

**METHODOLOGY FOR HOUSEHOLD PANELS AND
LONGITUDINAL DATA ANALYSIS: WHERE ARE WE
AND WHERE DO WE GO FROM HERE? A VIEW FROM THE
BRITISH HOUSEHOLD PANEL STUDY.**

BY

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Methodology for Household Panels and Longitudinal Data Analysis:

Where Are We and Where Do We Go From Here ?

A View from the British Household Panel Study ¹

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ABSTRACT

This paper serves four purposes. First, it provides an introduction to the series of conference sessions on *Household Panels and Longitudinal Data Analysis*. Second, it gives a brief overview of the European Science Foundation (ESF) Network on Household Panel Studies which coordinated these sessions. Third it addresses some of the methodological themes which are less well covered within the limited time frame of the sessions, especially with regard to data collection and data quality issues bearing on problems of measurement error. Finally it offers examples from the British Household Panel Study of forms of methodological research which are particularly relevant to improving the quality of household panel studies and provides some speculative views on possible forms of methodological research on data analysis and data resource management.

Introduction to the Sessions and Welcome

Good afternoon. I would like to welcome our speakers, session chairs, discussants and most importantly the audience to this series of sessions on Household Panels and Longitudinal Data Analysis. These sessions were organized under the auspices of the European Science Foundation's Scientific Network of Household Panel Studies. More details of the work of the Network will become apparent both in what we have to say in this paper as well as in the contributions of other Network members over the next few days. However, a few words about the Network and its role might help those of you who are not familiar with it.

The initiative for an existing loose network of panel study teams for discussion of problems of common interest was taken by CEPS/INSTEAD, Luxembourg, a centre which specialises in research networking and already co-ordinates the prestigious Luxembourg Income Study. The ESF Network, initiated by the British Household Panel Study (BHPS) and established in 1990, allows the CEPS idea to be further developed and to embrace all of the European household panels, plus the US Panel Study of Income Dynamics (PSID). These existing national studies (from Belgium, France, Germany, Great Britain, Greece, Hungary, Ireland, Luxembourg, the Netherlands, Spain and Sweden) share similar research objectives, parallel modes of operation and similar methodological and analytic problems. By pooling their knowledge and expertise, each Study benefits; by bringing in researchers from outside the panel centres to meetings such as this, the Network serves as an important means of sharing and disseminating information about panel studies. Its *Working Papers* and newsletter, *Household Panels*, serve a similar function.²

The Network has three main objectives: investigating the possibility of creating a set of identically defined measurements of key concepts for each national dataset, with the aim of establishing a larger comparative European dataset; pooling the experience and expertise in the specialist techniques involved in both panel and comparative research; and training researchers in these methods (see Schaber, 1990). The first objective has so far predominated. In this respect the Network has established a number of working groups to investigate specific substantive areas - for example, household allocative systems, household formation and dissolution, poverty dynamics and poverty indicators, and female labour force participation.

In addition, however, it has pursued discussions of design and methodological work in relation to panel data management and methodological issues for household panel studies. This Conference provides a further opportunity for discussion of these issues.

Before we make our presentation I want to extend my thanks to the Conference Organizing Committee for agreeing to allow us to hold these sessions and for all the assistance they have given to us; and most especially to thank all the Network members who have helped to put the programme together. In particular, I am grateful to Uli Rendtel, Ruud Muffels and Marcia Taylor. Nevertheless I am sure they would agree with me that without the sterling efforts of Pamela Campanelli and Louise Corti, assisted by Liz Addison and Penny Martin of the BHPS secretarial team, we would not have what promises to be such an exciting set of papers to discuss. Finally, my thanks to all those of you who are presenting papers. Beyond the normal rewards which follow from this, we hope that many of the papers will be published in a special conference volume.

Introduction

There can be no doubt that household panel studies offer unique opportunities for a range of important and innovative methodological research projects. This is partly because of their nature as surveys, offering challenges to their designers and managers which reflect both complicated variations on the cross-sectional survey method as well as unique design features and problems of their own. Equally, the complex data produced by panel surveys set new puzzles and problems for both substantive researchers and statisticians and methodologists, placing panel data analysts at the cutting edge of methodological developments in the social sciences. The papers offered at this conference provide testimony for these claims.

One vital task of the European Science Foundation Scientific Network on Household Panel Studies is to explore some of these multifarious methodological issues, including, of course, those presented in conducting cross-national, comparative research projects. In this regard, it is very much the case that the Network's strategy with respect to methodological work has largely (and quite properly) been concerned to explore methodological problems by doing substantive research (see, for example, the papers presented at this conference by Buck and Scott, 1992; Dex and Laurie, 1992; Langeheine et al, 1992; Everaers and Davies, 1992; and Guillot and Jeandidier, 1992). However, the occasion for further methodological discussions presented to the Network by the *Third ISA Conference on Social Science Methodology* was one we could not afford to miss. Apart from its benefits to the substantive researchers among us, it offers a great opportunity to those of our colleagues whose main concerns are with methodological, design and data management issues to convene and examine some of the key developments in these areas, to learn and to share ideas with others. By also inviting people from outside the Network to join in these discussions, we hope all our endeavours will benefit. Therefore, although these sessions were coordinated by the Network, our aim was to provide a general forum for the discussion of the special methodological issues posed by the collection, management and analysis of longitudinal data.

As you can see from the programme, we are covering a broad range of topics. The session this afternoon, for example, focuses on various survey design issues and the

experiences that particular studies have had. Other sessions focus on longitudinal measurement error issues, the special problems of event history models, general analysis issues, weighting and imputation. We also have a database theme with a "hands on" practical database session on Tuesday and a more formal set of presentations on Thursday. One afternoon is also devoted to the methodological difficulties facing cross-national comparative analyses and draws upon the experience of the ESF panels over a range of substantive areas. Thus, we offer a variety of sessions to cover many tastes.

Of course, what can be encompassed in our sessions is but a small part of the wide scope of work, either ongoing or possible, with regard to panel methods. There are by now, however, many texts which offer an overview of important issues not fully covered here (for example, Magnusson and Bergman, 1990; Kasprzyk *et al*, 1989; Skinner *et al*, 1989; van de Pol, 1989; Uncles, 1988; Crouchley, 1987; and Hsiao, 1986). Nevertheless, the papers to be presented in the next few days offer a good indication of the distinctive contributions being made by panel researchers, as well as of those unique aspects of panel studies for which we need to develop best practice techniques, most especially in terms of data collection, data quality, data management and data analysis. Equally, of course, we must remember the need to develop ways of assisting others in the use and exploitation of panel data. This implies a requirement for carefully researched documentation and dissemination practices and good training policies, especially for young researchers. In the case of the BHPS, we would add the need for an examination of data linkage.

In this paper we are going to try and indicate how the BHPS has addressed some of the issues raised in this Introduction as well as our ideas for future work in the relevant areas concerned. In the process we hope to cover a wide area of relevant issues, although we are aware that the relative youth of our Study means that we have spent more time so far on data quality, data collection and data management problems than we have on those concerned with analysis. In this latter area we have some ideas but we have basically come here to learn from those with more experience.

Panel Studies and Methodological Research

Table 1 contains a list of some specific issues deserving survey methodological work and which we discuss in the second half of this paper. At a glance you will see that many of these issues are equally relevant to problems with cross-sectional data. However, they are generally intensified in the case of longitudinal studies. Unit non-response, for example, is translated into the problem of panel attrition. Thus, an important area for experimentation is the effect of incentives not only on initial response but also as a means for countering attrition. At the same time we must develop weighting and imputation techniques to handle the problems of censoring. Problems of questionnaire design are also compounded when extended to the longitudinal context. Questions in future waves may appear at different places in the overall questionnaire and thus can suffer from unanticipated context effects, thereby complicating longitudinal comparisons. Alternatively, an identically worded question may mean different things at different points in time. Similarly interviewer effect issues are compounded over time. An issue which could benefit from empirical investigation is the extent to which maintaining the same interviewers throughout the life of the panel is beneficial for response rates and data quality.

If we stand back from these detailed issues for a moment, however, and ask what are the strengths and weaknesses of panel designs, and how might methodological research build on the strengths and alleviate the problems, a number of things become apparent. In his keynote paper, Duncan (1992) identifies a number of advantages and disadvantages shared by all household panel studies. The disadvantages are well known: bias arising from attrition; various kinds of measurement error problems; and panel conditioning effects. As Duncan notes, both sound design and various forms of good practice can serve to minimise these problems but they never entirely go away; hence the need for methodological research to improve design and practice and counteract the various potential forms of bias to which panel studies are prone. Perhaps the greatest problems affecting data quality are those of non-response; recall and various other reliability problems; representativeness over the life of a panel; and interviewer effects. We shall have something to say on all of these matters.

Benefiting as we have from the long experience and careful teaching of experienced panel researchers, the BHPS did all it could during its design phase to absorb key lessons of the kind indicated by Duncan's paper (see Rose *et al*, 1991). At the same time, however, we recognised the need for a part of our research programme to be devoted to various kinds of methodological issues and this became in-built to the Centre's objectives. Thus one of the goals of the ESRC Research Centre on Micro Social Change, which runs the BHPS, is 'to contribute significantly to methodological advances in the collection and use of panel data'. In addition we have to 'promote the use of the panel survey data by academic scholars..(and) industry and commerce'. These objectives provide the basis of our methods programme. Equally, our substantive research programme is expected to lead to various forms of methodological innovation, partly by virtue of being an *interdisciplinary* research centre. In the next section we briefly examine some of the parameters of the BHPS as a prelude to a discussion of our methodological work.

The British Household Panel Study

Duncan's advice on the requirements of any household panel study, if its advantages are to be maximised and its disadvantages minimised, include: an initial sample of the highest possible quality; a heavy investment in a panel maintenance programme to counter attrition; the use of feedback or feed-forward techniques as an aid to recall and data reliability; and the collection of continuous (event history) data. The BHPS was designed with all these points in mind. However, before we discuss the research we have done or intend to do on these issues, we need to place our methodological work in the context of the Study itself. This is important in order to emphasise the fact that all the issues addressed here and elsewhere in our sessions are essential to our vital substantive research goals. In this way we hope to reinforce the points made in Duncan's keynote paper.

The design of any study begins from its theoretical blueprint. The British Household Panel Study has been developed from the outset to maximize the research potential of the data. The survey is a multi-purpose study and its unique value resides in the fact that:

- a) it is a longitudinal panel design;
- b) it is a household sample, interviewing every adult member of the household;
- c) it contains sufficient cases for meaningful analysis of certain sub-populations, for example, one parent families and the elderly; and
- d) it allows for linkage of data from other surveys and from local area statistics.

The research objectives of the survey have informed both the design of the original sample and the development of the survey instrument, as discussed below.

The Sample Design.

The objective of the survey is to further our understanding of social and economic change at the individual and household levels through the 1990s. Therefore, it is essential that the sample remains broadly representative of the British population as it changes in the next decade. In order to achieve this goal, the same individuals will be re-interviewed in successive waves, and, if they split-off from original households to form new ones, all adult members of these households will be interviewed. Similarly, children in original households will be interviewed as they reach the age of 16. In order to ensure continuing representativeness, great effort was placed in achieving a high response rate (75% upper rate; 70% middle rate)³ at Wave I and, from now on, in minimising attrition. Thus well-researched field work practices to enhance response rates, and extensive efforts to ensure panel maintenance, are implicitly dictated by *research* goals.

Research needs dictated the minimum sample size required for a study of this kind. A sample size of 5000 households and 10,000 individuals was considered essential in order to provide accurate estimates and analysis for both the population as a whole and for subgroups. Also a large sample is needed to generate sufficient events over time for the analysis of transitions. In fact we exceeded our targets and recruited 5600 households and 10,200 respondents. Research objectives have also influenced the decision to interview every member of the household, rather than only a household head. This decision, which has major

cost implications, is justified by the substantive goal of exploring intra-household structures and processes, as well as examining individual outcomes.

Questionnaire design

The basic format of the questionnaire has, of course, been developed in response to distinct research goals. In the contract with our funders, the UK Economic and Social Research Council, the survey is committed to covering certain core substantive areas: income and wealth, labour market behaviour, household organization and consumption, residential mobility, health, and socio-economic values.

About four-fifths (34 minutes) of the individual schedule consists of core questions which are to be repeated each year. This *core component* covers a broad range of social science interests that fall within the six areas specified in the contract. One distinctive focus is the collection of information on changes that have occurred within the households in the year between interviews - event history data. The remainder of the individual questionnaire consists of a *variable component*. This variable component, although short - only about 8 minutes - allows us to insert new questions that will reflect the changing policy and research agendas of the next 10 years. In addition the variable component will include those questions which need to be asked less frequently than annually, because the variables they are measuring are not expected to change with great frequency. To establish initial conditions, the first few variable components also include one-off questions to elicit retrospective data on the life histories of panel members before the first interview. The collection of data on initial conditions will also enhance the potential for analysis, by providing a longitudinal element to the data in the early years of the study.

Research objectives have played and continue to play a central role in the content of the questionnaire, both in the core and the future variable components. This is no easy task because it necessitates balancing competing specific research interests within a limited survey instrument. Financial pressure, as well as concern for respondent burden, has required that the entire interview package is no longer than one hour. This has meant that the inclusion of each question has to be justified not only by its potential for longitudinal analysis, but also

for its critical role in addressing central research questions of the 1990s. Similarly, there is far more demand for variable component items than could possibly be included in even the next ten waves. After considerable consultation, it was decided to include a fertility, marital and employment status history in Wave II, and an outline job history in Wave III. What is desirable for research has to be constantly balanced against what is desirable in terms of response rate and other practical survey considerations. This conflict has influenced the decision to limit the income and wealth questions and to delay questions on assets until Wave IV, when the panel has been fully established.

The distinctive longitudinal research opportunities afforded by the panel data have guided both the content of the questionnaire and the design of the questions in important ways. First, for example, research can be focused on change at the level of the individual or the household, rather than the population level, which is the focus of repeated cross-sectional analysis. In other words panel data allow for the direct study of shifts at the individual level (e.g., changes in the preference for mothers to work), even though such shifts may cancel out when aggregated across the population. It is, therefore, important to select questions that are concerned with characteristics, behaviour or attitudes that are expected to change, or are significant factors affecting the likelihood of change. Of course, for understanding social structures and individual lives, continuity may be as important and interesting a finding as change. A second, and most distinctive feature of the panel design is that it allows analysis of the interaction of different strands in individual's lives over time. Therefore, the aim is to produce questions that will enable us to construct continuous measures of, for example, income, employment histories and labour market participation, household structure and residential mobility over the life-cycle. This is collected much more reliably than in retrospective history surveys, but it does mean that many questions have to be concerned with events in the twelve months between interviews, rather than with the current situation at the time of the interview. A further goal of the BHPS is to ask about expectations of change, so that these can be compared with actual subsequent changes, especially with respect to changes in occupation, economic circumstances, and mobility.

The British Household Panel Study has thus been designed in a way which attempts to ensure that the full advantages of panel data are realised. One important analytical

objective is to examine how individuals and households experience change in their socio-economic environment and how they respond to those changes. Experience with socio-economic panel studies in other countries suggest that these studies constitute a major research resource which allow types of analysis that are impossible with cross sectional data. In particular, it will be possible to analyze the incidence of conditions and events (such as ill-health, poverty, or unemployment) over time, and examine how such events or transitions are linked temporally. In order for this to be achieved it is crucial that events and transitions are dated as accurately and as precisely as possible. Techniques for modelling transitions (such as event history analysis, or survival analysis) require that we have, as near as possible, continuous measures of change across time. We shall return to this point later. Note, however, that all we have said thus far about the BHPS echoes Duncan's prescripts concerning the design of panels in order to maximise advantage and minimise disadvantage.

The Pilot Panel

In addition to the contractual scientific research programme that has guided the content and design of the main panel survey, we have noted that the Centre is committed to making a significant contribution to methodological advances in the collection and use of panel data. Panel data are sufficiently novel in the UK to require considerable testing of both longitudinal survey procedures and data collection instruments. The BHPS, therefore, has a pilot panel which combines these two functions by acting as a dress rehearsal for the mainstage survey while simultaneously providing a laboratory setting for various methodological projects. These include new methods of validation (e.g., multi-method convergent validation), new methods of data collection (e.g., CAPI, CATI, self-report diaries) and experimental and quasi-experimental procedures (e.g. split-ballot alternatives with randomisation), as well as testing for accuracy and systematic distortion in recall. The pilot panel will also be used for research that is more demanding of respondents, but might be inappropriate for the main survey where the concern is to minimize attrition and to maintain as good a response rate as possible. Some examples of this type of research are given later.

The BHPS Methodological Programme

We are now in a position to deal with the main purposes of this paper: research on some of the key methodological issues arising in the design and operation of household panels and the way these are being tackled on the BHPS. The methodological research programme of the Centre has four major strands: data collection, data quality, data analysis and data linkage (see Appendix I). If we relate this to Table 1, in terms of data collection and data quality we have already undertaken research on various means for countering non-response and reducing measurement error. This has been done through the design and thorough pre-testing of data collection instruments, research on the use of respondent incentives, research on best practice for panel maintenance, examination of problems of recall, research on interviewer training, research on interview contamination and investigation of feed-forward techniques. All of these are discussed in what follows. Of course, we are also interested in research in the area of data analysis, although much of this should flow from our substantive work; and data linkage work will soon begin as part of the process of validating our data. In addition we are concerned to undertake research in relation to the documentation and dissemination of our data so that it can have the widest possible use and be as easy to manipulate as practicable, given the complexity of the data. Each area of the programme is examined below.

Data Collection

As Table 1 suggests, methodological research on data collection has concentrated on issues related to attaining and maintaining high levels of response. Hence we have been concerned with research on incentive payments, panel maintenance, interviewer training, design aids to recall (such as calendars and feed-forward techniques) and reliable methods for establishing household relationships. Some of this work has taken place within our pre-tests, of course.

In the early stages of the survey much effort has gone into investigating how best to maximise initial response and minimise respondent burden and subsequent attrition. In our first pilot we included a split-ballot test designed to investigate the effects of individual

incentive payments on both initial response and subsequent attrition. Because of interviewer variation, results have to be interpreted with some caution, but the incentive appeared to have a positive effect on response and incentive payments have therefore been continued.

Of course, it is not only the moral and material commitments of respondents which need to be considered but also those of the interviewers (see, for example, Barnes 1991). With this in mind the BHPS has paid particular attention to the training of interviewers and has produced a special interviewer training video which is now the subject of evaluative research (see Smith, 1992). Finally, there is at least anecdotal evidence from the German Socio-Economic Panel that the use of the same interviewer for each wave is itself a factor in maintaining a respondent's commitment and, therefore, is conducive to high response rates. Thus, this, too, is the basis for potential systematic research.

Contact failures must be minimised in any panel survey, because of the tendency for attrition to increase with the age of the panel. In the early years of the study, evaluation research on the different tracking and tracing procedures are crucial. Currently we have two staff members responsible for the implementation and evaluation of panel maintenance procedures. A special computer programme has been written to assist in this task.

One important innovation in the British Household Panel Study lies in an attempt to include detailed income questions without suffering either high item non-response, or subsequent adverse effects on attrition. Following careful research, the Study has integrated questions on earnings with the job history, combining the financial questions with other measures of job characteristics. A random split-ballot experiment would be required to test whether this design does lead to a significant reduction in item non-response. Considerable effort is being put into ensuring that the collection of income data is as accurate as possible. Respondents are asked to consult documents where possible. Tax codes are collected where pay slips are available and economists in the Centre will be using this data to check the accuracy of respondent reporting. Nevertheless, we expect to encounter problems of item non-response and so we will need to examine weighting and imputation techniques to cope with this.

Another complex task of a household panel survey is that of household enumeration. Finding out the relationship of all members to a head of household is not sufficient where the unit of analysis is to be the individual. Instead the entire matrix of household relationships must be established. Different methods of collecting this information have been pre-tested in the field. A research project is underway assessing the quality of data associated with the different collection instruments we have used (see Brynin, 1992).

The longitudinal focus of the survey requires that many of the measures are concerned with changes in the past year, rather than with current state at the time of interview. This means that much effort must be devoted to helping respondents place events in time and improving recall accuracy. One pre-test has been devoted to improving recall with a calendar design. Although calendars are used in the main survey, new designs are still needed to bring question structure into line with what is known from cognitive psychology concerning short-term memory. Several researchers in the Centre are interested in the application of psychology to questionnaire design and considerable research has taken place on the use of calendars as an aid to recall (see Corti, 1992a). Methodologies to deal with memory error are preventative or *post hoc*. Recent research has looked at ways of estimating and adjusting for memory effects at the analysis stage (see Dosselaar *et al*, 1989). However, the majority of research in this area is focused on trying to understand what gives rise to recall error and then designing methods to counteract the errors.

A principal issue confronting us for Wave II concerns the feeding forward (or, as Duncan terms it, 'feedback') of information. There is concern that this leads to an under-reporting of change, whereas repeated measures lead to an over-estimate of change. Systematic experimentation is needed to establish the impact of the different strategies for measuring change on the subsequent estimates.

There are two basic purposes for feeding forward computer-stored information collected in an earlier wave or waves of a panel survey for use in a subsequent wave. The first is for re-contacting households and maintaining contact with respondents. The second is for substantive data quality issues. The first purpose is of overwhelming importance to any panel survey. Details of names, addresses and key information from the household

enumeration are essential to ensure that all members eligible for the survey can be recontacted. All existing panel surveys have some form of this type of feed-forward information, but employ different means of managing and utilising it.

The second purpose is more contentious in nature. It is to use feed-forward techniques to alleviate or at least minimize measurement error problems. For example, the U.S. Census Bureau has found that the monthly recollection of industry and occupation information leads to a spuriously high rate of change and is investigating various feed-forward techniques to reduce this type of gross-flow error. However, such benefits can be outweighed by the sheer complexity, timeliness, cost and field problems of preparing and feeding forward information already given by respondents. In addition there are problems with regard to confidentiality guarantees given to respondents.

Different panels employ different strategies for dealing with simple demographic discrepancies across waves of data (such as discrepancies in age, race and gender). The most recent value can be regarded as "truth", previous reports can be updated at the time of interview by explicit checks (as SIPP does), or a specific procedure may be applied, such as taking the modal value across waves (the German panel study procedure). In practice the decision is one of preserving original data against editing older and possibly erroneous data, but in many circumstances which is the "true value" can be highly ambiguous. Given that correcting inconsistencies is a highly contentious issue, some panel studies choose not to feed forward substantive information, but instead rely on asking the same core questions, even if the answers seem obvious (see, for example, PSID, SOEP, ADEPS, and PSELL) or only feed forward a few items (see, for example, SLUSS for employment and tenure, and the Dutch SOEP for employment).

One perplexing problem encountered by the SIPP and PSID panels is the difficulties in obtaining accurate information about changes in income receipt and amount. As Duncan notes (1992:19), SIPP refers to this as the "seam problem" (Burkhead and Coder, 1985; Marquis and Moore, 1990; Jabine, 1990). This is a tendency for respondents to *over-report* changes in status and in amounts received between adjacent calendar months included in the reference periods for different interviews, and to *under-report* changes between months

covered by the reference period for a single interview. A similar problem has been observed in the PSID (Duncan and Mathiowetz, 1985; Hill, 1987) where changes in labour force and income items cluster at the seams. As a result, SIPP has conducted numerous feed-forward experiments in attempts to collect more reliable change measures. The use of feeding forward data to minimise measurement error is a relatively new area which deserves extensive further research. This is a high priority in our methodological programme (see Corti and Campanelli, 1992).

Data Quality

The prime concern for any survey must be the quality of the data. Referring again to Table 1, much of the BHPS methodological research programme in this area is therefore devoted to the reliability and validity of our measures. A more general concern is to investigate the extent of response bias in the data. There are many different sources of response bias and the Centre currently has projects concerning interviewer effects, the interview situation and recall. In addition, Corti (1992b), using data from the pilot panel, sought to investigate how responses are affected by the presence at interview of third parties. This type of response contamination is of major concern to all surveys, but it is especially relevant to household studies, where other members of the household are often present when respondents are interviewed.

In a clustered survey, response bias due to interviewer effects is of special concern, because effects of clustering may otherwise be confounded with interviewer effects. In order to gain estimates of measurement error due to interviewer effects, an interpenetrating sample design is planned for the first genuine longitudinal wave (Wave II) of the BHPS. This will be the subject of research in collaboration with Research Associates of the Centre.

In any survey the quality of the data relies heavily on interviewer skills. The Centre is concerned to collect and analyze data from the interviewers themselves about the process of the interview and the quality of the survey instruments. We have, therefore, collected recordings of many interviews and plan to carry out a detailed analysis of the interaction processes (see Oksenberg *et al*, 1991; Cannell *et al*, 1989; Morton-Williams and Sykes, 1984;

and Morton-Williams, 1979). This may help explain interviewer effects. We are also conducting a test of coder reliability. Very little research has been done in this area. In addition to human reliability, work is in progress on comparing machine and human coding, both for occupational coding and verbatim text.

The interview itself is also an area which can be studied in its own right. One collaborative methodological project that the Centre hopes to promote in the future is an ethnomethodological study of survey interviews. To be conducted with Research Associates from the University of Surrey, the purpose of this project would be to analyze video-taped interviews from the BHPS to further our understanding of the apparent rules of interview-respondent interaction in the structured survey context.

Research documenting the quality and reliability of recall data for European panel studies is extremely limited, in part because many of the national household panel studies have only been established since the early- to mid-eighties. Considering the evidence presented by cognitive studies on recall in the social survey setting, it is somewhat surprising that much of the recall data anticipated to be highly susceptible to reporting error is never tested for reliability. The BHPS hopes to improve on this situation. Our data offer two different types of opportunity to estimate the magnitude of memory error.

First there is the situation where retrospective questions addressing the *same events from the distant past* are gathered from two different survey years. For example, a respondent is asked at two different waves to describe various attributes of his/her first job. Assuming the same essential survey conditions are operating at both waves, and other aspects of measurement error remain constant, a comparison of the two different versions offers an opportunity to investigate individual response deviations. Second is the situation where information about the person's *current circumstances* is collected in one year and the same data are gathered from the same person one year later on a retrospective basis. For example, a respondent is asked to describe various attributes of his/her current job and then a year later is asked to give a complete retrospective employment history, which overlaps with the information given the previous year. By treating the non-retrospective description as the "true value," a comparison of the two different versions offers an opportunity to investigate

individual response bias. Such a study could proceed to examine the correlates of memory error, say the type of question, topic of question, difficulty of the reporting task, likely salience of the events, and various measures of respondent characteristics. Similarly the effect of such errors on actual models can be assessed.

Data Analysis

When we consider research relating to data analysis, the BHPS has little experience to offer because it is so new. However, we do have ideas for research on which we would welcome comments.

Among the projects under consideration in the methodological area of data analysis are, first, the investigation of modelling change in variables subject to large measurement error, and especially in variables which are themselves likely to display a large degree of variation over time, such as attitudes. This could constitute use of simulation studies with given measurement error structure where the effects of varying magnitudes and forms of error could be evaluated within differing modelling environments. A second idea is the investigation of possible model specification for repeated measure panel data that would take into account the inherent clustering of the data. In the first instance, this would be concerned with the effect of clustering at the household level. The focus of the research would be into whether account need be taken of such clustering and of the specific model specification that would most efficiently enable such effects to be evaluated - the use of random effects within given modelling frameworks, for example. Third, we would like to examine the utility and ease of application of stochastic, latent variable and multilevel models as frameworks for the investigation of change within a panel data set. The use of stochastic models, for example, whose transition probabilities could be estimated from the BHPS, could facilitate the study of household population dynamics.

In common with many others, the Centre has particular research interests in event history analysis which carry forward existing work. This includes, more specifically, methods of taking account of complex patterns of time dependence in modelling the interactions of multiple transitions in differing domains (the family and the labour market, for example), and

the use of more flexible functional forms for the relationship of hazard rates to time (e.g. 'local hazard models'). Centre researchers are also interested in promoting developments in database design and user interfaces which will tackle some of the problems of data preparation which techniques such as Event History Analysis raise. Next, the Centre has collected open-ended verbatim data that will enable qualitative and quantitative analysis to be combined. A problem of open ended data is the difficulty and expense of coding. New computer-aided text analysis methods could make the process both cheaper and more rigorous, if fully developed and utilized. A fruitful way forward would be to apply AI techniques in machine learning to the coding of open-ended survey data. Finally, we would be interested in an investigation of pattern recognition in very large data sets, bringing Artificial Intelligence (AI) techniques to statistical analysis in an attempt to develop techniques. This work could be based on Genetic Algorithms (GA) to find patterns in the data. The BHPS data would be used for testing but the results would be generalised for use in social, financial, medical, environmental and other research domains.

While our own research staff cannot undertake all these projects, for most of them we have potential collaborators among our Research Associates in the University of Essex and elsewhere. Fortuitously, the UK ESRC has recently set aside £7m for a research programme on the Analysis of Large and Complex Datasets. The Centre hopes to be involved in collaborative projects within this Programme.

Data Linkage

Turning once more to Table 1, data linkage covers many different activities but is important especially in relation to the validity of panel data. One of the primary concerns of the Centre is to link the survey to other methods of data collection, such as the diary method, or more in depth qualitative life histories or data sets. For example, we are cooperating with one of our Research Associates who is undertaking a qualitative study of retirement using members of our pilot panel. This study will, therefore, be most useful as a test of the validity of our survey measures against those deriving from a life-history approach. Similarly, our project on household allocative systems (see Laurie 1992 and 1991; Rose and Laurie, 1991;

Laurie and Sullivan, 1991) combines a qualitative approach with the more limited but more representative possibilities of the panel study in this area.

Another important strand is to link the BHPS data to other survey data, for a variety of purposes. While the British Household Panel Survey will be unique, in that there is no other comparable data set for monitoring social change in Britain, there are, however, several other studies which can be linked to our data in order to increase their research potential. The first purpose of comparison with other data sets is *validation*. (In this respect, it is particularly fortunate that Wave I followed only six months after the population census). A second purpose is for *comparative analysis*, both with cross-sectional and longitudinal data from other countries. Thirdly, data from other sources can be used *to impute characteristics that are not directly measured in the BHPS*. For example, detailed consumption data in the Family Expenditure Survey can be used to expand on the more limited consumption data that is collected in the BHPS annual core. The survey has, therefore, been designed to maximise the possibility of data linkage, both with other British surveys such as the General Household Survey, and the Labour Force Survey; and also with other household panel studies in Europe and America.

Data Documentation and Dissemination

A complex survey such as the BHPS must be adequately documented and widely disseminated, if it is to have the impact which is required of it. There are at least three reasons why dissemination is important: the *epistemological* - for something to be knowledge it must be known; the *economic* - in order to make full use of data which are expensive to acquire; and the *ethical* - the expenditure of public money should lead to a public good. In pursuit of these aims, the Centre has entered into a collaborative relationship with Information Management and Engineering, developers and suppliers of the TINman software system which forms the basis of the information management systems we use. Development of additional modules within TINman, and of imaginative new extensions to the system, are currently under way, and a development project with the ZUMA library in Germany is under discussion. Several projects will also be carried out in collaboration with the ESRC Data Archive, including potential links between the information retrieval systems of the two centres.

As in the area of data analysis, there are a number of other potential areas for development under the rubric of dissemination and documentation which seem to us worth considering. Data Resource Management is, of course, an area of particular concern to all panel studies. The BHPS will clearly be one of several large and complex data resources for the whole of the UK social science research community. Comprehensive and easy-to-use documentation and intelligent front-ends to aid the researcher in the use of individual datasets, as well as other tools to allow linkage between these data resources, will clearly be essential developments over the next few years. Below are a number of possible collaborative projects in these areas which have been discussed with other researchers:

1. The Research Centre hopes that its documentation will be a model for other UK datasets produced in the future. It will contain much of the metadata required by the researcher before and during the analysis process. The application of "expert systems" and other AI techniques would greatly enhance the system presently being developed. Discussions concerning possible collaboration have begun with the Centre for Educational Sociology in Edinburgh, as well as with other European panel studies.
2. Investigation of possibilities for the expansion of the metadata currently within the BHPS documentation system (for example, full computer-readable questionnaires from comparable surveys with complex linkages to BHPS questions).
3. Some work is already being done within Britain on the potential of integrating metadata to the statistical data itself - allowing, for example, the interactive searching and browsing of metadatabases and subsequent retrieval of data elements, and the incorporation of "electronic footnotes" within the statistical database. There is interest in the expansion of this research, using the BHPS as a test case.
4. The design, production and evaluation of a complete system for the use of the data analyst, providing an interface between the analyst, the data information and documentation, the analytic packages commonly in use and the database itself, using the BHPS as the basis of a prototype system.

5. The development of teaching packs based on the BHPS will obviously be a great utility to researchers within the social science community. The Data Archive would be a natural partner in such activities.
6. Investigation of the possibilities of attaching selected variables from other data sources to enhance the value of the BHPS, with full consideration of the confidentiality and cost considerations.
7. The development of standards is an area in which the ESRC has already expressed interest. The Centre has taken some initiatives which would benefit from further research and generalisation - ethical research standards, for example, standards of data documentation and metadata, establishment of good practice standards in data collection and the commissioning of surveys.

Finally, dissemination includes the need for training of both existing researchers and graduate students; and for research resources to support staff and visitors. In the training area, in conjunction with two other universities, the Centre has established a series of training seminars - Longitudinal and Multi-level Data Analysis (LAMDA). So far as research resources are concerned, the Centre has established a research information centre, the *Research Resources Unit*. The Unit plays a central role in the management of information within the Centre, and provides a variety of services to its staff and to the wider research community, including the ESF Network. It is seen as a key component in the achievement of the Centre's research and resource objectives. The RRU's main areas of activity and research support relevant to this paper are its Library and documentation activities.

First, the RRU Library includes a unique collection of written material on panel research, a great deal of it being methodological in nature. Much of this material is 'grey' literature on panel studies (unpublished documents, bulletins, newsletters, conference papers, etc.) which is not indexed in standard bibliographies and therefore not easily traced. Second, the RRU also serves as the central node in the Centre's information system, creating and maintaining the index for all of the major documents produced during the survey design, data collection and research processes. All Centre research and information publications are

distributed through the Unit. A full documentation of the question origin and interrelationships within the pilot and mainstage surveys (Wave 1 and pilot for Wave 2) has been carried out, as has documentation of links between these questions, the other surveys from which they have been extracted (where relevant) and all related primary and secondary publications. These tasks are vital to our methodological work as well as to the basic documentation of the BHPS.

Conclusion

The very complexity of panel studies demands that we take their methodological problems seriously and that we share our accumulating knowledge and experience with one another and with the users of our data. The ESF Network has an important part to play in this area by the exchange of ideas and the dissemination of knowledge. In this paper we have barely touched upon many of the important issues precisely because we have yet to face some of them! However, as a young panel, we could not have proceeded even so far as we have without the unique knowledge base which the Network provides. Nevertheless we hope we have conveyed some of the possibilities for fruitful research on panel methods and we expect to learn more in the course of the next few days.

Finally, we should bear in mind the relationship between methodological work of the kind advocated in this paper and the standards by which users and funders are likely to judge household panels. In their work on the evaluation of longitudinal surveys, Boruch and Pearson (1985) note that the improvement to the use and usefulness of longitudinal surveys depends on a range of requirements. These include, *inter alia*, the need for panel centres to be regarded as "‘observatories’ in which attention is given to the development of user communities and to the support of the calibration, validation, meaning, and uses of the data instrument" (p.21). In addition they note the following standards for evaluating longitudinal surveys: the ease of data linkage between the study concerned and other data; the ease of sample modification; the extent of the resources devoted to the measurement and reporting of nonsampling as well as sampling error; and the mechanisms for minimizing non-response and attrition, and for adjusting for these in analysis via weighting and imputation. In other words, research of the kind discussed in the papers at this meeting is vital to the ways in

which we will be judged and must, therefore, be taken very seriously. In particular Boruch and Pearson note that assessing and improving the quality of measurement should have a high priority; that data linkage is vital to the improved usefulness of panel databases because of the need to check data quality, enlarge the data available for basic research and reduce the overall costs of research; and that mechanisms should be found to document, minimise and understand non-response and attrition. This seems to us sensible advice which should inform all our methodological work.

Notes

1. The authors wish to extend their thanks to Nick Buck and Jackie Scott for helpful comments on an earlier draft of this paper.
2. Further details on the Network, its working paper series and newsletter may be obtained from Marcia Taylor, ESRC Research Centre on Micro-social Change, University of Essex, Colchester, CO4 3SQ, England.
3. These measures of response are those used for the GB General Household Survey. The upper rate indicates at least one interview per household; the middle rate indicates that all eligible household members were interviewed.

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Appendix I BHPS Methodological Work In Progress

Data collection

<u>Topic</u>	<u>Data</u>	<u>Person Responsible</u>	<u>Status</u>
Documentation of incentives split ballot	Pilot 0	Corti	In progress
Panel maintenance and tracking	All	Brynin	In progress
Household relationships	Pilot 1	Brynin	SGSCA 92
Calendars and recall	Pretests and Pilots	Corti	AAPOR 92
Feeding forward of information	Review article	Corti/Campanelli	SGSCA 92
Documentation of pretest and pretest methods	Pretests	Smith	In progress
Interviewer training	Wave 1 video	Smith	AAPOR 92

Data Quality

<u>Topic</u>	<u>Data</u>	<u>Person Responsible</u>	<u>Status</u>
Respondent Contamination	Pilot 0	Corti/Clissold	Working Paper (revised AAPOR 91)
Interviewer variance	Mainstage 2	Campanelli	In progress
Coder reliability	Pilots and Mainstage	Campanelli	In progress
Documentation of household allocative split ballot	Pilot 0	Laurie	In progress
Reliability of retrospective data (linked with JSCM work on NCDS)	Longitudinal Pretests/Pilot/ Mainstage	Campanelli/Corti Dex	In progress Working Paper
Behaviour Coding	CPS	Campanelli	AAPOR 92
CASOC reliability and feasibility test	Mainstage 1/ Pilot 2	Campanelli	In progress

Data Analysis

<u>Topic</u>	<u>Data</u>	<u>Person Responsible</u>	<u>Status</u>
Methodological quirks in event history analysis	PSID	Buck/Scott	Trento 92
Use of ML3 on	Pilot 1	Taylor/Campanelli	ASA 92/ RSS 92
Weighting and Imputation	Mainstage	Taylor	Just begun

Data Linkage and Linked Research

<u>Topic</u>	<u>Data</u>	<u>Person Responsible</u>	<u>Status</u>
Data Linkage in general	--	Buck/Taylor	In progress

Qualitative reinterviews with older respondents	Pilot 0 & 1	Corti	In progress
Social organisation of Interviewer/Respondent interaction (Surrey project)	Pilot 0	Corti	Proposal stage

Table 1 Selected Methodological Issues for Panel Surveys**I Nonresponse issues**

Use of incentives
 Post collection imputation and weighting
 Panel Maintenance

II Measurement error issues

Questionnaire design

Longitudinal design issues/Pretesting for longitudinal questions
 Feeding forward of information

Respondent

Self vs Proxy
 Reliability of retrospective data/recall problems
 Panel conditioning
 Presence of third parties on reporting

Interviewer

Interviewer effects

Mode of Data Collection

Computer assisted interviewing vs. paper and pencil
 In person vs. telephone

III Data Management

Data base design
 Data processing/longitudinal coding and editing rules

IV Data Analysis

Analytic techniques for longitudinal data

V Data Linkage/External Validity Checks

Qualitative in-depth reinterviews
 Aggregate comparisons to other surveys (Validation)

VI Data Documentation/Dissemination

User interfaces
 Training and teaching/User groups
 Expert systems