In what month and year did your [fill first] marriage begin?	(month) / (year)	All respondents who report being married
vq8af	Are you still married?	1 Yes 2 No	All respondents who report being married
vq8ag	How did this marriage end?	1 separation 2 divorce 3 spouse died 4 other	All respondents who report the marriage ending
v8adi / v8ade	In what month and year did this spouse die?	(month) / (year)	All respondents who the marriage ending because of spouse's death
vq8ah	In what month and year did you stop living together?	(month) / (year)	All respondents who report the marriage ending because of separation or divorce
vq8ai	In what year did you separate?	________ (year)	All respondents who report the marriage ending because of separation or divorce
vq8aj / vq8ak	In what month and year did you get divorced?	(month) / (year)	All respondents who report the marriage ending because of separation or divorce
vq43	Had you ever been married prior to your current [fill 12fl]?	1 Yes 2 No	All respondents who report being in a current relationship
vq80 / vq80b	What is your date of birth?	(month) / (year)	All respondents

Note: These questions were given to the expert to review. Not all questions are used in the measurement error analysis. Record values of questions not used in the measurement error analysis were used in the nonresponse analysis.

Table A.119: Question wording, response options and population who received questions, NPSAS

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
N4ELIG / TCURENRL	Have you been enrolled at [NPSAS] at any time since July 1, 2003?	0 = No 1 = Yes, currently enrolled 2 = Yes, but not currently enrolled 3 = Have been enrolled, but still enrolled in high school	All students
N4DRPMY	Have you been enrolled at [NPSAS] at any time since July 1, 2003?	0 = No 1 = Yes, currently enrolled 2 = Yes, but not currently enrolled 3 = Have been enrolled, but still enrolled in high school	All students
N4DRPTM	When did you last attend [NPSAS]?	MMYYYY	Respondents who have been enrolled since July 1, 2003 but were not enrolled at NPSAS during the time of the interview.
N4DRPTM	[If N4DRPMY is blank] When you last attended [NPSAS], did you leave at the end of the term, or did you leave before the term ended?	1 = Left at the end of the term 2 = Left before the term ended	Respondents who have been enrolled since July 1, 2003 but were not enrolled at NPSAS during the time of the interview.
N4STAT	For all questions about your 2003-2004 enrollment at [NPSAS], please refer to your most recent term of enrollment at the school. (Currently enrolled students) In your most recent term at [NPSAS], have you been enrolled as an undergraduate or graduate student, or have you been taking courses without being enrolled in a degree program? (Not currently enrolled students) In your most recent term at [NPSAS], were you enrolled as an undergraduate or graduate student, or were you taking courses without being enrolled in a degree program?	1 = Undergraduate student (includes associate's and bachelor's degrees, postsecondary diplomas and certificates at the undergraduate level, as well as professional degrees that do not require a bachelor's degree) 2 = Graduate student (includes master's and doctoral degrees, and post-baccalaureate and post-master's certificates, as well as professional degrees that may be pursued after obtaining a bachelor's degree) 3 = Taking classes without being enrolled in a degree program	All students
N4DGUG	Earlier you indicated that you (if TCURENRL=1] are [else] were) working on a professional degree. By professional degree, we mean only the following programs -- chiropractic, dentistry, law,	1 = Bachelor's degree 2 = Associate's degree 3 = Undergraduate certificate or diploma (occupational or technical program) 4 = Undergraduate student, not	Undergraduate respondents.

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
	medicine, optometry, osteopathic medicine, pharmacy, podiatry, divinity/theology, or veterinary medicine). If you ([if TCURENRL=1] are [else] were) working on one of those programs, please select first professional degree. Otherwise, please select a degree from one of the other options.	in a degree program 8 = Post-baccalaureate certificate 11 = Professional degree (only includes the following degree programs: chiropractic, dentistry, law, medicine, optometry, osteopathic medicine, pharmacy, podiatry, divinity/theology, or veterinary medicine) 99 = Misclassified professional	
N4ASSOC	What type of associate's degree were you working on at [NPSAS]?	1 = AA, AS, general education or transfer program 2 = AAS, occupational or technical program	Undergraduate respondents who were working on an associate's degree during the 2003-2004 school year.
TSTAT / N4UGYR	What was your year or level during your most recent term at [NPSAS] in the 2003-2004 school year?	1 = First year or freshman 2 = Second year or sophomore 3 = Third year or junior 4 = Fourth year or senior 5 = Fifth year or higher undergraduate 6 = Unclassified undergraduate 7 = Graduate student taking undergraduate classes	Undergraduate respondents who were working on a degree during the 2003-2004 school year
N4DBLMAJ	Have you declared a major yet?	0 = Not in a degree program 1 = Declared major 2 = Declared double major 3 = Not yet declared	All students
N4MAJ1B	What is/was your [(if N4DBLMAJ=2) primary] major or field of study at [NPSAS] during your most recent term of the 2003-2004 school year? [If self-administered] Please indicate which category below best represents the major you provided above. [else] [TIO] Please bear with me while I code this………….	[List of Majors]	All students
N4GPA1	Is your grade point average (GPA) measured on a 4.00 scale?	1 = Yes 2 = No, it is measured on another grading scale 3 = No, the school does not award grades 4 = Yes, but no GPA yet	All students
N4MAJ2B	What was your secondary major or field of study at [NPSAS] during your most recent term of the 2003-2004 school year? (Please do not include a minor.)	[List of majors]	Undergraduate respondents who declared a double major during the 2003-2004 school

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
			year
N4GPA	What was your cumulative GPA at [NPSAS] through the end of your most recent term in the 2003-2004 school year?	0.00 to 4.00	Respondents whose GPA was measured on a 4.0 scale.
N4GPAEST	Which of the following would you say best describes your grade point average at [NPSAS]?	1 = Mostly A's (3.75 and above) 2 = A's and B's (3.25-3.74) 3 = Mostly B's (2.75-3.24) 4 = B's and C's (2.25-2.74) 5 = Mostly C's (1.75-2.24) 6 = C's and D's (1.25-1.74) 7 = Mostly D's or below (below 1.24) 8 = Don't know	Respondents whose GPA was on a 4.0 point scale and did not know their numeric GPA, or who were on a grading scale other than a 4.0 point scale.
N4DGBMY	In what month and year did you first attend [NPSAS] after completing high school requirements?	YYYYMM	Undergraduate respondents.
N4CMPDGN	Have you completed all the requirements for your [TDEGREN]?	0 = No 1 = Yes	Respondents in a degree program.
N4EXNMY	In what month and year do you expect to complete the requirements for your [TDEGREN]?	YYYYMM	Respondents who were working toward a degree at NPSAS who expect to complete it
N4EXPN	In what month and year do you expect to complete the requirements for your [TDEGREN]? Will not finish the [TDEGREN]	0 = No 1 = Yes	Respondents who are working toward a degree at NPSAS but have not completed it.
N4DGNMY	In what month and year did you complete your [TDEGREN] at [NPSAS]?	YYYYMM	Respondents who completed a degree at NPSAS.
N4ENRPLN	Do you plan to be enrolled at [NPSAS] during the 2004-2005 school year?	0 = No 1 = Yes	Respondents who are not currently enrolled at NPSAS and have not completed a degree
N4NFST	Was [NPSAS] the first college or trade school you enrolled in after completing your high school requirements?	0 = No 1 = Yes	Undergraduate respondents
N4FSTMY	In what month and year did you first attend any college, university, or trade school after high school?	YYYYMM	Respondents for whom NPSAS was not the first school after high school.
N4CMPCLS	Did you complete one or more postsecondary classes (at a college or trade school) toward a degree or formal award between the time you completed high school and July 1,	0 = No 1 = Yes	Undergraduates who first enrolled at a postsecondary institution prior to July 1, 2003 and are

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
	2003?		either in the first or second year of a degree program, or not in a degree program.
N4TRNCRD	Did [NPSAS] accept all, some, or none of the credits you wanted to transfer?	0 = None 1 = All 2 = Some	Undergraduate respondents who transferred to NPSAS from another school during the 2003-2004 school year.
N4PRDG	Have you earned any degrees or certificates since you left high school? [else] Other than the [TDEGREN] that you [are working on/earned] at [NPSAS], have you earned any other degrees or certificates since you left high school?	0 = No 1 = Yes	All students
N4GENDR	So that the rest of this interview may be customized for you, please answer the following questions. What is your gender?	1 = Male 2 = Female	All students
N4LT30 / TAGE /	So that the rest of this interview may be customized for you, please answer the following questions. In what month and year were you born?	MMYYYY	All students
N4DOBMY	What is your age? Are you...	1 = Under 24 2 = 24-29 3 = 30 or over	Respondents who did not provide a date of birth.
N4MARR	What is your current marital status?	1 = Single, never married 2 = Married 3 = Separated 4 = Divorced 5 = Widowed	All students
N4DIPL	Which of the following best describes your high school completion?	1 = Received a high school diploma 2 = Passed a GED (General Educational Development) test 3 = Received a high school completion certificate 4 = Attended a foreign high school 5 = Did not complete high school or a high school equivalency program 6 = I was home schooled	Undergraduate respondents
N4HSYR	When did you complete high school? When did you last attend high	_____ [Year]	Undergraduate respondents

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
	school? When did you receive your high school diploma? When did you receive your high school certificate? When did you receive your GED?		
N4HSST	In what state did you last attend high school?	[List of states]	Undergraduate respondents who were not enrolled in a foreign high school.
N4WKST	During the 2003-2004 school year, have you participated / did you participate in either work study or a paid assistantship? (Please check all that apply.) Work-study	0 = No 1 = Yes	Undergraduate respondents
N4ASST	During the 2003-2004 school year, have you participated / did you participate in either work study or a paid assistantship? (Please check all that apply.) Assistantship	0 = No 1 = Yes	Undergraduate respondents
N4WAAMT / N4WAERNT	How much did you earn from your [assistantship/fellowship/traineeship/ work study job] while you were enrolled during the 2003–2004 school year?	______ Per 1 = Year 2 = Term/semester 3 = Month	All respondents.
N4RCVAID	Besides your [work study/assistantship] did you receive any other financial aid - such as grants, loans, or scholarships during the 2003-2004 school year? [else] Did you receive financial aid - such as grants, loans, or scholarships during the 2003-2004 school year?	0 = No 1 = Yes	All students.
N4APPAID	Did you apply for financial aid for the 2003-2004 school year?	0 = No 1 = Yes	All students
N4FEDLN	Did you receive a federal Stafford student loan for the 2003-2004 school year?	0 = No 1 = Yes	Respondents who received financial aid
N4PELL	Did you receive a Pell grant for the 2003-2004 school year?	0 = No 1 = Yes	Undergraduate respondents who received financial aid.
N4STGRT, N4INGRT	Did you receive any scholarships or grants from your school or from a state grant program during the 2003-2004 school year? State grant or scholarship School grant/scholarship	0 = No 1 = Yes	Respondents who received financial aid
N4STAMT /	Did you receive any scholarships or	______(amount)	Respondents who

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
N4INAMT	grants from your school or from a state grant program during the 2003-2004 school year? State grant/scholarship amount School grant/scholarship amount		received financial aid
N4STNONE	Did you receive any scholarships or grants from your school or from a state grant program during the 2003-2004 school year? Did not receive state or college aid	0 = No 1 = Yes	Respondents who received financial aid
N4ADNEMP, N4ADNPRV, N4ADNVET, N4ADNPMP	Did you receive any financial aid during the 2003–2004 school year that did not come from the financial aid office? Did you receive...? Tuition reimbursement from your employer Grants or scholarships from a private organization Veteran's or DoD (Department of Defense) benefits Aid from your parent's employer	0 = No 1 = Yes	All students
N4AMNEMP, N4AMNPRV, N4AMNVET, N4AMNPMP	Did you receive any financial aid during the 2003–2004 school year that did not come from the financial aid office? Did you receive...? Amount of employer aid Amount of private organization aid Amount of veteran's benefits Amount of parent's employer aid	________ Amount	All students
N4PRVLN	Did you receive any type of commercial or private loan (such as TERI, Excel, or Access loans) from a bank or private organization for your enrollment during the 2003–2004 school year?	0 = No 1 = Yes	All respondents
N4PRVAMT	How much did you borrow in commercial or private loans during the 2003-2004 school year?	__________ Amount	All students
N4SCHRES	While you were enrolled during the 2003-2004 school year, did you live on campus, with your parents or guardians, or some place else? (If you lived in more than one residence, choose the place were you lived for the longest period of time.)	1 = On-campus 2 = With parents or guardians 3 = Some place else (off campus)	Undergraduate respondents
N4OUTST	At [NPSAS], are/were you charged for out-of-state or out-of-district tuition or fees?	0 = No 1 = Yes	Respondents who attended a public institution
N4DEP03	Did anyone claim you as a dependent on their 2003 taxes?	0 = No 1 = Yes, parents/guardians	Respondents under 30

Questionnaire variable	Codebook description for Questionnaire	Response Options	Population
		2 = Yes, another individual 3 = Don't know	
N4UGLN	How much have you already borrowed in student loans for your undergraduate education? (Please do not include any money borrowed from family or friends.) [else] How much did you borrow in student loans for your undergraduate education? (Please do not include any money borrowed from family or friends.)	__________ Amount	All students
N4ACTSAT	Did you take the SAT or ACT college entrance exam?	0 = No 1 = Yes, SAT 2 = Yes, ACT 3 = Yes, both the SAT and ACT	BPS eligible respondents
N4STATE	What is your state of legal residence?	[List of states]	All students
N4HISP	Are you of either Hispanic or Latino origin?	0 = No 1 = Yes	All students.
N4RACEA / N4RACEB / N4RACEC / N4RACED / N4RACEE	What is your race? Check all that apply.	White Black or African American Asian American Indian or Alaska Native Native Hawaiian or Other Pacific Islander	All students.
N4parst	What is your parents' marital status?	1 = Married/remarried 2 = Single 3 = Divorced/separated 4 = Widowed	Undergraduates under 30 with parent/ guardians
N4USBORN	Were you born in the United States?	0 = No 1 = Yes	All students.
N4CITIZN	Are you a U.S. citizen?	1 = Yes 2 = No - Resident alien, permanent resident, or other eligible non-citizen; hold a temporary resident's card or other eligible non-citizen temporary resident's card 3 = No - Student visa, in the country on an F1 or F2 visa, or on a J1 or J2 exchange visitor visa	All students
N4MILA / N4MILB / N4MILC / N4MILN	Are you a veteran of the U.S. Armed Forces, or are you currently serving in the Armed Forces either on active duty or in the reserves? (Please check all that apply.)	Veteran Active duty Reserves None of the above	All students.

Note: These questions were given to the expert to review. Not all questions are used in the measurement error analysis. Record values of questions not used in the measurement error analysis were used in the nonresponse analysis. Question source: (Cominole et al. 2006)

Table A.120: Mean Rating of Burden, Sensitivity, Social Undesirability, and Failure at Comprehension, Retrieval, Judgment and Editing Stages across Six Expert Reviewers by Question

	Burden	Sensiti-vity	Social Undesi-rability	Any Failure	Comp-rehension	Retrieval	Judgment	Editing
WDS								
Ever married	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.17
Number of Marriages	0.00	0.50	0.67	0.67	0.00	0.00	0.00	0.67
Month and Year of Birth	0.00	0.50	0.17	0.50	0.00	0.00	0.00	0.50
Month and Year of Marriage	0.83	0.00	0.00	0.83	0.33	1.17	0.00	0.00
Ever divorced	0.00	0.50	0.00	0.17	0.00	0.00	0.00	0.17
Month and Year of Divorce	1.00	0.33	0.17	1.00	0.00	1.33	0.00	0.17
NPSAS								
Applied for financial aid	0.00	0.33	0.17	0.00	0.00	0.17	0.00	0.17
Received financial Aid	0.00	0.33	0.17	0.17	0.17	0.17	0.00	0.17
Received Stafford Loan	0.00	0.33	0.00	0.33	0.50	0.67	0.00	0.17
Received Pell Grant	0.00	0.33	0.00	0.33	0.50	0.67	0.00	0.17
Received any work study	0.00	0.17	0.17	0.33	0.50	0.17	0.00	0.17
Amount of Work Study	0.67	0.67	0.00	1.00	0.50	1.67	0.50	0.67
Received any institutional or state aid	0.50	0.33	0.00	0.50	0.83	0.83	0.17	0.17
Amount of Institutional or State Aid	0.83	0.67	0.00	1.00	0.67	1.83	0.83	0.67
Grade Point Average	0.33	0.83	0.83	0.83	0.17	1.67	0.67	1.17

Table A.121: Exact Match Rate in Coding by Reviewer, All Questions, All Categories, WDS Below Diagonal, NPSAS Above Diagonal

WDS/NPSAS	Reviewer 1	Reviewer 2	Reviewer 3	Reviewer 4	Reviewer 5	Reviewer 6
Reviewer 1		0.45	0.75	0.86	0.59	0.93
Reviewer 2	0.75		0.43	0.41	0.53	0.39
Reviewer 3	0.92	0.83		0.70	0.59	0.75
Reviewer 4	0.81	0.75	0.88		0.59	0.88
Reviewer 5	0.75	0.75	0.79	0.79		0.59
Reviewer 6	0.77	0.65	0.77	0.83	0.81	

Table A.122: Item Nonresponse Rates for College, Some College, High School Degree, and Less than High School Degree Education Levels, WDS

	Item Nonresponse					SE				
	Miss.	college	Some college	HS degree	<HS	Miss.	college	Some college	HS degree	< HS
Ever married	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ever divorced	4.0	1.8	0.0	0.9	4.4	4.0	1.2	0.0	0.6	3.1
Birth date	0.0	0.9	0.9	0.9	0.0	0.0	0.9	0.9	0.6	0.0
Number of marriages	0.0	0.0	0.0	0.4	4.4	0.0	0.0	0.0	0.4	3.1
Marriage Date	0.0	0.0	3.7	2.2	11.1	0.0	0.0	1.8	1.0	4.7
Divorce Date	8.0	7.1	3.7	9.1	22.2	5.5	2.4	1.8	1.9	6.3

Note: Miss. Indicates that education was missing on the frame for the respondents.

Table A.123: Item Nonresponse Rates for Full-time, Part-time, Unknown, and Not Enrolled Students, NPSAS

	Item Nonresponse Rates					SE			
	FT	PT	Un-known	Not enrolled		FT	PT	Un-known	Not enrolled
Applied for Financial Aid	0.50	0.53	0.80	0.52		0.06	0.11	0.29	0.13
Received Financial Aid	0.53	0.47	1.13	0.63		0.06	0.10	0.34	0.14
Received Stafford Loan	0.82	0.71	1.05	0.74	***	0.08	0.13	0.33	0.15
Received Pell Grant	0.93	0.55	1.19	0.87		0.08	0.11	0.17	0.87
Received Work Study	1.69	2.97	2.67	2.79	****	0.11	0.24	0.39	0.31
Amount of Work Study Received	2.15	1.46	1.97	2.27	*	0.12	0.16	0.37	0.27
Received State Aid	0.83	0.56	1.37	0.97		0.08	0.11	0.38	0.18
Amount of State Aid Received	2.86	1.89	1.99	2.87	***	0.14	0.19	0.41	0.30
Received Institutional Aid	0.83	0.56	1.37	0.97		0.08	0.11	0.38	0.18
Amount of Institutional Aid Received	2.60	1.21	2.37	2.60	****	0.13	0.15	0.45	0.28
GPA	2.84	5.94	5.08	6.00	****	0.13	0.29	0.54	0.42

Note: FT indicates that the student was enrolled full-time at least one month during Spring semester. PT indicates that the student was enrolled part-time at least one month during Spring semester, and was not enrolled full-time in any month. Unknown indicates that the enrollment level of the student was unknown. Not enrolled indicates that the student was not enrolled during Spring semester. Stars indicate significant differences observed across the four groups. *p<.05, **p<.01, ***p<.001, ****p<.0001

Table A.124: Item Nonresponse Rates Across Modes, Web Only, Web After Phone Prompting, and Phone, NPSAS

	Item nonresponse rates			SE		
	web, no phone	web, w/ phone	phone	web, no phone	web, w/ phone	phone
Applied for Financial Aid	0.04	0.10	0.99	0.02	0.05	0.10
Received Financial Aid	0.12	0.23	0.99	0.05	0.07	0.10
Received Stafford Loan	0.25	0.47	1.27	0.06	0.11	0.11
Received Pell Grant	0.35	0.42	1.35	0.07	0.10	0.11
Received Work Study	1.28	1.98	2.81	0.14	0.21	0.15
Amount of Work Study Received	1.38	1.07	2.75	0.14	0.14	0.15
Received State Aid	0.12	0.23	1.49	0.05	0.07	0.12
Amount of State Aid Received	1.39	1.86	3.57	0.14	0.20	0.17
Received Institutional Aid	0.12	0.23	1.49	0.05	0.07	0.12
Amount of Institutional Aid Received	1.27	1.35	3.25	0.13	0.17	0.16
Grade Point Average	1.18	1.84	6.83	0.13	0.19	0.22

Note: All of the web item nonresponse rates vary significantly from the phone item nonresponse rates.

Table A.125: Logistic Regression Coefficients, Predicting Item Nonresponse on 11 Items, using Interviewer Ratings of Items, NPSAS

	Beta		SE	Beta		SE
Intercept	-3.57	****	0.02	-3.84	****	0.03
Sensitivity rating <=0.33	-1.03	****	0.04			
Retrieval rating <.0.67				-0.70	****	0.04

Note: Logistic models predicted item nonresponse on all 11 items in the NPSAS. Estimates account for the clustering of items within students, for unequal probabilities of selection of students, and stratification.

Table A.126: Logistic Regression Coefficients, Predicting Item Nonresponse on 11 Items, Using Interviewer Ratings, Respondent Enrollment, and Mode, NPSAS

	Beta		SE	Beta		SE	Beta		SE
Intercept	-3.67	****	0.04	-3.91	****	0.07	-3.01	****	0.06
Mode									
Web, no phone	-1.31	****	0.07				-1.17	****	0.07
Web, with phone	-1.05	****	0.08				-0.99	****	0.07
Phone	0.00	.	0.00				0.00	.	0.00
Spring Enrollment									
FT enrollment				-0.24	**	0.08	-0.16	*	0.06
PT enrollment				-0.24	**	0.09	-0.27	***	0.07
Unknown enrollment				-0.01		0.17	-0.11		0.13
Not enrolled				0.00	.	0.00	0.00	.	0.00
Sensitivity rating <=0.33							-1.22	****	0.07
Retrieval rating <.0.67							0.25	****	0.06

Note: Logistic models predicted item nonresponse on all 11 items in the NPSAS. Estimates account for the clustering of items within students, for unequal probabilities of selection of students, and stratification.

Table A.127: Generalized Logistic Regression Coefficients and Standard Errors, Predicting Overreporting and Accurate Reporting vs. Underreporting, using Interviewer Ratings of Sensitivity and Retrieval Difficulties, NPSAS

	Model 1						Model 2					
	Overreporting vs. Underreporting			Accurate reporting vs. Underreporting			Overreporting vs. Underreporting			Accurate reporting vs. Underreporting		
	Beta		Se	Beta		Se	Beta		Se	Beta		Se
Intercept	0.15	****	0.01	-0.44	****	0.02	-0.01		0.01	1.71	****	0.01
Sensitivity<=0.33	1.5	****	0.01	1.12	****	0.01						
Retrieval<=0.67							-0.05	*	0.02	1.2	****	0.02

Note: Logistic models predicted directional measurement error on all 11 items in the NPSAS. Estimates account for the clustering of items within students, for unequal probabilities of selection of students, and stratification.

Table A.128: Generalized Logistic Regression Coefficients and Standard Errors, Predicting Overreporting and Accurate Reporting vs. Underreporting, using Interviewer Ratings of Sensitivity and Retrieval Difficulties, NPSAS

	Model 1						Model 2					
	Overreporting vs. Underreporting			Accurate reporting vs. Underreporting			Overreporting vs. Underreporting			Accurate reporting vs. Underreporting		
	Beta		SE	Beta		SE	Beta		SE	Beta		SE
Intercept	0.1	***	0.03	2.46	****	0.02	0.32	****	0.03	1.88	****	0.02
Sensitivity<=0.33							-0.8	****	0.02	0.61	****	0.01
Retrieval<=0.67							0.6	****	0.03	0.8	****	0.02
Age												
15-19 vs. 28+	-0.31	****	0.04	-0.54	****	0.03	-0.36	****	0.04	-0.64	****	0.03
20-21 vs. 28+	-0.22	****	0.04	-0.47	****	0.03	-0.27	****	0.04	-0.56	****	0.03
22-27 vs. 28+	0.08		0.04	-0.15	****	0.03	0.03	****	0.04	-0.2		0.03

Note: Logistic models predicted directional measurement error on all 11 items in the NPSAS. Estimates account for the clustering of items within students, for unequal probabilities of selection of students, and stratification.

Table A.129: Percent and Standard Errors, Reported Answer by Record Value, Receipt of Types of Financial Aid, NPSAS

	%				SE			
	Record				Record			
	Yes		No		Yes		No	
	Report		Report		Report		Report	
	No	Yes	No	Yes	No	Yes	No	Yes
NPSAS								
Applied for financial aid	8.81	91.19	80.61	19.39	0.22	0.22	0.53	0.53
Received financial aid	9.10	90.90	85.10	14.90	0.24	0.24	0.41	0.41
Received Stafford loan	15.45	84.55	92.71	7.29	0.39	0.39	0.22	0.22
Received Pell Grant	14.55	85.45	95.44	4.56	0.16	0.16	0.42	0.42
Received Work Study	33.42	66.58	94.59	5.41	1.10	1.10	0.16	0.16
Received State Aid	54.81	45.19	93.15	6.85	0.69	0.69	0.19	0.19
Received Institutional Aid	36.89	63.11	93.16	6.84	0.64	0.64	0.19	0.19

Table A.130: Logistic Regression Coefficients and OLS Regression Coefficients for the Accuracy and Signed Deviations of Reported Marriage Date, WDS

	Accuracy of marriage Date			Signed Deviations of marriage Date		
	Logistic regression			OLS		
	Beta		SE	Beta		SE
Intercept	1.09	**	0.41	-26.32	**	11.83
Months since marriage	0.00		0.00	0.10	***	0.03
Number of Marriages	-0.78	**	0.24	2.01		7.05
Female	0.65	**	0.21	4.65		5.85
# of children in respondent's sole custody	0.01		0.14	2.02		3.93
# of children in shared custody	0.44	**	0.15	-0.02		3.52
# of children in ex-spouse's sole custody	0.01		0.16	-18.85	****	4.57

Note: *p<.05, **p<.01, ***p<.001, ****p<.0001. All covariates from records.

Table A.131: Logistic Regression Coefficients and OLS Regression Coefficients for the Accuracy and Signed Deviations of Reported Divorce Date, WDS

	Accuracy of Divorce Date			Signed Deviations of Divorce Date		
	Logistic regression			OLS		
	Beta		SE	Beta		SE
Intercept	1.02	**	0.39	-3.61		4.59
Divorce in 1989 vs. 1993	-0.37	+	0.20	2.45		2.40
Number of Marriages	-1.14	****	0.28	-6.05	+	3.14
Female	0.60	**	0.21	1.66		2.55
# of children in respondent's sole custody	0.07		0.15	3.56	+	1.82
# of children in shared custody	0.34	**	0.13	1.62		1.48
# of children in ex-spouse's sole custody	-0.13		0.18	2.79		2.17

Note: *p<.05, **p<.01, ***p<.001, ****p<.0001. All covariates from records.

Table A.132: Underreporting Rates on Financial Aid Items by Age Groups, NPSAS

	Underreport					SE			
	15-19	20-21	22-27	28+		15-19	20-21	22-27	28+
Applied for Financial Aid	4.39	4.78	7.31	9.80	****	0.25	0.30	0.34	0.45
Received Financial Aid	5.82	5.85	5.58	6.63	****	0.28	0.33	0.30	0.37
Received Stafford Loan	6.87	6.99	5.09	3.82	****	0.30	0.36	0.28	0.29
Received Pell Grant	4.53	3.70	4.14	4.33	*	0.23	0.25	0.25	0.29
Received Work Study	3.64	3.17	1.70	0.65	****	0.20	0.23	0.17	0.11
Amount of Work Study Received	7.48	6.87	2.87	1.15	****	0.28	0.34	0.21	0.15
Received State Aid	14.99	12.68	9.69	10.24	****	0.40	0.45	0.37	0.42
Amount of State Aid Received	21.89	18.87	12.41	13.03	****	0.47	0.54	0.42	0.47
Received Institutional Aid	11.18	10.30	7.43	5.12	****	0.36	0.42	0.34	0.31
Amount of Institutional Aid Received	22.57	20.74	11.93	6.40	****	0.47	0.56	0.42	0.34
GPA	26.97	28.00	25.26	22.74	****	0.59	0.70	0.65	0.75

Note: *p<.05, **p<.01, ***p<.001, ****p<.0001. All covariates from records.

Table A.133: Item Nonresponse Rates and Standard Errors by At-Home Contact Propensity Strata, Respondents Only, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	3.41	1.04	1.82	0.00	0.85	1.95	1.04	1.28	0.00	0.85
Number of marriages	2.27	0.00	0.91	0.00	0.00	1.60	0.00	0.91	0.00	0.00
Marriage date	6.82	4.17	1.82	1.80	0.00	2.70	2.05	1.28	1.27	0.00
Divorce date	13.64	13.54	6.36	5.41	5.93	3.68	3.51	2.34	2.16	2.18
Birth date	0.00	1.04	0.91	1.80	0.00	0.00	1.04	0.91	1.27	0.00
NPSAS										
Applied for Financial Aid	0.49	0.65	0.55	0.53	0.48	0.12	0.15	0.12	0.10	0.09
Received Financial Aid	0.56	0.73	0.50	0.55	0.57	0.13	0.16	0.11	0.10	0.10
Received Stafford Loan	0.83	1.10	0.92	0.69	0.60	0.16	0.19	0.16	0.11	0.10
Received Pell Grant	0.77	0.99	0.98	0.79	0.81	0.15	0.18	0.16	0.11	0.11
Received Work Study	3.21	2.59	1.88	1.92	1.89	0.32	0.25	0.21	0.19	0.18
Amount of Work Study	2.00	2.20	1.98	1.96	1.95	0.24	0.24	0.21	0.18	0.17
Received State Aid	0.75	1.02	0.79	0.95	0.68	0.15	0.19	0.13	0.14	0.11
Amount of State Aid	2.46	2.88	2.45	2.91	2.28	0.26	0.28	0.23	0.23	0.19
Received Institutional Aid	0.75	1.02	0.79	0.95	0.68	0.15	0.19	0.13	0.14	0.11
Amount of Institutional Aid	1.92	2.13	2.09	2.74	2.32	0.24	0.24	0.20	0.22	0.19
Grade Point Average	6.01	5.64	3.98	3.32	2.95	0.40	0.35	0.28	0.23	0.20

Table A.134: Mismatch Rates and Standard Errors by At Home Contact Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	3.41	2.08	0.91	1.80	0.00	1.95	1.47	0.91	1.27	0.00
Ever divorced	15.3	4.2	10.2	8.1	4.3	3.93	2.07	2.92	2.60	1.88
Number of marriages	12.8	10.4	8.3	10.8	3.4	3.62	3.13	2.65	2.96	1.67
Marriage date	44.3	33.3	35.5	29.0	23.7	5.62	5.00	4.65	4.41	3.93
Divorce date	65.1	50.6	48.9	51.0	41.5	6.05	5.66	5.24	5.13	4.81
Birth date	17.2	7.4	12.8	12.8	5.1	4.07	2.69	3.22	3.22	2.03
NPSAS										
Applied for Financial Aid	14.8	14.2	10.3	9.2	11.3	0.7	0.6	0.5	0.4	0.4
Received Financial Aid	14.0	13.0	10.5	9.0	10.7	0.6	0.5	0.5	0.4	0.4
Received Stafford Loan	10.5	9.6	10.6	11.6	9.3	0.5	0.5	0.5	0.5	0.4
Received Pell Grant	9.1	8.0	7.9	7.0	6.1	0.5	0.4	0.4	0.3	0.3
Received Work Study	6.0	6.4	7.2	7.8	8.5	0.4	0.4	0.4	0.4	0.4
Amount of Work Study	6.7	7.4	10.2	12.2	13.3	0.4	0.4	0.4	0.4	0.4
Received State Aid	17.0	17.1	20.5	17.9	14.3	0.6	0.6	0.6	0.5	0.4
Amount of State Aid	20.5	22.1	28.1	27.7	20.7	0.7	0.6	0.7	0.6	0.5
Received Institutional Aid	11.6	11.3	14.1	15.1	15.3	0.6	0.5	0.5	0.5	0.5
Amount of Institutional Aid	13.4	14.9	22.9	28.5	30.8	0.6	0.6	0.6	0.6	0.6
Grade Point Average	81.4	82.8	84.1	81.6	83.0	0.9	0.7	0.6	0.6	0.5

Table A.135: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by At Home Contact Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	3.5	7.3	3.7	7.2	2.5	2.0	2.7	1.8	2.5	1.4
Truth=Report	87.2	89.6	91.7	89.2	96.6	3.6	3.1	2.6	2.9	1.7
Truth>Report	9.3	3.1	4.6	3.6	0.9	3.1	1.8	2.0	1.8	0.8
Marriage date										
Truth<Report	32.9	18.5	19.4	18.4	11.0	5.2	4.0	3.8	3.7	2.9
Truth=Report	53.7	65.2	63.9	69.7	76.3	5.5	5.0	4.6	4.4	3.9
Truth>Report	13.4	16.3	16.7	11.9	12.7	3.8	3.9	3.6	3.1	3.1
Divorce date										
Truth<Report	54.0	37.4	37.9	40.0	33.3	5.7	5.3	4.8	4.8	4.5
Truth=Report	29.0	47.0	45.6	44.8	55.9	5.2	5.5	4.9	4.9	4.7
Truth>Report	17.1	15.7	16.5	15.2	10.8	4.3	4.0	3.7	3.5	2.9
Birth date										
Truth<Report	11.4	5.3	9.2	5.5	3.4	3.4	2.3	2.8	2.2	1.7
Truth=Report	81.8	92.6	87.2	87.2	94.9	4.1	2.7	3.2	3.2	2.0
Truth>Report	6.8	2.1	3.7	7.3	1.7	2.7	1.5	1.8	2.5	1.2
NPSAS										
Applied for Financial Aid										
Truth<Report	5.1	5.4	3.9	4.6	6.4	0.41	0.36	0.30	0.30	0.32
Truth=Report	85.2	85.8	89.7	90.8	88.7	0.66	0.57	0.47	0.41	0.41
Truth>Report	9.7	8.8	6.4	4.6	4.9	0.55	0.48	0.37	0.30	0.28
Received Financial Aid										
Truth<Report	6.7	6.0	4.7	4.2	5.1	0.47	0.38	0.34	0.29	0.29
Truth=Report	86.0	87.0	89.5	91.0	89.3	0.65	0.55	0.47	0.40	0.40
Truth>Report	7.3	7.0	5.8	4.8	5.6	0.49	0.42	0.35	0.29	0.30
Received Stafford Loan										
Truth<Report	5.6	4.9	4.5	4.4	4.0	0.39	0.37	0.32	0.30	0.25
Truth=Report	89.5	90.4	89.4	88.4	90.7	0.53	0.49	0.47	0.45	0.38
Truth>Report	4.9	4.7	6.1	7.2	5.4	0.38	0.34	0.36	0.36	0.30
Received Pell Grant										
Truth<Report	3.7	3.4	3.5	3.2	2.8	0.34	0.29	0.27	0.25	0.21
Truth=Report	90.9	92.0	92.1	93.0	93.9	0.50	0.43	0.39	0.35	0.29
Truth>Report	5.4	4.6	4.5	3.8	3.3	0.39	0.33	0.29	0.25	0.21
Received Work Study										
Truth<Report	4.9	5.0	5.0	4.6	5.6	0.39	0.37	0.33	0.29	0.30
Truth=Report	94.0	93.6	92.8	92.2	91.5	0.43	0.40	0.39	0.36	0.35
Truth>Report	1.1	1.4	2.2	3.2	2.9	0.19	0.17	0.21	0.22	0.20
Amount of Work Study										
Truth<Report	4.5	5.0	5.8	6.3	6.8	0.38	0.35	0.35	0.34	0.33
Truth=Report	93.3	92.6	89.8	87.8	86.7	0.45	0.41	0.44	0.43	0.42
Truth>Report	2.1	2.5	4.4	5.9	6.5	0.25	0.23	0.29	0.29	0.29
Received State Aid										
Truth<Report	5.5	5.4	5.4	5.8	4.8	0.41	0.37	0.34	0.31	0.27
Truth=Report	83.0	82.9	79.5	82.1	85.7	0.65	0.59	0.59	0.51	0.44
Truth>Report	11.5	11.7	15.1	12.1	9.5	0.53	0.49	0.52	0.43	0.36
Amount of State Aid										
Truth<Report	7.1	6.8	8.0	8.8	6.8	0.46	0.41	0.41	0.38	0.33
Truth=Report	79.5	77.9	71.9	72.3	79.3	0.70	0.65	0.67	0.60	0.51
Truth>Report	13.5	15.3	20.1	18.9	13.9	0.58	0.55	0.59	0.53	0.43

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	5.9	5.0	4.8	5.1	5.5	0.44	0.36	0.31	0.31	0.29
Truth=Report	88.4	88.7	85.9	84.9	84.7	0.58	0.50	0.52	0.49	0.47
Truth>Report	5.7	6.3	9.3	10.0	9.9	0.40	0.37	0.44	0.41	0.38
Amount of Institutional Aid										
Truth<Report	6.6	5.9	7.5	8.9	9.7	0.45	0.38	0.38	0.39	0.39
Truth=Report	86.6	85.1	77.1	71.5	69.2	0.60	0.55	0.61	0.61	0.59
Truth>Report	6.9	9.0	15.5	19.6	21.0	0.44	0.44	0.53	0.53	0.51
Grade Point Average										
Truth<Report	59.7	60.2	58.7	54.2	54.4	1.10	0.97	0.85	0.79	0.71
Truth=Report	18.6	17.2	15.9	18.4	17.0	0.87	0.73	0.61	0.60	0.52
Truth>Report	21.7	22.6	25.5	27.4	28.6	0.94	0.82	0.75	0.70	0.64

Table A.136: Average Signed Deviation and Standard Error by At Home Contact Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.06	-0.04	0.01	-0.05	-0.02	0.04	0.03	0.03	0.03	0.02
Marriage date	-18.50	-0.67	-15.40	-0.22	0.10	9.08	7.28	8.69	2.89	2.09
Divorce date	-7.71	-7.62	-5.39	-7.63	-3.43	2.64	3.66	2.47	3.31	1.09
Birth date	-17.70	-3.57	-12.00	0.99	1.93	10.17	3.45	6.90	4.25	3.02
NPSAS										
Amount of Work Study	-110	-126	-80	-57	-48	19.40	22.94	18.49	15.59	17.64
Amount of State Aid	40	94	236	192	205	14.43	18.57	19.42	21.22	17.94
Amount of Institutional Aid	-71	55	294	390	435	30.31	26.65	35.19	37.66	39.00
Grade Point Average	-0.26	-0.22	-0.19	-0.14	-0.11	0.01	0.01	0.01	0.01	0.00

Table A.137: Mean Absolute Deviation by At Home Contact Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.13	0.10	0.08	0.12	0.03	0.04	0.03	0.03	0.03	0.02
Marriage date	29.10	21.33	30.78	10.44	6.15	8.72	6.92	8.29	2.71	2.01
Divorce date	11.17	9.14	8.59	10.35	4.93	2.43	3.61	2.37	3.23	1.03
Birth date	27.55	5.93	18.72	11.76	4.00	9.92	3.41	6.76	4.10	3.00
NPSAS										
Amount of Work Study	172	203	226	243	275	19.27	22.82	18.21	15.27	17.31
Amount of State Aid	275	367	531	585	489	13.80	17.76	18.18	19.91	17.08
Amount of Institutional Aid	345	390	708	896	1061	28.97	26.01	33.68	36.19	37.16
Grade Point Average	0.36	0.32	0.27	0.21	0.18	0.01	0.01	0.01	0.01	0.00

Table A.138: Item Nonresponse Rates and Standard Errors by Access Impediments Contact Propensity Model, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	1.04	0.00	1.75	2.80	0.87	1.04	0.00	1.24	1.60	0.87
Number of marriages	1.04	0.00	0.88	0.93	0.00	1.04	0.00	0.88	0.93	0.00
Marriage date	3.13	5.49	1.75	2.80	0.87	1.79	2.40	1.24	1.60	0.87
Divorce date	13.54	8.79	7.02	7.48	6.96	3.51	2.98	2.40	2.55	2.38
Birth date	2.08	0.00	0.88	0.00	0.87	1.47	0.00	0.88	0.00	0.87
NPSAS										
Applied for Financial Aid	0.69	0.35	0.51	0.68	0.47	0.23	0.07	0.11	0.12	0.08
Received Financial Aid	0.64	0.46	0.58	0.67	0.55	0.21	0.09	0.12	0.11	0.09
Received Stafford Loan	1.04	0.86	0.60	0.80	0.84	0.26	0.14	0.11	0.12	0.12
Received Pell Grant	0.89	0.93	0.67	0.69	1.13	0.23	0.15	0.12	0.11	0.14
Received Work Study	2.30	2.79	2.23	2.07	1.84	0.28	0.26	0.21	0.20	0.18
Amount of Work Study	2.37	2.22	1.69	1.92	2.06	0.33	0.23	0.18	0.19	0.18
Received State Aid	0.82	0.77	0.82	0.88	0.85	0.25	0.13	0.14	0.13	0.11
Amount of State Aid	2.35	2.44	2.32	2.99	2.61	0.32	0.23	0.22	0.23	0.20
Received Institutional Aid	0.82	0.77	0.82	0.88	0.85	0.25	0.13	0.14	0.13	0.11
Amount of Institutional Aid	1.85	1.85	1.85	2.36	3.04	0.30	0.20	0.19	0.20	0.21
Grade Point Average	6.19	5.82	5.03	3.47	2.05	0.44	0.34	0.30	0.24	0.17

Table A.139: Mismatch Rates and Standard Errors by Access Impediments Contact Propensity, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	6.25	0.00	0.00	0.93	0.87	2.48	0.00	0.00	0.93	0.87
Ever divorced	12.6	3.3	4.5	10.6	9.7	3.43	1.88	1.96	3.03	2.78
Number of marriages	15.8	6.6	10.6	3.8	7.8	3.76	2.62	2.91	1.86	2.52
Marriage date	35.6	30.2	29.5	30.1	36.3	5.16	4.98	4.33	4.54	4.54
Divorce date	50.7	52.5	45.5	54.6	49.0	5.98	5.62	4.98	5.34	5.13
Birth date	16.0	10.0	5.3	11.2	12.3	3.80	3.18	2.12	3.06	3.09
NPSAS										
Applied for Financial Aid	13.1	12.7	13.5	10.3	10.0	0.7	0.5	0.5	0.4	0.4
Received Financial Aid	13.8	12.2	10.9	10.4	10.2	0.7	0.5	0.5	0.4	0.4
Received Stafford Loan	9.5	9.3	9.3	11.1	11.4	0.6	0.5	0.4	0.4	0.4
Received Pell Grant	10.0	8.6	7.1	6.2	6.9	0.6	0.4	0.4	0.3	0.3
Received Work Study	7.3	5.9	5.1	6.9	10.7	0.5	0.4	0.3	0.3	0.4
Amount of Work Study	7.6	6.6	6.6	10.1	18.0	0.5	0.4	0.4	0.4	0.5
Received State Aid	19.0	19.2	16.4	17.4	15.6	0.7	0.6	0.5	0.5	0.5
Amount of State Aid	23.4	25.0	23.0	25.5	23.0	0.8	0.6	0.6	0.6	0.5
Received Institutional Aid	11.6	11.2	10.8	14.9	17.9	0.6	0.5	0.5	0.5	0.5
Amount of Institutional Aid	13.7	14.6	15.1	26.4	37.8	0.7	0.5	0.5	0.6	0.6
Grade Point Average	84.8	84.0	84.2	82.2	80.7	0.9	0.7	0.6	0.6	0.5

Table A.140: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Access Impediments Contact Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	7.4	3.3	6.2	0.9	6.1	2.7	1.9	2.3	0.9	2.2
Truth=Report	84.2	93.4	89.4	96.2	92.2	3.7	2.6	2.9	1.9	2.5
Truth>Report	8.4	3.3	4.4	2.8	1.7	2.8	1.9	1.9	1.6	1.2
Marriage date										
Truth<Report	25.8	12.8	23.2	10.6	22.8	4.5	3.6	4.0	3.0	3.9
Truth=Report	60.2	69.8	70.5	69.2	63.2	5.1	5.0	4.3	4.5	4.5
Truth>Report	14.0	17.4	6.3	20.2	14.0	3.6	4.1	2.3	3.9	3.3
Divorce date										
Truth<Report	47.0	37.4	34.0	43.4	38.3	5.5	5.3	4.6	5.0	4.7
Truth=Report	42.2	45.8	51.9	40.4	45.8	5.4	5.5	4.9	4.9	4.8
Truth>Report	10.8	16.9	14.2	16.2	15.9	3.4	4.1	3.4	3.7	3.5
Birth date										
Truth<Report	5.3	7.7	4.4	5.6	10.5	2.3	2.8	1.9	2.2	2.9
Truth=Report	84.0	89.0	94.7	88.8	87.7	3.8	3.3	2.1	3.0	3.1
Truth>Report	10.6	3.3	0.9	5.6	1.8	3.2	1.9	0.9	2.2	1.2
NPSAS										
Applied for Financial Aid										
Truth<Report	6.0	5.4	5.8	4.5	4.7	0.50	0.37	0.34	0.29	0.28
Truth=Report	86.9	87.3	86.5	89.7	90.0	0.73	0.53	0.50	0.42	0.40
Truth>Report	7.2	7.3	7.6	5.8	5.3	0.56	0.41	0.40	0.32	0.30
Received Financial Aid										
Truth<Report	6.1	6.4	5.4	4.7	4.4	0.51	0.42	0.32	0.30	0.27
Truth=Report	86.2	87.8	89.1	89.6	89.8	0.73	0.53	0.45	0.42	0.40
Truth>Report	7.8	5.8	5.5	5.7	5.8	0.56	0.36	0.33	0.31	0.31
Received Stafford Loan										
Truth<Report	5.2	4.8	4.0	4.2	5.0	0.41	0.38	0.28	0.28	0.27
Truth=Report	90.5	90.7	90.7	88.9	88.6	0.56	0.47	0.42	0.43	0.41
Truth>Report	4.4	4.4	5.3	6.9	6.4	0.40	0.31	0.32	0.35	0.32
Received Pell Grant										
Truth<Report	2.9	3.0	3.5	3.1	3.5	0.33	0.26	0.27	0.23	0.24
Truth=Report	90.0	91.4	92.9	93.8	93.1	0.57	0.42	0.37	0.32	0.32
Truth>Report	7.1	5.6	3.6	3.2	3.4	0.48	0.34	0.25	0.23	0.22
Received Work Study										
Truth<Report	6.4	5.0	3.6	4.4	6.3	0.52	0.34	0.27	0.28	0.32
Truth=Report	92.7	94.1	94.9	93.1	89.3	0.54	0.36	0.32	0.34	0.38
Truth>Report	0.9	0.9	1.5	2.5	4.4	0.16	0.14	0.16	0.21	0.23
Amount of Work Study										
Truth<Report	5.9	4.9	4.0	5.7	8.3	0.48	0.33	0.29	0.31	0.36
Truth=Report	92.4	93.4	93.4	89.9	82.0	0.53	0.38	0.35	0.40	0.46
Truth>Report	1.6	1.7	2.6	4.4	9.7	0.24	0.19	0.21	0.26	0.33
Received State Aid										
Truth<Report	4.8	5.5	4.4	5.7	6.0	0.38	0.35	0.29	0.32	0.31
Truth=Report	81.0	80.8	83.6	82.6	84.4	0.71	0.59	0.53	0.50	0.46
Truth>Report	14.2	13.7	12.1	11.8	9.6	0.62	0.50	0.47	0.41	0.36
Amount of State Aid										
Truth<Report	6.0	7.5	6.4	8.2	8.4	0.44	0.41	0.36	0.38	0.36
Truth=Report	76.6	75.0	77.0	74.5	77.0	0.77	0.64	0.60	0.56	0.53
Truth>Report	17.4	17.5	16.6	17.4	14.5	0.68	0.55	0.53	0.48	0.43

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	5.0	5.7	5.6	4.5	5.5	0.46	0.36	0.34	0.28	0.29
Truth=Report	88.4	88.8	89.2	85.1	82.1	0.62	0.48	0.45	0.47	0.50
Truth>Report	6.6	5.6	5.2	10.4	12.5	0.44	0.34	0.32	0.40	0.42
Amount of Institutional Aid										
Truth<Report	5.6	6.7	7.0	7.5	11.1	0.48	0.40	0.37	0.35	0.39
Truth=Report	86.3	85.4	84.9	73.6	62.2	0.65	0.53	0.51	0.57	0.60
Truth>Report	8.1	7.9	8.1	18.9	26.7	0.47	0.40	0.39	0.50	0.54
Grade Point Average										
Truth<Report	62.1	61.3	59.4	54.2	53.1	1.23	0.97	0.84	0.76	0.70
Truth=Report	15.2	16.0	15.8	17.8	19.3	0.93	0.72	0.60	0.57	0.53
Truth>Report	22.7	22.7	24.8	28.0	27.6	1.05	0.83	0.74	0.68	0.62

Table A.141: Average Signed Deviation by Access Impediments Contact Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.01	0.00	-0.02	0.02	-0.05	0.04	0.03	0.03	0.02	0.03
Marriage date	-2.62	-7.19	-6.38	-3.83	-10.80	6.97	5.95	3.62	6.77	7.47
Divorce date	-5.46	-4.31	-10.40	-4.55	-5.19	1.89	1.63	4.19	1.64	2.10
Birth date	-3.33	-1.66	-3.81	-2.10	-15.20	7.03	3.86	2.24	7.50	6.48
NPSAS										
Amount of Work Study	-166	-108	-64	-72	-42	30.01	15.19	16.71	18.34	17.08
Amount of State Aid	155	120	179	194	166	20.06	17.28	17.77	19.87	17.92
Amount of Institutional Aid	29	-48	39	402	612	35.01	28.01	19.04	34.40	43.71
Grade Point Average	-0.27	-0.24	-0.20	-0.14	-0.10	0.01	0.01	0.01	0.01	0.00

Table A.142: Mean Absolute Difference and Standard Error by Access Impediments Contact Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.16	0.07	0.11	0.04	0.09	0.04	0.03	0.03	0.02	0.03
Marriage date	23.08	14.81	10.88	19.08	25.57	6.52	5.79	3.53	6.51	7.14
Divorce date	7.92	7.26	12.86	6.84	7.17	1.77	1.49	4.12	1.55	2.04
Birth date	18.71	6.03	4.24	19.84	16.24	6.76	3.81	2.24	7.25	6.46
NPSAS										
Amount of Work Study	227	163	170	234	326	29.88	15.08	16.60	18.05	16.61
Amount of State Aid	397	406	421	540	514	19.32	16.37	16.90	18.65	16.91
Amount of Institutional Aid	310	357	322	813	1438	34.47	27.28	18.40	33.32	40.69
Grade Point Average	0.37	0.34	0.30	0.21	0.16	0.01	0.01	0.01	0.01	0.00

Table A.143: Item Nonresponse Rate and Standard Error, by Combined Main Effects Contact Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	3.49	1.01	0.92	0.91	0.84	1.99	1.01	0.92	0.91	0.84
Number of marriages	2.33	0.00	0.92	0.00	0.00	1.63	0.00	0.92	0.00	0.00
Marriage date	6.98	4.04	2.75	0.91	0.00	2.76	1.99	1.57	0.91	0.00
Divorce date	13.95	13.13	4.59	7.27	5.88	3.76	3.41	2.01	2.49	2.17
Birth date	0.00	1.01	0.00	2.73	0.00	0.00	1.01	0.00	1.56	0.00
NPSAS										
Applied for Financial Aid	0.49	0.70	0.51	0.49	0.50	0.12	0.16	0.11	0.10	0.08
Received Financial Aid	0.55	0.70	0.55	0.48	0.62	0.13	0.16	0.11	0.10	0.10
Received Stafford Loan	0.93	1.01	0.81	0.74	0.65	0.18	0.18	0.13	0.12	0.11
Received Pell Grant	0.92	0.74	0.82	0.95	0.88	0.18	0.16	0.13	0.13	0.12
Received Work Study	3.07	2.42	2.31	1.93	1.78	0.31	0.27	0.21	0.20	0.17
Amount of Work Study	2.12	2.10	2.16	1.94	1.82	0.27	0.25	0.20	0.19	0.17
Received State Aid	0.77	1.00	0.83	0.70	0.87	0.17	0.19	0.14	0.11	0.12
Amount of State Aid	2.44	2.62	2.83	2.60	2.41	0.29	0.26	0.24	0.21	0.20
Received Institutional Aid	0.77	1.00	0.83	0.70	0.87	0.17	0.19	0.14	0.11	0.12
Amount of Institutional Aid	2.19	1.95	1.87	2.48	2.72	0.28	0.23	0.19	0.21	0.20
Grade Point Average	6.16	5.96	4.56	3.06	2.52	0.41	0.36	0.30	0.21	0.19

Table A.144: Mismatch Rate and Standard Error by Combined Main Effects Contact Propensity Model, WDS and NPSAS

Contact Model 3	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	3.49	3.03	0.00	0.91	0.84	1.99	1.73	0.00	0.91	0.84
Ever divorced	15.7	6.1	8.3	6.4	5.9	4.01	2.43	2.67	2.36	2.18
Number of marriages	13.1	10.1	10.2	8.2	4.2	3.70	3.04	2.92	2.63	1.85
Marriage date	41.6	37.0	34.0	25.9	27.1	5.65	5.06	4.62	4.24	4.11
Divorce date	65.6	51.3	50.5	51.6	39.1	6.13	5.62	5.16	5.15	4.78
Birth date	17.7	10.2	10.1	11.2	6.7	4.16	3.07	2.90	3.06	2.31
NPSAS										
Applied for Financial Aid	14.6	13.2	11.4	10.0	10.7	0.7	0.6	0.5	0.4	0.4
Received Financial Aid	15.2	12.1	10.7	9.6	10.3	0.7	0.5	0.5	0.4	0.4
Received Stafford Loan	9.8	10.3	10.2	11.5	9.6	0.5	0.5	0.5	0.4	0.4
Received Pell Grant	9.9	8.5	7.6	6.7	6.1	0.5	0.4	0.4	0.3	0.3
Received Work Study	6.6	5.6	6.5	8.0	9.2	0.5	0.4	0.4	0.4	0.4
Amount of Work Study	6.5	6.3	8.5	12.3	15.4	0.5	0.4	0.4	0.4	0.4
Received State Aid	19.2	17.3	18.4	17.8	14.7	0.7	0.6	0.6	0.5	0.4
Amount of State Aid	22.5	22.6	26.1	26.7	21.5	0.8	0.6	0.6	0.6	0.5
Received Institutional Aid	12.7	10.7	13.1	14.8	16.2	0.6	0.5	0.5	0.5	0.5
Amount of Institutional Aid	13.7	13.6	19.3	27.9	34.7	0.6	0.5	0.6	0.6	0.6
Grade Point Average	82.8	85.2	83.1	82.3	81.4	0.9	0.7	0.6	0.6	0.5

Table A.145: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Combined Main Effects Contact Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	3.6	5.1	7.4	5.5	2.5	2.0	2.2	2.5	2.2	1.4
Truth=Report	86.9	89.9	89.8	91.8	95.8	3.7	3.0	2.9	2.6	1.8
Truth>Report	9.5	5.1	2.8	2.7	1.7	3.2	2.2	1.6	1.6	1.2
Marriage date										
Truth<Report	31.3	22.1	17.0	16.5	13.5	5.2	4.3	3.6	3.6	3.1
Truth=Report	56.3	61.1	66.0	73.4	72.3	5.5	5.0	4.6	4.2	4.1
Truth>Report	12.5	16.8	17.0	10.1	14.3	3.7	3.8	3.6	2.9	3.2
Divorce date										
Truth<Report	55.4	38.4	39.4	39.2	31.3	5.8	5.2	4.8	4.8	4.4
Truth=Report	28.4	45.4	45.2	45.1	57.1	5.2	5.4	4.9	4.9	4.7
Truth>Report	16.2	16.3	15.4	15.7	11.6	4.3	4.0	3.5	3.6	3.0
Birth date										
Truth<Report	11.6	6.1	7.3	6.5	3.4	3.5	2.4	2.5	2.4	1.7
Truth=Report	81.4	89.8	89.9	88.8	93.3	4.2	3.1	2.9	3.0	2.3
Truth>Report	7.0	4.1	2.8	4.7	3.4	2.7	2.0	1.6	2.0	1.7
NPSAS										
Applied for Financial Aid										
Truth<Report	5.50	5.23	4.64	4.36	6.01	0.46	0.37	0.32	0.27	0.32
Truth=Report	85.37	86.75	88.59	90.00	89.28	0.70	0.56	0.48	0.41	0.41
Truth>Report	9.13	8.02	6.77	5.64	4.71	0.57	0.45	0.37	0.32	0.28
Received Financial Aid										
Truth<Report	7.20	5.88	5.02	4.15	4.91	0.51	0.40	0.34	0.27	0.29
Truth=Report	84.77	87.90	89.33	90.37	89.69	0.71	0.54	0.46	0.40	0.40
Truth>Report	8.02	6.22	5.64	5.48	5.40	0.54	0.39	0.33	0.31	0.29
Received Stafford Loan										
Truth<Report	5.52	5.07	4.93	3.67	4.38	0.40	0.37	0.34	0.26	0.25
Truth=Report	90.21	89.69	89.82	88.48	90.44	0.54	0.50	0.45	0.45	0.37
Truth>Report	4.27	5.25	5.25	7.85	5.18	0.38	0.35	0.32	0.38	0.28
Received Pell Grant										
Truth<Report	3.62	3.14	3.46	3.31	2.95	0.36	0.26	0.27	0.25	0.22
Truth=Report	90.13	91.46	92.44	93.30	93.92	0.54	0.44	0.37	0.34	0.29
Truth>Report	6.25	5.40	4.09	3.39	3.13	0.42	0.36	0.27	0.24	0.21
Received Work Study										
Truth<Report	6.02	4.48	4.47	4.88	5.59	0.48	0.34	0.30	0.30	0.30
Truth=Report	93.40	94.40	93.54	92.05	90.84	0.49	0.37	0.36	0.37	0.36
Truth>Report	0.58	1.12	1.99	3.07	3.57	0.12	0.16	0.20	0.23	0.21
Amount of Work Study										
Truth<Report	5.40	4.42	5.16	6.46	7.21	0.45	0.32	0.33	0.34	0.33
Truth=Report	93.52	93.67	91.49	87.67	84.65	0.48	0.37	0.40	0.44	0.43
Truth>Report	1.08	1.91	3.35	5.87	8.15	0.19	0.20	0.25	0.31	0.31
Received State Aid										
Truth<Report	5.93	5.19	4.94	5.53	5.43	0.46	0.33	0.32	0.31	0.29
Truth=Report	80.78	82.71	81.59	82.17	85.31	0.73	0.56	0.55	0.52	0.44
Truth>Report	13.29	12.11	13.47	12.30	9.26	0.60	0.48	0.48	0.44	0.36
Amount of State Aid										
Truth<Report	7.05	6.88	7.43	8.37	7.54	0.49	0.38	0.39	0.39	0.34
Truth=Report	77.49	77.43	73.90	73.27	78.54	0.77	0.63	0.63	0.60	0.51
Truth>Report	15.46	15.69	18.67	18.36	13.93	0.64	0.54	0.56	0.52	0.43

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	6.38	5.00	5.29	4.94	5.15	0.48	0.35	0.33	0.30	0.28
Truth=Report	87.30	89.29	86.87	85.19	83.76	0.63	0.48	0.49	0.49	0.47
Truth>Report	6.31	5.71	7.84	9.87	11.10	0.43	0.35	0.39	0.41	0.40
Amount of Institutional Aid										
Truth<Report	6.28	5.95	7.08	8.76	10.30	0.48	0.38	0.37	0.39	0.39
Truth=Report	86.33	86.41	80.68	72.09	65.31	0.64	0.53	0.57	0.60	0.60
Truth>Report	7.39	7.64	12.24	19.15	24.40	0.47	0.40	0.47	0.53	0.53
Grade Point Average										
Truth<Report	61.05	61.67	59.05	54.57	52.71	1.18	0.96	0.86	0.76	0.70
Truth=Report	17.25	14.84	16.94	17.73	18.63	0.92	0.69	0.64	0.57	0.53
Truth>Report	21.71	23.49	24.01	27.70	28.65	0.99	0.83	0.74	0.69	0.64

Table A.146: Average Signed Deviation and Standard Error by Combined Main Effects Contact Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.06	0.00	-0.05	-0.04	-0.01	0.04	0.03	0.03	0.03	0.02
Marriage date	-18.60	-4.27	-7.90	-6.24	1.36	9.31	8.43	7.22	4.02	2.52
Divorce date	-7.61	-6.84	-6.69	-7.62	-2.94	2.58	3.61	2.44	3.34	1.11
Birth date	-18.20	-5.02	-8.43	-2.98	3.53	10.41	4.80	5.90	4.51	3.27
NPSAS										
Amount of Work Study	-136	-113	-85	-52	-46	17.38	19.71	19.62	18.68	16.12
Amount of State Aid	76	106	206	199	188	19.18	17.05	19.31	20.02	17.98
Amount of Institutional Aid	-65	-31	168	405	564	34.61	23.34	30.74	34.80	43.14
Grade Point Average	-0.28	-0.23	-0.20	-0.14	-0.09	0.01	0.01	0.01	0.01	0.00

Table A.147: Average Absolute Deviation and Standard Error, by Combined Main Effects Contact Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.13	0.10	0.10	0.09	0.04	0.04	0.03	0.03	0.03	0.02
Marriage date	29.2	25.5	23.0	12.3	8.42	8.94	8.01	6.91	3.88	2.40
Divorce date	10.5	9.34	8.80	10.6	4.83	2.41	3.54	2.36	3.26	1.05
Birth date	28.2	10.4	12.9	11.9	5.58	10.14	4.71	5.83	4.37	3.25
NPSAS										
Amount of Work Study	169	175	207	272	282	17.29	19.62	19.40	18.21	15.81
Amount of State Aid	345	377	477	548	512	18.40	16.27	18.26	18.79	17.03
Amount of Institutional Aid	320	319	494	874	1307	34.08	22.82	29.99	33.06	40.79
Grade Point Average	0.39	0.33	0.29	0.21	0.16	0.01	0.01	0.01	0.01	0.00

Table A.148: Item Nonresponse Rate and Standard Error by Interaction Contact Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	4.65	1.01	0.99	0.85	0.00	2.28	1.01	0.99	0.85	0.00
Number of marriages	3.49	0.00	0.00	0.00	0.00	1.99	0.00	0.00	0.00	0.00
Marriage date	8.14	4.04	1.98	0.85	0.00	2.97	1.99	1.39	0.85	0.00
Divorce date	13.95	8.08	8.91	6.84	6.67	3.76	2.75	2.85	2.34	2.29
Birth date	1.16	1.01	0.99	0.85	0.00	1.16	1.01	0.99	0.85	0.00
NPSAS										
Applied for Financial Aid	0.58	0.53	0.44	0.73	0.41	0.16	0.13	0.09	0.13	0.08
Received Financial Aid	0.52	0.53	0.52	0.74	0.52	0.16	0.12	0.10	0.13	0.09
Received Stafford Loan	0.78	0.97	0.79	0.82	0.69	0.18	0.16	0.12	0.14	0.11
Received Pell Grant	0.73	0.83	0.70	0.99	0.96	0.18	0.14	0.11	0.14	0.13
Received Work Study	2.41	2.74	2.09	1.97	2.03	0.27	0.26	0.20	0.20	0.19
Amount of Work Study	1.96	2.07	1.81	2.25	1.91	0.29	0.22	0.18	0.21	0.17
Received State Aid	0.67	0.83	0.83	1.04	0.71	0.18	0.16	0.12	0.15	0.10
Amount of State Aid	2.16	2.83	2.69	3.16	1.95	0.27	0.27	0.22	0.24	0.17
Received Institutional Aid	0.67	0.83	0.83	1.04	0.71	0.18	0.16	0.12	0.15	0.10
Amount of Institutional Aid	1.55	2.11	2.10	2.79	2.40	0.23	0.24	0.19	0.23	0.19
Grade Point Average	5.73	5.45	4.28	3.22	3.22	0.39	0.34	0.27	0.23	0.22

Table A.149: Mismatch Rates and Standard Errors by Interaction Contact Propensity Strata, WDS and NPSAS

Contact Model 5	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	3.49	4.04	0.00	0.00	0.83	1.99	1.99	0.00	0.00	0.83
Ever divorced	12.2	12.2	6.0	7.8	4.2	3.64	3.33	2.39	2.49	1.83
Number of marriages	12.1	12.1	12.9	5.1	4.2	3.59	3.30	3.35	2.05	1.83
Marriage date	32.9	41.8	36.4	27.6	26.1	5.43	5.20	4.86	4.17	4.04
Divorce date	57.8	55.7	54.7	41.0	46.7	6.22	5.62	5.40	4.94	4.85
Birth date	16.5	13.4	8.0	6.9	10.8	4.05	3.48	2.73	2.36	2.85
NPSAS										
Applied for Financial Aid	13.9	12.9	11.5	9.5	11.8	0.7	0.6	0.5	0.4	0.4
Received Financial Aid	14.0	12.1	10.2	9.8	11.3	0.7	0.5	0.4	0.4	0.4
Received Stafford Loan	10.8	9.8	9.8	10.6	10.7	0.6	0.5	0.4	0.4	0.4
Received Pell Grant	8.8	8.4	6.9	6.6	7.4	0.5	0.4	0.3	0.3	0.3
Received Work Study	6.1	5.8	7.0	8.3	8.4	0.5	0.4	0.4	0.4	0.3
Amount of Work Study	6.4	7.2	9.6	12.1	14.0	0.5	0.4	0.4	0.4	0.4
Received State Aid	19.5	17.1	17.1	18.4	15.3	0.7	0.6	0.5	0.5	0.5
Amount of State Aid	23.9	22.7	24.3	27.1	21.7	0.8	0.6	0.6	0.6	0.5
Received Institutional Aid	10.8	12.3	13.9	15.3	14.7	0.6	0.5	0.5	0.5	0.5
Amount of Institutional Aid	13.5	16.3	21.7	28.5	30.0	0.6	0.6	0.6	0.6	0.6
Grade Point Average	83.2	82.6	84.9	82.3	81.1	0.9	0.7	0.6	0.6	0.6

Table A.150: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Interaction Contact Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	3.6	6.1	7.9	3.4	3.3	2.0	2.4	2.7	1.7	1.6
Truth=Report	88.0	87.9	87.1	94.9	95.8	3.6	3.3	3.3	2.0	1.8
Truth>Report	8.4	6.1	5.0	1.7	0.8	3.0	2.4	2.2	1.2	0.8
Marriage date										
Truth<Report	22.8	29.5	18.2	14.7	14.2	4.7	4.7	3.9	3.3	3.2
Truth=Report	64.6	55.8	63.6	72.4	73.3	5.4	5.1	4.8	4.1	4.0
Truth>Report	12.7	14.7	18.2	12.9	12.5	3.7	3.6	3.9	3.1	3.0
Divorce date										
Truth<Report	51.4	46.2	37.0	35.8	33.0	5.8	5.2	5.0	4.6	4.4
Truth=Report	36.5	38.5	42.4	54.1	50.9	5.6	5.1	5.2	4.8	4.7
Truth>Report	12.2	15.4	20.7	10.1	16.1	3.8	3.8	4.2	2.9	3.5
Birth date										
Truth<Report	8.2	10.2	5.0	6.0	5.0	3.0	3.1	2.2	2.2	2.0
Truth=Report	83.5	85.7	92.0	93.1	89.2	4.0	3.5	2.7	2.4	2.8
Truth>Report	8.2	4.1	3.0	0.9	5.8	3.0	2.0	1.7	0.9	2.1
NPSAS										
Applied for Financial Aid										
Truth<Report	5.0	4.8	4.5	3.9	7.1	0.43	0.37	0.31	0.28	0.33
Truth=Report	86.1	87.1	88.5	90.5	88.2	0.69	0.55	0.46	0.42	0.43
Truth>Report	8.9	8.1	7.0	5.6	4.7	0.58	0.44	0.37	0.32	0.29
Received Financial Aid										
Truth<Report	5.8	6.2	4.8	3.8	5.9	0.47	0.42	0.31	0.28	0.30
Truth=Report	86.0	87.9	89.8	90.2	88.7	0.70	0.54	0.43	0.42	0.42
Truth>Report	8.2	5.9	5.4	6.0	5.4	0.55	0.36	0.32	0.33	0.30
Received Stafford Loan										
Truth<Report	5.9	5.3	4.5	3.9	4.2	0.47	0.36	0.30	0.28	0.27
Truth=Report	89.2	90.2	90.2	89.4	89.3	0.60	0.47	0.42	0.43	0.41
Truth>Report	4.9	4.5	5.2	6.7	6.5	0.41	0.32	0.32	0.34	0.33
Received Pell Grant										
Truth<Report	2.9	3.5	3.3	2.7	3.7	0.31	0.30	0.25	0.22	0.25
Truth=Report	91.2	91.6	93.1	93.4	92.6	0.51	0.44	0.35	0.33	0.33
Truth>Report	5.8	4.9	3.6	3.9	3.7	0.42	0.34	0.25	0.26	0.23
Received Work Study										
Truth<Report	5.2	4.5	5.0	5.4	5.1	0.46	0.32	0.31	0.32	0.29
Truth=Report	93.9	94.2	93.0	91.7	91.6	0.49	0.37	0.35	0.38	0.35
Truth>Report	0.9	1.4	2.0	2.9	3.3	0.17	0.19	0.18	0.22	0.21
Amount of Work Study										
Truth<Report	4.8	4.8	5.8	6.5	6.6	0.43	0.34	0.33	0.34	0.32
Truth=Report	93.6	92.8	90.4	87.9	86.0	0.48	0.41	0.40	0.43	0.42
Truth>Report	1.6	2.3	3.8	5.7	7.3	0.24	0.24	0.24	0.29	0.30
Received State Aid										
Truth<Report	5.5	5.6	5.5	5.3	5.1	0.44	0.37	0.32	0.30	0.28
Truth=Report	80.5	82.9	82.9	81.6	84.7	0.73	0.58	0.52	0.52	0.46
Truth>Report	14.0	11.5	11.6	13.1	10.2	0.62	0.48	0.44	0.44	0.38
Amount of State Aid										
Truth<Report	6.5	7.6	7.7	8.1	7.2	0.47	0.42	0.38	0.38	0.34
Truth=Report	76.1	77.3	75.7	72.9	78.3	0.78	0.65	0.61	0.59	0.52
Truth>Report	17.3	15.1	16.6	19.0	14.5	0.67	0.54	0.52	0.52	0.44

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	4.5	5.9	5.4	5.0	5.3	0.39	0.39	0.32	0.30	0.29
Truth=Report	89.2	87.7	86.1	84.7	85.3	0.59	0.52	0.49	0.49	0.46
Truth>Report	6.2	6.4	8.6	10.3	9.5	0.46	0.37	0.40	0.41	0.38
Amount of Institutional Aid										
Truth<Report	5.8	6.7	7.5	9.0	9.4	0.45	0.40	0.37	0.39	0.38
Truth=Report	86.5	83.7	78.3	71.5	70.0	0.64	0.57	0.58	0.60	0.57
Truth>Report	7.7	9.5	14.2	19.5	20.6	0.49	0.45	0.49	0.53	0.50
Grade Point Average										
Truth<Report	60.6	60.1	60.2	53.6	53.4	1.17	0.94	0.81	0.76	0.75
Truth=Report	16.8	17.4	15.1	17.7	18.9	0.89	0.73	0.57	0.57	0.57
Truth>Report	22.6	22.5	24.7	28.7	27.7	0.98	0.79	0.71	0.69	0.67

Table A.151: Average Signed Difference and Standard Error by Interaction Contact Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.05	0.00	-0.03	-0.02	-0.03	0.04	0.04	0.04	0.02	0.02
Marriage date	-15.30	-9.80	-7.76	-5.68	2.56	9.42	8.07	7.84	4.04	2.77
Divorce date	-7.50	-8.61	-4.95	-6.33	-4.31	2.31	3.77	2.68	2.67	1.91
Birth date	-7.85	-8.94	-6.33	-6.14	0.22	9.04	6.31	6.95	4.22	3.06
NPSAS										
Amount of Work Study	-122	-107	-95	-53	-49	21.1	20.6	19.3	16.3	17.0
Amount of State Aid	139	114	142	227	178	22.1	16.8	18.8	20.0	17.4
Amount of Institutional Aid	-59	58	228	420	420	34.3	32.4	33.7	36.9	36.9
Grade Point Average	-0.25	-0.22	-0.18	-0.13	-0.12	0.01	0.01	0.01	0.01	0.01

Table A.152: Average Absolute Deviation by Interaction Contact Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.12	0.12	0.13	0.05	0.05	0.04	0.03	0.03	0.02	0.02
Marriage date	25.97	26.02	25.54	11.80	9.38	9.10	7.66	7.44	3.92	2.64
Divorce date	9.91	9.92	9.51	7.71	6.78	2.16	3.73	2.53	2.63	1.85
Birth date	23.38	15.06	14.03	8.95	7.22	8.71	6.19	6.83	4.17	2.98
NPSAS										
Amount of Work Study	173	185	237	238	278	21.0	20.4	19.1	16.0	16.6
Amount of State Aid	411	378	461	553	484	21.2	15.9	17.8	18.8	16.6
Amount of Institutional Aid	318	423	647	922	1047	33.7	31.7	32.4	35.4	34.8
Grade Point Average	0.37	0.31	0.25	0.21	0.20	0.01	0.01	0.01	0.01	0.01

Table A.153: Item Nonresponse Rates and Standard Errors by Social Isolation Cooperation Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	2.15	3.00	0.00	0.90	0.88	1.51	1.71	0.00	0.90	0.88
Number of marriages	1.08	0.00	0.00	0.90	0.88	1.08	0.00	0.00	0.90	0.88
Marriage date	4.30	4.00	2.86	0.90	1.75	2.12	1.97	1.63	0.90	1.24
Divorce date	6.45	16.00	9.52	5.41	6.14	2.56	3.68	2.88	2.16	2.26
Birth date	0.00	1.00	0.95	0.00	1.75	0.00	1.00	0.95	0.00	1.24
NPSAS										
Applied for Financial Aid	0.54	0.57	0.50	0.64	0.47	0.11	0.14	0.09	0.14	0.10
Received Financial Aid	0.54	0.56	0.54	0.69	0.59	0.11	0.14	0.10	0.13	0.11
Received Stafford Loan	0.78	0.73	0.95	0.74	0.79	0.14	0.16	0.14	0.13	0.12
Received Pell Grant	0.96	0.79	0.77	0.85	0.93	0.14	0.16	0.12	0.14	0.14
Received Work Study	1.90	2.59	1.91	2.28	2.35	0.19	0.27	0.19	0.24	0.21
Amount of Work Study	2.31	2.02	1.83	2.32	1.69	0.22	0.25	0.18	0.23	0.17
Received State Aid	0.71	0.85	0.93	0.96	0.76	0.12	0.17	0.14	0.15	0.12
Amount of State Aid	2.50	2.85	2.94	2.71	2.07	0.23	0.28	0.24	0.24	0.19
Received Institutional Aid	0.71	0.85	0.93	0.96	0.76	0.12	0.17	0.14	0.15	0.12
Amount of Institutional Aid	2.27	2.43	2.61	2.23	1.95	0.22	0.25	0.22	0.21	0.19
Grade Point Average	3.78	4.47	3.81	3.92	4.56	0.28	0.33	0.25	0.27	0.26

Table A.154: Mismatch Rates and Standard Errors by Social Isolation Cooperation Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	1.08	3.00	0.00	2.70	0.88	1.08	1.71	0.00	1.55	0.88
Ever divorced	9.89	6.19	4.76	10.00	9.73	3.15	2.46	2.09	2.87	2.80
Number of marriages	9.78	10.00	10.48	10.00	4.42	3.11	3.02	3.00	2.87	1.94
Marriage date	39.77	37.63	32.35	28.04	26.13	5.25	5.05	4.66	4.36	4.19
Divorce date	53.85	61.54	57.78	43.62	37.50	5.68	5.54	5.24	5.14	4.97
Birth date	13.04	8.08	5.77	10.81	16.07	3.53	2.75	2.30	2.96	3.49
NPSAS										
Applied for Financial Aid	11.1	10.6	11.0	10.2	14.3	0.5	0.5	0.5	0.5	0.5
Received Financial Aid	10.8	10.3	10.5	9.5	13.5	0.5	0.5	0.4	0.5	0.5
Received Stafford Loan	11.1	10.7	10.6	10.0	9.3	0.5	0.5	0.4	0.5	0.4
Received Pell Grant	8.8	6.6	6.5	6.4	8.5	0.4	0.4	0.3	0.4	0.4
Received Work Study	8.6	7.1	7.9	7.3	6.1	0.4	0.4	0.4	0.4	0.3
Amount of Work Study	11.7	8.8	12.8	11.2	8.3	0.5	0.5	0.5	0.5	0.4
Received State Aid	16.6	18.5	17.2	17.6	16.7	0.6	0.6	0.5	0.6	0.5
Amount of State Aid	22.9	24.1	25.1	25.5	23.0	0.6	0.7	0.6	0.7	0.5
Received Institutional Aid	13.8	13.1	14.4	13.6	14.0	0.5	0.6	0.5	0.5	0.5
Amount of Institutional Aid	23.1	19.5	28.7	26.4	20.3	0.6	0.7	0.6	0.7	0.5
Grade Point Average	84.9	86.2	80.3	79.9	82.6	0.6	0.6	0.6	0.7	0.6

Table A.155: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Social Isolation Cooperation Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	5.4	5.0	6.7	5.5	1.8	2.4	2.2	2.4	2.2	1.2
Truth=Report	90.2	90.0	89.5	90.0	95.6	3.1	3.0	3.0	2.9	1.9
Truth>Report	4.4	5.0	3.8	4.6	2.7	2.1	2.2	1.9	2.0	1.5
Marriage date										
Truth<Report	21.4	25.0	21.6	17.3	12.5	4.3	4.4	4.1	3.6	3.1
Truth=Report	59.6	60.4	67.7	70.0	73.2	5.2	5.0	4.6	4.4	4.2
Truth>Report	19.1	14.6	10.8	12.7	14.3	4.2	3.6	3.1	3.2	3.3
Divorce date										
Truth<Report	46.0	46.4	40.0	39.1	29.9	5.3	5.4	5.0	4.8	4.4
Truth=Report	41.4	35.7	40.0	50.5	56.1	5.3	5.2	5.0	4.9	4.8
Truth>Report	12.6	17.9	20.0	10.5	14.0	3.6	4.2	4.1	3.0	3.4
Birth date										
Truth<Report	7.5	6.1	3.9	6.3	9.8	2.7	2.4	1.9	2.3	2.8
Truth=Report	86.0	91.9	94.2	89.2	83.9	3.6	2.7	2.3	2.9	3.5
Truth>Report	6.5	2.0	1.9	4.5	6.3	2.5	1.4	1.3	2.0	2.3
NPSAS										
Applied for Financial Aid										
Truth<Report	3.9	3.7	4.6	4.4	8.1	0.31	0.33	0.31	0.34	0.36
Truth=Report	88.9	89.4	89.0	89.8	85.7	0.49	0.53	0.46	0.49	0.47
Truth>Report	7.2	6.8	6.3	5.8	6.2	0.40	0.43	0.36	0.38	0.33
Received Financial Aid										
Truth<Report	4.6	4.6	4.7	4.4	7.1	0.33	0.38	0.31	0.34	0.34
Truth=Report	89.2	89.7	89.5	90.5	86.5	0.48	0.53	0.45	0.47	0.46
Truth>Report	6.3	5.7	5.8	5.1	6.4	0.37	0.40	0.33	0.34	0.33
Received Stafford Loan										
Truth<Report	4.7	4.7	4.0	4.5	4.9	0.33	0.36	0.28	0.34	0.29
Truth=Report	88.9	89.3	89.4	90.0	90.7	0.48	0.53	0.44	0.47	0.39
Truth>Report	6.4	6.0	6.6	5.5	4.4	0.37	0.40	0.35	0.35	0.28
Received Pell Grant										
Truth<Report	3.7	2.6	3.2	3.0	3.5	0.29	0.25	0.25	0.26	0.25
Truth=Report	91.2	93.4	93.5	93.6	91.5	0.42	0.38	0.34	0.37	0.36
Truth>Report	5.0	3.9	3.3	3.3	5.0	0.32	0.29	0.24	0.27	0.28
Received Work Study										
Truth<Report	6.1	5.4	5.1	4.5	4.2	0.36	0.38	0.32	0.33	0.27
Truth=Report	91.4	92.9	92.1	92.7	93.9	0.42	0.44	0.38	0.40	0.31
Truth>Report	2.5	1.8	2.8	2.9	1.8	0.23	0.22	0.22	0.23	0.16
Amount of Work Study										
Truth<Report	7.0	5.8	6.4	5.6	4.7	0.39	0.39	0.35	0.35	0.28
Truth=Report	88.3	91.2	87.2	88.8	91.7	0.48	0.47	0.46	0.46	0.35
Truth>Report	4.7	3.0	6.3	5.5	3.6	0.32	0.28	0.32	0.30	0.22
Received State Aid										
Truth<Report	5.7	5.3	5.2	5.8	5.0	0.35	0.38	0.31	0.36	0.28
Truth=Report	83.4	81.5	82.8	82.4	83.3	0.56	0.63	0.52	0.57	0.48
Truth>Report	10.9	13.1	11.9	11.8	11.7	0.46	0.53	0.44	0.48	0.41
Amount of State Aid										
Truth<Report	7.8	7.2	7.5	8.7	6.8	0.41	0.43	0.37	0.43	0.33
Truth=Report	77.1	75.9	74.9	74.5	77.0	0.64	0.70	0.61	0.66	0.54
Truth>Report	15.1	16.9	17.6	16.8	16.1	0.54	0.60	0.53	0.55	0.46

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	4.8	5.5	4.9	4.6	6.3	0.32	0.38	0.31	0.33	0.32
Truth=Report	86.2	86.9	85.6	86.4	86.0	0.53	0.56	0.49	0.53	0.46
Truth>Report	9.1	7.7	9.5	9.0	7.7	0.44	0.44	0.41	0.43	0.35
Amount of Institutional Aid										
Truth<Report	7.1	6.8	9.2	8.6	8.2	0.39	0.43	0.41	0.43	0.36
Truth=Report	76.9	80.5	71.3	73.6	79.7	0.64	0.66	0.63	0.66	0.53
Truth>Report	16.1	12.7	19.5	17.8	12.1	0.56	0.55	0.55	0.56	0.42
Grade Point Average										
Truth<Report	60.5	61.5	53.9	53.1	55.2	0.86	0.93	0.79	0.86	0.82
Truth=Report	15.1	13.8	19.7	20.1	17.4	0.63	0.65	0.63	0.68	0.61
Truth>Report	24.3	24.7	26.4	26.8	27.4	0.76	0.82	0.70	0.77	0.74

Table A.156: Average Signed Deviation by Social Isolation Cooperation Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	-0.011	-0.010	-0.029	-0.009	0.009	0.03	0.04	0.03	0.03	0.02
Marriage date	-2.06	-8.24	-7.48	-7.16	-6.32	5.16	4.57	5.55	7.03	7.65
Divorce date	-11.60	-6.71	-5.09	-4.29	-4.07	4.20	2.56	1.68	1.54	3.02
Birth date	-0.22	-4.91	-3.70	-5.83	-11.70	3.64	4.14	5.40	5.41	8.29
NPSAS										
Amount of Work Study	-122	-122	-28	-38	-83	19.96	25.16	17.81	13.35	16.49
Amount of State Aid	104	152	217	132	208	19.63	20.01	18.79	20.74	18.12
Amount of Institutional Aid	348	119	471	324	59	40.16	31.17	41.80	37.52	30.80
Grade Point Average	-0.18	-0.21	-0.15	-0.15	-0.15	0.01	0.01	0.01	0.01	0.01

Table A.157: Average Absolute Deviation by Social Isolation Cooperation Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.10	0.11	0.10	0.10	0.04	0.03	0.03	0.03	0.03	0.02
Marriage date	19.44	15.42	15.54	19.63	22.75	4.73	4.36	5.38	6.80	7.36
Divorce date	13.40	9.40	8.18	5.88	6.93	4.13	2.45	1.53	1.48	2.96
Birth date	8.72	9.54	8.88	13.43	23.17	3.53	4.06	5.34	5.29	8.07
NPSAS										
Amount of Work Study	288	228	242	190	205	19.56	24.94	17.47	13.11	16.32
Amount of State Aid	436	413	502	480	500	18.58	19.04	17.70	19.67	17.30
Amount of Institutional Aid	728	482	1002	810	642	38.82	30.20	40.02	35.94	29.78
Grade Point Average	0.26	0.29	0.22	0.23	0.25	0.01	0.01	0.01	0.01	0.01

Table A.158: Item Nonresponse Rates and Standard Errors by Positive Affect Toward Sponsor Cooperation Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	0.70	0.99	3.39	1.68	--	0.70	0.69	2.38	1.18	
Number of marriages	0.70	0.00	3.39	0.00	--	0.70	0.00	2.38	0.00	
Marriage date	2.82	1.48	8.47	1.68	--	1.39	0.85	3.66	1.18	
Divorce date	10.56	4.93	20.34	6.72	--	2.59	1.52	5.29	2.31	
Birth date	0.70	0.00	0.00	2.52	--	0.70	0.00	0.00	1.44	
NPSAS										
Applied for Financial Aid	0.20	0.57	0.33	0.55	0.57	0.10	0.12	0.09	0.08	0.10
Received Financial Aid	0.42	0.65	0.32	0.55	0.66	0.24	0.12	0.09	0.08	0.10
Received Stafford Loan	0.64	0.79	0.78	0.75	0.91	0.36	0.13	0.16	0.10	0.13
Received Pell Grant	0.71	0.87	0.78	0.73	1.08	0.36	0.13	0.14	0.09	0.14
Received Work Study	3.74	2.45	1.50	1.84	2.57	0.82	0.18	0.21	0.16	0.22
Amount of Work Study	4.20	1.81	2.03	2.07	1.96	0.96	0.17	0.28	0.16	0.18
Received State Aid	0.79	0.83	0.58	0.82	0.96	0.44	0.14	0.14	0.10	0.12
Amount of State Aid	2.62	2.44	2.15	2.75	2.68	0.79	0.19	0.28	0.18	0.21
Received Institutional Aid	0.79	0.83	0.58	0.82	0.96	0.44	0.14	0.14	0.10	0.12
Amount of Institutional Aid	2.54	1.77	1.83	2.47	2.72	0.75	0.17	0.24	0.17	0.21
Grade Point Average	7.43	6.77	4.40	2.82	2.84	1.32	0.29	0.38	0.18	0.21

Note: -- indicates that only four groups could be created in the WDS Positive Affect Toward Sponsor Model.

Table A.159: Mismatch Rates and Standard Errors by Positive Affect Toward Sponsor Cooperation Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	0.70	0.49	0.00	5.04	--	0.70	0.49	0.00	2.01	--
Ever divorced	8.51	6.47	10.53	9.40	--	2.36	1.74	4.10	2.71	--
Number of marriages	11.35	4.93	7.02	13.45	--	2.68	1.52	3.41	3.14	--
Marriage date	38.69	27.64	37.04	30.63	--	4.18	3.18	6.63	4.40	--
Divorce date	52.17	47.22	53.66	52.00	--	4.68	3.73	7.88	5.02	--
Birth date	12.06	9.36	11.86	11.30	--	2.75	2.05	4.25	2.97	--
NPSAS										
Applied for Financial Aid	9.9	13.5	11.6	8.9	13.4	1.3	0.4	0.7	0.3	0.4
Received Financial Aid	10.3	12.4	11.8	9.3	12.1	1.4	0.4	0.7	0.3	0.4
Received Stafford Loan	8.2	8.3	11.2	11.7	10.3	1.3	0.4	0.7	0.4	0.4
Received Pell Grant	14.9	8.4	8.4	6.8	6.4	1.6	0.3	0.5	0.3	0.3
Received Work Study	11.7	4.9	6.6	8.0	9.0	1.6	0.3	0.5	0.3	0.4
Amount of Work Study	11.1	5.2	9.0	12.2	14.3	1.6	0.3	0.6	0.3	0.4
Received State Aid	22.6	17.5	20.3	18.1	14.3	2.0	0.4	0.8	0.4	0.5
Amount of State Aid	28.0	22.0	27.3	26.3	21.4	2.1	0.5	0.9	0.5	0.5
Received Institutional Aid	14.1	10.0	12.9	15.8	15.4	1.8	0.4	0.6	0.4	0.5
Amount of Institutional Aid	14.9	11.1	20.6	30.0	29.4	1.8	0.4	0.8	0.5	0.6
Grade Point Average	83.1	82.5	82.9	84.0	80.9	2.5	0.6	0.9	0.5	0.6

Note: -- indicates that only four groups could be created in the WDS Positive Affect Toward Sponsor Model.

Table A.160: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Positive Affect Toward Sponsor Cooperation Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	7.8	3.0	0.0	6.7	--	2.3	1.2	0.0	2.3	
Truth=Report	88.7	95.1	93.0	86.6	--	2.7	1.5	3.4	3.1	
Truth>Report	3.6	2.0	7.0	6.7	--	1.6	1.0	3.4	2.3	
Marriage date										
Truth<Report	23.2	15.0	24.1	19.7	--	3.6	2.5	5.8	3.7	
Truth=Report	60.9	72.0	63.0	65.8	--	4.2	3.2	6.6	4.4	
Truth>Report	15.9	13.0	13.0	14.5	--	3.1	2.4	4.6	3.3	
Divorce date										
Truth<Report	38.6	37.8	44.7	42.3	--	4.3	3.5	7.3	4.7	
Truth=Report	43.3	49.2	40.4	43.2	--	4.4	3.6	7.2	4.7	
Truth>Report	18.1	13.0	14.9	14.4	--	3.4	2.4	5.2	3.3	
Birth date										
Truth<Report	6.4	6.9	10.2	5.2	--	2.1	1.8	3.9	2.1	
Truth=Report	87.9	90.6	88.1	87.9	--	2.7	2.0	4.2	3.0	
Truth>Report	5.7	2.5	1.7	6.9	--	1.9	1.1	1.7	2.4	
NPSAS										
Applied for Financial Aid										
Truth<Report	3.2	5.3	4.0	3.8	7.3	0.71	0.30	0.43	0.23	0.34
Truth=Report	90.1	86.5	88.4	91.1	86.6	1.30	0.44	0.69	0.34	0.45
Truth>Report	6.7	8.2	7.7	5.1	6.1	1.11	0.35	0.58	0.26	0.32
Received Financial Aid										
Truth<Report	3.4	5.9	4.6	3.9	6.5	0.75	0.32	0.46	0.23	0.32
Truth=Report	89.7	87.6	88.2	90.7	87.9	1.41	0.43	0.70	0.34	0.42
Truth>Report	6.9	6.5	7.2	5.4	5.6	1.23	0.30	0.55	0.27	0.30
Received Stafford Loan										
Truth<Report	5.2	4.3	4.6	4.1	5.4	1.10	0.27	0.46	0.23	0.28
Truth=Report	91.8	91.7	88.8	88.3	89.7	1.29	0.35	0.65	0.37	0.39
Truth>Report	2.9	4.0	6.6	7.6	4.9	0.72	0.24	0.49	0.30	0.28
Received Pell Grant										
Truth<Report	2.2	3.0	3.6	3.0	3.8	0.60	0.22	0.39	0.19	0.24
Truth=Report	85.1	91.6	91.6	93.2	93.6	1.63	0.33	0.53	0.28	0.32
Truth>Report	12.7	5.4	4.8	3.7	2.6	1.54	0.26	0.37	0.21	0.22
Received Work Study										
Truth<Report	9.7	4.0	5.3	4.8	6.0	1.56	0.25	0.46	0.25	0.31
Truth=Report	88.3	95.1	93.4	92.0	91.0	1.64	0.27	0.50	0.30	0.37
Truth>Report	2.0	0.9	1.4	3.2	3.0	0.60	0.10	0.21	0.18	0.21
Amount of Work Study										
Truth<Report	7.4	3.7	5.8	6.4	7.4	1.37	0.23	0.47	0.28	0.34
Truth=Report	88.9	94.8	91.0	87.8	85.7	1.60	0.26	0.56	0.35	0.44
Truth>Report	3.7	1.5	3.2	5.8	6.9	0.91	0.13	0.31	0.23	0.30
Received State Aid										
Truth<Report	6.3	4.8	5.3	5.8	5.4	1.19	0.25	0.43	0.27	0.30
Truth=Report	77.4	82.5	79.7	81.9	85.7	1.96	0.44	0.78	0.43	0.45
Truth>Report	16.3	12.7	15.0	12.3	8.9	1.67	0.38	0.68	0.36	0.36
Amount of State Aid										
Truth<Report	8.3	6.4	7.3	8.6	7.3	1.30	0.29	0.51	0.32	0.34
Truth=Report	72.0	78.0	72.7	73.7	78.6	2.14	0.48	0.87	0.49	0.51
Truth>Report	19.8	15.6	20.0	17.8	14.1	1.86	0.41	0.77	0.42	0.43

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	7.6	5.8	4.7	5.3	4.7	1.40	0.29	0.41	0.26	0.27
Truth=Report	85.9	90.0	87.1	84.2	84.6	1.75	0.36	0.64	0.42	0.47
Truth>Report	6.5	4.2	8.2	10.6	10.7	1.15	0.22	0.51	0.35	0.40
Amount of Institutional Aid										
Truth<Report	7.5	6.0	6.9	9.1	9.0	1.42	0.30	0.49	0.33	0.36
Truth=Report	85.1	88.9	79.4	70.0	70.6	1.82	0.37	0.76	0.50	0.57
Truth>Report	7.4	5.1	13.7	20.9	20.4	1.25	0.24	0.64	0.44	0.50
Grade Point Average										
Truth<Report	60.5	60.7	59.1	55.8	53.5	3.17	0.75	1.17	0.63	0.75
Truth=Report	16.9	17.5	17.1	16.0	19.1	2.46	0.58	0.88	0.45	0.57
Truth>Report	22.6	21.8	23.8	28.1	27.4	2.66	0.63	1.01	0.57	0.66

Note: -- indicates only four groups could be created for the WDS Positive Affect Toward Sponsor Model.

Table A.161: Average Signed Deviation by Positive Affect Toward Sponsor Cooperation Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	-0.04	-0.02	0.07	0.00	--	0.03	0.02	0.03	0.03	--
Marriage date	-2.68	-4.95	-27.8	-2.93	--	5.29	4.37	13.41	3.63	--
Divorce date	-5.03	-5.94	-2.83	-9.17	--	2.46	1.64	2.06	3.18	--
Birth date	-3.62	-6.18	-18.3	-0.07	--	4.47	3.43	13.83	4.49	--
NPSAS										
Amount of Work Study	-115	-89	-95	-37	-113	62.56	13.26	21.16	14.04	19.82
Amount of State Aid	124	52	302	230	150	55.07	11.25	27.19	16.30	18.36
Amount of Institutional Aid	-217	-63	164	384	501	132.8	14.80	23.35	27.51	44.06
Grade Point Average	-0.24	-0.25	-0.20	-0.15	-0.11	0.03	0.01	0.01	0.00	0.01

Note: -- indicates only four groups could be created for the WDS Positive Affect Toward Sponsor Model.

Table A.162: Average Absolute Difference and Standard Error by Positive Affect Toward Sponsor Cooperation Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.11	0.05	0.07	0.13	--	0.03	0.02	0.03	0.03	
Marriage date	20.12	16.78	34.17	12.73	--	5.00	4.22	13.13	3.43	
Divorce date	8.49	7.41	8.00	10.95	--	2.38	1.61	1.69	3.13	
Birth date	11.92	9.81	29.76	11.53	--	4.37	3.38	13.48	4.36	
NPSAS										
Amount of Work Study	306	146	207	240	310	60.98	13.20	20.97	13.76	19.51
Amount of State Aid	460	283	569	568	489	51.90	10.89	26.01	15.32	17.19
Amount of Institutional Aid	353	205	438	856	1268	131.8	14.62	22.29	26.37	41.36
Grade Point Average	0.34	0.35	0.28	0.22	0.18	0.03	0.01	0.01	0.00	0.00

Note: -- indicates only four groups could be created for the WDS Positive Affect Toward Sponsor Model.

Table A.163: Item Nonresponse Rates and Standard Errors by Social Environmental Factors Cooperation Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	1.00	2.30	1.72	1.80	0.00	1.00	1.62	1.21	1.27	0.00
Number of marriages	0.00	2.30	0.86	0.00	0.00	0.00	1.62	0.86	0.00	0.00
Marriage date	5.00	5.75	2.59	0.90	0.00	2.19	2.51	1.48	0.90	0.00
Divorce date	8.00	10.34	12.93	6.31	5.50	2.73	3.28	3.13	2.32	2.19
Birth date	2.00	0.00	0.86	0.00	0.92	1.41	0.00	0.86	0.00	0.92
NPSAS										
Applied for Financial Aid	0.55	0.65	0.70	0.34	0.50	0.19	0.15	0.12	0.07	0.09
Received Financial Aid	0.61	0.76	0.69	0.39	0.54	0.18	0.16	0.12	0.07	0.10
Received Stafford Loan	1.25	0.80	0.95	0.77	0.58	0.25	0.16	0.14	0.12	0.10
Received Pell Grant	1.11	0.99	0.93	0.86	0.66	0.21	0.18	0.13	0.12	0.11
Received Work Study	2.06	2.32	2.29	2.12	2.14	0.26	0.25	0.21	0.20	0.19
Amount of Work Study	2.49	2.02	1.87	1.89	2.08	0.38	0.23	0.18	0.17	0.18
Received State Aid	0.82	1.08	0.90	0.67	0.79	0.20	0.19	0.14	0.10	0.12
Amount of State Aid	2.09	2.91	2.51	2.69	2.48	0.29	0.28	0.22	0.21	0.20
Received Institutional Aid	0.82	1.08	0.90	0.67	0.79	0.20	0.19	0.14	0.10	0.12
Amount of Institutional Aid	1.62	2.43	2.51	2.11	2.37	0.25	0.26	0.21	0.18	0.19
Grade Point Average	7.25	5.47	4.28	3.41	2.86	0.57	0.34	0.27	0.23	0.19

Table A.164: Mismatch Rates and Standard Errors by Social Environmental Factors Cooperation Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	4.00	1.15	0.00	2.70	0.00	1.97	1.15	0.00	1.55	0.00
Ever divorced	9.09	3.53	6.14	14.68	6.42	2.90	2.01	2.26	3.41	2.36
Number of marriages	12.00	5.88	8.70	8.11	9.17	3.27	2.57	2.64	2.60	2.78
Marriage date	24.18	23.46	42.48	33.64	33.94	4.51	4.74	4.67	4.59	4.56
Divorce date	45.78	46.67	55.32	46.59	55.21	5.50	5.80	5.16	5.35	5.10
Birth date	12.24	9.20	8.77	12.61	11.11	3.33	3.12	2.66	3.17	3.04
NPSAS										
Applied for Financial Aid	12.5	14.1	11.5	10.5	10.8	0.8	0.6	0.4	0.4	0.4
Received Financial Aid	12.9	11.8	11.3	10.4	10.7	0.8	0.6	0.4	0.4	0.4
Received Stafford Loan	9.5	8.0	11.3	10.3	11.3	0.6	0.5	0.4	0.4	0.4
Received Pell Grant	11.7	7.6	7.2	6.2	7.4	0.7	0.4	0.3	0.3	0.3
Received Work Study	6.7	5.6	7.2	7.8	8.4	0.6	0.4	0.4	0.3	0.3
Amount of Work Study	6.2	6.4	10.8	11.9	13.0	0.6	0.4	0.4	0.4	0.4
Received State Aid	19.2	17.8	16.4	17.1	17.1	0.9	0.6	0.5	0.5	0.5
Amount of State Aid	23.2	22.8	22.8	26.7	23.5	0.9	0.6	0.5	0.6	0.5
Received Institutional Aid	11.5	11.6	13.0	14.2	16.4	0.7	0.5	0.5	0.5	0.5
Amount of Institutional Aid	12.9	16.1	23.5	25.7	29.6	0.8	0.5	0.6	0.6	0.6
Grade Point Average	84.1	83.8	80.9	83.7	82.2	1.1	0.8	0.6	0.5	0.5

Table A.165: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Social Environmental Factors Cooperation Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	7.0	1.2	6.1	0.9	8.3	2.6	1.2	2.2	0.9	2.6
Truth=Report	88.0	94.1	91.3	91.9	90.8	3.2	2.6	2.6	2.6	2.8
Truth>Report	5.0	4.7	2.6	7.2	0.9	2.2	2.3	1.5	2.5	0.9
Marriage date										
Truth<Report	19.0	14.6	25.7	16.4	19.3	4.0	3.9	4.1	3.5	3.8
Truth=Report	72.6	75.6	57.5	64.6	66.1	4.6	4.7	4.7	4.6	4.5
Truth>Report	8.4	9.8	16.8	19.1	14.7	2.8	3.3	3.5	3.7	3.4
Divorce date										
Truth<Report	35.9	32.1	43.6	44.2	40.8	5.0	5.3	4.9	4.9	4.8
Truth=Report	48.9	51.3	41.6	45.2	41.8	5.2	5.7	4.9	4.9	4.9
Truth>Report	15.2	16.7	14.9	10.6	17.5	3.7	4.2	3.5	3.0	3.7
Birth date										
Truth<Report	8.2	5.8	6.1	6.3	7.4	2.8	2.5	2.2	2.3	2.5
Truth=Report	87.8	90.8	90.4	87.4	88.9	3.3	3.1	2.7	3.2	3.0
Truth>Report	4.1	3.5	3.5	6.3	3.7	2.0	2.0	1.7	2.3	1.8
NPSAS										
Applied for Financial Aid										
Truth<Report	5.1	6.4	5.1	4.3	5.1	0.46	0.44	0.30	0.27	0.29
Truth=Report	87.5	85.9	88.5	89.5	89.2	0.79	0.60	0.44	0.41	0.40
Truth>Report	7.5	7.7	6.5	6.2	5.6	0.67	0.45	0.34	0.32	0.30
Received Financial Aid										
Truth<Report	5.2	6.4	5.7	4.5	4.7	0.47	0.45	0.32	0.28	0.27
Truth=Report	87.1	88.2	88.7	89.6	89.3	0.79	0.56	0.44	0.41	0.40
Truth>Report	7.7	5.4	5.6	5.9	6.0	0.66	0.36	0.31	0.32	0.30
Received Stafford Loan										
Truth<Report	4.9	4.3	4.8	4.3	4.7	0.36	0.38	0.29	0.28	0.26
Truth=Report	90.5	92.0	88.7	89.7	88.7	0.56	0.48	0.44	0.41	0.40
Truth>Report	4.6	3.7	6.5	5.9	6.6	0.44	0.31	0.34	0.31	0.32
Received Pell Grant										
Truth<Report	3.2	3.2	3.6	2.8	3.5	0.38	0.28	0.26	0.22	0.24
Truth=Report	88.3	92.4	92.8	93.8	92.6	0.69	0.41	0.35	0.32	0.32
Truth>Report	8.5	4.4	3.6	3.4	3.9	0.59	0.31	0.25	0.24	0.23
Received Work Study										
Truth<Report	6.4	4.8	4.6	4.7	5.5	0.63	0.34	0.29	0.28	0.29
Truth=Report	93.3	94.4	92.8	92.2	91.6	0.64	0.36	0.35	0.35	0.34
Truth>Report	0.3	0.9	2.6	3.1	2.9	0.10	0.11	0.21	0.21	0.19
Amount of Work Study										
Truth<Report	5.2	4.8	5.5	6.2	6.9	0.57	0.33	0.31	0.32	0.32
Truth=Report	93.8	93.6	89.2	88.1	87.0	0.60	0.36	0.41	0.41	0.40
Truth>Report	1.0	1.7	5.3	5.7	6.1	0.19	0.15	0.29	0.27	0.26
Received State Aid										
Truth<Report	5.1	4.9	5.0	5.0	6.4	0.48	0.33	0.29	0.29	0.31
Truth=Report	80.8	82.2	83.6	82.9	82.9	0.87	0.57	0.49	0.49	0.47
Truth>Report	14.1	12.9	11.5	12.0	10.7	0.76	0.48	0.41	0.42	0.37
Amount of State Aid										
Truth<Report	6.1	6.5	6.8	8.6	8.2	0.54	0.38	0.34	0.38	0.35
Truth=Report	76.8	77.2	77.2	73.3	76.5	0.95	0.62	0.55	0.56	0.53
Truth>Report	17.0	16.3	16.0	18.1	15.2	0.84	0.53	0.47	0.48	0.44

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	7.0	5.0	5.0	4.4	6.0	0.63	0.36	0.30	0.27	0.30
Truth=Report	88.5	88.4	87.0	85.8	83.6	0.74	0.48	0.46	0.47	0.47
Truth>Report	4.6	6.6	8.0	9.8	10.4	0.41	0.34	0.36	0.40	0.38
Amount of Institutional Aid										
Truth<Report	7.5	6.2	7.9	8.0	9.4	0.66	0.38	0.37	0.35	0.36
Truth=Report	87.1	83.9	76.5	74.3	70.4	0.76	0.52	0.55	0.56	0.55
Truth>Report	5.4	9.9	15.6	17.8	20.2	0.42	0.40	0.47	0.49	0.48
Grade Point Average										
Truth<Report	60.0	62.3	56.0	55.6	54.7	1.52	0.99	0.79	0.74	0.70
Truth=Report	15.9	16.2	19.1	16.3	17.8	1.13	0.75	0.61	0.53	0.52
Truth>Report	24.1	21.6	25.0	28.1	27.5	1.32	0.82	0.69	0.67	0.63

Table A.166: Average Signed Deviations and Standard Error by Social Environmental Factors Cooperation Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	-0.020	0.035	-0.035	0.063	-0.083	0.03	0.03	0.03	0.03	0.03
Marriage date	-15.30	-3.67	1.62	-8.20	-7.25	7.36	3.01	5.00	7.01	7.05
Divorce date	-8.24	-1.79	-6.35	-6.49	-7.23	4.10	0.92	2.85	2.05	2.35
Birth date	-12.20	4.49	-3.25	-6.51	-8.88	7.89	3.40	3.42	6.87	5.79
NPSAS										
Amount of Work Study	-187	-105	-42	-58	-79	37.08	16.61	18.39	15.50	16.87
Amount of State Aid	134	143	148	190	184	21.75	15.78	17.19	18.48	19.03
Amount of Institutional Aid	-68	81	454	312	266	37.37	26.97	43.21	30.82	30.73
Grade Point Average	-0.23	-0.24	-0.17	-0.15	-0.12	0.02	0.01	0.01	0.01	0.00

Table A.167: Average Absolute Deviations and Standard Errors by Social Environmental Factors Cooperation Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.12	0.06	0.09	0.08	0.10	0.03	0.03	0.03	0.03	0.03
Marriage date	20.4	6.7	17.6	23.5	22.5	7.22	2.94	4.72	6.67	6.75
Divorce date	10.9	4.32	9.35	7.97	9.58	4.02	0.80	2.76	1.99	2.26
Birth date	20.0	5.21	7.51	19.1	12.7	7.72	3.38	3.36	6.66	5.73
NPSAS										
Amount of Work Study	211	158	237	251	263	37.04	16.51	17.96	15.18	16.69
Amount of State Aid	369	363	437	526	542	20.77	15.00	16.39	17.13	17.94
Amount of Institutional Aid	282	409	956	780	869	37.04	26.27	41.07	28.81	29.16
Grade Point Average	0.35	0.34	0.25	0.23	0.20	0.01	0.01	0.01	0.00	0.00

Table A.168: Item Nonresponse Rate and Standard Errors by Discretionary Time Cooperation Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	1.09	1.94	0.90	0.00	2.73	1.09	1.37	0.90	0.00	1.56
Number of marriages	1.09	0.00	0.00	0.00	1.82	1.09	0.00	0.00	0.00	1.28
Marriage date	2.17	2.91	0.90	0.93	6.36	1.53	1.67	0.90	0.93	2.34
Divorce date	10.87	7.77	10.81	2.80	10.91	3.26	2.65	2.96	1.60	2.99
Birth date	1.09	1.94	0.90	0.00	0.00	1.09	1.37	0.90	0.00	0.00
NPSAS										
Applied for Financial Aid	0.50	0.56	0.63	0.38	0.55	0.11	0.13	0.10	0.11	0.10
Received Financial Aid	0.60	0.46	0.66	0.45	0.64	0.12	0.11	0.10	0.12	0.11
Received Stafford Loan	0.74	0.69	0.90	1.03	0.75	0.13	0.14	0.11	0.19	0.12
Received Pell Grant	0.86	0.52	0.99	1.13	0.87	0.15	0.12	0.11	0.20	0.12
Received Work Study	3.15	2.57	2.06	1.45	1.88	0.29	0.25	0.18	0.23	0.17
Amount of Work Study	2.15	1.44	2.16	2.13	2.10	0.23	0.19	0.19	0.25	0.18
Received State Aid	0.88	0.57	0.89	0.83	0.92	0.15	0.12	0.11	0.16	0.13
Amount of State Aid	2.61	1.98	3.15	3.10	2.37	0.25	0.21	0.22	0.31	0.20
Received Institutional Aid	0.88	0.57	0.89	0.83	0.92	0.15	0.12	0.11	0.16	0.13
Amount of Institutional Aid	2.31	1.24	2.46	2.59	2.62	0.24	0.17	0.18	0.27	0.20
Grade Point Average	6.58	5.47	5.00	2.22	2.40	0.37	0.34	0.27	0.25	0.18

Table A.169: Mismatch Rates and Standard Errors by Discretionary Time Cooperation Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	1.09	1.94	1.80	2.80	0.00	1.09	1.37	1.27	1.60	0.00
Ever divorced	6.59	8.91	10.00	7.48	7.48	2.62	2.85	2.87	2.55	2.55
Number of marriages	6.59	10.68	8.11	8.41	10.19	2.62	3.06	2.60	2.70	2.92
Marriage date	29.21	38.78	30.56	26.21	36.89	4.85	4.95	4.45	4.35	4.78
Divorce date	44.74	56.98	52.27	39.58	57.78	5.74	5.37	5.36	5.02	5.24
Birth date	15.38	11.88	10.00	6.60	10.91	3.80	3.24	2.87	2.42	2.99
NPSAS										
Applied for Financial Aid	17.7	15.8	8.3	7.5	9.8	0.6	0.6	0.4	0.5	0.4
Received Financial Aid	15.9	12.8	9.6	8.4	9.7	0.6	0.5	0.4	0.5	0.4
Received Stafford Loan	11.0	7.6	10.2	9.9	11.7	0.5	0.4	0.4	0.5	0.4
Received Pell Grant	8.1	7.3	8.1	6.8	7.0	0.4	0.4	0.3	0.4	0.3
Received Work Study	6.3	4.7	7.9	7.9	8.8	0.4	0.4	0.3	0.5	0.3
Amount of Work Study	7.0	4.8	12.0	14.5	13.0	0.4	0.4	0.4	0.6	0.4
Received State Aid	13.3	13.9	21.9	21.7	16.6	0.5	0.5	0.5	0.7	0.5
Amount of State Aid	16.4	17.9	30.7	31.9	24.3	0.6	0.6	0.6	0.8	0.5
Received Institutional Aid	12.1	9.1	15.9	15.1	15.6	0.5	0.5	0.5	0.7	0.4
Amount of Institutional Aid	15.1	11.0	27.5	29.6	30.3	0.6	0.5	0.5	0.8	0.6
Grade Point Average	81.6	83.5	80.4	83.5	83.6	0.7	0.7	0.6	0.7	0.5

Table A.170: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Discretionary Time Cooperation Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	3.3	4.9	4.5	4.7	6.5	1.9	2.1	2.0	2.0	2.4
Truth=Report	93.4	89.3	91.9	91.6	89.8	2.6	3.0	2.6	2.7	2.9
Truth>Report	3.3	5.8	3.6	3.7	3.7	1.9	2.3	1.8	1.8	1.8
Marriage date										
Truth<Report	15.6	23.0	15.5	17.9	24.3	3.8	4.2	3.4	3.7	4.2
Truth=Report	70.0	60.0	68.2	71.7	63.1	4.8	4.9	4.4	4.4	4.8
Truth>Report	14.4	17.0	16.4	10.4	12.6	3.7	3.8	3.5	3.0	3.3
Divorce date										
Truth<Report	37.8	44.2	46.5	27.9	42.9	5.4	5.1	5.0	4.4	5.0
Truth=Report	51.2	39.0	42.4	55.8	38.8	5.5	5.0	5.0	4.9	4.9
Truth>Report	11.0	16.8	11.1	16.4	18.4	3.5	3.8	3.2	3.6	3.9
Birth date										
Truth<Report	7.7	7.9	6.4	3.7	8.2	2.8	2.7	2.3	1.8	2.6
Truth=Report	84.6	88.1	90.0	92.5	89.1	3.8	3.2	2.9	2.5	3.0
Truth>Report	7.7	4.0	3.6	3.7	2.7	2.8	1.9	1.8	1.8	1.6
NPSAS										
Applied for Financial Aid										
Truth<Report	7.79	5.27	3.29	3.45	5.40	0.43	0.37	0.23	0.34	0.28
Truth=Report	82.31	84.25	91.71	92.54	90.24	0.62	0.60	0.37	0.48	0.38
Truth>Report	9.91	10.49	5.00	4.00	4.36	0.49	0.51	0.29	0.35	0.26
Received Financial Aid										
Truth<Report	9.07	5.26	3.49	2.94	5.04	0.47	0.36	0.24	0.30	0.28
Truth=Report	84.05	87.20	90.40	91.56	90.34	0.60	0.55	0.38	0.50	0.38
Truth>Report	6.88	7.54	6.11	5.50	4.61	0.42	0.43	0.31	0.41	0.26
Received Stafford Loan										
Truth<Report	5.88	3.78	4.03	3.27	5.20	0.37	0.30	0.26	0.31	0.28
Truth=Report	89.01	92.44	89.77	90.09	88.29	0.51	0.42	0.38	0.53	0.41
Truth>Report	5.11	3.78	6.20	6.63	6.51	0.36	0.31	0.30	0.45	0.31
Received Pell Grant										
Truth<Report	4.13	2.67	2.90	3.38	3.26	0.32	0.25	0.21	0.32	0.22
Truth=Report	91.85	92.66	91.85	93.24	93.04	0.44	0.41	0.34	0.44	0.30
Truth>Report	4.01	4.67	5.25	3.38	3.69	0.32	0.33	0.27	0.32	0.22
Received Work Study										
Truth<Report	5.13	3.91	4.30	4.79	6.12	0.36	0.33	0.26	0.39	0.29
Truth=Report	93.72	95.32	92.09	92.05	91.15	0.40	0.35	0.33	0.49	0.34
Truth>Report	1.15	0.78	3.61	3.16	2.72	0.17	0.13	0.21	0.31	0.19
Amount of Work Study										
Truth<Report	4.88	3.73	5.41	6.87	7.47	0.35	0.32	0.28	0.46	0.32
Truth=Report	92.97	95.20	87.95	85.51	86.97	0.41	0.35	0.38	0.63	0.40
Truth>Report	2.15	1.06	6.63	7.62	5.56	0.22	0.16	0.27	0.46	0.27
Received State Aid										
Truth<Report	5.65	4.42	6.28	6.06	4.93	0.38	0.32	0.31	0.43	0.26
Truth=Report	86.75	86.10	78.15	78.26	83.38	0.53	0.54	0.51	0.74	0.45
Truth>Report	7.61	9.47	15.57	15.68	11.70	0.40	0.45	0.44	0.64	0.39
Amount of State Aid										
Truth<Report	7.21	5.98	8.88	9.03	7.19	0.42	0.38	0.36	0.52	0.32
Truth=Report	83.58	82.08	69.34	68.05	75.70	0.58	0.60	0.58	0.84	0.52
Truth>Report	9.21	11.94	21.79	22.92	17.12	0.44	0.50	0.51	0.75	0.46

Received Institutional Aid										
Truth<Report	6.47	3.81	5.08	4.92	5.62	0.40	0.30	0.30	0.39	0.28
Truth=Report	87.89	90.86	84.09	84.88	84.38	0.52	0.45	0.47	0.65	0.45
Truth>Report	5.64	5.33	10.83	10.19	10.00	0.36	0.36	0.39	0.55	0.37
Amount of Institutional Aid										
Truth<Report	7.55	4.50	8.67	8.70	9.51	0.43	0.32	0.36	0.50	0.36
Truth=Report	84.90	89.02	72.47	70.41	69.70	0.57	0.49	0.55	0.82	0.55
Truth>Report	7.55	6.48	18.85	20.89	20.79	0.41	0.39	0.47	0.73	0.48
Grade Point Average										
Truth<Report	59.25	59.61	54.70	55.81	55.61	0.95	0.94	0.73	0.97	0.70
Truth=Report	18.42	16.54	19.61	16.48	16.41	0.74	0.69	0.56	0.72	0.52
Truth>Report	22.33	23.85	25.69	27.71	27.98	0.81	0.83	0.64	0.88	0.63

Table A.171: Average Signed Deviations and Standard Errors by Discretionary Time Cooperation Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.00	0.01	-0.009	-0.009	-0.037	0.03	0.03	0.03	0.03	0.03
Marriage date	2.46	-9.79	-1.19	-9.17	-13.20	6.02	6.98	4.45	7.65	5.92
Divorce date	-5.83	-6.42	-9.53	-1.67	-7.62	1.92	2.18	4.22	1.03	2.95
Birth date	2.87	-12.80	-1.49	-5.54	-9.75	4.70	6.17	3.18	8.10	5.59
NPSAS										
Amount of Work Study	-114	-102	-13	-34	-102	16.82	17.13	10.68	21.23	19.40
Amount of State Aid	-10	45	245	290	230	16.34	14.30	17.28	27.72	18.36
Amount of Institutional Aid	-109	31	387	561	389	32.07	16.51	32.78	51.88	36.44
Grade Point Average	-0.24	-0.21	-0.19	-0.12	-0.12	0.01	0.01	0.01	0.01	0.00

Table A.172: Average Absolute Deviations and Standard Errors by Discretionary Time Cooperation Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.07	0.11	0.08	0.08	0.11	0.03	0.03	0.03	0.03	0.03
Marriage date	19.31	21.58	13.53	19.71	19.71	5.67	6.70	4.25	7.45	5.74
Divorce date	7.62	9.86	10.83	4.56	10.16	1.83	2.02	4.19	0.94	2.86
Birth date	10.45	14.45	7.98	18.61	13.58	4.58	6.14	3.10	7.91	5.52
NPSAS										
Amount of Work Study	169	148	193	272	314	16.72	17.05	10.48	20.69	19.05
Amount of State Aid	263	236	600	652	556	15.53	13.75	16.03	25.75	17.32
Amount of Institutional Aid	441	213	891	976	1003	30.76	16.18	31.20	49.69	34.93
Grade Point Average	0.33	0.32	0.29	0.20	0.17	0.01	0.01	0.01	0.01	0.00

Table A.173: Item Nonresponse Rates and Standard Errors by Combined Main Effects Cooperation Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	3.61	0.99	0.00	0.85	1.74	2.06	0.99	0.00	0.85	1.22
Number of marriages	1.20	0.00	0.00	0.00	1.74	1.20	0.00	0.00	0.00	1.22
Marriage date	6.02	2.97	0.93	0.00	4.35	2.63	1.70	0.93	0.00	1.91
Divorce date	12.05	11.88	3.74	6.84	9.57	3.59	3.24	1.84	2.34	2.75
Birth date	1.20	0.00	0.93	0.00	1.74	1.20	0.00	0.93	0.00	1.22
NPSAS										
Applied for Financial Aid	0.41	0.73	0.56	0.52	0.44	0.11	0.15	0.11	0.10	0.09
Received Financial Aid	0.52	0.65	0.60	0.59	0.53	0.13	0.13	0.11	0.11	0.10
Received Stafford Loan	0.87	0.90	0.78	0.89	0.64	0.17	0.15	0.13	0.14	0.11
Received Pell Grant	1.04	0.95	0.97	0.71	0.80	0.19	0.16	0.14	0.12	0.13
Received Work Study	2.69	2.26	2.18	1.79	2.38	0.33	0.24	0.21	0.17	0.21
Amount of Work Study	2.19	2.26	1.78	2.02	1.95	0.32	0.24	0.18	0.19	0.18
Received State Aid	0.85	0.92	0.78	0.80	0.85	0.20	0.16	0.12	0.13	0.13
Amount of State Aid	2.57	2.67	2.68	2.88	2.16	0.34	0.25	0.22	0.23	0.18
Received Institutional Aid	0.85	0.92	0.78	0.80	0.85	0.20	0.16	0.12	0.13	0.13
Amount of Institutional Aid	2.50	2.10	2.31	2.31	2.28	0.33	0.22	0.20	0.20	0.19
Grade Point Average	6.21	5.45	3.87	3.23	3.55	0.48	0.34	0.26	0.21	0.23

Table A.174: Mismatch Rates and Standard Errors by Combined Main Effects Cooperation Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	0.00	1.98	2.80	0.85	1.74	0.00	1.39	1.60	0.85	1.22
Ever divorced	6.25	8.00	6.54	8.62	10.62	2.72	2.73	2.40	2.62	2.91
Number of marriages	7.32	8.91	9.35	6.84	11.50	2.89	2.85	2.83	2.34	3.01
Marriage date	38.46	31.25	29.13	31.90	32.41	5.54	4.76	4.50	4.35	4.52
Divorce date	58.82	49.38	53.13	42.42	50.00	6.01	5.59	5.12	4.99	5.24
Birth date	7.32	11.88	9.43	11.21	13.27	2.89	3.24	2.85	2.94	3.21
NPSAS										
Applied for Financial Aid	13.6	13.6	10.8	10.1	11.7	0.8	0.6	0.5	0.4	0.4
Received Financial Aid	14.9	11.8	10.6	9.6	11.2	0.8	0.5	0.4	0.4	0.4
Received Stafford Loan	12.3	9.7	10.4	9.9	10.4	0.7	0.5	0.4	0.4	0.4
Received Pell Grant	10.3	8.4	7.0	6.2	7.4	0.6	0.4	0.3	0.3	0.3
Received Work Study	7.1	6.4	7.3	8.6	7.0	0.6	0.4	0.4	0.4	0.3
Amount of Work Study	7.5	7.9	10.7	12.3	11.5	0.6	0.4	0.4	0.4	0.4
Received State Aid	17.0	16.6	17.8	17.9	16.6	0.8	0.6	0.5	0.5	0.5
Amount of State Aid	19.8	21.9	25.6	26.7	22.9	0.8	0.6	0.6	0.6	0.5
Received Institutional Aid	12.6	11.6	14.4	13.9	15.2	0.7	0.5	0.5	0.5	0.5
Amount of Institutional Aid	14.9	17.1	25.0	26.8	26.7	0.7	0.6	0.6	0.6	0.5
Grade Point Average	81.6	84.3	83.2	82.0	82.2	1.0	0.7	0.6	0.6	0.6

Table A.175: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent and Standard Errors by Combined Cooperation Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	4.9	5.0	5.6	5.1	3.5	2.4	2.2	2.2	2.0	1.7
Truth=Report	92.7	91.1	90.7	93.2	88.5	2.9	2.8	2.8	2.3	3.0
Truth>Report	2.4	4.0	3.7	1.7	8.0	1.7	1.9	1.8	1.2	2.5
Marriage date										
Truth<Report	19.2	22.5	17.9	14.5	22.7	4.5	4.2	3.7	3.3	4.0
Truth=Report	61.5	67.4	68.9	67.5	66.4	5.5	4.7	4.5	4.3	4.5
Truth>Report	19.2	10.2	13.2	18.0	10.9	4.5	3.1	3.3	3.5	3.0
Divorce date										
Truth<Report	48.0	39.3	37.9	34.9	41.4	5.8	5.2	4.8	4.6	4.8
Truth=Report	38.4	46.1	43.7	52.3	44.2	5.7	5.3	4.9	4.8	4.9
Truth>Report	13.7	14.6	18.5	12.8	14.4	4.0	3.7	3.8	3.2	3.4
Birth date										
Truth<Report	6.1	5.0	4.7	8.6	8.9	2.6	2.2	2.1	2.6	2.7
Truth=Report	92.7	88.1	90.6	88.0	86.7	2.9	3.2	2.8	3.0	3.2
Truth>Report	1.2	6.9	4.7	3.4	4.4	1.2	2.5	2.1	1.7	1.9
NPSAS										
Applied for Financial Aid										
Truth<Report	5.5	4.8	4.4	4.9	6.1	0.52	0.34	0.30	0.30	0.31
Truth=Report	86.4	86.4	89.2	89.9	88.3	0.76	0.56	0.45	0.41	0.42
Truth>Report	8.1	8.8	6.4	5.2	5.6	0.60	0.47	0.36	0.30	0.30
Received Financial Aid										
Truth<Report	7.9	5.1	4.5	4.4	5.6	0.62	0.35	0.31	0.30	0.30
Truth=Report	85.1	88.2	89.4	90.4	88.8	0.80	0.53	0.45	0.41	0.41
Truth>Report	7.0	6.7	6.0	5.2	5.6	0.56	0.42	0.34	0.30	0.30
Received Stafford Loan										
Truth<Report	6.5	4.5	4.1	4.0	5.0	0.50	0.31	0.29	0.29	0.27
Truth=Report	87.7	90.3	89.6	90.1	89.6	0.68	0.46	0.44	0.42	0.40
Truth>Report	5.8	5.2	6.3	5.9	5.4	0.49	0.35	0.35	0.32	0.30
Received Pell Grant										
Truth<Report	4.2	3.5	2.7	3.0	3.5	0.45	0.29	0.21	0.23	0.24
Truth=Report	89.7	91.6	93.0	93.8	92.6	0.63	0.43	0.35	0.31	0.33
Truth>Report	6.0	4.9	4.3	3.2	3.9	0.47	0.32	0.28	0.22	0.23
Received Work Study										
Truth<Report	6.3	4.9	4.7	5.3	4.6	0.55	0.35	0.30	0.31	0.27
Truth=Report	92.9	93.6	92.7	91.4	93.0	0.58	0.39	0.36	0.38	0.31
Truth>Report	0.8	1.5	2.6	3.3	2.4	0.19	0.17	0.21	0.23	0.17
Amount of Work Study										
Truth<Report	5.6	5.1	5.9	6.5	6.0	0.52	0.35	0.33	0.33	0.30
Truth=Report	92.5	92.1	89.3	87.7	88.5	0.59	0.42	0.43	0.43	0.38
Truth>Report	1.9	2.8	4.9	5.8	5.5	0.30	0.23	0.29	0.29	0.26
Received State Aid										
Truth<Report	6.5	5.3	5.0	4.9	5.9	0.54	0.34	0.31	0.29	0.30
Truth=Report	83.0	83.4	82.2	82.1	83.4	0.79	0.56	0.53	0.50	0.47
Truth>Report	10.5	11.3	12.9	13.0	10.7	0.62	0.46	0.46	0.43	0.38
Amount of State Aid										
Truth<Report	7.5	7.2	7.5	7.6	7.7	0.58	0.40	0.38	0.36	0.34
Truth=Report	80.2	78.1	74.4	73.3	77.1	0.85	0.63	0.61	0.58	0.53
Truth>Report	12.3	14.7	18.1	19.0	15.2	0.68	0.53	0.53	0.50	0.44

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	7.2	4.8	5.0	4.5	5.7	0.58	0.34	0.31	0.28	0.30
Truth=Report	87.4	88.4	85.6	86.1	84.8	0.70	0.50	0.49	0.46	0.46
Truth>Report	5.4	6.8	9.4	9.4	9.5	0.43	0.38	0.41	0.39	0.38
Amount of Institutional Aid										
Truth<Report	7.9	6.5	8.0	8.4	8.7	0.60	0.39	0.38	0.37	0.36
Truth=Report	85.1	82.9	75.0	73.2	73.3	0.74	0.58	0.60	0.58	0.55
Truth>Report	7.0	10.6	17.0	18.4	18.0	0.49	0.47	0.52	0.50	0.47
Grade Point Average										
Truth<Report	60.6	61.9	56.8	54.9	53.9	1.32	0.90	0.80	0.75	0.75
Truth=Report	18.4	15.7	16.8	18.0	17.8	1.04	0.66	0.59	0.57	0.56
Truth>Report	21.0	22.4	26.5	27.1	28.3	1.12	0.78	0.71	0.67	0.68

Table A.176: Average Signed Deviation and Standard Error by Combined Main Effects Cooperation Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	-0.02	-0.01	-0.03	-0.03	0.04	0.03	0.03	0.03	0.02	0.03
Marriage date	-0.24	-0.03	-12.4	-1.72	-15.6	3.50	6.34	6.46	5.79	7.38
Divorce date	-11.5	-3.17	-6.01	-3.55	-7.72	4.72	0.93	2.37	1.35	3.38
Birth date	-0.32	-0.65	-8.05	-3.53	-13.3	0.37	4.91	6.32	4.42	8.18
NPSAS										
Amount of Work Study	-160	-100	-51	-54	-82	26.78	17.54	17.72	17.11	17.60
Amount of State Aid	26	77	187	246	182	21.64	16.14	18.58	18.73	18.64
Amount of Institutional Aid	-168	181	414	356	244	45.99	29.85	39.09	34.05	32.34
Grade Point Average	-0.27	-0.21	-0.17	-0.14	-0.12	0.01	0.01	0.01	0.01	0.01

Table A.177: Average Absolute Deviation and Standard Error by Combined Main Effects Cooperation Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.07	0.09	0.10	0.07	0.12	0.03	0.03	0.03	0.02	0.03
Marriage date	13.6	19.6	19.7	17.4	21.9	3.14	6.01	6.28	5.56	7.22
Divorce date	14.1	5.05	8.32	5.97	10.6	4.61	0.82	2.30	1.26	3.29
Birth date	0.76	13.5	17.2	8.10	22.7	0.36	4.72	6.15	4.36	7.99
NPSAS										
Amount of Work Study	215	182	242	247	245	26.60	17.41	17.30	16.82	17.43
Amount of State Aid	317	346	482	542	525	20.74	15.47	17.42	17.70	17.65
Amount of Institutional Aid	471	485	843	830	827	45.01	28.89	37.52	32.65	31.14
Grade Point Average	0.37	0.30	0.25	0.22	0.20	0.01	0.01	0.01	0.01	0.00

Table A.178: Item Nonresponse Rates and Standard Errors by Cooperation Interaction Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	2.35	1.03	0.94	0.85	1.71	1.65	1.03	0.94	0.85	1.20
Number of marriages	1.18	0.00	0.00	0.00	1.71	1.18	0.00	0.00	0.00	1.20
Marriage date	5.88	4.12	0.94	0.00	3.42	2.57	2.03	0.94	0.00	1.69
Divorce date	8.24	11.34	6.60	5.93	11.11	3.00	3.24	2.42	2.18	2.92
Birth date	1.18	1.03	0.00	0.00	1.71	1.18	1.03	0.00	0.00	1.20
NPSAS										
Applied for Financial Aid	0.55	0.80	0.38	0.50	0.52	0.17	0.15	0.08	0.09	0.11
Received Financial Aid	0.71	0.78	0.42	0.51	0.60	0.20	0.14	0.09	0.09	0.12
Received Stafford Loan	1.10	0.85	0.72	0.90	0.65	0.23	0.14	0.13	0.12	0.12
Received Pell Grant	0.96	0.92	0.86	0.81	0.84	0.21	0.15	0.13	0.11	0.14
Received Work Study	2.69	1.99	2.00	1.99	2.52	0.35	0.21	0.20	0.19	0.21
Amount of Work Study	2.38	1.97	1.88	1.97	2.05	0.36	0.22	0.19	0.18	0.19
Received State Aid	1.04	0.97	0.63	0.79	0.89	0.24	0.15	0.11	0.11	0.14
Amount of State Aid	2.91	2.46	2.73	2.80	2.22	0.37	0.24	0.23	0.21	0.20
Received Institutional Aid	1.04	0.97	0.63	0.79	0.89	0.24	0.15	0.11	0.11	0.14
Amount of Institutional Aid	2.59	2.30	2.09	2.39	2.23	0.35	0.23	0.19	0.19	0.20
Grade Point Average	6.59	4.26	4.03	3.44	3.93	0.50	0.29	0.27	0.23	0.24

Table A.179: Mismatch Rates by Cooperation Interaction Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	0.00	2.06	0.94	0.85	3.42	0.00	1.45	0.94	0.85	1.69
Ever divorced	3.61	8.33	2.86	11.11	13.04	2.06	2.84	1.63	2.92	3.15
Number of marriages	4.76	7.22	9.43	9.32	12.17	2.34	2.64	2.85	2.69	3.06
Marriage date	32.50	35.16	29.81	30.77	33.94	5.27	5.03	4.51	4.29	4.56
Divorce date	56.00	52.56	50.00	43.88	50.56	5.77	5.69	5.13	5.04	5.33
Birth date	8.33	11.46	6.67	11.86	14.78	3.03	3.27	2.45	2.99	3.32
NPSAS										
Applied for Financial Aid	15.2	12.7	11.4	9.2	12.1	0.8	0.5	0.5	0.4	0.4
Received Financial Aid	14.9	11.5	11.2	9.2	11.4	0.8	0.5	0.5	0.4	0.4
Received Stafford Loan	10.3	9.9	10.5	10.4	10.3	0.6	0.5	0.4	0.4	0.4
Received Pell Grant	9.1	8.0	7.4	6.9	7.1	0.6	0.4	0.4	0.3	0.3
Received Work Study	6.5	6.6	7.3	8.3	7.3	0.6	0.4	0.4	0.4	0.3
Amount of Work Study	6.8	9.0	10.1	12.3	11.5	0.5	0.4	0.4	0.4	0.4
Received State Aid	14.4	16.2	18.6	19.4	15.5	0.7	0.6	0.5	0.5	0.4
Amount of State Aid	16.9	22.0	25.6	28.8	21.7	0.8	0.6	0.6	0.6	0.5
Received Institutional Aid	11.1	12.8	14.2	15.3	13.7	0.6	0.5	0.5	0.5	0.4
Amount of Institutional Aid	13.7	19.5	23.6	28.1	25.1	0.7	0.6	0.6	0.6	0.5
Grade Point Average	83.3	83.3	84.0	81.7	81.9	1.0	0.7	0.6	0.6	0.6

Table A.180: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Cooperation Interaction Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	2.4	2.1	8.5	5.9	4.4	1.7	1.4	2.7	2.2	1.9
Truth=Report	95.2	92.8	90.6	90.7	87.8	2.3	2.6	2.8	2.7	3.0
Truth>Report	2.4	5.2	0.9	3.4	7.8	1.7	2.2	0.9	1.7	2.5
Marriage date										
Truth<Report	16.3	21.5	17.1	19.5	21.2	4.1	4.3	3.7	3.6	3.8
Truth=Report	67.5	63.4	69.5	68.6	63.7	5.2	5.0	4.5	4.3	4.5
Truth>Report	16.3	15.1	13.3	11.9	15.0	4.1	3.7	3.3	3.0	3.4
Divorce date										
Truth<Report	41.0	44.2	31.3	41.4	41.4	5.6	5.4	4.7	4.7	4.8
Truth=Report	42.3	43.0	48.5	49.6	42.3	5.6	5.3	5.0	4.7	4.8
Truth>Report	16.7	12.8	20.2	9.0	16.4	4.2	3.6	4.0	2.7	3.6
Birth date										
Truth<Report	7.1	4.2	4.7	10.2	7.0	2.8	2.0	2.1	2.8	2.4
Truth=Report	91.7	88.5	92.5	88.1	85.2	3.0	3.3	2.6	3.0	3.3
Truth>Report	1.2	7.3	2.8	1.7	7.8	1.2	2.7	1.6	1.2	2.5
NPSAS										
Applied for Financial Aid										
Truth<Report	6.4	5.2	4.6	3.6	6.7	0.57	0.36	0.32	0.25	0.32
Truth=Report	84.8	87.3	88.6	90.8	87.9	0.82	0.55	0.47	0.39	0.42
Truth>Report	8.8	7.5	6.8	5.7	5.5	0.65	0.44	0.37	0.31	0.30
Received Financial Aid										
Truth<Report	7.6	5.6	4.6	3.7	6.1	0.61	0.38	0.31	0.26	0.31
Truth=Report	85.1	88.5	88.8	90.8	88.6	0.81	0.53	0.46	0.39	0.41
Truth>Report	7.3	5.9	6.7	5.5	5.3	0.58	0.39	0.36	0.30	0.28
Received Stafford Loan										
Truth<Report	5.9	4.9	4.2	3.7	5.1	0.45	0.35	0.29	0.27	0.29
Truth=Report	89.7	90.1	89.5	89.6	89.7	0.60	0.48	0.44	0.42	0.40
Truth>Report	4.5	5.0	6.3	6.7	5.2	0.41	0.35	0.35	0.34	0.29
Received Pell Grant										
Truth<Report	3.9	3.5	2.8	3.1	3.4	0.39	0.29	0.23	0.23	0.24
Truth=Report	90.9	92.0	92.6	93.1	92.9	0.59	0.42	0.36	0.33	0.32
Truth>Report	5.2	4.5	4.5	3.8	3.7	0.45	0.32	0.28	0.24	0.23
Received Work Study										
Truth<Report	5.9	5.0	4.9	4.9	4.9	0.54	0.36	0.31	0.29	0.28
Truth=Report	93.5	93.4	92.7	91.7	92.7	0.55	0.40	0.37	0.36	0.32
Truth>Report	0.6	1.6	2.4	3.4	2.4	0.12	0.19	0.21	0.22	0.17
Amount of Work Study										
Truth<Report	5.4	5.4	5.5	6.3	6.2	0.51	0.36	0.32	0.33	0.31
Truth=Report	93.2	91.0	89.9	87.7	88.5	0.55	0.45	0.42	0.42	0.38
Truth>Report	1.3	3.5	4.6	5.9	5.3	0.22	0.27	0.28	0.29	0.25
Received State Aid										
Truth<Report	5.5	5.1	5.6	5.4	5.2	0.49	0.35	0.33	0.30	0.28
Truth=Report	85.6	83.8	81.4	80.6	84.5	0.72	0.56	0.53	0.52	0.45
Truth>Report	8.9	11.1	13.0	14.0	10.3	0.56	0.47	0.45	0.45	0.37
Amount of State Aid										
Truth<Report	6.4	7.1	7.6	8.5	7.2	0.52	0.41	0.37	0.38	0.33
Truth=Report	83.1	78.0	74.4	71.2	78.3	0.77	0.64	0.60	0.60	0.51
Truth>Report	10.4	14.9	18.0	20.3	14.5	0.61	0.54	0.53	0.53	0.43

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	6.3	5.5	4.8	4.9	5.5	0.52	0.37	0.31	0.29	0.29
Truth=Report	88.9	87.2	85.8	84.7	86.3	0.64	0.52	0.49	0.48	0.44
Truth>Report	4.8	7.3	9.3	10.4	8.3	0.40	0.39	0.41	0.41	0.35
Amount of Institutional Aid										
Truth<Report	6.8	7.5	7.4	8.5	8.7	0.53	0.42	0.37	0.37	0.36
Truth=Report	86.3	80.5	76.4	71.9	74.9	0.70	0.61	0.59	0.59	0.53
Truth>Report	6.8	12.0	16.2	19.6	16.4	0.49	0.49	0.51	0.52	0.45
Grade Point Average										
Truth<Report	62.5	60.3	57.8	53.5	54.8	1.30	0.90	0.79	0.75	0.76
Truth=Report	16.7	16.7	16.0	18.3	18.1	0.98	0.67	0.58	0.57	0.57
Truth>Report	20.8	23.1	26.2	28.1	27.0	1.08	0.78	0.70	0.68	0.68

Table A.181: Average Signed Deviations and Standard Errors by Cooperation Interaction Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.00	0.031	-0.08	-0.03	0.035	0.02	0.03	0.03	0.03	0.03
Marriage date	-4.35	0.01	-0.90	-13.1	-11.1	4.57	5.66	4.45	7.14	7.50
Divorce date	-7.00	-6.17	-4.19	-8.95	-4.44	2.99	1.81	2.79	3.42	1.67
Birth date	-0.43	-1.04	-0.51	-12.8	-10.0	0.38	5.80	2.80	5.50	8.65
NPSAS										
Amount of Work Study	-163	-92	-51	-41	-100	28.24	17.39	13.63	17.17	19.65
Amount of State Aid	30	108	171	226	190	18.53	17.36	17.96	19.55	18.10
Amount of Institutional Aid	-63	189	363	376	222	36.09	36.08	38.13	35.16	31.34
Grade Point Average	-0.26	-0.20	-0.17	-0.14	-0.14	0.01	0.01	0.01	0.01	0.01

Table A.182: Average Absolute Deviations by Cooperation Interaction Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.05	0.07	0.09	0.10	0.12	0.02	0.03	0.03	0.03	0.03
Marriage date	16.0	17.2	11.6	24.5	22.4	4.23	5.36	4.30	6.88	7.27
Divorce date	10.6	7.14	7.77	10.1	7.23	2.85	1.77	2.71	3.38	1.56
Birth date	0.86	14.6	5.53	16.0	24.5	0.37	5.61	2.75	5.43	8.39
NPSAS										
Amount of Work Study	196	202	210	255	257	28.16	17.16	13.34	16.87	19.48
Amount of State Aid	259	374	465	590	490	18.02	16.61	16.94	18.26	17.05
Amount of Institutional Aid	386	624	764	877	778	35.09	34.89	36.97	33.40	29.97
Grade Point Average	0.36	0.27	0.25	0.22	0.22	0.01	0.01	0.01	0.01	0.01

Table A.183: Item Nonresponse Rates and Standard Errors by Interview Main Effects Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	2.35	3.49	1.92	0.00	0.00	1.65	1.99	1.35	0.00	0.00
Number of marriages	1.18	2.33	0.00	0.00	0.00	1.18	1.63	0.00	0.00	0.00
Marriage date	8.24	4.65	1.92	0.00	0.79	3.00	2.28	1.35	0.00	0.79
Divorce date	18.82	11.63	5.77	5.79	4.72	4.27	3.48	2.30	2.13	1.89
Birth date	2.35	0.00	0.00	0.83	0.79	1.65	0.00	0.00	0.83	0.79
NPSAS										
Applied for Financial Aid	0.45	0.65	0.55	0.59	0.42	0.12	0.14	0.11	0.11	0.09
Received Financial Aid	0.55	0.59	0.59	0.64	0.51	0.14	0.13	0.11	0.12	0.10
Received Stafford Loan	0.92	0.86	0.87	0.90	0.57	0.18	0.15	0.13	0.14	0.10
Received Pell Grant	0.94	0.96	1.02	0.74	0.75	0.18	0.16	0.14	0.12	0.12
Received Work Study	2.60	2.51	2.08	1.86	2.29	0.30	0.26	0.21	0.17	0.20
Amount of Work Study	2.26	2.13	1.94	2.00	1.91	0.30	0.24	0.19	0.19	0.17
Received State Aid	0.89	0.87	0.77	0.85	0.83	0.21	0.15	0.12	0.14	0.12
Amount of State Aid	2.73	2.65	2.37	3.05	2.24	0.35	0.25	0.21	0.23	0.19
Received Institutional Aid	0.89	0.87	0.77	0.85	0.83	0.21	0.15	0.12	0.14	0.12
Amount of Institutional Aid	2.42	2.18	2.05	2.46	2.34	0.32	0.23	0.19	0.21	0.19
Grade Point Average	6.24	5.81	3.97	3.21	3.36	0.48	0.37	0.26	0.22	0.21

Table A.184: Mismatch Rates and Standard Errors by Interview Main Effects Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	2.35	3.49	0.96	0.83	0.79	1.65	1.99	0.96	0.83	0.79
Ever divorced	9.64	9.64	7.84	9.92	4.72	3.26	3.26	2.68	2.73	1.89
Number of marriages	10.71	14.29	7.69	7.44	6.30	3.39	3.84	2.63	2.40	2.16
Marriage date	42.11	35.44	35.64	30.83	23.20	5.70	5.42	4.79	4.23	3.79
Divorce date	63.93	55.88	54.44	48.04	38.26	6.20	6.07	5.28	4.97	4.55
Birth date	10.84	10.59	12.50	13.33	7.14	3.43	3.36	3.26	3.12	2.30
NPSAS										
Applied for Financial Aid	14.1	13.4	11.0	10.5	11.3	0.8	0.6	0.5	0.4	0.4
Received Financial Aid	15.2	12.3	10.4	9.9	10.9	0.8	0.6	0.4	0.4	0.4
Received Stafford Loan	12.4	9.7	10.5	9.9	10.3	0.7	0.5	0.4	0.4	0.4
Received Pell Grant	10.5	8.9	6.8	6.3	7.1	0.6	0.5	0.3	0.3	0.3
Received Work Study	7.5	5.8	6.9	9.1	7.0	0.6	0.4	0.4	0.4	0.3
Amount of Work Study	7.5	7.2	9.7	12.9	12.0	0.6	0.4	0.4	0.4	0.4
Received State Aid	17.3	17.3	17.6	17.9	16.2	0.8	0.6	0.5	0.5	0.5
Amount of State Aid	20.0	22.4	25.4	26.3	22.9	0.9	0.7	0.6	0.6	0.5
Received Institutional Aid	12.3	11.8	14.0	13.9	15.4	0.7	0.5	0.5	0.5	0.5
Amount of Institutional Aid	14.2	16.0	23.7	27.0	28.1	0.7	0.6	0.6	0.6	0.5
Grade Point Average	81.2	84.2	84.1	81.5	82.2	1.1	0.7	0.6	0.6	0.5

Table A.185: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Interview Main Effects Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	6.0	7.1	3.9	4.1	3.9	2.6	2.8	1.9	1.8	1.7
Truth=Report	89.3	85.7	92.3	92.6	93.7	3.4	3.8	2.6	2.4	2.2
Truth>Report	4.8	7.1	3.9	3.3	2.4	2.3	2.8	1.9	1.6	1.3
Marriage date										
Truth<Report	28.2	19.5	25.5	16.5	11.1	5.1	4.4	4.3	3.4	2.8
Truth=Report	56.4	62.2	63.7	68.6	76.2	5.6	5.4	4.8	4.2	3.8
Truth>Report	15.4	18.3	10.8	14.9	12.7	4.1	4.3	3.1	3.2	3.0
Divorce date										
Truth<Report	53.6	42.1	39.8	36.8	33.1	6.0	5.7	4.9	4.5	4.3
Truth=Report	31.9	39.5	41.8	46.5	58.7	5.6	5.6	5.0	4.7	4.5
Truth>Report	14.5	18.4	18.4	16.7	8.3	4.2	4.4	3.9	3.5	2.5
Birth date										
Truth<Report	6.0	8.1	8.7	7.5	4.0	2.6	2.9	2.8	2.4	1.7
Truth=Report	89.2	88.4	87.5	86.7	92.9	3.4	3.5	3.2	3.1	2.3
Truth>Report	4.8	3.5	3.9	5.8	3.2	2.4	2.0	1.9	2.1	1.6
NPSAS										
Applied for Financial Aid										
Truth<Report	5.8	4.5	4.5	5.2	5.8	0.5	0.3	0.3	0.3	0.3
Truth=Report	85.9	86.6	89.0	89.5	88.7	0.8	0.6	0.5	0.4	0.4
Truth>Report	8.4	8.9	6.5	5.3	5.5	0.6	0.5	0.4	0.3	0.3
Received Financial Aid										
Truth<Report	7.9	5.2	4.6	4.7	5.3	0.6	0.4	0.3	0.3	0.3
Truth=Report	84.8	87.7	89.6	90.1	89.1	0.8	0.6	0.4	0.4	0.4
Truth>Report	7.3	7.1	5.8	5.2	5.6	0.6	0.4	0.3	0.3	0.3
Received Stafford Loan										
Truth<Report	6.6	4.4	4.4	4.0	4.8	0.5	0.3	0.3	0.3	0.3
Truth=Report	87.6	90.3	89.5	90.1	89.7	0.7	0.5	0.4	0.4	0.4
Truth>Report	5.8	5.3	6.1	5.9	5.5	0.5	0.4	0.3	0.3	0.3
Received Pell Grant										
Truth<Report	3.9	3.7	2.7	3.1	3.4	0.4	0.3	0.2	0.2	0.2
Truth=Report	89.5	91.1	93.2	93.7	92.9	0.6	0.5	0.3	0.3	0.3
Truth>Report	6.6	5.2	4.2	3.2	3.7	0.5	0.3	0.3	0.2	0.2
Received Work Study										
Truth<Report	6.8	4.4	4.8	5.5	4.6	0.6	0.3	0.3	0.3	0.3
Truth=Report	92.5	94.2	93.1	90.9	93.0	0.6	0.4	0.4	0.4	0.3
Truth>Report	0.7	1.4	2.1	3.6	2.4	0.2	0.2	0.2	0.2	0.2
Amount of Work Study										
Truth<Report	6.0	4.6	5.6	6.6	6.2	0.5	0.3	0.3	0.3	0.3
Truth=Report	92.5	92.8	90.3	87.1	88.0	0.6	0.4	0.4	0.4	0.4
Truth>Report	1.5	2.6	4.1	6.3	5.9	0.3	0.2	0.3	0.3	0.3
Received State Aid										
Truth<Report	6.8	5.3	4.5	5.2	5.8	0.6	0.4	0.3	0.3	0.3
Truth=Report	82.7	82.7	82.4	82.1	83.8	0.8	0.6	0.5	0.5	0.5
Truth>Report	10.5	12.0	13.1	12.7	10.3	0.6	0.5	0.5	0.4	0.4
Amount of State Aid										
Truth<Report	7.8	7.3	7.1	7.7	7.8	0.6	0.4	0.4	0.4	0.3
Truth=Report	80.0	77.6	74.6	73.7	77.1	0.9	0.7	0.6	0.6	0.5
Truth>Report	12.2	15.2	18.3	18.6	15.1	0.7	0.6	0.5	0.5	0.4

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	7.2	5.1	4.9	4.6	5.6	0.6	0.4	0.3	0.3	0.3
Truth=Report	87.7	88.2	86.0	86.1	84.6	0.7	0.5	0.5	0.5	0.5
Truth>Report	5.0	6.7	9.1	9.3	9.8	0.4	0.4	0.4	0.4	0.4
Amount of Institutional Aid										
Truth<Report	7.6	6.4	7.8	8.4	9.0	0.6	0.4	0.4	0.4	0.4
Truth=Report	85.8	84.0	76.3	73.0	71.9	0.7	0.6	0.6	0.6	0.5
Truth>Report	6.6	9.6	15.9	18.6	19.1	0.5	0.5	0.5	0.5	0.5
Grade Point Average										
Truth<Report	61.1	61.4	58.6	54.2	53.6	1.3	0.9	0.8	0.7	0.7
Truth=Report	18.8	15.8	15.9	18.5	17.8	1.1	0.7	0.6	0.6	0.5
Truth>Report	20.1	22.8	25.5	27.3	28.6	1.1	0.8	0.7	0.7	0.7

Table A.186: Average Signed Difference and Standard Errors of Signed Difference by Main Effects Interview Model Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	-0.01	0.00	0.00	-0.02	-0.02	0.04	0.04	0.03	0.03	0.02
Marriage date	-5.08	-10.20	-7.12	-12.40	1.74	7.77	7.85	7.18	6.91	1.51
Divorce date	-6.18	-5.04	-8.26	-7.92	-3.56	2.15	1.95	3.66	3.37	1.07
Birth date	-4.90	-9.96	-5.96	-8.83	0.63	6.31	7.93	5.05	6.10	4.18
NPSAS										
Amount of Work Study	-181	-92	-76	-33	-80	28.2	17.1	17.4	17.2	17.4
Amount of State Aid	23	78	183	239	186	21.8	16.8	17.9	18.8	18.5
Amount of Institutional Aid	-176	95	377	388	289	45.4	29.0	37.4	35.4	32.6
Grade Point Average	-0.28	-0.22	-0.18	-0.14	-0.12	0.02	0.01	0.01	0.01	0.01

Table A.187: Average Absolute Difference and Standard Errors of Absolute Difference by Main Effects Interview Model Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.11	0.14	0.08	0.08	0.06	0.03	0.04	0.03	0.03	0.02
Marriage date	24.84	18.43	23.51	25.17	4.93	7.24	7.66	6.82	6.61	1.45
Divorce date	8.97	7.96	11.03	10.29	5.23	1.98	1.80	3.57	3.31	1.00
Birth date	13.84	13.07	11.88	19.33	7.46	6.15	7.88	4.95	5.90	4.13
NPSAS										
Amount of Work Study	226	170	220	262	252	28.0	17.0	17.1	16.9	17.2
Amount of State Aid	316	353	466	540	527	20.9	16.1	16.9	17.7	17.5
Amount of Institutional Aid	411	445	779	860	880	44.7	27.8	36.1	33.9	31.3
Grade Point Average	0.38	0.31	0.27	0.22	0.19	0.01	0.01	0.01	0.01	0.00

Table A.188: Item Nonresponse Rates and Standard Errors by Interview Interaction Effects Propensity Strata, WDS and NPSAS

	Item Nonresponse					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married										
Ever divorced	1.54	1.04	0.95	2.46	0.74	1.54	1.04	0.95	1.41	0.74
Number of marriages	0.00	1.04	0.00	1.64	0.00	0.00	1.04	0.00	1.15	0.00
Marriage date	6.15	6.25	0.00	2.46	0.74	3.00	2.48	0.00	1.41	0.74
Divorce date	10.77	9.38	7.62	8.20	8.15	3.87	2.99	2.60	2.49	2.36
Birth date	3.08	0.00	0.95	0.82	0.00	2.16	0.00	0.95	0.82	0.00
NPSAS										
Applied for Financial Aid	0.25	0.94	0.43	0.58	0.43	0.08	0.18	0.08	0.12	0.08
Received Financial Aid	0.40	0.91	0.51	0.59	0.49	0.13	0.17	0.10	0.12	0.08
Received Stafford Loan	1.00	0.92	0.69	0.97	0.62	0.21	0.16	0.12	0.15	0.10
Received Pell Grant	0.92	0.96	0.87	0.90	0.75	0.20	0.16	0.13	0.14	0.11
Received Work Study	2.47	2.30	1.87	2.22	2.27	0.31	0.25	0.19	0.21	0.19
Amount of Work Study	1.93	2.14	1.86	2.16	1.92	0.31	0.24	0.19	0.20	0.16
Received State Aid	0.73	1.16	0.74	0.87	0.71	0.19	0.19	0.12	0.14	0.10
Amount of State Aid	2.44	2.91	2.79	2.72	2.17	0.32	0.27	0.23	0.23	0.17
Received Institutional Aid	0.73	1.16	0.74	0.87	0.71	0.19	0.19	0.12	0.14	0.10
Amount of Institutional Aid	2.44	2.53	2.04	2.33	2.24	0.33	0.25	0.19	0.20	0.18
Grade Point Average	6.81	4.69	3.94	3.35	3.77	0.52	0.32	0.25	0.24	0.22

Table A.189: Mismatch Rates and Standard Errors by Interview Interaction Effects Propensity Strata, WDS and NPSAS

	Mismatch Rates					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Ever married	3.08	1.04	0.95	2.46	0.74	2.16	1.04	0.95	1.41	0.74
Ever divorced	6.25	10.5	7.69	7.56	8.21	3.05	3.17	2.63	2.43	2.38
Number of marriages	9.23	11.6	7.62	10.8	5.93	3.62	3.30	2.60	2.85	2.04
Marriage date	45.8	39.3	28.9	31.0	25.6	6.54	5.21	4.46	4.31	3.80
Divorce date	59.3	54.6	46.1	58.3	38.9	6.75	5.71	5.31	4.88	4.61
Birth date	7.94	12.6	11.5	8.26	12.6	3.43	3.43	3.15	2.51	2.87
NPSAS										
Applied for Financial Aid	15.0	13.0	10.8	10.1	11.7	0.8	0.6	0.5	0.4	0.4
Received Financial Aid	14.8	12.5	10.7	9.6	10.8	0.8	0.6	0.4	0.4	0.4
Received Stafford Loan	10.9	10.0	9.4	10.7	10.7	0.6	0.5	0.4	0.4	0.4
Received Pell Grant	9.8	8.9	7.7	5.9	6.9	0.6	0.5	0.4	0.3	0.3
Received Work Study	6.9	6.6	7.3	7.8	7.6	0.6	0.4	0.4	0.4	0.3
Amount of Work Study	7.1	8.9	10.0	11.3	12.2	0.6	0.4	0.4	0.4	0.4
Received State Aid	16.3	17.9	18.0	17.8	16.0	0.8	0.6	0.5	0.5	0.4
Amount of State Aid	19.1	23.4	25.2	26.2	23.1	0.8	0.7	0.6	0.6	0.5
Received Institutional Aid	11.9	12.3	13.7	14.7	14.7	0.7	0.5	0.5	0.5	0.4
Amount of Institutional Aid	13.7	18.9	23.1	26.5	27.1	0.7	0.6	0.6	0.6	0.5
Grade Point Average	82.2	83.0	83.5	82.7	82.0	1.0	0.7	0.6	0.6	0.5

Table A.190: Percent Overreporting, Accurate Reporting, and Underreporting and Standard Error of Percent by Interview Interaction Propensity Strata, WDS and NPSAS

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages										
Truth<Report	3.1	5.3	4.8	6.7	3.7	2.1	2.3	2.1	2.3	1.6
Truth=Report	90.8	88.4	92.4	89.2	94.1	3.6	3.3	2.6	2.8	2.0
Truth>Report	6.2	6.3	2.9	4.2	2.2	3.0	2.5	1.6	1.8	1.3
Marriage date										
Truth<Report	31.2	23.3	16.2	21.9	11.2	5.9	4.5	3.6	3.8	2.7
Truth=Report	52.5	60.0	70.5	67.2	73.9	6.4	5.2	4.5	4.3	3.8
Truth>Report	16.4	16.7	13.3	10.9	14.9	4.7	3.9	3.3	2.9	3.1
Divorce date										
Truth<Report	46.6	41.4	35.1	42.9	36.3	6.5	5.3	4.8	4.7	4.3
Truth=Report	37.9	40.2	49.5	38.4	55.7	6.4	5.3	5.1	4.6	4.5
Truth>Report	15.5	18.4	15.5	18.8	8.1	4.8	4.2	3.7	3.7	2.4
Birth date										
Truth<Report	4.8	8.3	9.6	5.8	5.2	2.7	2.8	2.9	2.1	1.9
Truth=Report	92.1	86.5	88.5	91.7	87.4	3.4	3.5	3.1	2.5	2.9
Truth>Report	3.2	5.2	1.9	2.5	7.4	2.2	2.3	1.3	1.4	2.3
NPSAS										
Applied for Financial Aid										
Truth<Report	5.6	5.0	4.5	4.5	6.1	0.5	0.4	0.3	0.3	0.3
Truth=Report	85.0	87.0	89.2	89.9	88.3	0.8	0.6	0.5	0.4	0.4
Truth>Report	9.4	8.0	6.3	5.5	5.6	0.7	0.4	0.3	0.3	0.3
Received Financial Aid										
Truth<Report	7.2	5.8	4.6	4.4	5.4	0.6	0.4	0.3	0.3	0.3
Truth=Report	85.2	87.5	89.3	90.4	89.2	0.8	0.6	0.4	0.4	0.4
Truth>Report	7.6	6.7	6.1	5.2	5.4	0.6	0.4	0.3	0.3	0.3
Received Stafford Loan										
Truth<Report	6.0	5.2	3.7	4.1	4.9	0.5	0.4	0.3	0.3	0.3
Truth=Report	89.1	90.0	90.6	89.3	89.3	0.6	0.5	0.4	0.4	0.4
Truth>Report	4.9	4.8	5.7	6.5	5.9	0.5	0.3	0.3	0.3	0.3
Received Pell Grant										
Truth<Report	3.7	4.0	2.8	2.7	3.5	0.4	0.3	0.2	0.2	0.2
Truth=Report	90.2	91.1	92.3	94.1	93.1	0.6	0.5	0.4	0.3	0.3
Truth>Report	6.1	5.0	4.9	3.2	3.4	0.5	0.3	0.3	0.2	0.2
Received Work Study										
Truth<Report	6.2	5.3	5.0	4.7	4.9	0.6	0.4	0.3	0.3	0.3
Truth=Report	93.1	93.4	92.7	92.2	92.4	0.6	0.4	0.4	0.4	0.3
Truth>Report	0.7	1.3	2.4	3.1	2.7	0.2	0.2	0.2	0.2	0.2
Amount of Work Study										
Truth<Report	5.7	5.6	5.3	6.1	6.4	0.5	0.4	0.3	0.3	0.3
Truth=Report	92.9	91.1	90.0	88.7	87.8	0.6	0.4	0.4	0.4	0.4
Truth>Report	1.4	3.3	4.7	5.2	5.8	0.2	0.3	0.3	0.3	0.3
Received State Aid										
Truth<Report	5.9	5.5	5.6	5.0	5.3	0.5	0.4	0.3	0.3	0.3
Truth=Report	83.7	82.1	82.0	82.2	84.0	0.8	0.6	0.5	0.5	0.4
Truth>Report	10.4	12.4	12.4	12.8	10.8	0.6	0.5	0.4	0.4	0.4
Amount of State Aid										
Truth<Report	6.9	7.3	7.6	7.9	7.5	0.5	0.4	0.4	0.4	0.3
Truth=Report	80.9	76.6	74.8	73.8	76.9	0.8	0.7	0.6	0.6	0.5
Truth>Report	12.3	16.2	17.6	18.3	15.5	0.7	0.6	0.5	0.5	0.4

	Measurement Error Direction					SE				
	Low	2	3	4	High	Low	2	3	4	High
Received Institutional Aid										
Truth<Report	7.0	5.1	4.9	4.5	5.7	0.6	0.3	0.3	0.3	0.3
Truth=Report	88.1	87.7	86.3	85.3	85.3	0.7	0.5	0.5	0.5	0.4
Truth>Report	4.9	7.2	8.8	10.1	9.0	0.4	0.4	0.4	0.4	0.3
Amount of Institutional Aid										
Truth<Report	7.3	7.2	7.2	8.3	9.0	0.6	0.4	0.4	0.4	0.4
Truth=Report	86.3	81.1	76.9	73.5	72.9	0.7	0.6	0.6	0.6	0.5
Truth>Report	6.5	11.7	15.9	18.2	18.1	0.5	0.5	0.5	0.5	0.4
Grade Point Average										
Truth<Report	61.1	60.8	57.6	55.2	53.7	1.3	0.9	0.8	0.8	0.7
Truth=Report	17.8	17.0	16.5	17.3	18.0	1.0	0.7	0.6	0.6	0.5
Truth>Report	21.2	22.2	25.9	27.5	28.2	1.1	0.8	0.7	0.7	0.7

Table A.191: Average Signed Deviation and Standard Errors by Interview Interaction Propensity Strata, WDS and NPSAS

	Signed Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.03	0.01	-0.02	-0.03	-0.02	0.04	0.04	0.03	0.03	0.02
Marriage date	0.39	-10.5	-10.3	-10.3	0.03	7.27	8.42	7.19	5.37	4.06
Divorce date	-8.17	-4.66	-5.97	-8.53	-4.16	2.86	1.66	3.16	3.67	1.05
Birth date	-0.87	-3.72	-13.3	-8.14	-0.56	2.77	6.48	6.44	5.05	5.65
NPSAS										
Amount of Work Study	-156	-103	-72	-30	-86	26.2	18.1	17.7	16.4	17.6
Amount of State Aid	49	121	175	200	194	18.9	18.4	19.8	17.8	17.8
Amount of Institutional Aid	-79	182	379	333	262	42.2	40.5	34.2	36.2	30.9
Grade Point Average	-0.27	-0.20	-0.18	-0.16	-0.12	0.01	0.01	0.01	0.01	0.01

Table A.192: Average Absolute Deviations and Standard Errors by Interview Interaction Propensity Strata, WDS and NPSAS

	Absolute Difference					SE				
	Low	2	3	4	High	Low	2	3	4	High
WDS										
Number of marriages	0.09	0.12	0.08	0.12	0.06	0.04	0.03	0.03	0.03	0.02
Marriage date	19.98	28.58	19.98	17.50	11.46	6.78	7.92	6.99	5.20	3.93
Divorce date	10.06	7.49	8.98	12.15	4.97	2.74	1.52	3.08	3.57	1.02
Birth date	4.56	16.73	14.42	11.66	14.58	2.71	6.26	6.41	5.00	5.50
NPSAS										
Amount of Work Study	193	196	240	222	265	26.1	18.0	17.3	16.2	17.4
Amount of State Aid	276	400	488	518	513	18.2	17.6	18.7	16.7	16.8
Amount of Institutional Aid	391	606	716	845	847	41.4	39.5	33.1	34.6	29.6
Grade Point Average	0.37	0.28	0.26	0.23	0.20	0.01	0.01	0.01	0.01	0.005

Table A.193: Correlation Between Contact Propensity and Item Nonresponse, Four Contact Propensity Models, WDS and NPSAS

	corr(Item Nonresponse,p)			
	At home patterns	Access Impediments	Combined	Interaction
WDS				
Ever divorced	-0.056	0.032	-0.044	-0.085
Birth date	0.019	-0.060	0.030	-0.010
Number of marriages	-0.066	0.004	-0.065	-0.098
Marriage Date	-0.121	-0.064	-0.135	-0.143
Divorce Date	-0.122	-0.027	-0.112	-0.074
NPSAS				
Applied for Financial Aid	0.000	0.003	0.001	0.000
Received Financial Aid	0.000	0.005	0.002	0.006
Received Stafford Loan	-0.010	-0.004	-0.006	-0.002
Received Pell Grant	-0.004	0.007	0.003	0.011
Received Work Study	-0.032	-0.012	-0.024	-0.012
Amount of Work Study	-0.005	-0.009	-0.009	0.002
Received State Aid	-0.001	0.008	0.004	0.007
Amount of State Aid	-0.005	0.012	0.002	0.002
Received Institutional Aid	-0.001	0.008	0.004	0.007
Amount of Institutional Aid	0.012	0.025	0.017	0.021
Grade Point Average	-0.064	-0.063	-0.063	-0.043

Table A.194: Correlation Between Contact Propensity and Mismatch Between Record and Reports, Four Contact Propensity Models, WDS and NPSAS

	corr(Mismatch,p)			
	At home patterns	Access Impediments	Combined	Interactions
WDS				
Ever married	-0.072	-0.165	-0.097	-0.084
Ever divorced	-0.118	-0.076	-0.129	-0.098
Birth date	-0.105	-0.074	-0.120	-0.094
Number of marriages	-0.078	-0.070	-0.097	-0.098
Marriage Date	-0.092	0.025	-0.090	-0.069
Divorce Date	-0.129	0.009	-0.129	-0.106
NPSAS				
Applied for Financial Aid	-0.048	-0.034	-0.045	-0.030
Received Financial Aid	-0.043	-0.038	-0.051	-0.035
Received Stafford Loan	-0.003	0.022	0.002	0.002
Received Pell Grant	-0.038	-0.037	-0.048	-0.021
Received Work Study	0.028	0.030	0.026	0.025
Amount of Work Study	0.074	0.094	0.086	0.066
Received State Aid	-0.013	-0.028	-0.022	-0.025
Amount of State Aid	0.021	-0.002	0.012	0.002
Received Institutional Aid	0.041	0.051	0.040	0.037
Amount of Institutional Aid	0.142	0.165	0.156	0.113
Grade Point Average	0.009	-0.024	-0.015	-0.004

Table A.195: Correlation between Signed Deviations and Contact Propensity, Four Contact Propensity Models, WDS and NPSAS

	corr(Signed Difference,p)			
	At home patterns	Access Impediments	Combined	Interaction
WDS				
Birth date	0.122	0.013	0.127	0.079
Number of marriages	-0.064	-0.064	-0.077	-0.065
Marriage Date	0.103	0.003	0.103	0.106
Divorce Date	0.038	-0.013	0.039	0.043
NPSAS				
Amount of Work Study	0.017	0.030	0.025	0.018
Amount of State Aid	0.041	0.011	0.029	0.017
Amount of Institutional Aid	0.067	0.077	0.073	0.053
Grade Point Average	0.114	0.113	0.130	0.086

Table A.196: Correlation between Signed Deviations and Contact Propensity, Four Contact Propensity Models, WDS and NPSAS

	corr(Absolute Difference,p)			
	At home patterns	Access Impediments	Combined	Interaction
WDS				
Birth date	-0.140	-0.095	-0.153	-0.111
Number of marriages	-0.073	-0.062	-0.089	-0.088
Marriage Date	-0.147	-0.007	-0.139	-0.130
Divorce Date	-0.052	0.015	-0.054	-0.056
NPSAS				
Amount of Work Study	0.024	0.022	0.024	0.020
Amount of State Aid	0.063	0.032	0.048	0.029
Amount of Institutional Aid	0.095	0.130	0.118	0.084
Grade Point Average	-0.159	-0.158	-0.177	-0.119

Table A.197: Correlation between Item Nonresponse and Cooperation Propensity, Six Cooperation Propensity Models, WDS and NPSAS

	corr(Item Nonresponse,p)					
	Social Isolation	Social Environ-mental Factors	Discretionary Time	Positive Affect Toward Sponsor	Combined	Interaction
WDS						
Ever divorced	-0.043	-0.015	0.027	0.036	-0.029	-0.016
Birth date	0.046	-0.082	-0.074	0.046	-0.033	-0.038
Number of marriages	0.013	-0.012	0.043	-0.009	0.008	0.006
Marriage Date	-0.029	-0.088	0.104	0.016	-0.027	-0.063
Divorce Date	-0.025	-0.015	0.043	-0.014	-0.048	0.001
NPSAS						
Applied for Financial Aid	-0.004	-0.010	0.006	0.003	-0.006	-0.006
Received Financial Aid	0.000	-0.011	0.010	0.001	-0.003	-0.003
Received Stafford Loan	0.001	-0.024	0.007	0.000	-0.014	-0.011
Received Pell Grant	0.004	-0.018	0.009	0.004	-0.012	-0.004
Received Work Study	0.005	-0.005	-0.027	0.007	-0.003	0.003
Amount of Work Study	-0.009	-0.002	0.002	0.001	-0.005	-0.007
Received State Aid	-0.002	-0.007	0.009	0.004	-0.003	-0.005
Amount of State Aid	-0.012	0.001	-0.003	0.000	-0.008	-0.012
Received Institutional Aid	-0.002	-0.007	0.009	0.004	-0.003	-0.005
Amount of Institutional Aid	-0.009	0.006	0.011	0.022	-0.003	-0.008
Grade Point Average	0.007	-0.061	-0.068	-0.076	-0.045	-0.026

Table A.198: Correlation between Mismatch of Record and Report and Cooperation Propensity, Six Cooperation Models, WDS and NPSAS

	corr(Mismatch,p)					
	Social Isolation	Social Environ-mental Factors	Discretion-ary Time	Positive Affect Toward Sponsor	Combined	Interaction
WDS						
Ever married	-0.026	-0.123	-0.014	0.130	0.031	0.049
Ever divorced	-0.013	-0.020	0.020	0.045	0.039	0.079
Birth date	-0.007	-0.017	-0.029	0.007	0.023	0.048
Number of marriages	-0.066	-0.063	0.035	0.045	0.004	0.074
Marriage Date	-0.103	0.041	0.033	-0.054	-0.053	-0.020
Divorce Date	-0.131	0.066	0.054	-0.001	-0.073	-0.064
NPSAS						
Applied for Financial Aid	0.030	-0.028	-0.083	0.010	-0.020	-0.015
Received Financial Aid	0.033	-0.019	-0.064	-0.002	-0.023	-0.017
Received Stafford Loan	-0.009	0.020	0.022	0.024	-0.007	0.000
Received Pell Grant	0.018	-0.026	-0.010	-0.038	-0.023	-0.015
Received Work Study	-0.022	0.032	0.026	0.051	0.009	0.008
Amount of Work Study	-0.025	0.081	0.061	0.108	0.046	0.039
Received State Aid	0.007	-0.011	0.025	-0.048	0.002	0.002
Amount of State Aid	0.008	0.011	0.054	-0.027	0.025	0.019
Received Institutional Aid	0.008	0.049	0.037	0.058	0.031	0.015
Amount of Institutional Aid	-0.016	0.128	0.114	0.160	0.087	0.065
Grade Point Average	-0.027	-0.007	0.015	-0.012	-0.008	-0.018

Table A.199: Correlation between Signed Differences and Cooperation Propensity, Six Cooperation Propensity Models, WDS and NPSAS

	corr(Signed Difference,p)					
	Social Isolation	Social Environ-mental Factors	Discretion-ary Time	Positive Affect Toward Sponsor	Combined	Interaction
WDS						
Birth date	-0.062	0.015	-0.076	-0.009	-0.059	-0.065
Number of marriages	0.017	-0.062	-0.039	0.066	0.028	-0.027
Marriage Date	-0.018	0.021	-0.085	-0.020	-0.057	-0.050
Divorce Date	0.088	0.007	0.025	-0.031	0.032	0.001
NPSAS						
Amount of Work Study	0.013	0.017	-0.003	-0.005	0.012	0.007
Amount of State Aid	0.027	0.023	0.053	0.019	0.042	0.034
Amount of Institutional Aid	-0.037	0.036	0.056	0.075	0.025	0.016
Grade Point Average	0.035	0.090	0.101	0.118	0.099	0.077

Table A.200: Correlation between Absolute Deviation and Cooperation Propensity, Six Cooperation Propensity Models, WDS and NPSAS

	corr(Absolute Difference,p)					
	Social Isolation	Social Environ-mental Factors	Discretion-ary Time	Positive Affect Toward Sponsor	Combined	Interaction
WDS						
Birth date	0.054	-0.025	0.038	0.035	0.088	0.099
Number of marriages	-0.068	-0.056	0.042	0.042	0.005	0.075
Marriage Date	0.010	0.028	0.025	-0.021	0.027	0.045
Divorce Date	-0.079	-0.012	-0.016	0.023	-0.033	-0.008
NPSAS						
Amount of Work Study	-0.018	0.023	0.035	0.043	0.015	0.016
Amount of State Aid	0.024	0.050	0.081	0.043	0.059	0.048
Amount of Institutional Aid	-0.002	0.067	0.077	0.162	0.049	0.032
Grade Point Average	-0.022	-0.129	-0.142	-0.156	-0.125	-0.094

Table A.201: Correlation Between Item Nonresponse and Interview Propensity, Two Interview Propensity Models, WDS and NPSAS

	corr(Item Nonresponse,p)	
	Main Effects	Interaction
WDS		
Ever divorced	-0.067	-0.024
Birth date	-0.019	-0.073
Number of marriages	-0.057	-0.012
Marriage Date	-0.137	-0.130
Divorce Date	-0.137	-0.042
NPSAS		
Applied for Financial Aid	-0.005	-0.006
Received Financial Aid	-0.002	-0.004
Received Stafford Loan	-0.014	-0.011
Received Pell Grant	-0.010	-0.004
Received Work Study	-0.007	0.004
Amount of Work Study	-0.006	-0.002
Received State Aid	-0.002	-0.006
Amount of State Aid	-0.007	-0.012
Received Institutional Aid	-0.002	-0.006
Amount of Institutional Aid	0.001	-0.007
Grade Point Average	-0.051	-0.035

Table A.202: Correlation Between Mismatch and Interview Propensity Strata, Two Interview Propensity Models, WDS and NPSAS

	corr(Mismatch,p)	
	Main Effects	Interaction
WDS		
Ever married	-0.059	-0.022
Ever divorced	-0.032	0.017
Birth date	-0.029	0.028
Number of marriages	-0.082	-0.035
Marriage Date	-0.112	-0.110
Divorce Date	-0.147	-0.097
NPSAS		
Applied for Financial Aid	-0.025	-0.016
Received Financial Aid	-0.030	-0.026
Received Stafford Loan	-0.007	0.002
Received Pell Grant	-0.028	-0.028
Received Work Study	0.013	0.010
Amount of Work Study	0.058	0.046
Received State Aid	-0.005	-0.011
Amount of State Aid	0.021	0.011
Received Institutional Aid	0.036	0.022
Amount of Institutional Aid	0.108	0.082
Grade Point Average	-0.010	-0.013

Table A.203: Correlation Between Signed Deviations and Interview Propensity, Two Interview Propensity Models, WDS and NPSAS

	corr(Signed Difference,p)	
	Main Effects	Interaction
WDS		
Birth date	0.019	-0.017
Number of marriages	-0.032	-0.042
Marriage Date	0.023	0.001
Divorce Date	0.031	0.004
NPSAS		
Amount of Work Study	0.016	0.011
Amount of State Aid	0.042	0.033
Amount of Institutional Aid	0.038	0.019
Grade Point Average	0.111	0.091

Table A.204: Correlation Between Absolute Difference and Interview Propensity, Two Interview Propensity Models, WDS and NPSAS

	corr(Absolute Difference,p)	
	Main Effects	Interaction
WDS		
Birth date	-0.017	0.044
Number of marriages	-0.075	-0.029
Marriage Date	-0.076	-0.054
Divorce Date	-0.044	-0.024
NPSAS		
Amount of Work Study	0.018	0.019
Amount of State Aid	0.060	0.047
Amount of Institutional Aid	0.067	0.046
Grade Point Average	-0.143	-0.114

Table A.205: Means and Standard Error for Survey Variables of Interest, Full Sample Using Records, Respondents Only Using Records, and Respondents Only Using Reports, WDS and NPSAS

	Overall		Respondents Only			
	Record		Record		Report	
	Mean	SE	Mean	SE	Mean	SE
DS						
Ever Married	100.0	0.00	100.0	0.00	98.47	0.54
Ever Divorced	100.0	0.00	100.0	0.00	91.86	1.20
Months Since Marriage	180.04	3.63	184.60	4.35	192.38	4.88
Months Since Divorce	49.75	0.90	50.44	1.06	55.74	1.62
Number of marriages	1.22	0.02	1.20	0.02	1.21	0.02
NPSAS						
Applied for financial aid	72.65	0.25	73.5	0.29	72.20	0.30
Received financial aid	63.65	0.26	65.11	0.31	64.39	0.31
Received Stafford loan	35.79	0.26	37.37	0.31	35.98	0.31
Received Pell Grant	29.02	0.24	28.96	0.29	27.71	0.29
Received Work Study	6.17	0.12	6.93	0.15	9.68	0.19
Amount of Work Study	128	3.40	146	4.47	220	8.06
Received State Aid	20.8	0.21	21.7	0.25	15.14	0.23
Amount of State Aid	463	6.16	502	7.84	317	7.53
Received Institutional Aid	21.7	0.21	23.3	0.25	19.95	0.24
Amount of Institutional Aid	1111	19.58	1217	19.91	904	17.16
Grade Point Average	2.91	0.00	2.97	0.00	3.43	0.01

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