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Changing from PAPI to CAPI: A longitudinal study of Mode-Effects based on an Experimental Design

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Abstract

This paper examines the implication of the move to CAPI for data quality by analyzing the conversion from PAPI to CAPI of a subsample of the German Socio-Economic Panel (SOEP) which was done within an experimental design.

The 2000 addresses for the sample E of SOEP were split into two subsamples E1 and E2 with the same structure using twin - sample points. Each of the 125 sample points contained 16 addresses (8 for E1 and 8 for E2) and had to be realized in the first wave alternately with PAPI and CAPI mode per interviewer. In the subsequent waves the PAPI mode was partly replaced by CAPI. With this experimental longitudinal design we are able to control for possible interviewer effects in the analysis of mode effects.

The paper assesses whether any mode effects are apparent for the response rate. Within the data, we examine monetary dimensions such as gross income, item and unit nonresponse rates. We were able to find some minor effects but our main results show that we have made the shift without introducing strong mode effects.

Keywords: CAPI, Mode effects, data quality, interviewer effects
JEL classification: C81

1 Introduction

This paper assesses the effect of a change from the traditional Paper-and-Pencil Interviewing (PAPI) method to Computer-Assisted Personal Interviewing (CAPI) within an ongoing panel study by means of an experimental design. This was done for a subsample of the German Socio-Economic Panel (SOEP) from the year 1998 on.

Computer-Assisted Personal Interviewing (CAPI) is a newly developing field and an increasingly viable alternative for data collection in survey research. In CAPI, interviewers visit respondents with a portable computer and conduct a face-to-face interview using the computer. After the interview the data are sent to a central computer. CAPI was first tested in Europe by Statistics Sweden (Danielsson/Maarstad 1982) in 1982 and by Statistics Netherlands in 1984 (Bemelmans-Spork/Sikkel 1985). The first national household survey which used CAPI for all of its data collection was the Netherlands Labor Force Survey in 1987 (van Bastelaer/Kerssemakers/Sikkel 1988). In the same year the first U.S. national household survey, the Nationwide Food Consumption Survey, used CAPI for at least part of its data collection and was conducted by national analysts (Rothschild/Wilson 1988). Since that time the use of CAPI grew rapidly, the further history and development of the implementation process worldwide is described in detail by Couper and Nicholls (1998).

An important challenge is the step from PAPI to CAPI within an ongoing panel study. This step was done for the British Household Panel Study (BHPS) which had no means to check the potential influence of the new mode on results (cf. Laurie 2003). Even if CAPI could deliver better data quality than PAPI, an impact resulting from a change in interviewing mode would be undesirable since it could potentially create artificial longitudinal results. For the second major household panel study in Europe, the German Socio-Economic Panel (SOEP), it was possible to introduce CAPI in a more controlled manner than was possible for BHPS. In this paper we analyze the results of the controlled change from PAPI to CAPI.

2 Previous experiences on the use of CAPI in surveys

De Leeuw and Nicholls (1996) point out that "whether computer assisted data collection methods (CADAC) should be used for survey data collection is no longer an issue. Most professional research organizations ... are adopting these new methods with enthusiasm."The main potential advantages and disadvantages of CAPI as well as the effects of the transition from PAPI to CAPI are discussed by Weeks (1992), Martin/Manners (1995) and Nicholls et al. (1997). Often anticipated benefits in moving from PAPI to CAPI are cost saving and reduction in the time elapsed between fieldwork and the availability of the data for analysis. For academic studies like BHPS and SOEP, the potential improvement in data quality is much more important. Better quality is not only due to CAPI itself, but can be the result of a self-selection process among interviewers: if the professional interviewers want to work with CAPI, the quality of surveys administrated by PAPI may go down because there was negative self-selection into the group of remaining interviewers.

Nevertheless, cost saving does not seem to be a common outcome when PAPI inter-

view methods are replaced by CAPI (Couper/Nicholls 1998). CAPI requires a sizeable investment in hardware and more front-end design and development work than PAPI. These costs have to be balanced against the avoidance of costs of producing and handling paper questionnaires, data keying and office editing at the back-end (Martin et al. 1993). Since these back-end costs are variable and the front-end costs are largely fixed, CAPI is economically attractive for large surveys and ongoing surveys (Weeks 1992).

A main advantage of CAPI is that at the end of the interview the CAPI data are in electronic form and ready to be combined into a simple raw data set. Hence the time elapsed between the fieldwork and the availability of the data for analysis is reduced (Martin et al. 1993). Nicholls and De Leeuw (1996) found that increased timelessness was the most frequently given reason for adopting computer assisted interviewing for specific studies mentioned in the literature.

Another important aspect is that there is empirical evidence that computer assisted interviewing (CAI) and especially CAPI improves data quality. The literature reports fewer instances of missing data (Sebestik et al. 1988, Olsen 1992) mostly because interviewers cannot make routing errors. Nicholls et al. (1997) report that "one of the most consistent conclusions of the CAI literature is that CAI can eliminate virtually all respondent and interviewer omissions of application items, but provide little or no reduction in rates of explicit refusals".

In the case of unit nonresponse, there was some concern that CAPI respondents would object to having their information stored on a computer. But the studies that compared the refusal rates in CAPI with those of PAPI have found no significant differences (c.f. Baker et al. 1995) or only slightly higher rates of unit nonresponse with computer-assisted data collection than with conventional paper methods (Tourangeau et al. 1997). Often these small differences are attributed to the inevitable hardware difficulties when a new technology is introduced, but it is also possible that they reflect some resistence to the computer on the part of interviewer or respondents.

Respondent's and interviewer's acceptance of the new technology could also affect the data quality. Baker (1992) reports that most respondents find CAPI interesting and amusing, and attribute a greater degree of professionalism to CAPI. Generally most reactions are neutral or positive, only a steady minority of 5% preferred paper-and-pencil versions of the interview (De Leeuw et al. 1995). De Leeuw et al. (1995) report that when explicitly asked about the data privacy, 47% have more trust in the privacy of computer-collected data, 5% have more trust in traditionally collected data, and 48% see no difference. Respondents' positive reactions to the new data collection methods are in line with the findings in some studies that compare PAPI and CAPI and report slightly less social desirability bias with CAPI (Baker/Bradburn 1992, Martin et al. 1993). Baker et al. (1995) reported a greater respondent willingness to disclose sensitive information. But overall these differences seem to be rather small (De Leeuw

et al. 1995).

De Leeuw et al. (1995) and Martin et al. (1993) also describe broad interviewer acceptance of CAPI. Once trained, most interviewers preferred to use CAPI. The only important complaint raised by interviewers was the difficulty of grasping the overall structure of the questionnaire (Riede and Dorn 1991) and some complain about the weight of the computer (Edwards et al. 1993, cited from De Leeuw et al. 1995).

3 The experimental design of sample E in the SOEP

The German Socio-Economic Panel (SOEP) Survey (cf. Wagner et al. 1993) was extended by a refreshment sample E in 1998 (Infratest 1998, 2000). The aim of this new sample is fourfold: 1. stabilization of the number of cases, 2. in-depth analysis of potential panel effects, 3. extended analysis of SOEP's overall representativeness and 4. analysis of the transition from PAPI to CAPI using an experimental design.

3.1 Design of sample E

All samples of SOEP are multi-stage random samples which are regionally clustered and the respondents (households) are selected by random walk[1]. The SOEP is conducted by a "method mix". The preferred procedure for performing the survey is PAPI-based face-to-face interviews. Respondents also may complete the questionnaire themselves in the presence of the interviewer (self-completed) and receive help from the interviewer if needed. Sometimes a single interview combines both procedures (mixed). In waves 2 and later, interviews were conducted by mail in cases where respondents would otherwise probably not cooperate.

Wave 1 of subsample E was done in a rarely performed "textbook version"of a random walk. The listing of the addresses was separated from the interviewing process, so the interviewers had fixed addresses (like register addresses). Sample E contains 2000 German households which were split into two identical subsamples E1 and E2 with the same structure using twin sample points. Each of the 125 sample points contains 16 addresses (8 for E1 and 8 for E2) and had to be realized in the first wave alternately with PAPI-based methods and CAPI modes from the same interviewer. For each address it was defined in advance if the interviewer has to use PAPI or CAPI. Nevertheless, to realize the intended sample size and to prevent refusals or non-participation some exceptions were allowed:

- in some CAPI-households with many respondents, some individuals were allowed to use PAPI as well. In the case of large households the PAPI method is slightly

[1]The "guestworker sample"(subsample B) was the only exception: it was surveyed by means of register data.

more flexible than CAPI because the other respondents can complete their questionnaire by paper and pencil at the same time in the presence of the interviewer in the household (Von Rosenbladt/Stutz 1998).

- in the last stage of the fieldwork there were very few good PAPI interviewers who also worked in the CAPI subsample and used paper and pencil
- in a few cases in both subsamples the interview was carried out by mail to prevent refusals

Table 1 shows the response rate in wave 1 of subsample E1 and E2. Because of 3.4% neutral losses (apartments had no inhabitants) in E1 and 2.6% in E2, 52 reserve addresses were used. After that the remaining gross sample consists of 994 addresses in E1 and 998 addresses in E2. The systematic losses in E1 were caused by 40.1% refusals (41.2% in E2) and 4.0% non-contacts (5.2% in E2) as well as 0.5% non-utilisable interviews (0.6% in E2). The resulting total response rate was 54.1% of sample E1 and 51.9% of sample E2. In addition 23 household interviews could be detected as fabricated by two interviewers (12 in E1 and 11 in E2).

Table 2 shows the effective data collection methods in both subsamples E1 and E2 on the household and the individual level in the first wave. Overall from the 2,000 household addresses (E1 + E2) 1,056 household interviews could be realized. According to the survey plan over 80% of the household interviews in E1 are in fact collected via face-to-face and over 76% of the household interviews in E2 are in fact collected via CAPI. On the individual level the according proportions are slightly lower. Hence we can conclude that the intended method split is not assert completely in order to avoid unit non-response, but the partly segregation of data collection methods and interviewer clusters does allow us to analyze these components separately.

TABLE 1: *Response rate in wave 1 of subsample E1 and E2*

	E1 (PAPI)		E2 (CAPI)	
	N	%	N	%
Household addresses	1000		1000	
neutral losses*)	34		26	
reserve addresses	28		24	
Household addresses	994	100.0	998	100.0
not reached	40	4.0	52	5.2
final refused	399	40.1	411	41.2
not evaluable	5	0.5	6	0.6
faked household interviews	12	1.2	11	1.1
number of realized household interviews	538	54.1	518	51.9

*) apartments were uninhabited or resident had died

TABLE 2: *Data collection methods in the subsamples E1 and E2, wave 1 (1998)*

	E1 (PAPI)		*E2 (CAPI)*		*total*	
Method	*N*	*%*	*N*	*%*	*N*	*%*
Households						
PAPI	432	80.3	90	17.4	522	49.4
CAPI	16	3	398	76.8	414	39.2
Self completed	41	7.6	6	1.2	47	4.5
Mixed	25	4.6	6	1.2	31	2.9
Mail	22	4.1	16	3.1	38	3.6
d.k.	2	0.4	2	0.4	4	0.4
Total	538	100	518	100	1056	100
Persons						
PAPI	650	65.4	158	17.2	808	42.3
CAPI	24	2.4	679	74.1	703	36.8
Proxy	2	0.2	-	-	2	0.1
Self completed	146	14.7	43	4.7	189	9.9
Mixed	127	12.7	15	1.7	142	7.4
Mail	21	2.1	19	2.1	40	2.1
d.k.	24	2.4	2	0.2	26	1.4
Total	994	100	916	100	1910	100

Source: SOEP 1998, Sample E

Table 3 shows the distribution of the data collection methods in the first five waves of sample E on the household and individual level. We can recognize that it was tried to keep up the method split between CAPI and PAPI in the first two waves. 49% of all households were interviewed by face-to-face and 39% by CAPI. In the second wave the proportion of face-to-face interviews declines to 40% and CAPI is used in 41% of all household interviews. After the second wave the PAPI mode is by intention replaced by CAPI. We can observe that the proportion of the PAPI-based face-to-face interviews declines from 49% in the first wave to 19% in wave five on the household level and from 42% to 17.5% on the individual level. At the same time the proportion of computer assisted personal interviewing increases from 39% in wave one to 57% in wave five on the household level.

TABLE 3: *Development of the data collection methods in Sample E, 1998 - 2002*

	1998		*1999*		*2000*		*2001*		*2002*	
	n	*%*	*n*	*%*	*n*	*%*	*N*	*%*	*n*	*%*
Households										
PAPI-based methods										
Face-to-face	522	49.4	358	40.4	130	15.4	135	16.6	149	19.3
Self-completed	47	4.5	84	9.5	84	10	81	10	90	1.6
Mixed	31	2.9	21	2.4	10	1.2	9	1.1	18	2.3
Mail	38	3.6	57	6.4	68	8.1	73	9	78	10.1
CAPI	414	39.2	363	41	547	65	510	62.9	438	56.7
d.k.	4	0.4	3	0.3	3	0.4	3	0.4	-	-
Total	1056	100	886	100	842	100	811	100	773	100
Persons										
PAPI-based methods										
Face-to-face	808	42.3	589	36.2	237	15.3	225	15.4	240	17.5
Self-completed	189	9.9	232	14.2	180	11.6	174	1.9	208	15.1
Mixed	142	7.4	51	3.21	44	2.8	29	2	50	3.6
Proxy	2	0.1	1	0.1	1	0.1	1	0.1	-	-
Mail	40	2.1	97	6	116	7.5	119	8.1	125	9.1
CAPI	703	36.8	647	39.7	958	61.8	913	62.4	750	54.6
d.k.	26	1.4	10	0.6	13	0.8	3	0.2	-	-
Total	1910	100	1629	100	1549	100	1464	100	1373	100

Source: SOEP, Sample E, 1998 - 2002

3.2 Field experiences with CAPI in sample E

Although the response rate in CAPI subsample E2 is, at 51.9% slightly lower than in PAPI sample E1 (54.1%) in wave 1 (see table 1) we cannot conclude that respondents exhibit a more reserved reaction to interviews conducted using laptops. The experiences show that the decision about participation or non-participation is made before the interviewer has unpacked the laptop (Infratest 1998). Furthermore no problems about respondents' acceptance with CAPI is reported by the interviewers. And the difference between the two response rates is not significant.

One advantage of computer-assisted interviewing is that some errors like routing mistakes are not possible. Some data and consistency checks which are normally done after the data collection can be done automatically during the interview process in CAPI. Therefore the editing group of the fieldwork organization has had less work with

the CAPI data set in the SOEP.

One result is that the whole interview process in large households with many respondents will take more time in the case of CAPI than a flexible mix of traditional PAPI methods, where self-completion of questionnaires either in the presence or in the absence of the interviewer is allowed. Table 4 shows the percentages of CAPI interviews in the CAPI split sample E2 by the number of respondents in the household. We can see that with increasing numbers of respondents, interviewers increasingly used PAPI-based methods. It can be assumed that the time required for CAPI interviewing of all household members is the reason behind this tendency.

TABLE 4: *Data collection method in the CAPI split sample E2 by number of respondents in the household*

	Number of respondents in household			
	1	*2*	*3*	*4*
CAPI	75.2	75.4	63.3	55.6
self-completed	3.2	4.8	13.3	16.7
other methods	21.6	19.8	23.4	27.7
Total	100	100	100	100

Source: SOEP Sample E, 1998

4 Mode effects on data quality

As mentioned above one reason to move from PAPI to CAPI is the expectation of data quality improvements based on several different calculations. However, even in the best case this could create survey artefacts due to mode effects in the SOEP and could create a break in time series within the longitudinal study. In this section we use some key indicators to examine data collection mode effects in sample E. These indicators are unit-nonresponse, missing values, and gross income-nonresponse.

4.1 Hypotheses

Based on recent results in the literature and the first fieldwork experiences with the move from PAPI to CAPI of the SOEP group we derive three hypotheses:

Respondent's acceptance: Baker (1992) describe broad respondent acceptance in the case of CAPI. Moreover, no problems about respondent's acceptance with CAPI

is reported by the SOEP interviewers. We can assume that respondents who were asked to respond to the survey using CAPI, but were unhappy with this, will refuse to participate in the following wave. On this basis, we derive our first hypothesis: we can assume that there are no significant differences between PAPI and CAPI for the probability of non-participation in the following wave. However, the effect may be small.

Implausible values: Some studies report that CAPI may reduce routing errors due to the use of consistency checks during the interview process. Our second hypothesis is that CAPI interviews have a lower number of implausible values than PAPI. However, the SOEP is edited carefully, so a non-significant effect is also possible.

Willingness to disclose sensitive information: Baker et al. (1995) and de Leeuw (1995) report a greater willingness of respondents to disclose sensitive information for CAPI. They assume that respondents are not concerned about having their information stored on the computer. Monthly income is one of these sensitive items. Therefore we can assume that we will not find significant differences between income nonresponse rates for CAPI and PAPI. However, because there has been much public discussion about privacy issues in computer databases in Germany, there could be a significant effect here as well.

4.2 Respondent's acceptance - Unit Nonresponse

In this subsection we examine the probability to participate in the next wave after a CAPI interview took place. Unit nonresponse (non-participation) is given when respondents are unable (ill, deceased, or moved abroad) or unwilling (refusing) to participate in the survey. A few households could not be found during the fieldwork. Table 4 shows the frequencies of these categories in wave 1 up to 5 in Sample E. Interviewers classify over 80 percent of this attrition as unwilling respondents and refusals. Again, note that we restrict our non-response analysis to respondents who participate in at least 1 wave.

TABLE 5: *Reasons for unit-nonresponse in Sample E*

	Wave									
	2		3		4		5		total	
	N	%	N	%	N	%	N	%	N	%
unsuccessful at the time (e.g. sick)	13	3.4	9	3.6	13	5.9	5	2.1	40	3.6
unwilling	92	24.2	72	28.5	74	33.8	96	39.7	334	30.5
final refusal	271	71.1	146	57.7	110	50.2	116	47.9	643	58.7
dead			15	5.9	13	5.9	20	8.3	48	4.4
HH not found	5	1.3	11	4.4	9	4.1	5	2.1	30	2.7
total	381	100	253	100	219	100	242	100	1095	100

Source: SOEP, Sample E, 1998 - 2002

To show the influence of earning-related institutions and occupation on unit nonresponse we use the classification of table 6 and classify occupation in three groups. These groups are defined on type of position (wage, salary, or civil service) and occupational skills. Figures 1 and 2 show the unit nonresponse rate by the mode of data

Table 6: Classification of the vocational position

	vocational position	occupation
LOW	hourly-paid worker	unskilled worker, semiskilled worker
MEDIUM	hourly-paid worker	skilled worker, foreman, master,
	salaried employee	industry- and works foreman, employee with simple activity, skilled activity
	civil servant*	minor and lower-grade civil service
HIGH	salaried employee	highly skilled activity, executive function
	civil servant*	high and senior service

* civil servant includes also government officials

collection used in the previous wave and by respondent's vocational position. A fairly inconsistent pattern can be seen in the graph on the right. After a strong decrease of drop outs for respondents in low earning positions from 20% in wave 2 to approximately 5% in waves 2 and 3, the rate increases again to 20% in wave 5. The rates for medium and high earners decreases moderately from 18% to 11% in wave 5. Schräpler (2004) has shown that in sample A of the SOEP the mail mode is a strong indicator for cooperation problems and that respondents who answer by mail often drop out of the survey in the next wave. The left graph in figure 1 shows a similar pattern: mail interviews have higher unit nonresponse rates in the following wave than the other modes. Furthermore, it seems that CAPI performs slightly better than PAPI because the rate of lost respondents declines from wave to wave and is only 8% in wave 5 whereas for PAPI, the unit nonresponse rate increases to 16% in the last wave. In wave 5, these increasing rates could indicate serious cooperation problems for respondents in low occupational states, and the PAPI mode has seen in figures 1 and 2. For the explanation of unit nonresponse and the impact of the interview mode we estimate multilevel logit regression models.

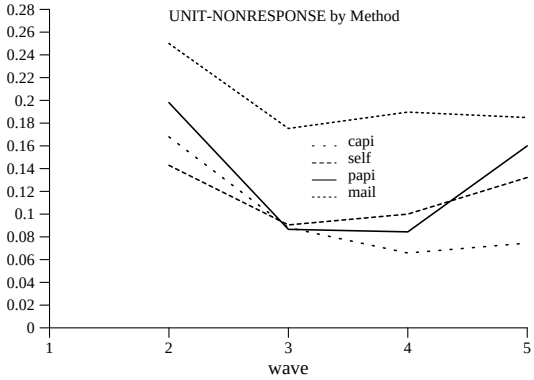


FIGURE 1: *SOEP, Sample E: Share of unit nonresponse by data collection method .*

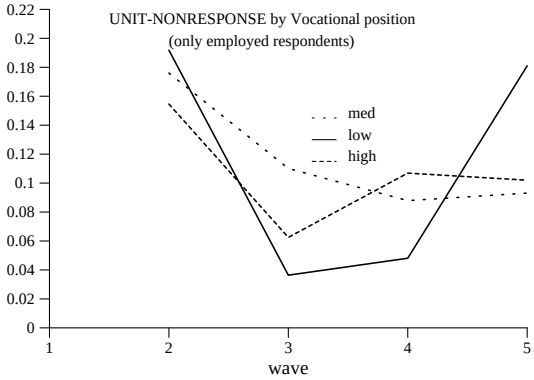


FIGURE 2: *SOEP, Sample E: Share of unit nonresponse by vocational position*

4.2.1 Modeling unit nonresponse

The respondent chose between two alternatives, participation or non-participation in the following wave. We use a regression framework to determine how various factors influence the attractiveness of the alternatives to different types of individuals. Because of the binary response character we can use a probit or an ordinary logit model with multilevel extension.

Level 1 consists of i respondents and level 2 represents the aggregate level, which is formed by j interviewers. Hence for respondent i and interviewer j one dichotomous variable y_{ij} is observed:

$$y_{ij} = \begin{cases} 1, & \text{if } y^*_{ij} > 0, \text{ unit-nonresponse (next wave)} \\ 0, & \text{otherwise} \end{cases}$$

$$y_{ij} = \pi_{ij} + u_{ij}$$

If we specify a two-level random intercept model (model 1) the probability for π_{ij} for each response is estimated from:

$$\pi_{ij} = \left[1 + exp(-(\beta_{0j} + \sum_{h=1}^{H} \beta_{h,ij} x_{h,ij} + v_{0j}))\right]^{-1} \tag{1}$$

where $x_{h,ij}$ represents values for covariates x_h $(h = 1, \ldots, H)$ of respondent i and interviewer j. The intercept β_{0j} is specified as random on level 2 (interviewer level)

and the variance is estimated as v_{0j}. The random variation among the respondents on level 1 is estimated as the variance u_{ij}.

Up to this point, we have assumed that the effects of the explanatory variables are the same for each interviewer. We will now modify this assumption in model 2 by allowing the effect of the CAPI mode to vary across interviewers. Therefore, we have to introduce a random coefficient for CAPI.

$$\beta_{(capi)j} = \beta_{capi} + v_{capi,j} \tag{2}$$

Hence we specify a two-level random coefficient model (model 2) with the probability π_{ij}:

$$\pi_{ij} = \left[1 + exp(-(\beta_{0j} + \sum_{h=1}^{H} \beta_{h,ij} x_{h,ij} + x_{capi} v_{capi,j} + v_{0j}))\right]^{-1} \tag{3}$$

where $v_{capi,j}$ is a normally distributed random effect with mean zero and variance $\sigma^2_{v,capi}$

$$\begin{bmatrix} v_{0,j} \\ v_{capi,j} \end{bmatrix} \sim N(0, \Sigma_R) : \Sigma_R = \begin{bmatrix} \sigma^2_{v,0} & \\ \sigma_{v,capi0} & \sigma^2_{v,capi} \end{bmatrix}$$

Allowing the coefficient of CAPI to vary across interviewers has also introduced the parameter $\sigma_{v,capi0}$ which is the covariance between v_{0j} and $v_{capi,j}$.

4.2.2 Regressors of the unit nonresponse model

Regressors can be considered in three groups:

1. *Demographic and household variables for the respondent*: "age"is the age of the respondent in years, "sex"= 1 indicates male respondent, "low, med. and high occup."= 1 as well as trainees, self-empl. and milit./civil serv. = 1 indicate the corresponding occupational status, "size of HH."indicates the number of persons living in respondents household. "Move"= 1 indicates that the respondent changed residence in the prior 12 months.

2. *Demographic variables for the interviewer*: "isex"= 1 indicates male interviewer[2].

3. *Variables that describe the interview situation*: "CAPI"= 1 indicates a CAPI interview, "self completed"= 1 indicates a self-completion mode of response in the presence of the interviewer, "mixed"= 1 indicates a mixed mode, "change of interviewer"= 1 indicates a change in interviewer.

[2]For further details of available data about interviewer characteristics in the SOEP see Schräpler/Wagner 2001.

4.2.3 Estimates

Table 7 on page 14 shows estimates of two univariate logit models for waves 1 to 4. Model 1 is a random intercept model where only the intercept is allowed to vary across the interviewers. Model 2 is a random coefficient model, where we allow this variation also for the slope for CAPI. The sample contains a total of 1,583 respondents who participated in wave 1, with 110 interviewers. In the following the samples in waves 2 to 4 decline due to attrition.

The estimates of model 1 and 2 show in the first wave no significant effects of respondent characteristics on unit nonresponse. But we find a strong positive significant effect on unit nonresponse for moving respondents (move) and also for the change of the interviewer (change of int.).

We were interested mainly in mode effects. Our first hypothesis states that we will not find significant differences between the coefficients for PAPI and CAPI. Although the coefficient for CAPI is negative in all waves it seems that this mode does not perform significantly better than the reference category PAPI in the first three waves. An exception is the significant negative effect of CAPI for waves 4 to 5, where the PAPI mode has the worst attrition rate of all interview modes. In addition to this main effect we find that the CAPI coefficient varies significantly between the interviewers in the random coefficient model 2 ($\sigma^2_{v,capi}$) in waves 1 and 2. This means that the impact of the CAPI mode at time t on the participation in the following wave t + 1 depends on interviewer's performance especially in the first two waves. We can assume that this finding is caused by interviewer's skill in managing the new data collection method. Interviewers who are confident with the new technique might be act in a more trustworthy manner than interviewers who are lack expertise in the use of CAPI.

Furthermore we find a gender interviewer effect: male interviewers lost significantly more respondents after the first wave than female interviewers. Besides this identifiable systematic effect we find significant interviewer/area variances σ^2_v in all waves and significant covariances $\sigma_{v,capi0}$ between the interviewer and the CAPI variance $\sigma^2_{v,capi}$ in the first two waves.

TABLE 7: *Multilevel Logit-model for unit nonresponse in the follwoing wave, model 1 - random intercept model; model 2 - random coefficient model*

	wave 1				wave 2				wave 3				wave 4			
	model 1		model 2		model 1		model 2		model 1		model 2		model 1		model 2	
	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.	$\hat{\beta}$	s.e.
Fixed																
Intercept	-2.099***	0.63	-2.012***	0.67	1.215	1.43	-1.125	1.52	-1.204	1.61	-0.952	1.43	-0.619	1.35	-0.761	1.361
respondent																
sex (1 - men)	-0.044	0.15	-0.061	0.16	-0.013	0.22	0.001	0.24	0.219	0.28	0.13	0.24	0.139	0.25	0.159	0.253
age (year)	0.005	0.01	-0.004	0.01	-0.022**	0.01	-0.020**	0.01	-0.028**	0.01	-0.022**	0.01	-0.017*	0.01	-0.017*	0.001
not empl. (ref)																
low occup.	-0.364	0.56	-0.343	0.6	-1.859*	1.05	-1.930*	1.09	-1.398	1.25	-1.254	1.1	-0.802	1.11	-0.817	1.118
med occup.	-0.278	0.51	-0.299	0.53	-0.902	0.87	-0.998	0.92	-1.834*	1.13	-1.532	0.99	-2.152*	1.06	-2.154*	1.067
high occup.	-0.167	0.55	-0.102	0.57	-1.86	0.97	-1.899*	1.02	-1.251	1.2	-0.941	1.04	-1.557	1.11	-1.536	1.121
Trainees	0.189	0.66	0.032	0.69	-0.198	0.96	-0.399	1.02	-2.174*	1.35	-1.847*	1.19	-1.551	1.16	-1.545	1.179
self-empl.	-0.27	0.59	-0.138	0.62	-0.822	0.93	-0.823	0.97	-0.799	1.19	-0.734	1.05	-1.29	1.11	-1.294	1.118
Milit./civi. serv.	-0.327	0.51	-0.297	0.54	-1.061	0.89	-1.167	0.93	-0.867	1.12	-0.748	0.99	-1.875*	1.07	-1.863*	1.077
size of HH	-0.077	0.07	-0.088	0.07	-0.291**	0.11	-0.267**	0.13	-0.470***	0.15	-0.422***	0.13	0.309***	0.11	0.307***	0.115
Move (t + 1)	1.290***	0.43	1.468***	0.44	1.933***	0.5	2.154***	0.56	3.014***	0.49	2.761***	0.45	1.457***	0.61	1.542***	0.627
Interviewer																
isex (1 - men)	0.946***	0.27	1.032***	0.28	-0.31	0.36	-0.35	0.39	0.717	0.52	0.477	0.36	0.204	0.39	0.169	0.387
Situation																
change of int. (t +1)	0.468*	0.29	0.438	0.3	2.318***	0.36	2.266***	0.39	3.831***	0.4	3.311***	0.32	3.973***	0.4	3.911***	0.407
sum of part.					0.573	0.52	0.36	0.56	0.133	0.34	0.083	0.3	-0.184	0.17	-0.19	0.174
Papi (ref)																
Capi	-0.244	0.17	-0.341	0.27	-0.022	0.25	0.182	0.41	-0.564	0.46	-0.295	0.44	**-1.000****	**0.4**	**-0.802****	**0.443**
self completed	-0.037	0.32	-0.092	0.34	-0.03	0.39	-0.279	0.47	0.505	0.59	0.304	0.56	-0.24	0.48	0.01	0.501
Mixed	-0.145	0.34	-0.294	0.36	0.508	0.6	0.345	0.66	1.561***	0.67	1.313**	0.64	-2.559**	1.55	-2.358	1.557
Random																
Respond. level																
σ_u^2	1		1		1		1		1		1		1		1	
Interv. Level																
σ_v^2	0.913***	0.22	1.293***	0.35	1.433***	0.41	3.075***	0.96	2.953***	0.79	3.279***	1.08	1.602***	0.48	1.891**	0.806
$\sigma_{v(capi)}^2$			**2.799*****	0.88			**5.572*****	1.93			0.659	1.13			3.104	2.112
$\sigma_{v,capi0}$			-1.265**	0.47			-3.396***	1.22			-1.645	0.96			-1.589	1.214
Interviewer	110		110		115		115		129		129		134		134	
Persons	1583		1583		1477		1477		1420		1420		1340		1340	

Source: SOEP Sample E, individual questionnaire, 1998 - 2002; significance: $*10\%$; $**5\%$; $***1\%$

4.3 Item Nonresponse

In the literature we can find some studies (Sebestik et al. 1988, Olsen 1992) that report fewer missing data in the case of CAPI. They assume that the usage of CAPI avoids routing errors and implausible values. Routing errors are not caused by cooperation or cognitive problems such as refusals and "don't knows". The SOEP distinguishes between implausible values and other types of missing values in sample E. Therefore we can explore if there are differences in these rates by varying data collection modes.

4.3.1 Missing values and implausible values

Table 8 shows the average number of missing values in the individual questionnaires by the data collection method. Because employed persons have to answer more questions than unemployed persons, we calculate the average number for employed respondents separately. The values in the table show a rather consistent result: the average number of missing values are highest in the case of employed respondents and mail and self-completed questionnaires, and lowest in the case of face-to-face interviews. CAPI interviews lie somewhere between these groups.

TABLE 8: *Average number of missing values in the individual questionnaires in Sample E by method*

missing	wave 1		wave 2		wave 3		wave 4		wave 5	
values	all	empl.	all	empl.	all	empl.	all	empl.	all	empl.
face-to-face	5.28	5.88	1.97	2.81	1.66	2.14	2.60	3.14	2.52	2.97
self	6.76	7.44	2.89	2.94	2.53	3.13	3.44	3.71	3.41	3.69
mail	6.48	6.10	3.66	3.91	5.72	6.17	4.91	5.38	5.22	5.44
CAPI	5.46	5.87	2.84	3.37	1.99	2.38	2.57	3.22	4.15	4.87
total	5.68	6.25	2.61	3.22	2.38	2.97	2.97	3.58	3.82	4.37

Source: SOEP, Sample E, individual questionnaire, 1998 - 2002 (own calc.)

Next we look at the average number of implausible values in the questionnaires. Implausible values may be either a result of coding errors caused by untrained interviewers who enter wrong values in the questionnaires or confused respondents who do not understand the question and answer in a wrong way. Well-trained interviewers should be able to detect these implausible values and call attention to them. Furthermore a well-programmed CAPI system should be able to detect values that are out of range automatically and should indicate this on the screen of the laptop immediately. Therefore we can assume that CAPI interviews will have lower rates of implausible

values than face-to-face interviews. Table 9 shows the average number of implausible values in the individual questionnaires by the interview mode used. We see that the total maximum rate of implausible values is only 0.1% in waves 1 and 2.

TABLE 9: *Average number of implausible values in the individual questionnaires in Sample E by method*

	wave 1		wave 2		wave 3		wave 4		wave 5	
	all	empl.	all	empl.	all	empl.	all	empl.	all	empl.
face-to-face	0.07	0.09	0.12	0.12	0.11	0.11	0.04	0.04	0.04	0.05
self	0.06	0.05	0.13	0.11	0.11	0.12	0.15	0.17	0.08	0.09
mail	0.03	0.03	0.09	0.07	0.06	0.06	0.13	0.04	0.09	0.1
CAPI	0.11	0.12	0.06	0.06	0.04	0.05	0.03	0.04	0.03	0.05
total	0.09	0.1	0.1	0.09	0.07	0.08	0.06	0.06	0.05	0.07

Source: SOEP, Sample E, individual questionnaire, 1998 - 2002 (own calc.)

In addition we see that – with the exception of wave 1 – CAPI reduces the number of implausible values in the data set. In waves 2 and 3 the average number for CAPI is half of the average number for face-to-face. In wave 4 and 5, both have nearly the same low rates. We can assume that CAPI has a higher rate in the first wave because of transposition problems. The software used has to be adjusted. Overall it seems that CAPI is the best mode for avoiding implausible values.

4.3.2 Willingness to disclose sensitive information - income nonresponse

In this section we explore if the CAPI mode has a significant effect on respondents' decisions to reveal their earnings. A detail conceptual and empirical explanation of the reasons for income nonresponse is given in Schräpler (2004, 2006). Our comparative study reveals that the same patterns for refusals and don't knows occur in the SOEP as well as in the BHPS and we have shown that it is important to distinguish between the two types of missing values. We do not want to repeat our conceptual framework and empirical results, but do have to repeat some statistical procedures.

Table 10 shows the income nonresponse rate for the gross income question of employed persons in sample E. We exclude in our analysis self-employed persons and trainees. The nonresponse rate is, at 23.7% highest in the first wave, declines to 15.4% in the second wave and then remains relatively constant between 14% and 15%.

Table 11 shows the income nonresponse rate by the applied data collection mode. We see that CAPI interviews have the highest rates of all modes in the first two waves.

TABLE 10: *Item nonresponse rates for the gross income question among employed persons in the SOEP, Sample E (in percent)*

	including self-employed and trainees			*excluding self-employed and trainees*		
wave	*employed respondents*	*missing*	*%*	*selected respondents*	*missing*	*%*
1	1032	272	26.4	870	206	23.7
2	886	167	18.8	736	113	15.4
3	858	151	17.6	716	106	14.8
4	805	153	19	658	95	14.4
5	746	131	17.6	613	89	14.5
total	4327	874	20.2	3593	609	16.9

Source: SOEP, Sample E, 1998 - 2002 (own calc.)

This finding suggests that respondents have some reservations regarding computer-based interviewing on their first encounter with it. Moreover, CAPI interviews have always higher rates than face-to-face interviews.

TABLE 11: *Gross income nonresponse rate by data collection method in sample E, employed persons*

	Wave					
method	*1*	*2*	*3*	*4*	*5*	*N*
Face-to-face	21.4	13.0	12.9	4.1	8.3	864
Mixed	14.6	12.5	14.8	28.6	23.0	173
Self-completed	22.8	12.9	8.9	12.1	1.6	546
Mail	22.2	15.0	23.3	16.2	22.1	305
CAPI	27.2	18.6	15.5	16.9	16.0	1676
N	870	736	716	658	613	3593

Source: SOEP, Sample E, 1998 - 2002 (own calc.)

Because refusals are not distinguished from don't knows in the SOEP, we have to use the same approach as described in Schräpler 2004 in the following. Table 12 shows the cross-tabulation of missing gross and net income, pooled over five waves. We have already established that it is reasonable to assume that respondents who do not state their gross income but do state their net income have cognitive problems in the majority of cases, and that we can classify this behavior as a "don't know"answer. In cases where respondents state neither their gross nor their net income, it is reasonable to assume that they are more or less uncooperative and that we can classify this as a refusal (see Schräpler 2006).

TABLE 12: *Missing gross and net income in sample E, wave 1 - 5*

	net-income					
	valid		missing			
gross-income	N	%	N	%	total	%
valid	2831	78.8	149	4.2	2980	83.0
missing	249	7.0	360	10.0	609	17.0
total	3080	85.8	509	14.2	3589	100.0

Source: SOEP, Sample E, 1998 - 2002 (own calc.)

Table 12 shows that - under these presumptions - the refusals are, at 10%, slightly higher than the don't knows, at 7%. Figures 3 and 4 display the income nonresponse rates by data collection methods. We can recognize that CAPI has in four of five waves the highest and PAPI (face-to-face) in all cases the lowest refusal rate. Furthermore PAPI shows a higher variation of the don't know rate than CAPI.

Figure 5 explores mode-induced differences in the refusal rate separated by respondent's gender. We see that for male respondents the refusal rates are highest in the self-completion mode and for female respondents in the CAPI mode. Nevertheless, we do not find gender differences for the nonresponse rates in CAPI. It seems that the gender effect lies in the fact that male respondents use the self-completion mode more often for refusing than female respondents. We have shown before that the interviewer has less control over the interview process if the respondents fill out their questionnaire by themselves (in front of the interviewer). In this situation it is much easier to skip an unpleasant statement.

Figures 6 and 7 show the influence of occupational positions on income nonresponse. Respondents in high earning positions tend to refuse their income statement whereas respondents in low occupational states have higher rates of don't knows.

Modeling income-nonresponse We estimate two logit models separately for waves 1, 2 and 3. First an univariate logit model for the indicator "income nonresponse"and second, a multivariate logit model with three response variables "refuse", "don't know"and "unit response in the following wave".[3] Again we account for the hierarchical structure of the survey data and use a multilevel model. Level 1 represents the different response variables in the multivariate model, level 2 represents j respondents and level 3 consists of k interviewers. Hence we estimate a multivariate logit model with three levels:

For respondent j and interviewer k one dichotomous variable y_{ijk} is observed:

$$y_{ijk} = \pi_{ijk} + u_{ijk}$$

[3] A similar model for income nonresponse with a probit specification can be found in Schräpler 2004

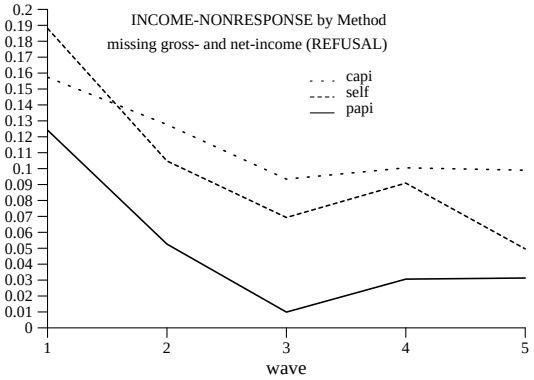


FIGURE 3: *SOEP, Sample E: Share of income nonresponse (refusals) by data collection method.*

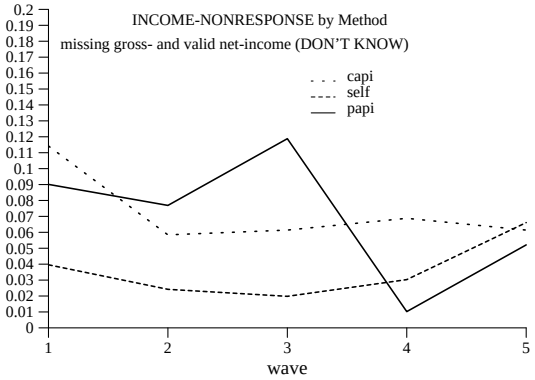
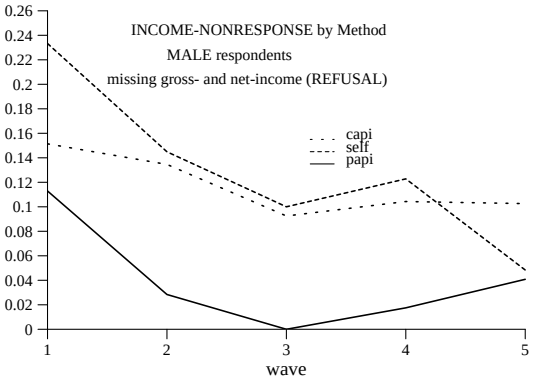


FIGURE 4: *SOEP, Sample E: Share of income nonresponse (don't know) by data collection method.*



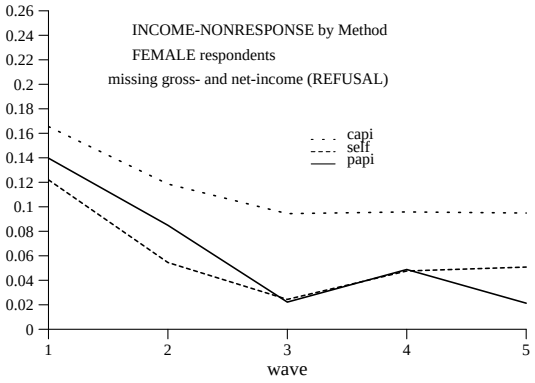


Figure 5: *SOEP, Sample E: Share of refusals by data collection method and gender.*

$$y_{1jk} = \begin{cases} 1, & \text{if } y^*_{1jk} > 0, \text{ refuse} \\ 0, & \text{otherwise} \end{cases} \tag{4}$$

$$y_{2jk} = \begin{cases} 1, & \text{if } y^*_{2jk} > 0, \text{ don't know} \\ 0, & \text{otherwise} \end{cases} \tag{5}$$

$$y_{3jk} = \begin{cases} 1, & \text{if } y^*_{3jk} > 0, \text{ unit-response (next wave)} \\ 0, & \text{otherwise} \end{cases} \tag{6}$$

The probability π_{ijk} for each response variable i estimated from:

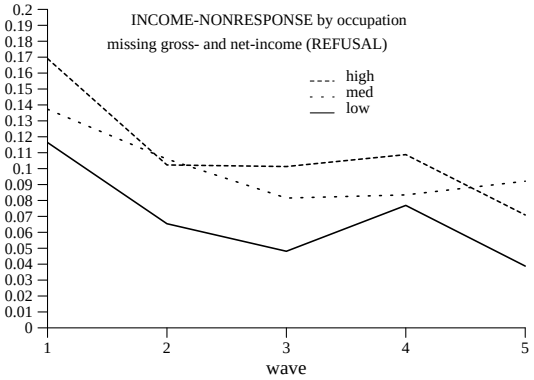


FIGURE 6: *SOEP, Sample E: Share of refusals by occupation.*

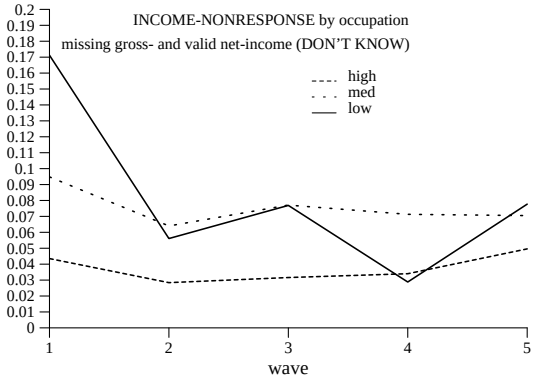


FIGURE 7: *SOEP, Sample E: Share of don't knows by occupation*

$$\pi_{ijk} = \left[1 + exp(-(\beta_{0k} + \sum_{h=1}^{H} \beta_{h,ijk} x_{h,ijk} + v_{0k}))\right]^{-1} \tag{7}$$

where $x_{h,ijk}$ represents values for covariates x_h $(h = 1, \ldots, H)$ of respondent j and interviewer k. The intercept is specified as random on level 3 (interviewer level) and the variance is estimated as v_{0k}. The random variation among the respondents on level 2 is estimated as the variance/covariance u_{ijk}. If they are dependent binomial variables, we have to estimate the residual variances $\sigma^2_{u_{ii}}$ and covariances $\sigma_{u_{ii'}}$.[4]

The regressors we used to explain income nonresponse are the same as in the section before. The only difference is that we restrict our sample to employed respondents and exclude self-employed and trainees.

Estimates Tables 13 - 15 on pages 22 - 24 show estimates of the univariate and the multivariate logit models for waves 1 to 3. The sample in wave 1 contains a total of 702 employed respondents from 106 interviewers. In wave 2 the sample size declines to 656 and in wave 3 to 637 employed respondents caused by the attrition process. The number of interviewers increases to 110 in wave 2 and 119 in wave 3.

The first column (0) in the tables refers to the univariate logit model (model 1) with gross income nonresponse as response variable. In this model we can recognize in wave 1 and 2 a consistent significant positive effect for CAPI in the fixed part of the model. This means that the CAPI mode produces more missing values for gross-income

[4]The correlation between the residual variance of "refuse"and "don't know"on level 2 has to be restricted to zero because the respondents can choose only one of the two alternatives (see Schräpler 2004).

than a face-to-face mode. Furthermore, in model 2 these missing values are separated in "refuse"(missings for gross and net income) and "don't know"(missing for gross and valid answer for net income). The estimates show that in all three waves the CAPI mode has a strong positive effect on the category "refuse"but no significant effect on "don't know". Interviewers that use computer assisted personal interviewing in sample E of the SOEP have a higher probability that respondents will refuse to state their gross- and net-income than interviewers that use the traditional PAPI mode. This finding rejects our third hypothesis and is also not in line with previous findings of Baker (1995) and de Leeuw (1995). It seems that CAPI respondents in sample E have at least in the very first contacts more problems to disclose their income statement than in the case of PAPI.

Beside these definite CAPI effects we find another mode effect: respondents who used a self-completion mode and filled out their questionnaires by themselves in front of the interviewer more often refused than in situations where the interviewers asked them orally. The self-completion mode partly reduces the interviewer's control over the interview situation and makes it easier for the respondent to skip embarrassing questions. Respondents in low earning positions have significantly more don't knows and in high earning positions more refusals than in medium positions.

The interviewer variances in the random part of the model are more than three times their standard error and indicate interviewer or area influences on all three response categories. Nevertheless, we could not find any identifiable influence of an interviewer gender or age effect. It may be that the interviewer variance is caused by unmeasured interviewer characteristics such as overall performance and skill of the interviewer.

5 Summary and Conclusion

This paper assesses the effect of a change from the Paper-and-Pencil Interviewing (PAPI) method to Computer-Assisted Personal Interviewing (CAPI) in sample E of the German Socio-Economic Panel (SOEP). Sample E contains 2,000 German households and is split into two subsamples, E1 and E2, with the same structure using twin sample points. The 16 addresses in each sample point had to be realized in the first wave alternately with PAPI or CAPI mode. This experimental design allows us to analyze CAPI effects and interviewer effects separately.

One important reason to change from PAPI to CAPI is the expectation of data quality improvement. We have examined data collection mode effects using quality indicators like unit nonresponse, missing values, implausible values and gross income nonresponse.

The interviewers did not report about problems in respondents acceptance of CAPI during the fieldwork. Hence our first hypothesis is that we will not find a CAPI

TABLE 13: *Multivariate multilevel logit model for income nonresponse, sample E, wave 1*

	model 1 - w1		model 2 - w1					
	(0)		(1)		(2)		(3)	
	itemnonresponse		Refuse		Don't Know		Uni-Response (t + 1)	
	$\hat{\beta}$	s.e.	$\hat{\beta}_1$	s.e.	$\hat{\beta}_1$	s.e.	$\hat{\beta}_1$	s.e.
Fixed								
Intercept	-0.912	0.839	-1.007	1.008	-3.368***	1.257	1.575*	0.899
respondent								
sex (1 - men)	-0.223	0.181	-0.083	0.202	-0.496***	0.206	-0.271	0.193
age (year)	0.008	0.009	0.005	0.010	0.013	0.010	-0.002	0.009
med occup. (ref)								
low occup.	0.355	0.260	-0.171	0.319	0.854***	0.274	0.058	0.284
high occup.	0.159	0.228	0.521***	0.239	-0.602**	0.310	-0.089	0.239
size of HH	0.014	0.079	0.079	0.087	-0.047	0.095	0.190**	0.083
move	-0.313	0.786	0.122	0.743	0.000	0.000	-1.722***	0.577
interviewer								
isex (1 - men)	0.016	0.293	-0.015	0.349	0.129	0.491	-1.126***	0.339
situation								
change of interviewer	0.137	0.373	0.565	0.408	-0.480	0.452	-0.194	0.358
face (ref)								
capi	0.460**	0.202	0.463**	0.228	0.362	0.236	-0.063	0.209
self completed	0.331	0.347	0.816***	0.363	-1.054**	0.590	0.063	0.377
Random								
respondent level								
	u1		u1		u2		u3	
u1	0.802	0.046	0.654	0.037				
u2			0.000°	0.000	0.413	0.024		
u3			-0.079***	0.028	-0.019	0.022	0.716	0.041
interviewer level								
	v1		v1		v2		v3	
v1	0.975	0.269	1.437	0.381				
v2			-0.608	0.398	2.951	0.716		
v3			0.054	0.258	0.194	0.359	1.224	0.324
interviewer cluster	106				106			
persons	702				702			
-2 * LogLikelih.	-526.09				-792.9			

NOTE: ° constrained to zero; Significance: ∗10%; ∗ ∗ 5%; ∗ ∗ ∗1%
Source: SOEP, Sample E, 1998, employed respondents
without self-employed and trainees, without mail interviews (own calc.)

mode effect on unit nonresponse (non participation) in the following wave. We use random coefficient multilevel logit models to explore mode effects. The estimates show only in wave 4 a direct negative effect of CAPI on unit nonresponse in the following wave. But in the first two waves we find a significant interviewer variation of the CAPI coefficient. This finding suggests that the impact of the CAPI mode at time t on the participation in the following wave $t+1$ depends on interviewer's skill in managing the data collection method especially in the first waves.

The second hypothesis is that CAPI reduces the number of implausible values. Our descriptive analysis supports this assumption: the rate of implausible values in wave 2 to 5 are lowest in the CAPI mode. In wave 1 the CAPI mode has the highest rate.

TABLE 14: *Multivariate multilevel logit model for income nonresponse, sample E, wave 2*

	model 1 - w2		model 2 - w2					
	(0)		(1)		(2)		(3)	
	itemnonresponse		Refuse		Don't Know		Uni-Response (t + 1)	
	$\hat{\beta}$	s.e.	$\hat{\beta}_1$	s.e.	$\hat{\beta}_1$	s.e.	$\hat{\beta}_1$	s.e.
Fixed								
Intercept	-1.566	1.264	-2.202	1.414	-5.120**	2.090	0.178	1.218
respondent								
sex (1 - men)	0.016	0.203	0.004	0.216	-0.190	0.232	0.001	0.233
age (year)	0.018*	0.010	0.001	0.010	0.048***	0.011	0.024**	0.011
med occup. (ref)								
low occup.	-0.249	0.326	-0.072	0.361	-0.743***	0.336	0.715*	0.427
high occup.	-0.151	0.263	0.136	0.276	-0.931***	0.332	0.777**	0.347
size of HH	-0.029	0.095	-0.012	0.104	0.000	0.107	0.112	0.114
move	1.302**	0.636	1.344**	0.593	0.000	0.000	-1.647***	0.564
interviewer								
isex (1 - men)	0.265	0.430	0.020	0.476	0.427	0.781	0.114	0.405
situation								
change of interviewer	-0.493	0.557	-0.489	0.544	-1.360	1.232	-1.607***	0.456
face (ref)								
capi	0.921***	0.236	1.339***	0.264	0.380	0.268	0.256	0.269
self completed	0.584*	0.351	1.293***	0.381	-0.783*	0.425	-0.435	0.373
Random								
respondent level								
	u1		u1		u2		u3	
u1	0.551	0.033	0.430	0.026				
u2			0.000°	0.000	0.224	0.013		
u3			-0.036	0.020	0.008	0.014	0.516	0.030
interviewer level								
	v1		v1		v2		v3	
v1	2.835	0.613	3.474	0.754				
v2			0.371	0.866	6.372	1.753		
v3			0.140	0.470	2.229	0.810	1.897	0.518
interviewer cluster	110				110			
persons	656				656			
-2 * LogLikelih.	-244.7				-3921.9			

NOTE: ° constrained to zero; Significance: ∗10%; ∗∗5%; ∗∗∗1%
Source: SOEP, Sample E, 1999, employed respondents
without self-employed and trainees, without mail interviews (own calc.)

It can be assumed that in the first wave the CAPI software system has to be adjusted for the special requirements of the SOEP. It may be that some transposition problems occured in the first wave that were fixed later.

The third hypothesis is that CAPI respondents do not have greater reservations about providing sensitive information such as gross income than respondents in the traditional PAPI mode. To explore this assumption we classify the missing values into two components: refusals and don't knows. The estimates of the multivariate multilevel logit models show that in the first three waves CAPI interviews have a significantly higher probability of refusals (missing gross and net income) than PAPI interviews. One possible explanation is that the use of laptops increases privacy or confidentiality

TABLE 15: *Multivariate multilevel logit model for income nonresponse, sample E, wave 3*

	model 1 - w3		model 2 - w3					
	(0)		(1)		(2)		(3)	
	itemnonresponse		Refuse		Don't Know		Uni-Response (t + 1)	
	$\hat{\beta}$	s.e.	$\hat{\beta}_1$	s.e.	$\hat{\beta}_1$	s.e.	$\hat{\beta}_1$	s.e.
Fixed								
Intercept	-0.599	1.325	-2.365	1.587	-2.124	2.058	3.854	2.355
respondent								
sex (1 - men)	-0.050	0.209	0.284	0.223	-0.614***	0.243	-0.081	0.285
age (year)	0.000	0.010	0.002	0.011	-0.005	0.012	0.038**	0.013
med occup. (ref)								
low occup.	0.095	0.332	-0.317	0.401	0.827**	0.352	-0.880**	0.433
high occup.	-0.006	0.274	0.323	0.274	-1.108***	0.416	-0.987**	0.393
size of HH	0.108	0.096	0.125	0.103	0.066	0.112	0.779**	0.160
move	-0.232	0.574	-1.079	0.713	0.902	0.673	-3.305***	0.468
interviewer								
isex (1 - men)	0.002	0.416	-0.300	0.508	0.299	0.679	0.084	0.766
situation								
change of interviewer	0.324	0.455	1.194**	0.463	-0.335	0.597	-6.190***	0.593
face (ref)								
capi	0.215	0.347	0.774*	0.423	-0.071	0.437	0.697	0.484
self completed	-0.200	0.433	0.706	0.504	-0.856*	0.532	-0.320	0.599
Random								
respondent level								
	u1		u1		u2		u3	
u1	0.556	0.034	0.383	0.023				
u2			0.000°	0.000	0.277	0.017		
u3			0.006	0.015	-0.011	0.012	0.305	0.018
interviewer level								
	v1		v1		v2		v3	
v1	2.451	0.584	3.592	0.859				
v2			0.198	0.845	5.352	1.547		
v3			-1.196	0.976	-1.089	1.301	8.144	1.820
interviewer cluster	119				119			
persons	637				637			
-2 * LogLikelih.	-227.9				-5078.4			

NOTE: ° constrained to zero; Significance: ∗10%; ∗ ∗ 5%; ∗ ∗ ∗1%
Source: SOEP, Sample E, 2000, employed respondents
without self-employed and trainees, without mail interviews (own calc.)

concerns. This finding is not in line with the assumption that respondents trust the confidentiality of computer-based data collection more than the traditional mode (de Leeuw 1995). This result is important because we can expect that in a few years the computer assisted personal interviewing method will increasingly replace the traditional paper-and-pencil method. In our study we have investigated only the gross income statement, but further research is needed to reinforce this finding. However, one general conclusion of our analysis is that it is crucial to address this problem, and to work to decrease possible mistrust of the new data collection technology.

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