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Up for a Dynamic Social Science

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UP FOR A DYNAMIC SOCIAL SCIENCE[1]

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Abstract

Taking account of time, and thereby studying modern society from a dynamic perspective, requires the acquisition of new concepts and methods of analysis. Using examples drawn from mainly from studies of poverty, this article briefly introduces the conceptual tools that underpin the dynamic study of society including: trajectories, duration, censorship, prevalence, and state dependency and heterogeneity. Sources of data are discussed including panel and life history surveys, qualitative panels and biographies, administrative and simulated information, as are methods of analysis, notably event history and sequence analyses.

METHODOLOGY, LONGITUDINAL ANALYSIS, PANEL SURVEYS, POVERTY

TOOLING UP FOR A DYNAMIC SOCIAL SCIENCE[1]

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Robert Walker and Lutz Leisering

To investigate and fully understand the changes in society, encapsulated in the concept of modernity, requires new ways of thinking and alternative modes of enquiry (Giddens, 1991). As chance would have it, or perhaps as a symbiotic part of the process of modernisation itself, an intellectual revolution is underway that emphases the dynamics of modern life and places it at the heart of the scientific project. Hitherto social science has sought to describe society in terms of structures and states that have more than a modicum of permanence. The sciences of social change and of social mobility, important though they have always been, have had many of the characteristics of sub-disciplines: areas of enquiry with their own language that have largely been left to specialists. By contrast, within dynamic approaches to the study of society, states and structures are conceived to be either the more or less long lasting products of ongoing social processes or even, on occasion, illusions that owe their existence to researchers being forced by data limitations to study ' stills' from the ' movie of real life' .

There is not space to do full justice to the emerging dynamic science of society. Rather, the aim to introduce the reader to some of the concepts and technical tools used by proponents of the new social science. The discussion is illustrated with reference to poverty: the new dynamic approach has already challenged preconceptions concerning the nature of poverty and the role of social assistance in preventing and alleviating it (Bradbury, et al., 2001; OECD, 2001; Goodin et al., 1999; Leisering and Leibfried, 1999; Walker, 1994, 1997a; Leibfried, et al., 1994)

Conceptual tools

States, trajectories and domains

Hindus expect to pass through five stages, asramas, during the course of their lives[2]. Each stage brings different challenges and responsibilities, new pleasures and a new way of living. Each stage is a process of development that is by way of preparation for the next. The transitions between stages are times of rapid change and uncertainty, often marked by celebration: the marshalling of moral, practical and symbolic support that helps to propel the person along the life cycle.

Everyone shares the experience of Hindus all to varying degrees. It also makes real, key concepts in a dynamic approach to the study of social science: social state, transitions and trajectories. Therefore within a dynamic approach to the study of society, individuals are conceptualised as following trajectories comprising a sequence of states and transitions. But in contrast to Hinduism, there is no expectation that the sequences that individuals follow will be fixed or linear: people can find themselves in similar states to those that they have experienced before and may regress as well as progress in material and other ways. For this reason the US term ' life course' is typically used in preference to the British ' life cycle' which, like the Hindu asramas, implies a fixed sequence.

Moreover, whereas, asramas apply to the whole life experience, it is often convenient to define trajectories in different domains of life that people follow simultaneously. Everybody, for

example, can be thought to be engaged on a trajectory defined with respect to the labour market. This will comprise such states as full time and part time employment, unemployment, and economic inactivity. School children and others who have not yet worked, may arbitrarily be omitted in studies of labour market trajectories but, in other respects, it may be appropriate to include them, likewise the retired or permanently incapacitated.

Often trajectories within different domains intersect with important implications for the individual and others. For example, much welfare provision is designed as a response to the intersections of family life and labour market trajectories: family dissolution often has implications for employment prospects, while unemployment is known to be associated with in increased risk of relationship breakdown. Moreover, as both of these examples show, the trajectories of different individuals also often intersect with consequences for all concerned.

Duration

If traditional social science has been concerned with the individual in a social context, the new, dynamic social science adds a third component, time, which is operationalised as duration[2]. Each social state has a duration that is often the focus of interest and can be used as part of the definition of the state. So, for example, whereas poverty has traditionally been defined as the state when resources fall short of needs, the dynamic perspective would additionally focus on the length of time for which a person remains in poverty (Walker, 1994; Atkinson et al., 2002). Moreover, analysts might well argue that long periods of poverty are intrinsically different from short ones, that the

experience, its antecedents and consequences are sufficiently unique for the two social states to be differentiated and categorised as separate social phenomena (Walker, 1997b, 2003).

Indeed, in much dynamic analysis the unit of analysis is a spell. Spells are composite, multi-level units of analysis comprising a subject of study, such as an individual or social institution, a social state and its duration. For example, research on poverty dynamics often focuses not on poor people as such but on spells of poverty. In such circumstances the nature of the research questions addressed changes from ones to do with how many people are poor to ones that concern the number and average length of spells and the time lapsing between them.

Stepping back from the individual to consider the wider institution, it is worth noting that the number of individuals currently occupying a state is a function of the flow of people in and out of the state and the average duration of their stay. So, for example, if the flow of people into unemployment remains constant but the number leaving decreases, the number of people in that state increases and the average time spent unemployed must lengthen.

Censorship

Very often is impossible directly to measure every dimension of a composite unit of analysis, not even one as basic as duration. Hence, the analyst has to be content to use models of the underlying temporal concept.

The reason for this is that the duration of the unit of analysis often exceeds the period for which it is observed. For example, it is historians rather than social scientists who are able to take a life as the unit of analysis since most of the latter are primarily concerned with people who are still alive today; they cannot, for instance, directly investigate the empirical reality of the seven life stages experienced by Hindus alive today. Similarly, the policy analyst cannot directly measure the time that the poor will spend in poverty, nor the average time for which current claimants will have received benefit when finally they leave. And, of course, research funds and the life times of researchers are limited.

Most data available to social scientists is therefore ' censored' . The examples given in the preceding paragraph were chosen so as to illustrate what is termed right-hand censorship: when the termination of a state is not known or cannot be directly observed. Left-hand censorship, when the beginning of a social state is unknown, also occurs frequently and can be even more problematic than right-hand censorship although there are tools to handle both.

The extent of censorship is a function of the ratio between the true duration of the unit of observation, such as a spell, and the period of time for which the unit is observed. Clearly, the longer the period of observation relative to the duration of the unit of observation, the smaller is the size of the problem.

Incidence, prevalence and continuity

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Extending the period of observation is likely to increase both the number of units counted and the number of people whose trajectories include the social state under investigation. This can have important substantive and policy implications. It may mean, for example, that the number of people who ever need to rely on social assistance will be many times the current caseload. However, the precise relationship between the number of people who are in a given state at a particular time (incidence), and the number who will experience that state over a given period (prevalence) is quite complex.

This may be illustrated with respect to poverty. The prevalence of poverty is determined by the total duration of poverty within a population, the length of spells, the degree to which the spells are recurrent and the time for which the system is observed. A lower bound is set by the situation in which poverty is experienced entirely by one sub-population comprising people who are permanently poor. In this case the incidence and prevalence are the same. The upper bound coincides with circumstances in which poverty is a once in a lifetime event, with each spell lasting for the shortest possible period that the global sum of poverty allows. In this case incidence and prevalence diverge: low incidence is accompanied by high prevalence. The kind of poverty that prevails in situations of low and high prevalence are markedly different: permanent in the first case and very transient in the second.

Plotting the prevalence of poverty against the length of the observation period also reveals much about the characteristics of poverty suffered by the population under study (Figure 1). If the line rises steeply and linearly (line C-C), the poverty is likely to be experienced in short spells by different people. A flat curve suggests that poverty tends to be permanent (B-B), whereas a convex

curve indicates that spells are comparatively short but that poverty is concentrated within a sub-population who suffer recurrent spells (A-A). A concave curve suggests that spells are distributed widely within the population but are of similar length (D-D).

Figure 1   Prevalence of poverty and the length of observation period

The curves plotted in Figure 1 provide a reminder that the distribution of a phenomenon within a population is intimately connected with its distribution over time. The two distributions are linked by the concepts of duration and continuity: duration is the time that a person spends in a particular state or for which the phenomenon persists; and continuity is the extent to which the state continues over time or is experienced as repeated episodes or spells. Moreover, the distribution of a phenomenon over time and across a population can serve to determine the social experience and meaning of the phenomenon in question.

Returning to poverty by way of illustration, low prevalence describes a situation in which poverty is borne by a few people who experience permanent poverty. They are likely to be cut off economically and socially from the wider community and to be demoralised by the limited prospect of ever sharing in the good life. Those in the same society who are not poor have little prospect of becoming so and, hence, are unlikely to be much moved by the plight of those less fortunate than themselves. These conditions are ideal for the development of social exclusion or an underclass and the enforcement of economic apartheid. On the other hand, in a society characterised by high prevalence, poverty - albeit as a short-lived phenomenon - will be a common and shared experience that may trigger a collective response to the problem. However, the lack of concentration of

poverty may also undermine the capability of the poor for collective action, whereas an underclass lends itself more easily both to self-organisation and to powerful dramatisation by the advocates of the poor.

In other situations, the risk of suffering poverty will be more variable and everybody' s prospects less certain. The poor will reasonably be able to hope that their poverty will end, although the chance that they could experience another spell will be real. Those not poor know that they could become so and various forms of poverty, defined in terms of the number, duration and spacing of spells, are likely to coexist.

Figure 2 links these abstract ideas with empirical data. A simple index of the relative duration of poverty in a society is provided by the ratio of the annual poverty rate to that observed over a longer time period. The lower the value, the greater is the average duration. For the years 1993 to 1995 this ratio (expressed as a percentage) was 47 percent for the US, which means that the number of people who experienced poverty increased by 47 percent as the window of observation was expanded from one year to three. Corresponding values for other countries were 59 per cent for Germany, 61 per cent for the United Kingdom, 73 percent for France and 93 percent in Denmark. These comparisons reveal the unusual permanence of poverty in the United States relative to that found in Europe, its low prevalence and thereby its concentration on a comparatively small section of the population. Canada also appears to differ from Europe in terms of the types of poverty that are most prevalent. Large numbers of Canadians experience very short spells, many – though less than in the United States – suffer long spells but comparatively few are poor repeatedly or for intermediate periods.

Figure 2   Ratio of three year to one year poverty rates, 1993-5

Fractals, state dependency and heterogeneity

Duration, the time that a person spends in a state, is not of interest solely for its own sake. Rather dynamic social science focuses on the consequences of different durations and the factors that cause duration to vary. Addressing the latter issue can be particularly challenging.

A common finding is that the longer a person occupies a social state, the lower his or her chances of leaving it. In the context of poverty and the receipt of social assistance, right wing commentators have taken this finding as evidence of dependency, the process by which people's attitudes and behaviour change over time in response to living on benefit and which, in turn, makes it increasingly difficult for them to leave (Murray, 1984; Mead, 1992, 1997). It is argued that claimants may no longer bother to look for work, or may have lost the habit of work that appeals to prospective employers.

However, others have challenged the importance of this so-called 'state dependency'. Walker and Ashworth (1998), for example, emphasise what might be labelled the greenhouse effect. Glass in a green house enables all wavelengths of light to pass through from the sun, but traps the long wave radiation emitted from the ground. Likewise, a broad range of people claim social assistance but only those with particular characteristics, notably good qualifications and recent work experience, are able to leave benefit quickly. The observed decline in the probability of leaving

benefit is therefore largely the result of a selection process: those able to do so leave early, while those unable to do so accumulate in the system. This process is termed the 'heterogeneity effect'. A further problem, however, is that there is usually some unobserved heterogeneity, that is heterogeneity that cannot be explained by the variables included in the analysis.

Attempts to establish the consequences of long durations in a state on future trajectories are plagued by similar problems. The fact, for example, that people who have suffered one spell of poverty are more likely to experience poverty again is not definitive evidence that poverty begets more poverty.

The thesis of state dependence suggests that individuals can change during the time that they occupy a particular social state, perhaps simply as a result of being in the state. This implies that individuals may follow trajectories within what might initially be assumed to be stable social states. In the same way that extending the observation period is likely to increase the numbers passing through any social state, so increasing the resolution of the time window is likely to reveal more instability and social mobility. This is the so-called fractal effect (Ashworth and Walker, 1995). So, for example, in an analysis of economic activity during the course of a year it may be appropriate to discount the fact that a person worked on a single day and to treat them as long termed unemployed. There are other occasions when it is necessary to adopt a higher resolution of time. For example, in Britain one day of employment could result in the person being denied social assistance for anywhere between one and 26 weeks.

Macro, micro and causality

But the major advance likely to be achieved through the adoption of a dynamic perspective is the development of causal theory that links individual dynamics and the dynamics of institutions and social structures. Jonathan Gershuny (1998) draws attention to the importance of individual history in explaining the way we are. Moreover, to demonstrate causality it is necessary, if not sufficient, to show that the cause precedes the effect.

Perhaps the most important area for theoretical development lies in contextualising the impact of events that would appear to trigger a change of social state. Such evidence as there is makes clear that the occurrence of a particular event will act as a trigger in some circumstances but not in others. Therefore any explanation of, for example, the nature and extent of poverty, has not only to take account of the probability that any particular event occurs, but also the probability that it will trigger a transition into poverty. The factors that discriminate between the occurrence of events and their effects as triggers are likely to depend on the personal capabilities of individuals, and the structural circumstances in which they find themselves or may have experienced in the past. Knowing the histories of the individuals, their trajectories in appropriate domains, and the institutions and sequence of events that have impacted on their lives, should make it possible to disentangle the effects of personal and structural factors. The same analytic sequence also opens the possibility of constructing theoretical structures that span micro and macro explanations. So Gershuny (1998) outlines a recursive model of action in which what individuals have done determines what they do next which, in turn, determines what they become and what next they do. Each action or event in these sequences generally involves the individual interacting with a wider social environment that both affects, and is affected, by the event. The events in individuals' lives gain salience through

interaction with social institutions that are themselves moulded by the actions of individuals. This is the most basic model of the relation between structure and action, or between macro and micro, a problem that has haunted modern social science ever since its beginnings.

Technical tools

The aim in this final section is to take note of the resources that make dynamic research possible, namely longitudinal data and the analytic techniques to handle them.

Panel surveys

The most important resource is undoubtedly the panel survey in which the same individuals are asked at regular intervals the same sequence of questions about their circumstances, attitudes and behaviour. Such data enable change to be directly observed and trajectories mapped. They also mean that information about what will subsequently become prior circumstances will be collected at the time, and not gathered retrospectively when the lens of history and the distortion of hindsight will necessarily intervene. Moreover, of course, panel data allow for the specification of antecedents and the identification of consequences; they also facilitate the investigation of situations in which an event operates as a trigger and when it does not. General household panel surveys have been established in most European countries, often modelled on the US Panel Study of Income Dynamics initiated in 1968 (PSID), and CHER, the Consortium of Household Panels for European Socio-Economic Research is engaged in the task of harmonising and integrating the data to facilitate cross-national analysis (Johnson, 2002). Table 1 indicates the dataset available through CHER.

Table 1 **Panel data sets available through CHER**

Valuable though panel surveys are, they are no panacea; nor do they serve as alternatives to the generation of dynamic theory. They are expensive which means that panel surveys are likely to remain the exception rather than the rule. Sample sizes will continue to be precariously small and the coverage of topics will veer towards breadth rather than depth in order to generate a sufficiently large constituency of users to justify the cost.

There are also specific problems. Sample attrition is inevitable because contact is lost with some respondents and others refuse to continue participating in the study. Even the high response rates that can usually be achieved from the third wave of interviews onwards still mean that, after a decade or so, only a minority of the initial sample will still appear in survey. Important though attrition can be, experience suggests that the degree of bias that results is rarely fatal and can be ameliorated by judicious weighting (Kalton and Brick, 2000). However, there are other difficulties. Often it is necessary to collect information about events that occur between interviews that often results in a disjuncture in the data series that occurs at the time of the interview. This is caused by the fact that people remember more recent events more accurately than earlier ones. Such ' seam effects' can have a marked effect on the outcome of modelling (see below) and are not easy to overcome. Another difficulty is that panel surveys are conducted in real time. This means that if the events of interest are rare or the processes take a long time to have a measurable effect, the lapse between the start of the project and the completion of the analysis will inevitably take years.

Finally, there is a generic difficulty that applies to all sources of longitudinal data. Whereas cross-sectional surveys often take the household or family as the unit of analysis, this is impractical in panel studies since households change so rapidly that they cannot sensibly be followed over time. Shifting the emphasis from household to individual may not be inappropriate response if one aspect of modernity is an increase in individualism. However, it requires some conceptual retooling when applied in studies of poverty or social assistance receipt since the traditional, if contested assumption (Middleton, et al., 1997), is that resources are shared within households or claimant units.

Life history surveys

The cost of panel surveys and the inevitable delay in assembling findings means that there is a premium in finding other sources of longitudinal data. One approach that scores on cost and speed of response is the application of life history techniques in a one-off survey (see King and Murray, 1996; McKay et al. 2000; McKay, 1998; Wagner and Motel, 1998). This involves compiling histories of events with dates by means of careful questioning. Typically, this is done domain by domain, beginning with the current situation and taking the respondent backwards in time. Often interviews can take in excess of two hours and may suffer comparatively low response rates as a consequence.

Among other problems with life history surveys are the biases introduced by the fact that respondents' recall of more distant events is less accurate than of current ones. One consequence of this is 'telescoping': respondents often forget short lived changes of social state with the further result that estimates of duration are frequently correlated with time (Barnes, Ashworth and Walker,

1997). Typically, life history samples are cross-sectional in form which means that they are necessarily biased in terms of survivors, since people who have already died or else moved out the system will not be included. This may have the effect of emphasising stability at the expense of change. Walker and Shaw (1998) report a novel attempt to overcome this difficulty using a sample that itself is drawn over a period time. In this way, they were able to capture all people entering a particular state (social assistance receipt) and to interview even those who were no longer in receipt of social assistance (although not, of course, those who had died!).

One other difficulty worth noting is the requirement for large sample sizes. Unless the sample is of a cohort of people of the same age, the observation period offered by the survey will be variable and determined by the age of respondents. This means that while the sample is likely to generate a large number of events that occurred when people were young, events occurring later in life will be comparatively rare since few people in the survey will be old enough already to have experienced them (Figure 3).

Figure 3   Illustrative design of life-history data collection

Qualitative panels and biographies

If life history surveys facilitate the construction of individual trajectories, qualitative studies make for the creation of biographies or narratives, explanatory accounts of the trajectories. Qualitative research can take many forms in the context of dynamic analysis. Retrospective studies are analogous to life history surveys in building up a picture of the past from the perspective of the

present (biographies), while prospective qualitative research follows panel surveys in collecting information on repeated occasions (qualitative panels). Qualitative methods can be used, as in traditional cross-sectional work, to prepare for, illuminate and qualify quantitative studies and may be especially valuable in this regard given the necessary complexity of much dynamic analysis (Ritchie and Lewis, 2002). They may also be used directly to explore the interactions between individuals and the institutions that comprise their social environment. For example, repeated interview with social assistance claimants and with the officials with which they interact can be used to investigate behavioural adaptations to bureaucratic procedures and to the explore the reality of the concept of welfare dependency (Leibfried et al., 1995). Similar studies with children and their parents may throw light on socialisation processes with respect to, for example, employment and consumption (Lister et al., 2001).

The biographical method, often linked to interactionalist sociology, aims to unravel the subjective dimension of time, the perceptions, self-interpretation and orientations that people develop vis-à-vis their lives. Some writers, like Martin Kohli (1986), distinguish between the ' life course' - the ' objective' events and transitions that define trajectories which are measured in quantitative terms, and biographies - the subjective side of people' s lives to be investigated qualitatively. But exciting possibilities arise from mixed designs that involve repeated interviews in which respondents are invited to look backwards and forwards in time. Data collection is recursive. Information is collected on intentions and expectations that are compared in subsequent interviews with actual events, behaviour and outcomes. The unique flexibility of qualitative research means that respondents can be invited to account for discrepancies between, for example, expectations and

outcomes. People following similar trajectories can also be brought together to explore shared experiences and to explain and better to understand differences (Unell, Leeming and Walker, 1994).

Qualitative research is never easy and demands enormous creativity from its practitioners, demands that are added to by the requirements of a dynamic perspective. Repeated interviews generate enormous quantities of information and, while computer assisted analysis is an important aid, there remain severe practical limits to the volume of material that can be analysed in depth. Sample attrition can be a major problem in the context of a small number of respondents, although the qualitative research process often engenders a strong commitment among research subjects. There are frequently ethical issues relating to the intensive nature of the research and severe problems of confidentiality when the research involves more than one participant in any interaction being studied. It is also possible that the research process, often deliberately designed to encourage self-reflection, will itself change respondent's understanding, expectations and trajectories.

Administrative data

Another source of longitudinal data is that drawn from administrative records (Buhr and Weber, 1998; Gustafsson and Voges, 1998). Such data overcome the problem of recall inherent in life-history surveys and can often generate very large samples (and indeed, sometimes entire populations). On the other hand, the analyst generally has no control over the scope, nature and quality of the information gathered by the administration and which is typically collected as the by-product of policy implementation. Very often, therefore, the researcher has to make do with a limited number of pieces of information about a large number of people. In addition, this information

is phrased in categories produced by the administration for its own purposes and can sometimes be expensive to collect when computerised data are not available.

Also it is rare for administrative data to cover more than one domain of a person' s life. While information on means-tested benefits is quite broad in scope, it is still generally impossible to use social assistance records to track people after they have left benefit.

Simulation

A final strategy is to dispense with true longitudinal data altogether and to simulate life histories from cross-sectional samples. Quasi-cohort analysis constructs synthetic cohorts from a series of cross sectional studies. For example, comparisons might be made between people aged 20 in a sample conducted in year T, those aged 21 in a similar survey conducted in year T+1 and with people aged 22 in year T+3. It should be emphasised that different individuals are interviewed in each year so that there is no possibility of identifying antecedent events and that analyses are made at a cohort rather than an individual level. Nevertheless, such techniques have been used to develop interesting hypotheses about lifetime trajectories and the contrasting experience of successive cohorts.

Dynamic population models are rather more sophisticated than quasi-cohort analysis (Falkingham and Hills, 1995). Such models seek to generate a comprehensive set of life histories by determining the attributes of an individual in year T+1 on the basis of their attributes in year T. Actual information is only available for one year, the year of the survey, but each individual is ' aged' throughout an entire lifetime using streams of randomly generated numbers combined with Monte

Carlo selection techniques and empirically derived transition probabilities. Dynamic cohort models depart from any single real sample and create model individuals on the basis of behavioural equations and transition probabilities. For example, a person' s educational status at any point in time would be determined on the basis of assumptions about age, sex, parental class and education received up until that time. In this way it is possible to simulate entire life histories, albeit on the basis that all the characteristics of the population, the relationships between them and the policy regime remained unaltered throughout everybody' s life. This latter proviso is both a strength and a weakness. It means that the long-term effects of existing policies can be modelled holding everything else constant, but it also means that the population generated is not a true representation of the actual population at any point in time.

Event history analysis

As important as the data, are the techniques to analyse them. The most important set of approaches are known collectively as ' event history analysis' after the nature of the data that can be analysed (Vermunt, 1996; Blossfeld and Rohwer, 1995). Such data, derived by the methods described above, will generally contain information on the number of specific events, their sequence and the time at which they occurred. The principal aim of the analysis is usually to explain why certain persons are more likely to experience such events than others.

Clearly this is not the point to discuss event history models in detail, but it is worth drawing attention to the close correspondence between the conceptual concepts covered earlier and the technical tools. The first step in any event history analysis is to define the states of interest, be it

poverty, family type or whatever. At any point in time a particular individual can only occupy one

state. An ' event' is the transition from one state to another: poverty to non-poverty; single to

cohabitation; etc.. ' Duration' is the time spent within a particular state, that is the time between

events. Finally, there are the concepts of the risk set and the risk period. The former is the group of

the people who are at risk of experiencing a particular event while the risk period is the length of

time for which a person is exposed to the risk.

Using these concepts event history analysis can be described as the analysis of the rate of

occurrence of an event during the risk period or the analysis of the duration of the non-occurrence of

an event (Yamaguchi, 1991). The risk of the event occurring within a short period is then regressed

on a set of covariates, some or all of which may themselves vary over time. Moreover, the analysis

allows for the possibility of censorship: at the end of the observation period it is known that an event

has not occurred but not whether and when it subsequently does so.

Event history models, sometimes termed hazard models because the dependent variable is

the rate at which a hazard (event) occurs, can be categorised in terms of the nature of the dependent

variable and the way in which time is treated. Different models allow the dependent variable to be

either discrete, one state or another, or continuous. Among event history models for discrete

dependent variables, some assume that the event may occur at any point in time (continuous time

models) while others assume that changes only occur at particular times (discrete time models). The

former can be further divided into those in which it is assumed that the time dependence of the

process being studied takes a particular form (parametric continuous-time models) and those in

which the form of the dependency is unspecified (semi-parametric continuous time models, Cox, 1972).

Figure 4a illustrates results of hazard modelling applied to data on poverty derived from the first nine annual waves of British Household Panel Study covering the years 1991-9. Based on a discrete time model, it plots the hazard rate for individuals from two contrasting household types escaping poverty for each year following the onset of poverty (Jenkins and Rigg, 2001). It can be seen that individuals from highly educated youthful families with two parents leave poverty much faster than poorly educated lone parents, but that in both cases the rate at which people leave poverty declines over time. From Figure 4b, which graphs the formal model reported at Annex A, it is apparent that low hazard rates, and hence long spells of poverty are characteristic of households headed by older people and, other things equal, those with under school-aged children. Short spells of poverty are a feature of households including more than one adult, and where education levels are high and people are employed.

Figure 4a   Hazard rate for leaving poverty, households headed by a person aged less than 60, Britain 1991-9.

Figure 4b   Hazard ratios for leaving poverty, households headed by a person aged less than 60, Britain 1991-9.

Clearly, the quality of the modelling can only be as good as the data. Missing data, often caused by variations in survey and item responses from wave to wave are an endemic problem for

which there are only partial solutions. Censorship is a form of missing data and, while it is often inevitable, even event history models need to assume that the censorship is independent of the process being studied.

Problems of measurement error are exacerbated because of the requirement in longitudinal research for repeated measures. Events, for example, are typically defined with reference to the difference between two measurements, both of which will be subject of error. Moreover, depending on the model used, it may be necessary to transform a continuous variable into a discrete one. Income poverty, for example, will be defined with regard to a particular point on a continuous distribution of the income to needs ratio which itself involves measurement of both income and needs. Furthermore, without adjustment, event history models are particularly sensitive to the problem of unobserved heterogeneity: that is to the omission of variables that affect the risk of an event occurring (Vermunt, 1996).

Nevertheless, despite the practical difficulties and the conceptual complexity, event history techniques have revolutionised the analysis of longitudinal data (Mayer and Huiink, 1990). They are invaluable tools for use in both the development and testing of dynamic theory.

Sequence analysis

Finally, brief mention should be made of sequence analysis, a set of techniques that are being developed to model individuals' trajectories between states (Johnson, 2002). The challenge it to find methods by which sequences of states and transitions can be compared and some determined

to be more similar to each other than to others. In this way, individuals can be grouped according to their life experiences.

This turns out to be much more difficult than might be supposed. The reason is that standard taxonomic techniques, such as factor analysis and cluster analysis, treat scores for each variable separately for each individual and fail to take account of sequence. Therefore, the sequence of states – 0-1-0-1-0-1 – and – 0-1-0-1-0-1 – would be viewed as entirely different even though both individuals were regularly alternating between the same two states.

A simple early example grouped US children who experienced poverty between birth and age sixteen into six, according to the number and duration of their spells (Walker, 1994). Transient poverty was defined as a single spell of poverty lasting a year, persistent poverty as a single spell lasting for between two and 13 years, and permanent poverty as an unbroken spell. Children were considered to be occasionally poverty when they experienced two or more spells each of a single year. Recurrent poverty required a child to suffer two or more spells with at least one lasting for more than a year, but with no less than one period of two or more years without poverty. A child who was never not poor for more than a year at a time was said to experience chronic poverty. Table 2 records the incidence of these different trajectories in and out of poverty: recurrent poverty was the most widely experienced followed by transient and persistent poverty. It also shows (Column 3) that cross-sectional statistics would overstate the incidence of recurrent, chronic and permanent poverty. Figure 5 reveals that transient poverty predominantly affected white children during the 1970s and 1980s in the US but that chronic and permanent poverty were endured largely by children of colour except when a white child lived with a lone parent.,

Table 2   **Poverty sequences during childhood (age 0 to 15), US, 1968-87**

Figure 5   **Characteristics of poor children, US, 1968-87**

Similarly, using just the first four waves of the British Household Panel Survey, Gardiner and Hills identified five income trajectories: flat; rising, falling, a ' blip' and ' other' and further distinguished between trajectories that took people across the poverty threshold and those which did not (Table 3). Overall, the most frequent trajectories were flat followed by ' blips', although individuals who experienced poverty were rather more likely experience unstable trajectories: namely ' blips' or repeated or one-off spells of poverty. Interestingly, though, individuals' trajectories were much more stable or directed than would have been expected purely based on chance which underlines the importance of either state dependency or the heterogeneity effect in explaining people' s financial circumstances.

Table 3   **Income trajectories over four years, Britain, early 1990s**

' Optimal matching' is a more sophisticated technique to achieve similar ends (Sherer, 2001; Halpin and Chan, 1998). It is a variant of exploratory regression analysis that involves counting the number of changes required to turn one sequence of states and transitions into another. Based on such calculations, it is possible to create an empirical typology by clustering similar sequences to generate sets of groups. It is important to note that this form of analysis is exploratory rather than explanatory.

Recapitulation

To reiterate, the dynamics that characterise modernism are made understandable by reference to temporal concepts such as those introduced in this article. Moreover, by good fortune, the concepts find their parallel in sets of analytic techniques that enable descriptive and explanatory theory to be informed by empirical data. This, then, is the project on which contributors to this issue of the Journal are engaged and in which readers are invited to join.

Notes

1   This article is a revised version of Walker and Liesering (1998).

2   The stages are childhood (usually counted as a pre-dharma stage); brahmacarin (student); grihasta (household); vanaprastha (forest dweller or hermit) and sannyasa (renouncement) (see Hoskins (1971) for details).

3   See Niklas Luhmann' s; (1990), distinction of matter, social, and time as dimensions of sociological analysis.

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Annex A   Multivariate model of the hazard rate of leaving poverty, individuals in households with non-elderly heads

Explanatory variable	Coefficient	Standard error
Number of dependent children	-0.214	0.05***
Chilsren aged 1-5	-0.349	0.11***
Number of adults	0.222	0.08***
Household head aged 30-9	-0.056	0.12
Household head aged 40-9	-0.164	0.14
Household head aged 50-9	-0.447	0.14***
Higher educational qualifications or advanced level school qualifications	0.201	0.09**
Household head in paid work	0.318	0.09**
Other paid workers in household	0.475	0.11***
Spell year 1	-0.489	0.14***
Spell year 2	-0.889	0.16***
Spell year 3	-1.002	0.19***
Spell year 4	-1.175	0.25***
Spell year 5	-1.387	0.34***
Spell year 6	-.1528	0.48**
Spell year 7	-1.804	0.80**
Log-likelihod	-2325	
Number of observations (person-years)	3782	

Statistical significance:

***p<0.01

**:0.01p=p<0.05

*:0.05=p=0.10=

Reference categories for dummy variables are: no children in household aged 1-5, household head aged less than 30 or household head aged 60-64, household head with educational qualifications less than A-level, household head not working, no other adult in the household. Estimates derived using discrete-time proportional hazards regression. Standard errors are adjusted for clustering within housholds.

Source: Jenkins and Rigg (2001) p.80.

Table 1 **Datasets available from CHER and coverage from 1990**

Country	Year												
	90	91	92	93	94	95	96	97	98		99	00	01
Austria						X	X	X	X		X	X	X
Belgium			X	X	X	X	X	X	X		X	X	X
Canada				X	X	X	X	X	X		X	X	X
Denmark					X	X	X	X	X		X	X	X
Finland							X	X	X		X	X	X
France					X	X	X	X	X		X	X	X
Germany	X	X	X	X	X	X	X	X	X		X	X	X
Greece					X	X	X	X	X		X	X	X
Hungary			X	X	X	X	X	X					
Ireland					X	X	X	X		X	X	X	X
Italy					X	X	X	X		X	X	X	X
Luxembourg						X	X	X	X	X	X	X	X
Netherlands					X	X	X	X	X	X	X	X	X
Poland II						X	X	X					
Poland III									X	X	X		
Spain						X	X	X	X	X	X	X	X
Switzerland											X	X	X
UK				X	X	X	X	X	X	X	X	X	X
USA		X	X	X	X	X	X	X	X	X	X	X	X
Total countries		2	2	5	7	15	16	17	17	16	17	16	16

Note: Panel data for the USA are also available from 1980.

Source: Johnson (2002)

The contact for further information on CHER is Gunther Schmaus, CEPS/INSTEAD, (B.P. 48), 44, rue Emile Mark, L-4501 Differdange/Luxembourg, tel:+352-585855-509/fax:+352-585560, e-mail: gunther.schmaus@ci.rech.lu

Table 2   **Poverty sequences during childhood (age 0 to 15), US, 1968-87**

Pattern of poverty[1]	Per cent of all children	Per cent of children ever experiencing poverty	Per cent of currently poor children[2]
	(1)	(2)	(3)
No poverty	62		
Transient	10	27	5
Occasional	3	8	4
Recurrent	16	41	53
Persistent	5	14	12
Chronic	2	5	13
Permanent	2	5	13
All	100	100	100

1   See text for definition

2   This is also equivalent to the proportion of all childhood poverty where childhood poverty is defined as the total number of years of poverty experienced by all children in the sample cohort (or the total number of child-years spent in poverty).

Source: Walker (1994)

Table 3 **Income trajectories over four years, Britain, early 1990s**

Type of trajectory	Observed in British Household Panel Survey			Randomly generated		
	Some poverty	Non poor	Sub total	Some poverty	Non poor	Sub total
Flat						
Poor	8.7			0.3		
Non-poor		32.4			1.1	
Sub total	*8.7*	*32.4*	*41.1*	*0.3*	*1.1*	*1.4*
Rising						
Out of poverty	2.6			2.6		
Non-poor		3.5			2.0	
Sub total	*2.6*	*3.5*	*6.1*	*2.6*	*2.0*	*4.6*
Falling						
Into poverty	1.5			2.5		
Non-poor		2.5			1.8	
Sub total	*1.5*	*2.5*	*4.0*	*2.5*	*1.8*	*4.3*
'Blips'						
Out of poverty	5.6			2.6		
Into poverty	5.1			4.5		
Non-poor		19.1			10.1	
Sub total	*10.7*	*19.1*	*29.8*	*7.1*	*10.1*	*17.2*
Other						
Repeated poverty	5.2			13.6		
One-off poverty	5.8			32.6		
Non-poor		8.0			26.3	
Sub total	*11.0*	*8.0*	*19.0*	*46.2*	*26.3*	*72.5*

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Total	34.5	65.5	100.0	58.7	41.3	100.0

Adapted from Gardiner and Hills (1999), adjusted to cope with rounding
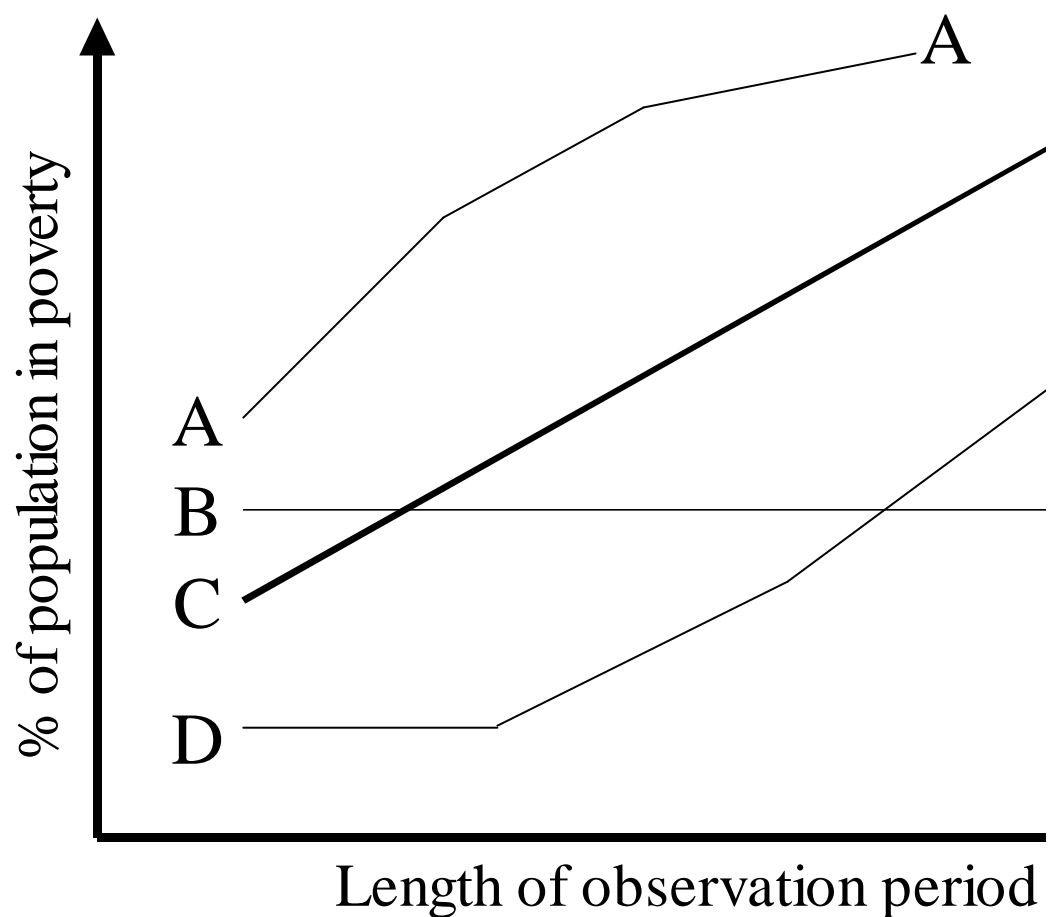
Figure 1   Prevalence of poverty and the length of c

F i g u r e 4 a   H a z a r d r a t e f o r l e a v i n g p o v e r t y , h o u s e h o l d s h e a d e d b y a p e r s o n a
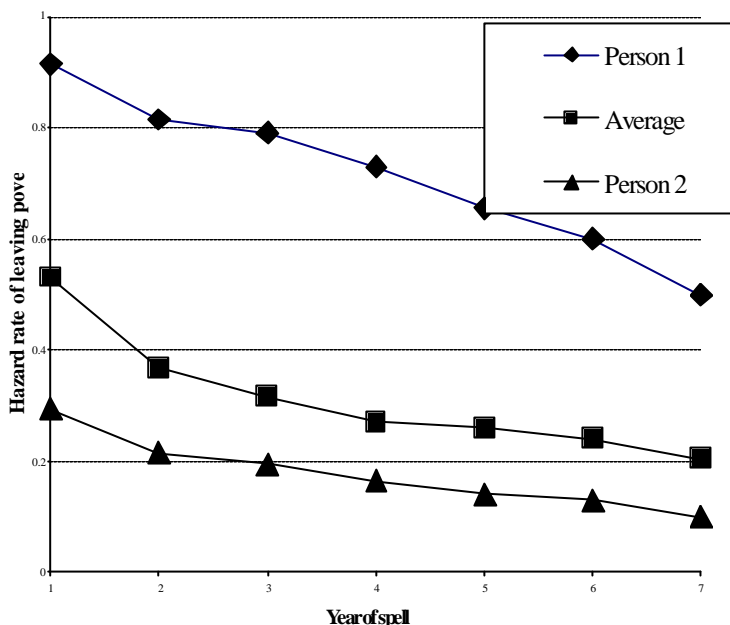**1 9 9 1 - 9**
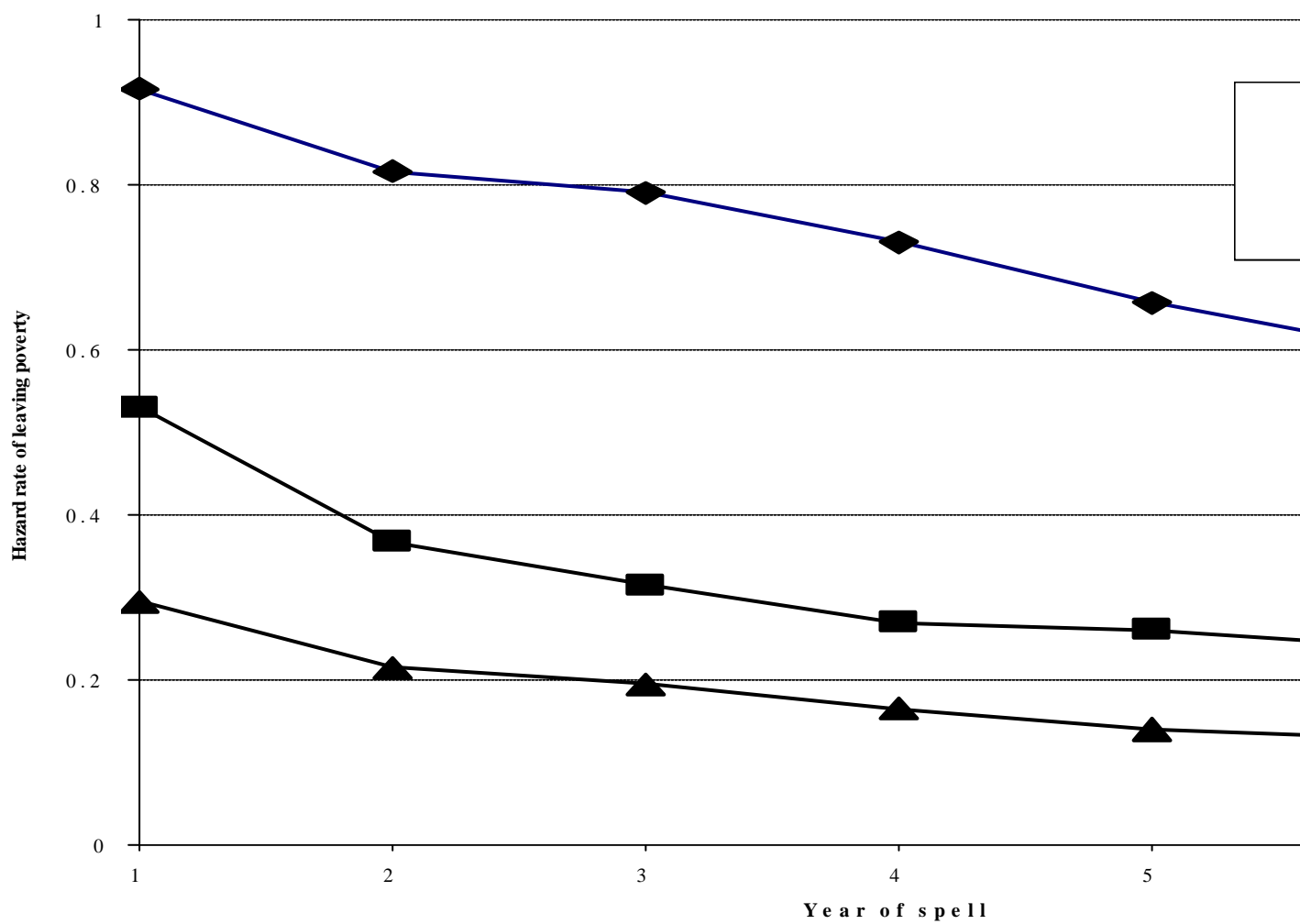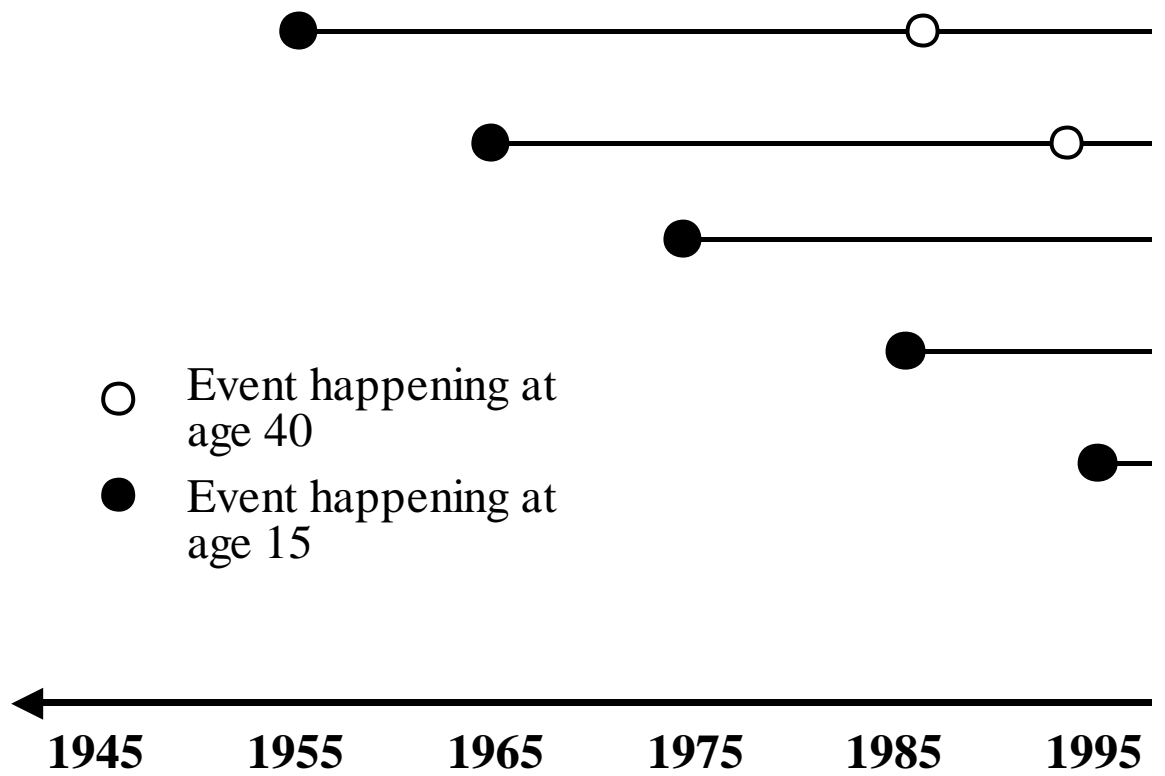
Figure 3 Illustrative design of life-history data col

Figure 4a Hazard rate for leaving poverty, households headed by a person aged less than 60, Britain 1991-9


Person 1: Household head aged less than 30 years, has A-levels or higher educational qualifications, household with no children, 2 adults, both working.
Person 2: one adult household, 2 children, one aged 0-5 years, houshold head has no a-levels and not working.
The average is based on life table estimates.
Source: Jenkins and Rigg (2001) p.81.

Figure 4b Hazard ratio for leaving poverty, households headed by a person aged less than 60, Britain 1991-9
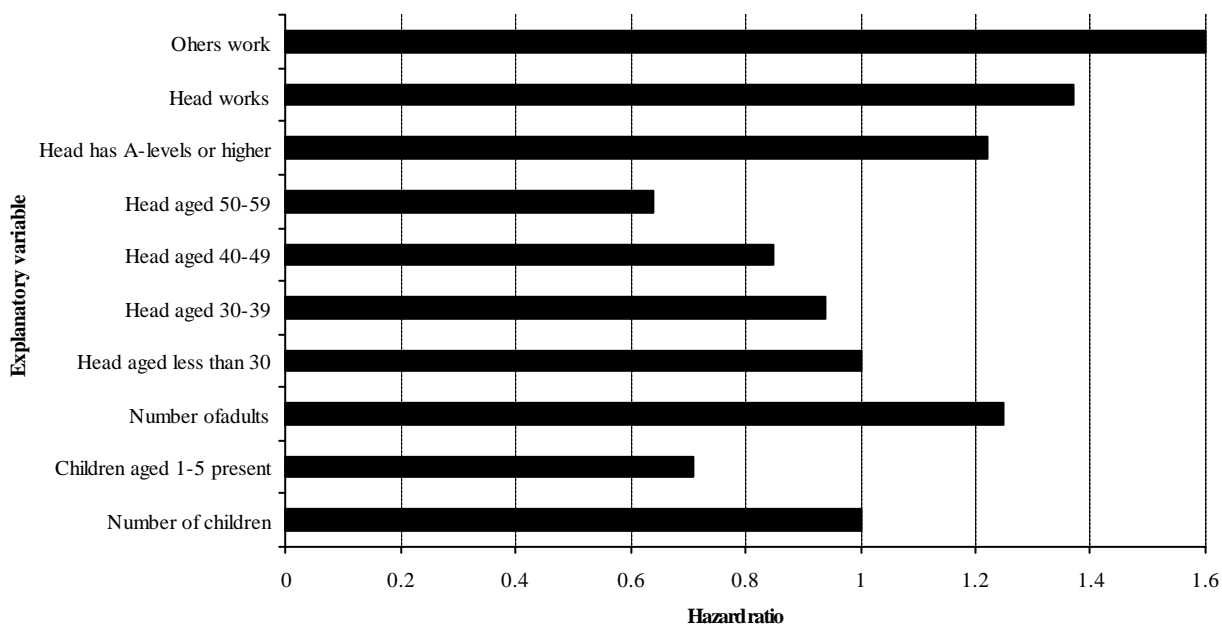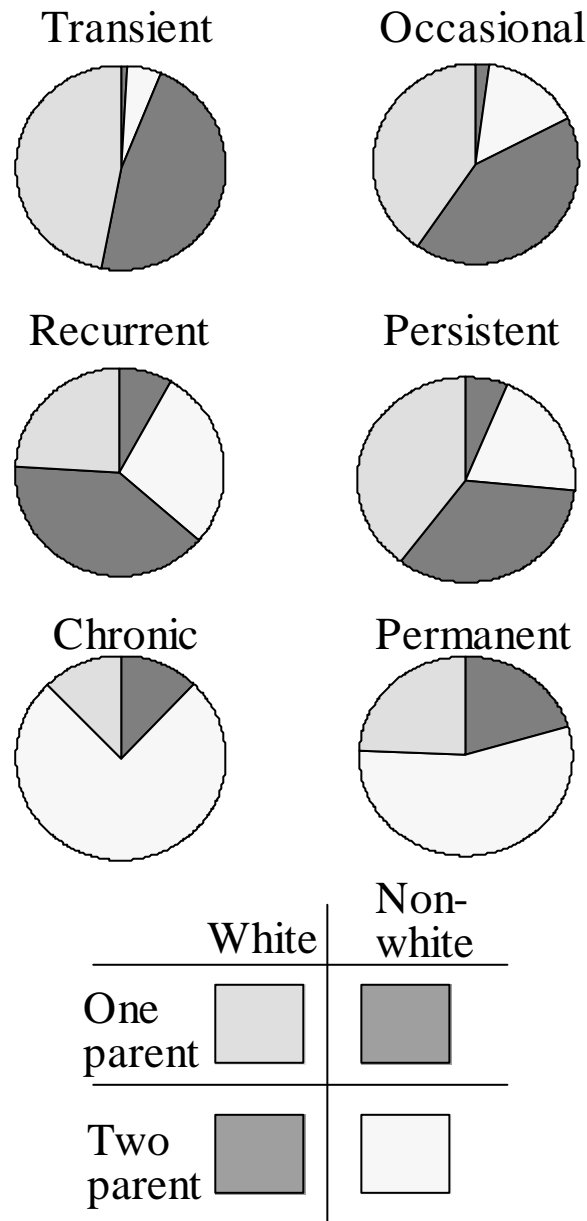

The hazard ratio shows the proportionate change in the hazard rate associated with a one unit change in the explanatory variable, other things equal. A hazard ratio of 1.0 indicates no change in the hazard rate; a value less than one, a decrease in the hazard rate; and a value greater than one, an increase in the hazard rate.
Source: Jenkins and Rigg (2001) p. 82.

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Figure 5   Characteristics of poor children, US, 1968 -87

Transient

Occasional

Recurrent

Persistent

Chronic

Permanent

	White	Non-white
One parent		
Two parent		

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