



## **Respondent Behaviour in Panel Studies – A Case Study for Income-Nonresponse by Means of the British Household Panel Study (BHPS)**

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The British Household Panel Survey is one of the main instruments for measuring social change in Britain. The BHPS comprises a nationally representative sample of around 5,500 households and over 10,000 individuals who are reinterviewed each year. The questionnaire includes a constant core of items accompanied by a variable component in order to provide for the collection of initial conditions data and to allow for the subsequent inclusion of emerging research and policy concerns.

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BHPS data provide the academic community, policymakers and private sector with a unique national resource and allow for comparative research with similar studies in Europe, the United States and Canada.

BHPS data are available from the Data Archive at the University of Essex  
<http://www.data-archive.ac.uk>

Further information about the BHPS and other longitudinal surveys can be obtained by telephoning +44 (0) 1206 873543.

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## ABSTRACT

Many validation studies deal with item-nonresponse and measurement error in earning data. In this paper we explore motives of respondents for the failure to reveal earnings using the British Household Panel (BHPS). BHPS collects socio-economic information of private households in Great Britain. We explain the evolution of income-nonresponse in the BHPS and demonstrate the importance of a discrimination between refusing the income-statement or don't know.

## 1. Introduction

This paper deals with income nonresponse and unit-nonresponse in the British Household Panel (BHPS). We describe the trend in the data and try to explain why respondents refuse to state their income question on the basis of a cognitive and rational choice theory. Thereby we use a cooperator model which is already introduced in a former paper using the German Socio-Economic Panel (GSOEP) (Schraepler 2003). The British Household Panel Study (BHPS) is conducted by the ESRC Centre on Micro-social Change at the University of Essex, U.K. with fieldwork implemented by NOP Research, London. Interviewing on the BHPS began in 1991. The BHPS was designed as an annual survey of each adult member of a nationally representative sample of approx. 5000 households. Children will be interviewed as they reach the age of 16. Like the GSOEP the BHPS provides methodological information about the survey methods. In addition there is for a quarter of the full sample in wave 2 an interpenetrating sample design experiment implemented (Campanelli/O'Muircheartaigh 1999). Characteristics of the interviewers are only provided for this sub-sample. Although additional sub-samples were added to the BHPS in 1997 and 1999, we restrict our study to the original sample.

## 2. Explaining respondent behavior in surveys

To understand the respondent's behavior, it is essential to know the motives of the respondent. Rational Choice theory (RC) (cf., Esser 1993) and cognitive theory (Tourangeau 1984; Tourangeau et al. 2000) provide useful theoretical frameworks to explain respondent behavior. In cognitive theory, several stages of cognitive processing are distinguished: interpreting the question to understand its meaning, retrieving relevant information, integrating that information into judgement, and formatting and editing a response. Editing is based on considerations of social desirability and self-presentation (Sudman/Bradburn/Schwarz 1996, Tourangeau 1984). This theoretical approach gives insight into the answering process. Nevertheless for the last stage of editing we need to understand the concepts of sensitivity and social desirability. Those concepts relate respondents behavior to interaction between the respondent and the interviewer. RC-theory and his variant the utility theory provides a useful framework for analyzing sensitivity. The application of utility theory to survey responding has been explored by several researchers (cf. Sirken et al. 1991, Esser 1993). RC theory states that respondents to a survey "choose" their answers, and that the choice depends on which of the possible replies appears to be the best choice. An attempt to integrate cognitive theory and RC-Theory in a comprehensive framework can be found in Schr pler (2003).

## 2.1. Item-Nonresponse

We learned much about earnings and their determinants from data collected in income and labor market surveys such as the British Household Panel (BHPS), the German Socio-Economic Panel (GSOEP), the Current Population Survey (CPS) and the Panel Study on Income Dynamics (PSID). Unfortunately the quality of data in these surveys is undermined by the failure of some participants to report their wages and salaries. Missing data create three major problems: 1. Nonrespondents are typically different from the respondent; naive analysis that ignores these differences will be biased; 2. missing data implies a loss of information. 3. Many standard statistical techniques require rectangular data sets; in the absence of imputation analyzes are restricted to the set of complete observations (cf., David et al. 1986, Little/Schenker 1995). Item-nonresponse is often treated by imputing the missing items. There are various techniques, many which are designed especially for income adjustments, that can be used (cf., David et al. 1986, Brownstone/Valetta 1996).

Several reasons for item-nonresponse are mentioned in the literature. Loosveldt et al. (1999) assume that item-nonresponse occurs when the answering process fails to proceed smoothly because the respondent lacks motivation or ability. Item-nonresponse also depends on the evaluation by the respondents of the questions asked: the questions are too difficult, not interesting, too embarrassing or too threatening (Loosveldt/Pickery/Billet 1999).

Income questions belong to the category of sensitive questions. Their content pertains to personal and intimate information and they encompass several aspects which have to be taken into account if we want to understand respondent's behavior. Tourangeau et al. (2000) distinguish three aspects: 1. invasion of privacy, 2. risk of disclosure of answers to third parties and 3. social (un)desirability of the answers. As we will see below, for each aspect we can expect a specific response behavior.

Furthermore Bollinger/David (2001), Burton/Laurie/Moon (1999) and Loosveldt et al. (1999) demonstrate that item-nonresponse to sensitive or threatening questions that are strongly related to the subjective topic of the questionnaire will predict unit-nonresponse. They express the idea that one can place all potential respondents to a survey on a cooperation continuum. At one end are those who will always take part and will answer any question, on the other end are those respondents who are hard to persuade and will tend to refuse often. Schr apler (2003) could also validate this idea in the case of the gross-income question in the GSOEP. In addition for understanding income-nonresponse Smith (1991) and Schr apler (2003) demonstrate the importance of distinguishing between cognitive limitations and respondent's assessment of the interview situation.

RC theory implies that respondents to a survey "choose" their answers, and that the choice depends on which of the possible replies appears to be the best choice. The

best choice thus depends on what the respondents presume to be the consequences of certain behavior or answers judging from visible or assumed features of their interview situations; on how the respondents assess the situation with regard to these assumed consequences (cf. probability of adverse outcomes); and on how they evaluate these consequences in the face of their own preferences (Esser 1993, p. 293-294). Thus the individual selects a specific action after assessing the situation and evaluating the consequences of possible actions. In rational choice theory individuals chose those alternatives which realize certain goals. It is generally assumed that actors attempt to attain social acceptance or avoid disapproval (cf., Phillips 1971, 1973).

In the case of income questions the respondent faces four alternatives: 1. He participates in the survey. 2. He participates and answers the income question in the accordance with the truth. 3. He participates, decides to lie, and reports false facts which may be more socially desirable. 4. The respondent participates and refuses to answer or has retrieval problems and does not know the answer. 5. The respondent refuses to participate.

Although false reporting can not be ruled out, detecting false reporting requires a true reference value (see Bollinger/David 2001), which is usually not available. We assume serious false reporting is difficult to realize, because in economic oriented panel studies like the BHPS many variables are related to income and therefore have also to be adjusted by the respondent. Moreover, for coherence, in each wave the false values have to be remembered by the respondent for subsequent waves. Hence we assume deliberately true reporting and restrict our analysis to alternatives one, two, four and five.

Table 1 relates to the four alternatives to underlying cognitive problems and respondents assessment and evaluation. The table distinguishes two origins for non-response.

**Cognitive and other limitations to retrieval:** At the first level income nonresponse as well as unit-nonresponse is not a result of unwilling or refusing but the impossibility of participating or difficulty in reporting the labor income. The cognitive work necessary to answer an income question - understanding, retrieval, and response production - implies that response errors can occur at any stage (cf. Sirken et al. 1999; Moore/Stinson/Welniak 2000). Some respondents cannot recall their gross-income. This is clearly a "don't know" response category. Our first hypothesis is that respondents who don't answer a particular question because of cognitive limitations (e.g. don't know) differ from respondents who are not willing to cooperate and refuse their statement.

In addition some problems cause people who would normally take part not to participate, e.g. sickness, work, schedules, change of address or death.

The second level deals with respondent's assessing and evaluation of the interview

TABLE 1: *Respondent behavior alternatives relating to cognitive or other limitations and respondent's assessment and evaluation*

	1. Cognitive and other limitations	2. Respondent's assessment and evaluation	
		benefits	costs
participation	<ul style="list-style-type: none"> <li>not possible (moved, sick, dead)</li> </ul>	<ul style="list-style-type: none"> <li>survey serves a meaningful purpose</li> <li>to endorse a scientific or public sponsor</li> <li>interesting entertainment</li> </ul>	<ul style="list-style-type: none"> <li>topic too sensitive</li> <li>topic out of interest</li> <li>survey not confidential</li> <li>opportunity costs</li> </ul>
response   participation	<ul style="list-style-type: none"> <li>cognitive limitations, "don't know" (understanding, retrieval, response production)</li> <li>doesn't apply</li> </ul>	<ul style="list-style-type: none"> <li>question serves a meaningful purpose</li> <li>to endorse a scientific or public sponsor</li> <li>interesting entertainment</li> </ul>	<ul style="list-style-type: none"> <li>loss due to disclosure to third parties</li> <li>loss due to social (un)desirability</li> <li>loss due to invade of privacy</li> </ul>
item-nonresponse   participation		<ul style="list-style-type: none"> <li>no fear of social disapproval</li> <li>keep particular information private</li> <li>keep particular information confidential</li> </ul>	<ul style="list-style-type: none"> <li>justification costs (depends on data collection method)</li> </ul>
unit-nonresponse		<ul style="list-style-type: none"> <li>time for other opportunities</li> <li>keep privacy</li> <li>keep confidentiality</li> </ul>	<ul style="list-style-type: none"> <li>justification costs (depends on data collection method)</li> </ul>

Source: Schr apler 2003

situation and his own choice to cooperate. As mentioned respondent's fear of disclosure to third parties, the influence of social desirability and the general aversion to report intimate facts, all contribute to non-response. In RC-Theory these aspects can be interpreted as costs of responding a sensitive question. The benefit of responding is apparent if the survey serves a meaningful purpose for the respondent. Often it is useful to emphasize the scientific or a public sponsor of the survey. Surveys conducted under the aegis of the Federal government typically achieve much higher levels of cooperation than non-government surveys (cf. Goyder 1987). After assessing the situation by facing costs and benefits the respondent evaluate the consequences of possible actions (probability of outcomes) and selects a specific action which realize his personal goals.

Measures of these factors are not available in the data, but we can use these concepts to predict respondent's behavior.

**Disclosure to third parties and confidence building:** In RC-theory we can interpret concerns about confidentiality as fear about loss to disclosure to third parties. Individuals appear to vary in the strength of their worries about confidentiality and this degree of concern could have some effect on their willingness to cooperate (Singer/Mathiowetz/Couper, 1993). The degree of concern may also be determined by the characteristics of the interviewer and by the relationship between respondent



and interviewer (cf. Sudman/Bradburn 1974, Pickery et al. 2001). As BHPS is a panel study, the respondent may meet the interviewer several times. When they first meet, the tendency to refuse may be stronger than on later occasions, because successive interview contacts build confidence<sup>1</sup>. Subsequent contacts increase trust, encouraging answers to sensitive questions like the income statement, and decreasing fear of negative consequences, including data abuse. We expect that refusing an answer concerning to the fear of disclosure to third parties is primarily a problem in the first contact. Therefore our second hypothesis is that the refusal rate is highest in the first wave and decreases in subsequent waves.

**Social desirability:** Social desirability includes two aspects. First, the respondent may be concerned to have the interviewer's approval. Approval depends on the presence of an interviewer, interviewer attributes, the topic of the question and the facts about the respondent's conduct or attitudes. Second, personality traits may cause respondents to distort their answers because of underlying needs, such as the need for social approval and the need to conform to social standards (cf. Tourangeau et al. 2000, p. 257-258). Fear of disapproval of low earnings by the more accomplished interviewer may create an incentive for low-earning respondents with a need for social approval to refuse earnings (cf. Smith 1991; Wagner/Motel 1996). These respondents refuse to give answers that reflect badly on them, in all other cases they cooperate. Our third hypothesis is that respondents in low-earning occupational groups have a higher refusal rate than respondents in high-earning occupational groups due to the influence of social desirability.

**Invasion of Privacy:** Some nonrespondents have a general aversion to answer intimate questions and think income questions are an invasion of privacy. These respondents are characterized by less cooperation and several refusals in their questionnaire. Privacy concern goes to the heart of a respondent's willingness to participate in a survey (Singer et al. 1993). We can assume that members of this group are not whole-hearted survey co-operators, and clearly have misgivings about the whole process. They drift to the end of the cooperation continuum and are harder to persuade in the following wave (Burton et al. 1999; Bollinger/David 2001). Our fourth hypothesis is that respondents who refuse their income statement are more likely to drop out of the survey than others. We expect a negative correlation between refusing the income question and survey participation in the following wave.

Respondents near the uncooperative extreme of the cooperation continuum are those respondents who will never take part in surveys of any kind as a matter of principle, either because of concerns about intrusiveness, confidentiality or because

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<sup>1</sup>For the GSOEP Rendtel (1995) has shown that a change of the interviewer is a strong indicator for unit-nonresponse.

they do not want to waste their time (Burton et al. 1999). Meta-analysis of studies on response rates to mail surveys shows, that the topic of a survey has a clear impact on people's willingness to take part in it (Yammarino/Skinner/Childers, 1991; Heberlein/Baumgartner 1978). Both respondent interest in the topic and the topic's sensitivity seem to be important for the willingness to participate.

**Justification costs:** The presence of third parties and the mode of the interview may also contribute to the difficulty respondents and interviewers experience when talking about income. Groves (1989) and Jordan et al. (1980) find more missing values for income in telephone surveys than in face-to-face interviews. Moore et al. (2000) argue that the telephone may simply lower some of the social barriers against expressing the discomfort about discussing income overtly. Following this idea we suspect the greater the social barriers the higher the justification costs for refusals. These costs may vary with the interview situation. In mail or self-completed questionnaires or in telephone interviews it is much easier for the respondent to refuse an answer than in face-to-face interviews where the interviewer asks the respondent directly (Schräpler 2003). Unlike the GSOEP the BHPS is not a multi-method survey, almost all interviews are face-to-face interviews<sup>2</sup>.

Nevertheless there may be other important method aspects which influence respondent's assessment and the interview outcome. Empirical results of some studies strongly suggest, that presence of third parties during the interview may have an impact on respondent behavior if the third person is involved in the topic of the question (cf. Reuband 1984; Scholl 1993). The direction of this impact is difficult to explore, it depends on the relationship between the respondent, the third person and the interviewer as well as on the asked question. In the case of income-nonresponse we can expect two different alternatives. 1. A control and support function: if the third person is involved, she could give support in the case of retrieval problems as well as may contribute to the validity of the response. 2. The third person may support respondent's aversion to answer intimate questions or concerns about confidentiality and lower the social barriers and the justification costs for refusing the answer. She may intervene in the interview process and articulates her concerns which results in a lower cooperation level. Hence we expect in our fifth hypothesis that the presence of partners in the interview situation leads to a lower probability of 'don't knows' in the case of retrieval problems and a higher probability of refusals in the case of uncooperative respondents.

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<sup>2</sup>At wave 9 of the BHPS the survey moved from paper-and-pencil (PAPI) mode of data collection to a computer assistant personal interview (CAPI) mode of collection. Nevertheless, both CAPI and PAPI are face-to-face interviews (Banks/Laurie 2000).

### 3. Item- and unit-nonresponse in the BHPS

As a first step we take a look at the history of the item-nonresponse rate for the gross-income question among employed persons in the original sample in the BHPS<sup>3</sup>.

TABLE 2: *Item-Nonresponse-rate for the gross-income question from employed persons in the original BHPS sample*

	in paid employed*	proxy	inapplicable	missing or wild	selected employed respondents	refused	don't know	total	percent
wave 1	4974	0	19	8	4947	359	214	573	11.6
wave 2	4756	177	15	1	4563	228	219	447	9.8
wave 3	4674	271	46	1	4356	186	199	385	8.8
wave 4	4639	199	43	0	4397	179	213	392	8.9
wave 5	4611	198	51	0	4362	155	230	385	8.8
wave 6	4741	128	50	1	4562	157	276	433	9.5
wave 7	4851	118	53	0	4683	171	246	417	8.9
wave 8	4813	68	64	1	4680	141	278	419	9.0
wave 9	4779	80	91	0	4608	145	276	421	9.1
total	42838	1239	432	12	41158	1721	2151	3872	9.4

Source: BHPS, original sample, 1991 - 1999 (own calculation) \*without self-employed and trainees

In the BHPS the missing values are classified as 'don't know' and 'refuse'. Special problems occur in the case of the income question for self-employed respondents. The income question is not designed to elicit estimates of business profits for the monthly reference period. Due to these problems self-employed respondents, trainees and proxies are excluded from our empirical analysis. The table 2 show decreasing item-nonresponse rates. The rate decreases from about 12 percent in the first wave to approximately 9 percent after 9 years. The reported gross-earnings item-nonresponse rates are quite low in an international comparison (Madow et al. 1983, p. 24; Schräpler 2003).

In the previous section we argued that item-nonresponse and unit-nonresponse can be understood as different locations on a cooperation continuum. Unit-Nonresponse is indicated if respondents are not able (sick, dead, moved abroad a.o.) or unwilling (refusing) to participate on the surveys. A small part of households could not be found during the field work or could not be contacted. Table 3 shows the frequencies of this categories for respondents who were employed in their last wave, from wave 2 to 9 in the BHPS<sup>4</sup>. The attrition is mainly caused by unwilling respondents and refusals. The

<sup>3</sup>BHPS: The annual question for all employed respondents asks:

"The last time you were paid, what was your gross pay - that is including any overtime, bonuses commission, tips or tax refund, but before any deductions for tax, national insurance or pension contributions, union dues and so on?

ENTER TO NEAREST (Pound): ... (Don't know, Refused)"

<sup>4</sup>In our study we don't use the different categories and focus only on participating or not participating

frequency for this category is 41 percent. Note that we don't use in our unit-nonresponse analysis the first wave because we apply only on respondents who participate at least one wave.

TABLE 3: *Reasons for unit-nonresponse in the BHPS (original sample), employed in the last wave*

	BHPS wave 2-9	
	N	%
unwilling, refusal	1039	40.9
moved abroad, out of scope	177	7.0
dead	54	2.1
HH not found, non-contact	425	16.7
isol. temporary sample member	722	28.4
unsuccessful at the time (sick, a.o.) or other non-interview	124	4.9
Total Unit-Nonresponse	2541	100.00

Source: BHPS 1992 - 1999 orig. sample, empl. in the last wave (own calcul.)

Unlike in the GSOEP refusals are distinguished from 'don't know' or 'blank' for gross-income in the BHPS. An additional item about respondent's net-income follows the gross-income question. Table 4 shows the frequency of all combinations of missing values for gross- and net-income. Over 76% of the "don't knows" for gross-income are connected with valid net-incomes in the BHPS. Over 77% of the respondents with missings in gross-and net-income refuse the answers in the BHPS.

TABLE 4: *Missing gross- and net-income in the BHPS*

gross- income	BHPS net-income			total
	valid	don't know	refusal	
valid	36845	407	21	37273
don't know	1639	489	17	2145
refusal	0	0	1721	1721
total	38484	896	1759	41139

Source: BHPS 1991 - 1999 without self-empl. and trainees (own calc.)

Table 5 shows the frequency of the defined categories. At first we define two "don't know" categories: the first DON'T KNOW (1) indicates a "don't know" for gross-income and a given valid net-income. The second DON'T KNOW (2) indicates a "don't know" for both, gross- and net-income.<sup>5</sup> We distinguish two categories because

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in the following wave.

<sup>5</sup>In this category falls also the few cases ( $n = 17$ ) of "don't know" for gross- and "refused" net-

it can't be ruled out that DON'T KNOW (2) is in fact a soft kind of refusing. A refusal is defined if the respondent refuse his gross-income statement explicitly in the BHPS.<sup>6</sup>

TABLE 5: *Definitions for "Refusal" and "Don't Know" in the BHPS*

defined category	BHPS income		N	%
	gross	net		
don't know (1)	don't know	valid	1639	42.40
don't know (2)	don't know	don't know, refuse	506	13.09
refuse	refuse	-	1721	44.51
			3866	100.00

Source: BHPS 1991 - 1999, without self-empl. and trainees (own calc.)

The figure 1 shows the trend for all defined categories. While the share of "refusals" declines, the share of "don't knows" seems to be stable or to increase slightly in the BHPS (DON'T KNOW (1)) over all waves.

To show the influence of earning-related institutions and occupation on income-nonresponse we classify occupation into three groups (table 6). The groups are defined on type of position (wage, salary, or civil service) and occupational skills. On average substantial differences in average wage exist between these groups<sup>7</sup>.

The figure 4 displays the distributions by the occupational states. Nevertheless, this tri-partite classification can not be used directly as a proxy for earnings, because it encompasses aspects of employment that go beyond current earnings to tenure, fringe benefits that are not paid in cash, prestige, and human capital. The interpretation from using this classification as regressors is that their coefficients reflect an aggregate effect of being in one of three major subdivisions of the employed population. In the BHPS the respondents in the high occupational group have the highest refusal rates, followed by the medium and low occupational group (2). These patterns correspond with the findings in the GSOEP (Schräpler 2003). The trend declines for all occupational states. The share for the "don't know" categories is shown in figure 3 and 4. There is no evidence for differences by the vocational state for category DON'T KNOW (1) but

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income.

<sup>6</sup>The net-income is indicated as "inapplicable" if the gross-income is refused in the BHPS. Hence we can assume that in this case the respondent refuses both items.

<sup>7</sup>Estimates from a random effects panel regression model show that these occupation related dummies explain approximately 24% of the variance of the logarithmic income from income reporting respondents in the BHPS.

<sup>8</sup>The classification of the vocational position is based on the variable "wJBGOLD". Agriculture workers are separated in partly scilled or unscilled using the variables "wJBSEG" and "wJBRGSC". Some employed persons who are in "wJBGOLD" semi or unskilled workers are skilled manual workers in "wJBSEG". In this cases we use the variable "wJBSEG".

TABLE 6: *Classification of the vocational position*

	BHPS <sup>8</sup>	
	vocational position	occupation
LOW	hourly-paid worker	unskilled worker, semi-skilled worker
MEDIUM	hourly-paid worker	skilled worker, manual foreman
	salaried employee	non-manual foreman, employee with simple and qualified activity, lower grade service class, small manager
	civil service	minor and lower-grade civil service
HIGH	salaried employee	professional employee large managers, higher grade service class
	civil service	high and senior service

Source: own classification

we find higher shares for respondents in low positions in the case of the category of respondents who do not know their gross- as well as their net-income (DON'T KNOW (2)).<sup>9</sup>

Respondent behavior may vary according to more distinguishing characteristics of the interview situation. Figures 5 - 6 examine the impact of respondent's gender. In the BHPS refusals are mainly caused by male respondents and female respondents have higher frequencies in the "don't know" category<sup>10</sup>.

Figure 7 show the share of income-nonresponse by the age of the respondent. We can observe a strong increase of refusals by age and a relatively stable share of don't knows.

Figure 9 and 10 show the impact of the presence of third parties during the interview. We distinguish between 'respondent alone', 'partner present' and 'other adults present'. While in the case of 'other adults present' the graph of income-nonresponse is more or less oscillating around the line of 'respondent alone', we observe explicit results for 'partner present'. In interview situations where the partner is present the share of 'refusals' is slightly higher and the share of 'don't knows' is lower as in the situation 'respondent alone'. This finding supports our fifth hypothesis about the two modes of impact: a present partner will help in the case of retrieval problems but may also support an uncooperative respondent.

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<sup>9</sup>Some previous studies find that those with income missing have lower income (cf., Smith 1991; Kalton/Kasprzyk/Santos 1981).

<sup>10</sup>The figure for DON'T KNOW (2) is not shown, but the trend is quite similar to DON'T KNOW (1).

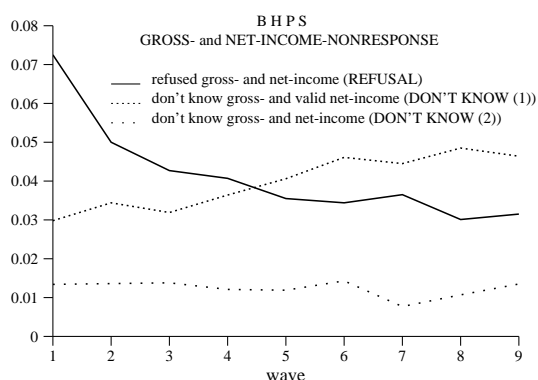


FIG. 1.— *BHPS: Share of gross- and net-income-nonresponse, 1991 - 1999. original sample, employed respondents.*

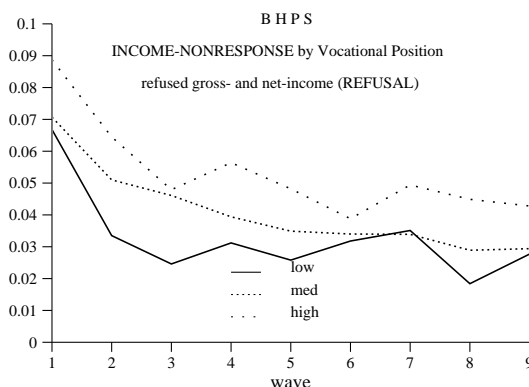


FIG. 2.— *BHPS: Share of refused answers by vocational position from 1991 - 1999, original Sample, employed persons.*

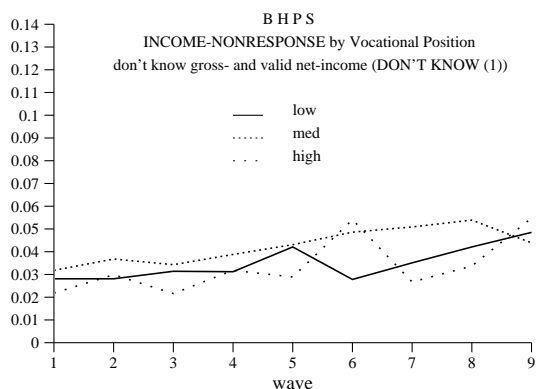


FIG. 3.— *BHPS: Share of don't know answers by vocational position from 1991 - 1999, original Sample, employed persons.*

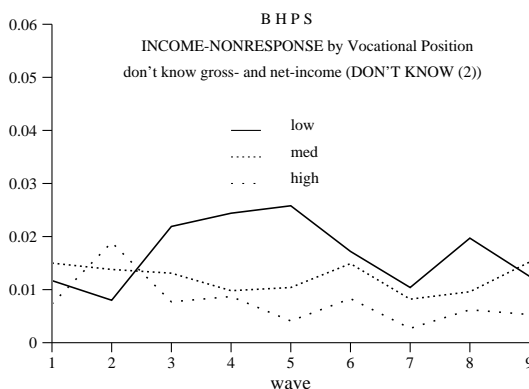


FIG. 4.— *BHPS: Share of don't know answers by vocational position from 1991 - 1999, original Sample, employed persons.*

In the BHPS interviewers are required to complete a series of interviewer observations after each individual interview describing whether or not the respondent was co-operative or if there are other problems which affected the interview. Figure 11 and 12 show the share of income-nonresponse by the assessed general cooperation. As expected, interviewer assess respondent's general cooperation as 'fair' to 'poor', if the respondent refuse answers. Hence the share of refusals is highest in the case of an assessed 'bad' cooperation.

Figure 8 refer to unit-nonresponse. Often it is recognized that the change of the interviewer increase the probability for unit-nonresponse. One explanation for this is that respondents learn to trust an interviewer and those with high level of distrust react to a strange interviewer by refusing to be interviewed (cf. Bollinger/David 2001;

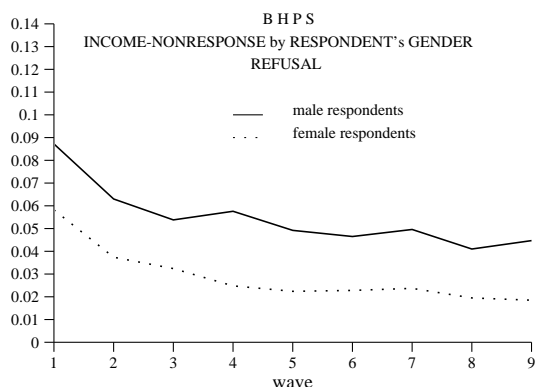


FIG. 5.— *BHPS: Share of refused answers by sex from 1991 - 1999, orig. Sample, empl. persons.*

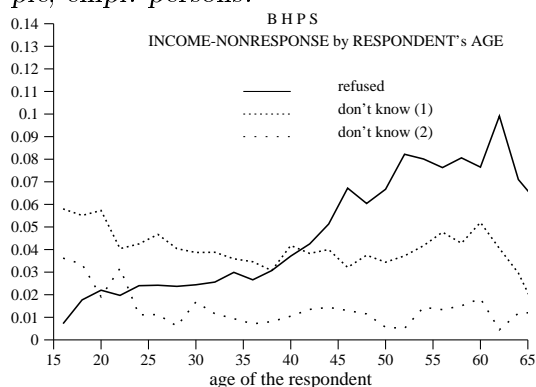


FIG. 7.— *BHPS: Share of income-nonresponse by age from 1991 - 1999, original Sample, employed respondents (local estimated).*

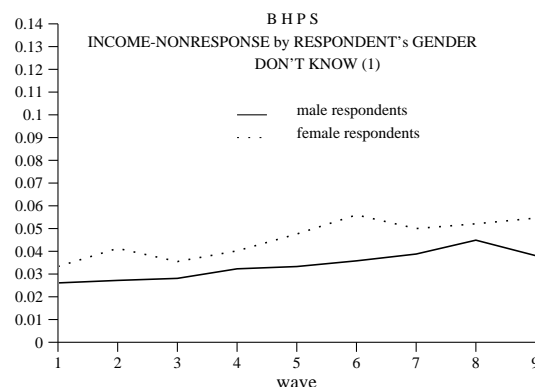


FIG. 6.— *BHPS: Share of don't know answers by sex from 1991 - 1999, orig. Sample, employed persons.*

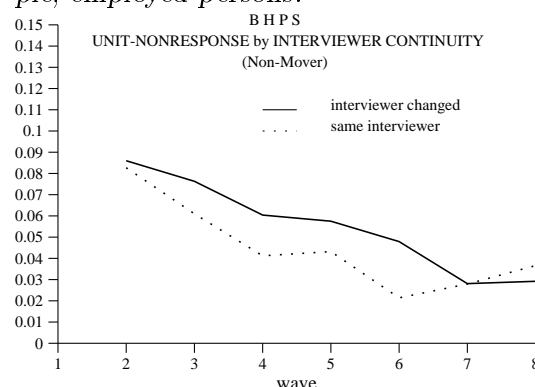


FIG. 8.— *BHPS: Share of unit-nonresponse by interviewer's continuity, 1991 - 1998, orig. Sample, resp. who were empl. in the last wave and drop out.*

Laurie/Smith/Scott 1999; Rendtel 1990). After the second wave the share of unit-nonresponse is slightly higher in the case of changing the interviewer for non-movers in the selected sample.<sup>11</sup> We find similar results in the GSOEP (Schräpler 2003). This descriptive finding must be considered with caution, Campanelli/O'Muircheartaigh (2002, 1999) argues that at least for the BHPS this finding can be interpreted as a result of confounding of interviewer attrition and interviewer continuity. The connection between continuity and response rate in a nonexperimental sample can occur due to nonrandom interviewer attrition, because "interviewer turnover is often highest in the most

<sup>11</sup>Similar to the previous analysis of Laurie et al. (1999) and Campanelli/O'Muircheartaigh (2002) the used sample in this figures is restricted to non-movers; also excluded were cases which needed telephone conversion or supervisor conversion in the BHPS.



'difficult' interviewer areas." (Campanelli/O'Muircheartaigh 2002, p.130).

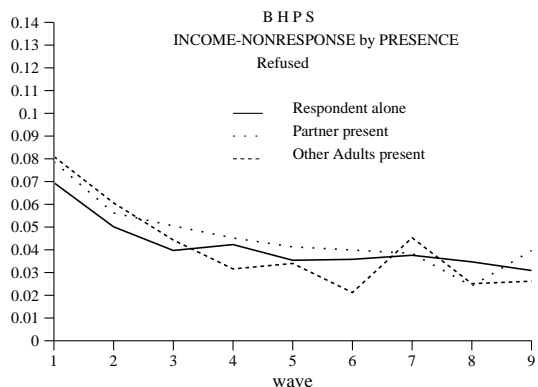


FIG. 9.— *BHPS: Share of "refusals" by presence of third parties from 1991 - 1999, original Sample, employed respondents.*

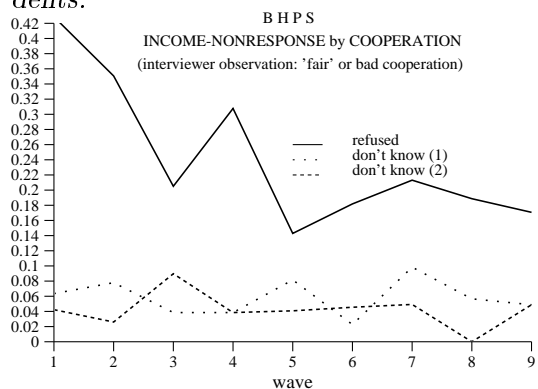


FIG. 11.— *BHPS: Share of income-nonresponse by interviewer's assessment about respondents cooperation from 1991 - 1999, orig. Sample, empl. respondents.*

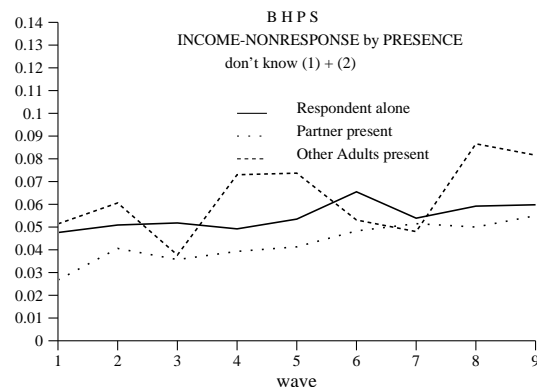


FIG. 10.— *BHPS: Share of "don't knows" by presence of third parties, 1991 - 1999, orig. Sample, employed respondents.*

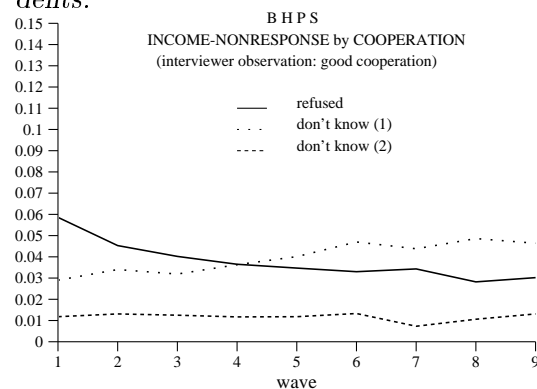


FIG. 12.— *BHPS: Share of income-nonresponse by interviewer's assessment about respondents cooperation from 1991 - 1999, orig. Sample, empl. respondents.*

To control for further respondent and interviewer variables we use in the next section a multilevel regression probit model.

#### 4. Modeling income-nonresponse

Section 2.1 refers to RC-Theory and the view respondents chose among three alternatives: reporting income, acknowledging lack of information by don't know, or refusing because of strongly held motives. The conventional model of choice in economics and other social sciences ascribes an unobservable level of utility  $\tilde{U}_{jm}$  to alternative  $m$  for decision maker (respondent)  $j$ . In RC-Theory the decision maker maximizes his utility.

Our primary purpose is to determine how various factors influence the attractiveness of the alternatives to different types of individuals, hence we use a regression-like framework (cf. Dubin/Rivers 1989, p.373):

$$\tilde{U}_{jm} = \beta_1' \tilde{x}_{jm} + \epsilon_{jm} \quad (m = 1, 2)$$

where the vector ( $k \times 1$ )  $\tilde{x}_{jm}$  includes the costs of alternative  $m$  and other relevant factors. The difference between the utility of two alternatives is:

$$y_j^* = \tilde{U}_{j1} - \tilde{U}_{j2} = \beta' x_j + u_j \quad (1)$$

where  $x_j = \tilde{x}_{j1} - \tilde{x}_{j2}$  and  $u_j = \epsilon_{j1} - \epsilon_{j2}$ . If  $y_j^* > 0$ , the first alternative (item-nonresponse) yields higher utility and is preferred, otherwise the second one is preferred. We observe two indicator variable,  $y_j$ :

$$y_j = \begin{cases} 1, & \text{if } y_j^* > 0, j = 1 \text{ indicator for refusal} \\ & j = 2 \text{ indicator for don't know} \\ 0, & \text{otherwise} \end{cases} \quad (2)$$

If  $\epsilon_{j1}$  and  $\epsilon_{j2}$  are characterized by a joint normal distribution, with zero means, the nonresponse choices can be analyzed by a bivariate probit model.

Studies of respondent and interviewer effects generally combine both respondent and interviewer variables. Typically, interviewer variables are disaggregated to the level of the dependent variable, i.e., the respondent level, and both interviewer and respondent variables are combined in a single regression model. Because the respondents are not usually assigned randomly to interviewers and because each interviewer questions many respondents, the usual regression assumption that errors are independent and identically distributed is violated. Any unmeasured interviewer variation results in apparent correlation of error terms across respondents. Lack of independence leads to underestimate standard errors for regression coefficients and inefficient estimates (cf. Hox 1994, p. 303).

Clearly, survey data have a hierarchical structure: in any year the respondents are nested within interviewers, where the respondent level is said to be the lower and the interviewer level the higher level<sup>12</sup>. The appropriate method of analysis is the use of hierarchical or multilevel models that estimate of both variance and the effects of explanatory variables measured at both the interviewer and the respondent level (cf. Hox 1994; Pannekoek 1991; Hill 1991). A variety of names for this statistical model

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<sup>12</sup>Of course, we can use other concepts with further levels like an additional household level. Due to our interest in this study and estimation problems that occur in cases of further levels, we restrict on four levels.

are used, including: mixed models (Longford 1987), multilevel models (Goldstein 1995), random coefficient models (Longford 1995) and hierarchical models (Bryk/Raudenbush 1992). These models generally involve linear regression in which some parameters other than the residuals are random rather than fixed.

#### 4.1. The cooperator model

The following regression analysis consists in two steps. First we use the early seven waves and estimate a multivariate probit model with three response variables "refuse", "don't know" ((1) and (2)) and "unit-response in the next wave" (participation). We collapse both don't know categories because the descriptive analysis in the former section strongly suggests equal respondent behavior. In the second step we try to separate interviewer and area effects and use the experimental subsample of wave 2 to estimate cross-classified probit models.

The hierarchical structure for this applications caused by multiple nesting in the longitudinal data.

Level 1 represents the different response variables in the multivariate model. We define  $i = 1$  (refuse),  $i = 2$  (don't know) and  $i = 3$  (subsequent unit-response). Level 2 represents the different times of measurement  $j$ . Level 3 consists of  $k$  respondents and level 4 represents the aggregate level, which is formed by  $l$  interviewers.

For person  $k$  and interviewer  $l$  three dichotomous variables  $y_{ijkl}$  are observed at time  $j$ .

$$y_{1jkl} = \begin{cases} 1, & \text{if } y_{1jkl}^* > 0, \text{ refuse} \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

$$y_{2jkl} = \begin{cases} 1, & \text{if } y_{2jkl}^* > 0, \text{ don't know} \\ 0, & \text{otherwise} \end{cases} \quad (4)$$

$$y_{3jkl} = \begin{cases} 1, & \text{if } y_{3jkl}^* > 0, \text{ unit-response (next wave)} \\ 0, & \text{otherwise} \end{cases} \quad (5)$$

We use a multivariate probit model with four levels:

$$y_{ijkl} = \pi_{ijkl} + u_{ijkl}. \quad (6)$$

When the intercept  $\beta_{0ikl}$  is only allowed to varies by the respondent and interviewer for each response indicator  $i = 1, 2, 3$  and the other coefficients ( $\beta_{ih}$ ) are specified as

fixed parameters. The probability  $\pi_{ijkl}$  for each response variable  $i$  estimated from:

$$\pi_{ijkl} = \Phi \left( \beta_{0ikl} + \sum_{h=1}^H \beta_{h,i} x_{h,ijkl} + v_{0,ikl} + f_{0,il} \right) \quad (7)$$

where  $\Phi$  is the cumulative distribution function of the standard normal distribution,  $y_{ijkl}$  is an indicator for a specific respondent behavior  $i$  (e.g. refuse) at time point  $j$  in context of respondent  $k$  and interviewer  $l$ .  $x_{h,ijkl}$  represent values for covariates  $x_h$  ( $h = 1, \dots, H$ ) of person  $k$  and interviewer  $l$  at time  $j$ . The intercept  $\beta_{0ikl}$  is specified as random on level 3 (respondent level) and level 4 (interviewer level) and the variance is estimated as  $v_{0,ikl}$  (matrix  $\Sigma_R$ ) and  $f_{0,il}$  (matrix  $\Sigma_I$ ). The random variation among the time periods on level 2 is estimated as the variance/covariance  $u_{ijkl}$  (matrix  $\Sigma_T$ ). Since these are dependent binomial variables<sup>13</sup>, the residual variances  $\sigma_{u_{ii}}^2$  and covariances  $\sigma_{u_{i'i'}}^2$  must be estimated.

Estimation requires three assumptions:

*Assumption 1.:* The variance/covariance matrices on time (matrix  $\Sigma_T$ ), respondent (matrix  $\Sigma_R$ ), and interviewer level (matrix  $\Sigma_I$ ), are

$$\begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix} \sim (0, \Sigma_T) : \Sigma_T = \begin{bmatrix} \sigma_{u_1}^2 & & \\ \sigma_{u_2 u_1} & \sigma_{u_2}^2 & \\ \sigma_{u_3 u_1} & \sigma_{u_3 u_2} & \sigma_{u_3}^2 \end{bmatrix}$$

$$\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} \sim N(0, \Sigma_R) : \Sigma_R = \begin{bmatrix} \sigma_{v_1}^2 & & \\ \sigma_{v_2 v_1} & \sigma_{v_2}^2 & \\ \sigma_{v_3 v_1} & \sigma_{v_3 v_2} & \sigma_{v_3}^2 \end{bmatrix}$$

$$\begin{bmatrix} f_1 \\ f_2 \\ f_3 \end{bmatrix} \sim N(0, \Sigma_I) : \Sigma_I = \begin{bmatrix} \sigma_{f_1}^2 & & \\ \sigma_{f_2 f_1} & \sigma_{f_2}^2 & \\ \sigma_{f_3 f_1} & \sigma_{f_3 f_2} & \sigma_{f_3}^2 \end{bmatrix}$$

*Assumption 2.:* The second, third and fourth level errors are assumed to be independent, so  $cov(u_{ijkl}, v_{ikl}, f_{il}) = 0, \forall i, j, k, l$ .

*Assumption 3.:* The coefficients for the covariates in the multivariate probit model are time invariant.

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<sup>13</sup>Often binomial distributed residuals on level 1 are assumed. Nevertheless they may be extra-binomial and can be estimated with the program MLwiN (Rasbash et al. 1999).

#### 4.1.1. Regressors of the cooperator model

Regressors can be considered in four groups:

1. *Demographic and household variables for the respondent:* "age" is the age of the respondent in years, "age squared" is age squared, "sex" = 1 indicates male respondents, "low position" = 1 and "high position" = 1 indicates the occupational position, "unsteady working" = 1 indicates if respondent is unsteady working (temporary or seasonal) and "dep. children in HH" = 1 indicates dependent children in respondent's household. "move" = 1 is a dummy for moved respondent.
2. *Demographic variables for the interviewer:* "isex" = 1 indicates male interviewer. This information is only available for the cross-classified models in the experimental sample in the BHPS.
3. *Variables that describe the interview situation:* "change of interviewer" = 1 indicates a change in interviewer, "partner present" = 1 indicates that respondent's partner was present during the interview, "care 2 years" = 1 indicates two successful interviews completed for a respondent - interviewer pairing and "care more than 2 years" = 1 indicates more than two successful interviews completed for a respondent - interviewer pairing.
4. *Time dummies:* "wave" control for time specific effects, wave 1 is the reference category.

## 4.2. Cross-classified multilevel Models

In the BHPS is for a quarter of the full sample in wave 2 an interpenetrating sample design experiment implemented which can be used to distinguish between interviewer and area effects. The BHPS adopted a constrained form of randomization in which addresses were allocated to interviewers at random within geographic 'pools'. These pools are sets of two or three PSU's. A systematic sample of 35 pools was then selected for the interpenetrating sample design. Within PSU's in a given pool, households were randomly assigned to the interviewer working in those PSU's (O'Muircheartaigh/Campanelli 1998; 1999).

The multilevel probit model which capture the interviewer by PSU cross-classification can be defined as

$$y_{ijk} = \pi_{ijk} + v_{ijk} \quad (8)$$

The probability  $\pi_{ijk}$  is:

$$\pi_{ijk} = \Phi\left(\beta_0 + \sum_{h=1}^H \beta_h x_{h,ijk} + f_j + m_k\right) \quad (9)$$

where  $\Phi$  is the cumulative distribution function of the standard normal distribution,  $y_{ijk}$  is an indicator for a specific respondent behavior (e.g. refuse) in context of respondent  $i$ , interviewer  $j$  and area  $k$ .  $\beta_0$  is an appropriate constant,  $x_{h,ijk}$  represent values for covariates  $x_h$  ( $h = 1, \dots, H$ ) of person  $i$  and interviewer  $j$  in area  $k$ .  $f_j$  is a random departure due to interviewer  $j$ ,  $m_k$  is a random departure due to area  $k$ ,  $v_{ijk}$  is an individual error term.

## 5. Estimates

### 5.1. Estimates of the cooperator model

The table 7 show the estimates<sup>14</sup> of the multivariate probit model for the BHPS. We use the first seven waves for both surveys. The sample contains a total of 31,247 observations on 12,469 respondents from 403 interviewers.

Estimates of the parameters for respondent variables are important for our first hypothesis, namely different attributes induce "refusal" and "don't know" responses. The estimates confirm the results of the description above: probability of "don't know" their gross-income decline with increasing position and the probability of refusal is higher in middle or higher vocational positions (but in this case not significant). Significant declines in refusals and increases in don't know are induced by the irregular working patterns (temporary or seasonal working). The gender hypothesis is confirmed in the description: Probability of "don't know" increase substantially for females and probability for refusals increase significant for males. Presence of dependent children in households decreases probability of refusals and has no effect on don't knows. Overall these findings support our first hypothesis: namely the respondent characteristics that influence refusals and don't know differ markedly. Our perception is, that it is important to interpret missing values correctly if we try to reduce item-nonresponse rates.

Our second hypothesis predicts higher refusal rates on the first contact because levels of trust are higher in subsequent waves. The hypothesis is supported by our findings. The variables (CARE two years, and CARE more than two years) indicates the number of successful contacts between respondent and the same interviewer. We

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<sup>14</sup>The analysis is done with MLwiN 1.2 (Rasbash et al. 1999). We used the iterative generalized least squares (IGLS) algorithm with extra binomial option and the 1st order marginal quasilielihood (MQL) procedure for the four level model.

TABLE 7: *BHPS: Multivariate Multilevel Probit-model for income-nonresponse, wave 1-7*

	BHPS					
	Refuse		Don't Know		Unit-Response (t+1)	
	$\hat{\beta}_1$	s.e.	$\hat{\beta}_2$	s.e.	$\hat{\beta}_3$	s.e.
Intercept	-2.389***	0.154	-1.136***	0.129	1.272***	0.118
<i>respondent</i>						
sex (1 - men)	0.275***	0.034	-0.143***	0.028	-0.071**	0.028
age (year)	0.028***	0.008	-0.024***	0.007	0.010***	0.006
age squared	0.000	0.000	0.000	0.000	0.000	0.000
medium position (ref.)						
low position	-0.046	0.033	-0.036	0.035	-0.035	0.025
high position	0.010	0.032	-0.118***	0.039	0.043	0.027
dep. children in HH	-0.145***	0.029	0.011	0.029	0.188***	0.023
unsteady working	-0.169***	0.044	0.189***	0.043		
move					-0.513***	0.020
<i>situation</i>						
change of interviewer					-0.095***	0.019
care 2 years	-0.037*	0.022	0.048	0.031		
care more than 2 years	-0.014	0.028	0.081***	0.037		
partner present	0.046**	0.022	-0.101***	0.029		
wave 1 (ref.)						
wave 2	-0.123***	0.031	0.020	0.047	0.002	0.024
wave 3	-0.201***	0.033	-0.025	0.050	-0.043**	0.024
wave 4	-0.253***	0.031	0.056	0.046	-0.110***	0.024
wave 5	-0.271***	0.033	0.088**	0.048	0.025	0.025
wave 6	-0.271***	0.037	0.144***	0.050	-0.010	0.026
wave 7	-0.260***	0.041	0.049	0.054	-0.140***	0.025
<i>period level</i>						
	$u_1$		$u_2$		$u_3$	
$u_1$	0.304***	0.003				
$u_2$	-0.042***	0.004	0.826***	0.008		
$u_3$	-0.002	0.002	-0.005	0.003	0.290***	0.003
<i>respondent level</i>						
	$v_1$		$v_2$		$v_3$	
$v_1$	2.692***	0.046				
$v_2$	-0.020	0.026	0.540***	0.028		
$v_3$	-0.221***	0.027	-0.053*	0.021	1.837***	0.030
<i>interviewer level</i>						
	$f_1$		$f_2$		$f_4$	
$f_1$	0.223***	0.025				
$f_2$	0.038**	0.015	0.152***	0.017		
$f_3$	-0.035***	0.012	0.010	0.009	0.061***	0.010
Interviewer cluster				403		
persons				12469		
N				31247		
-2 * LogLikelih.				-47,370.2		

NOTE: Asymptotic standard errors in parentheses; Significance: \*10%; \*\*5%; \*\*\*1%  
Source: BHPS 1991-1998, original Sample, empl. resp, without self-empl. and trainees (own calc.)

can assume that several contacts with the same interviewer will affect the interview situation. The estimates show that continued interviewing by the same interviewer decrease probability of refusals but increase don't knows.

Our third hypothesis is that respondents with low income have higher refusal rates than respondents in the high-earning vocational group due to social desirability. This does not appear to be the case. The estimates show that a high percentage of missing values of respondents in middle and low-income vocational groups results from don't know responses.

Our fourth hypothesis refers to a cooperation continuum and states a negative correlation between refusing the income statement and survey participation in the following wave. The random part consists of three covariance matrices  $\Sigma_T$ ,  $\Sigma_R$  and  $\Sigma_I$ .  $\Sigma_R$  describes the random variation among respondents and is estimated as the variance/covariance  $v_{ijkl}$ . The estimates in the table 7 show a small but highly significant negative covariance between the error terms of "Refuse" and "Unit-response in the following wave":  $\sigma_{v_1v_3} = -0.221$  (correlation  $r_{u_1u_3} = -0.100$ ).<sup>15</sup>. The covariance among the error term of "Don't know" and "Unit-response" is only -0.055. Although the values of  $r_{u_1u_3}$  and  $r_{u_1u_3}$  are not high, they support the idea of a cooperation continuum: employed respondents who refuse their income statement tend slightly to drop out of the surveys in the following wave.

Our fifth hypothesis predicts a higher refusal rate and a lower rate of don't knows in interview situations where respondent's partner is present, because of the two modes of impact: a present partner may help in the case of retrieval problems but may also support an uncooperative respondent. Our findings support this hypothesis, the probability of refusals are significant higher and the probability of don't knows significant lower in interviews where respondent's partner is present.

The multivariate probit model also shows that probability of non-participation is larger for male respondents, younger respondents, respondents who move and in cases where the interviewer changed.

Next we examine the random variation of the intercept  $\beta_{0,il}$  on level 4 (interviewer/area level). The estimates for this variance indicate a significant interviewer influence and/or a significant area effect to all three behaviors. Although the interviewer level is defined by the individual interviewer number, we can't distinguish from interviewer and area cluster because the interviewers are not assigned randomly to the sample points in the whole sample. We use in the next section the experimental sample in the BHPS to distinguish between both clusters.

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<sup>15</sup>The correlation result from

$$r_{i,i'} = \frac{\sigma_{u_{ii'}}}{\sqrt{\sigma_{u_i}^2} \times \sqrt{\sigma_{u_{i'}}^2}}$$



## 5.2. Estimates of the cross-classified multilevel models

The tables 8 and 9 show the estimates of the cross-classified multilevel probit models for the experimental sample in wave 2 in the BHPS. The sample contains a total of 1,119 employed respondents from 68 interviewers in 65 areas.

We estimate for each respondent behavior three probit models, the first one is a non-hierarchical model, the second takes the interviewer cluster into account and the third one is a full cross-classified multilevel model. We can recognize that in this small subsample the signs of the coefficients have the same direction as in the multivariate model, but only very few of the coefficients are significant. The probability of refusals declines in the case of dependent children in respondent's household and increase strongly for male interviewer. The most important finding is that there is no significant area effect in all cross classified models but always a significant strong interviewer effect. This result is in line with findings of O'Muircheartaigh/Campanelli (1998; 1999) in the BHPS database. The estimates suggest that the intraclass correlations of the multivariate probit model in the last section are mainly caused by interviewer cluster and not by area cluster.

TABLE 8: BHPS: Cross-classified multilevel Probit-models for income-nonresponse, wave 2

	Refuse			Don't Know						
	non-hierarchical	with interviewer-cluster	cross-classified	non-hierarchical	with interviewer-cluster	cross-classified				
	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.				
Intercept	-3.534**	1.674	-3.789*	2.074	-2.993*	1.676	-2.396	1.964	-2.610	1.958
<i>respondent</i>										
sex (1 - men)	0.096	0.132	0.119	0.133	0.133	0.133	0.133	0.133	-0.074	0.134
age (year)	0.017	0.036	0.018	0.037	0.037	0.037	0.037	0.037	0.013	0.037
age squared	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
medium position (ref.)										
low position	-0.108	0.196	-0.079	0.196	-0.079	0.196	0.006	0.186	-0.001	0.189
high position	-0.001	0.183	-0.029	0.189	-0.029	0.189	0.130	0.179	0.100	0.185
dep. children in HH	-0.368**	0.161	-0.377**	0.164	-0.377**	0.164	-0.026	0.150	0.000	0.152
unsteady working	-0.607	0.419	-0.661	0.438	-0.661	0.438	-0.055	0.284	-0.102	0.299
<i>interviewer</i>										
isex (1 - men)	0.391	0.249	0.567*	0.321	0.567*	0.321	-0.010	0.272	0.040	0.325
iage	0.078	0.061	0.089	0.079	0.089	0.079	0.040	0.060	0.019	0.073
iage2	-0.001	0.001	-0.001	0.001	-0.001	0.001	0.000	0.001	0.000	0.000
<i>respondent level</i>										
$\sigma^2_{\epsilon}$	1.000		1.000		1.000		1.000		1.000	
<i>interviewer level</i>										
$\sigma^2_f$			0.225**	0.088	0.225**	0.088			0.181**	0.081
<i>area level</i>										
$\sigma^2_{\eta}$					0.000	0.000				0.072
PSU's					65	65				65
Interviewer cluster					68	68				68
persons	1119		1119		1119		1119		1119	1119
N	1119		1119		1119		1119		1119	1119
-2 * LogLikelih.	-480.391		-475.011		-475.040		-353.219		-364.611	-366.656

NOTE: Asymptotic standard errors in parentheses; Significance: \*10%; \*\* 5%; \*\*\* 1%

Source: BHPS 1992, original Sample, empl. without self-empl. and trainees (own calc.)

TABLE 9: *BHPS: Cross-classified multilevel Probit-models for participation in the following wave, wave 2*

	non-hierarchical		<i>Unit-Response t+1</i> with interviewer-cluster		cross-classified	
	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.
Intercept	3.013*	1.529	2.839*	1.769	2.838*	1.768
<i>respondent</i>						
sex (1 - men)	-0.206*	0.119	-0.203*	0.120	-0.203*	0.120
age (year)	0.029	0.031	0.031	0.031	0.031	0.031
age squared	0.000	0.000	0.000	0.000	0.000	0.000
<i>medium position (ref.)</i>						
low position	-0.058	0.162	-0.073	0.163	-0.073	0.163
high position	0.219	0.186	0.206	0.189	0.206	0.189
<i>dep. children in HH</i>						
unsteady working	0.163	0.138	0.159	0.140	0.159	0.140
move	-0.150	0.235	-0.129	0.241	-0.129	0.241
<i>refusing gross-income</i>						
move	-0.363**	0.179	-0.376**	0.182	-0.376**	0.182
refusing gross-income	-0.195	0.240	-0.198	0.247	-0.198	0.247
<i>interviewer</i>						
isex (1 - men)	-0.377*	0.217	-0.368	0.266	-0.368	0.266
iage	-0.080	0.055	-0.076	0.066	-0.076	0.066
iage2	0.001	0.001	0.001	0.001	0.001	0.001
<i>situation</i>						
change of interviewer	-0.053	0.120	-0.017	0.124	-0.017	0.124
<i>respondent level</i>						
$\sigma_v^2$	1.000		1.000		1.000	
<i>interviewer level</i>						
$\sigma_f^2$			0.112*	0.059	0.112*	0.059
<i>area level</i>						
$\sigma_m^2$					0.000	0.000
PSU's					65	
Interviewer cluster			68		68	
persons	1119		1119		1119	
N	1119		1119		1119	
-2 * LogLikelih.	-33.052		-41.798		-41.820	

NOTE: Asymptotic standard errors in parentheses; Significance: \*10%; \*\* 5%; \*\*\*1%  
Source: BHPS 1992, original Sample, empl. resp, without self-empl. and trainees (own calc.)

## 6. Conclusion

Item-nonresponse for gross-income in the British Household Panel (BHPS) is factored into two components: refusals and don't know. We investigate why respondents do not reveal their income. The study uses information from British persons in 5000 households, information about interviewers, and characteristics of the data collection. BHPS permits investigating the behavior of respondents over a decade.

A conceptual framework for the failure to reveal earnings analysis is drawn from rational choice theory and cognitive theory. The statistical method uses multi-variate probit in a hierarchical specification.

A primary finding in this analysis is that refusals and don't knows relate to different

characteristics. The description in section 3 and the estimates in the multivariate analysis in section 5 presents evidence for our first hypothesis, that the respondent characteristics for refusal and don't know responses differ markedly. Respondents who refuse their answer are mainly male without dependent children in their household. Respondents who do not know their incomes are mainly females, respondents in low or middle occupational states and respondents who work irregularly. This finding is important for the interpretation and reduction of item-nonresponse. Many studies try to predict item-nonresponse with respondent characteristics but fail to use response categories such as refuse and don't know. The resultant conclusions are ambiguous and hard to interpret, which may be the reason for the inconsistency in this area.

The second relevant finding is that survey respondents fall on a cooperation continuum (Bollinger/David 2001; Burton et al. 1999; Loosveldt 1999b). Respondents who refuse to answer the sensitive questions (e.g. income) because of privacy concerns are often not whole-hearted survey co-operators and have misgivings about the whole process. They drift to the end of the cooperation continuum and are harder to persuade to participate in the following wave. The estimates of our multivariate probit model support this hypothesis, as we find a small negative but significant correlation between refusing the income question and survey participation in the following wave. As expected, the correlation in the case of don't know is very small.

The third relevant finding is that interviewer/area has an effect on a respondent's propensity to give refusals and don't know responses. Using the experimental subsample in wave 2 in the BHPS, the estimates of cross-classified multilevel models suggest predominantly interviewer cluster effects rather than area cluster effects. Furthermore, the estimates show that male interviewer get significant more refusals than female in this subsample.

## REFERENCES

- Banks, R. and Laurie, H. 2000. From PAPI to CAPI: The Case of the British Household Panel Study. *Social Science Computer Review*, 18(4):397–406.
- Bollinger, C. R. and David, M. H. 2001. Estimation with Response Error and Nonresponse: Food-Stamp Participation in the SIPP. *Journal of Business & Economic Statistics*, 19(2):129–141.
- Brownstone, D. and Valetta, R. G. 1996. Modeling Earnings Measurement Error: A Multiple Imputation Approach. *The Review of Economics and Statistics*, 78:705–717.
- Bryk, A. S. and Raudenbush, S. W. 1992. *Hierarchical Models: Applications and Data Analysis Methods*. Sage Publications, Inc., Newbury Park CA.

- Burton, J., Laurie, H., and Moon, N. 1999. "Don't ask me nothin' about nothin', I just might tell you the truth". The Interaction between unit non-response and item non-response. Paper presented on the International Conference on Survey Nonresponse October 1999, Portland, Oregon.
- Campanelli, P. and O'Muircheartaigh, C. 1999. Interviewers, Interviewer Continuity, and Panel Survey Nonresponse. *Quality and Quantity*, 33:59–76.
- Campanelli, P. and O'Muircheartaigh, C. 2002. The Importance of Experimental Control in Testing the Impact of Interviewer Continuity on Panel Survey Nonresponse. *Quality and Quantity*, 36:129–144.
- David, M., Little, R. J., Samuhel, M. E., and Triest, R. K. 1986. Alternative Methods for CPS Income Imputation. *Journal of the American Statistical Association*, 81:29–41.
- Dubin, J. A. and Rivers, D. 1989. Selection Bias in Linear Regression, Logit and Probit Models. *Sociological Methods and Research*, 18:360–390.
- Esser, H. 1993. Response Set: Habit, Frame or Rational Choice? In Krebs, D. and Schmidt, P., editors, *New Directions in Attitude Measurement*, pages 293–314, Berlin - New York. de Gruyter.
- Goldstein, H. 1995. *Multilevel Statistical Models*. Wiley, New York.
- Goyder, J. 1987. *The Silent Minority. Nonrespondents on Sample Surveys*. Polity Press, Cambridge.
- Groves, R. M. 1989. *Survey Errors and Survey Costs*. John Wiley & Sons, New York.
- Heberlein, T. and Baumgartner, R. 1978. Factors affecting response rates to mailed questionnaires: A quantitative analysis of the published literature. *American Sociological Review*, 43:447–462.
- Hill, D. H. 1991. Interviewer, Respondent, and Regional Office Effects on Response variance: A Statistical Decomposition. In Biemer, P., Groves, R., Lyberg, L., Nathiowitz, N., and Sudman, S., editors, *Measurement Errors in Surveys*, pages 463–483, New York. Wiley.
- Hox, J. J. 1994. Hierarchical Regression Models for Interviewer and Respondents Effects. *Sociological Methods & Research*, 22(3):300–318.
- Jordan, L. A., Marcus, A. C., and Reeder, L. G. 1980. Response Styles in Telephone and Household Interviewing: A Field Experiment. *Public Opinion Quarterly*, 44:210–222.
- Kahn, R. L. and Cannel, C. F. 1968. Interviewing. In Sills, D. L., editor, *International Encyclopedia of the Social Sciences*, volume 8, pages 149–161, New York.

- Kalton, G., Kasprzyk, D., and Santos, R. 1981. Issues of Nonresponse and Imputation in the Survey of Income and Program Participation. In Krewski, D., Platek, R., and Rao, J., editors, *Current Topics in Survey Sampling*, New York. Academic Press.
- Laurie, H., Smith, R., and Scott, L. 1999. Strategies for Reducing Nonresponse in a Longitudinal Panel Survey. *Journal of Official Statistics*, 15(2):269–282.
- Little, R. J. and Schenker, N. 1995. Missing Data. In Arminger, G., Clogg, C. C., and Sobel, M. E., editors, *Handbook of Statistical Modeling for the Social and Behavioral Sciences*, pages 39–75, New York - London. Plenum Press.
- Longford, N. T. 1987. A fast scoring algorithm for maximum likelihood estimation in unbalanced mixed models with nested effects. *Biometrics*, 74:817–827.
- Longford, N. T. 1995. Random Coefficient Models. In Arminger, G., Clogg, C., and Sobel, M., editors, *Handbook of Statistical Modeling for the Social and Behavioral Sciences*, pages 519–578, New York. Plenum Press.
- Loosveldt, G., Carton, A., and Billet, J. 1999a. Evaluation of the relationship between data quality and interviewer behavior during doorstep contact in face-to-face interviews. Paper presented at the International Conference on Survey Non-response, Portland, Oregon, USA.
- Loosveldt, G., Pickery, J., and Billet, J. 1999b. Item non-response as a predictor of unit non-response in a panel survey. Paper presented at the International Conference on Survey Non-response, Portland, Oregon, USA.
- Madow, W. G., Nisselson, H., and Olkin, I., editors 1983. *Incomplete Data in Sample Surveys*, volume I-III. Academic Press, New York - London.
- Moore, J. C., Stinson, L. L., and Edward J. Welniak, J. 2000. Income Measurement Error in Surveys: A Review. *Journal of Official Statistics*, 16(4):331–362.
- O’Muircheartaigh, C. and Campanelli, P. 1998. The relative impact of interviewer effects and sample design effects on survey precision. *Journal of the Royal Statistical Society*, A,161:63–77.
- O’Muircheartaigh, C. and Campanelli, P. 1999. A multilevel exploration of the role of interviewers in survey non-response. *Journal of the Royal Statistical Society*, A,162:437–446.
- Pannekoek, J. 1991. A Mixed Model for Analyzing Measurement Errors for Dichotomous Variables. In Biemer, P., Groves, R., Lyberg, L., Nathiowitz, N., and Sudman, S., editors, *Measurement Errors in Surveys*, pages 517–531, New York. Wiley.

- Phillips, D. L. 1971. *Knowledge From What?* Rand McNally, Chicago.
- Phillips, D. L. 1973. *Abandoning Method.* Jossey-Bass, San Francisco.
- Pickery, J., Loosveldt, G., and Carton, A. 2001. The Effects of Interviewer and Respondent Characteristics on Response Behavior in Panel Surveys. *Sociological Methods & Research*, 29(4):509–523.
- Rasbash, J., Browne, W., Goldstein, H., Yang, M., Draper, D., Plewis, I., Healy, M., and Woodhouse, G. 1999. *MLwiN User's guide.* Institute of Education, London.
- Rendtel, U. 1990. Teilnahmebereitschaft in Panelstudien: Zwischen Beeinflussung, Vertrauen und Sozialer Selektion. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 42(2):280–299.
- Rendtel, U. 1995. *Panelausfälle und Panelrepräsentativität.* Campus Verlag, Frankfurt/Main - New York.
- Reuband, K.-H. 1984. Dritte Personen beim Interview - Zuhörer, Adressaten oder Katalysatoren der Kommunikation. In Meulemann, H. and Reuband, K.-H., editors, *Soziale Realität im Interview*, pages 117–157, Frankfurt/Main - New York. Campus.
- Scholl, A. 1993. *Die Befragung als Kommunikationssituation.* Westdeutscher Verlag, Opladen.
- Schräpler, J.-P. 2003. Gross-Income-Nonresponse in the German Socio-Economic Panel (GSOEP) - Refusal or Don't Know? *Schmollers Jahrbuch. Zeitschrift für Wirtschaft- und Sozialwissenschaften*, 123(1).
- Singer, E., Mathiowetz, N., and Couper, M. 1993. The impact of privacy and confidentiality concerns on survey participation: The case of the 1990 U:S: census. *Public Opinion Quarterly*, 57:465–482.
- Sirken, M. G., Jabine, T., Willis, G. B., Martin, E., and Tucker, C. 1999. A New Agenda for Interdisciplinary Survey Research Methods. Proceedings of the CASM II Seminar. Hyattsville, Maryland: U.S. Department of Health and Human Services.
- Sirken, M. G., Willis, G. B., and Nathan, G. 1991. Cognitive aspects of answering sensitive questions. Proceedings of the International Association of Survey Statisticians. Paris: International Statistical Institute.
- Smith, T. W. 1991. An Analysis of Missing Income Information on the General Social Surveys. GSS Methodological Report No. 71.
- Sudman, S. and Bradburn, N. 1974. *Response Effects in Surveys.* Aldine Publishing Company, Chicago.

- Sudman, S., Bradburn, N., and Schwarz, N. 1996. *Thinking about questions: The application of cognitive processes to survey methodology*. Jossey-Bass, Chicago.
- Tourangeau, R. 1984. Cognitive Science and Survey Methods. In Jabine, T., Straf, M., Tanur, J., and Tourangeau, R., editors, *Cognitive Aspects of Survey Methodology: Building a Bridge Between Disciplines*, pages 73–100, Washington, DC. National Academic Press.
- Tourangeau, R., Rips, L. J., and Rasinski, K. 2000. *The Psychology of Survey Response*. Cambridge University Press, Cambridge - New York.
- Wagner, M. and Motel, A. 1996. Die Qualität der Einkommensmessung bei alten Menschen. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 48(3):493–512.
- Yammarino, F., Skinner, S., and Childers, T. 1991. Understanding mail survey response behavior. *Public Opinion Quarterly*, 55:613–639.