

# METHODS BRIEFING 28

## Modelling Attitude Stability and Change using Repeated Measures Data

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### Background and aims of research

A key aim of social scientific research is to understand how different phenomena are causally related to one another. Does an individual's social class influence their vote choice at elections, or are their perceptions of the economy and the competence of party leaders more important? Does becoming a parent cause people to change their views about the role of women in society, or are people with more traditional attitudes more likely to become parents?

In order to develop answers to such questions, it is necessary to collect either experimental data, or data which contains repeated measures of the same variable, taken from the same set of individuals over time. Because logistical and ethical constraints limit the utility of randomized experiments in social research, repeated measures data generally offer the greatest leverage on issues of causal order. While the incorporation of a time dimension yields more insight on questions of causality than is obtainable using cross-sectional data, the statistical techniques suitable for this type of data are generally more complex and difficult to apply than those appropriate for data collected at a single

time point. In particular, models must accommodate the fact that observations for the same individual over time are unlikely to be independent of one another, a basic assumption of cross-sectional modelling techniques, such as ordinary least squares regression. In an effort to bring some of these techniques to the closer attention of the community of social scientists, this project applied a range of different techniques to a number of substantive questions. Specifically it had four main aims:

1. To investigate the association between life course events and changes in political and gender role attitudes, and attitudes towards cohabitation, marriage and divorce, using repeated measures data.
2. To develop the methodology where necessary and provide strategies for choosing the most appropriate methods for analysing repeated measures data, particularly measures of attitude.
3. To provide guidance for social scientists on the use of panel data for assessing causal relationships.

4. To disseminate the results of this work by publishing papers in substantive and methodological journals, presenting papers at conferences, and by running a short course and a users workshop on the analysis of repeated measures data.

Data from the British Household Panel Study (BHPS) were used to investigate dynamics in individual gender role attitudes, attitudes towards divorce and cohabitation, and fertility intentions and subsequent fertility behaviours. Data from both the BHPS and the British Election Panel Studies (BEPS) were used to examine changes in political attitudes, while just data from the BEPS were used to examine changes in economic values and perceptions. The results of these analyses are summarised in the next section.

### Key results

The results from the research can be summarised under four substantive headings. Due to the nature of the project, each substantively driven research question also posed methodological questions that were addressed in various ways in the empirical analyses.

#### **Gender role attitudes, entry into parenthood, and changes in economic activity**

Methodological question: *What are the general pros and cons of different modeling frameworks for investigating attitude stability and change via panel data?*

We investigated the relationship between women's gender role attitudes and their fertility and economic activity experiences, comparing the graphical chain modelling, structural equation modelling (SEM) and multilevel modelling approaches.

Substantively we found that, while attitudes do not predict who becomes a mother among childless women, the majority of whom are working full-time, they do predict changes in labour force status. Women with more traditional views were slightly more likely to leave the labour force for family care upon becoming a parent. However, there is stronger evidence that gender role attitudes are shaped by individuals' experiences. We found that becoming a mother and continuing with the same (or increased) hours is not associated with a change in gender role attitude, whereas those who become a mother and reduce their working hours typically become more traditional in their view. While the results from using the graphical chain modelling and SEM approaches were very similar, we encountered problems fitting univariate multilevel models for gender role attitude. Hence, multivariate multilevel models were fitted to the vector of responses for each individual. These models revealed that changes in gender role attitudes were negatively auto-correlated, after controlling for the covariates. The SEM approach has the advantage that it yields a global likelihood for the model as a whole, which can be very useful for identifying model misspecification. On the other hand the GCM approach has the benefit of simplicity, with the overall model comprised of a series of block regressions estimated via conventional statistical techniques, such as linear and logistic regression. This makes it an accessible technique for most applied researchers and facilitates the use of appropriate variance estimators for complex sample designs.

#### **Attitudes to cohabitation and divorce and partnership experiences**

Methodological question: *What are the relative advantages of SEM and multi-level approaches to studying selection and adaptation effects?*

We examined the relationship between partnership changes and attitudes towards cohabitation and divorce using both SEM and multi-level models. We found a 'selection effect', where unmarried people with more traditional attitudes towards non-

marital partnerships were more likely to marry. There is less evidence in support of an ‘adaptation effect’, whereby marriage is associated with a move to more conservative attitudes. In contrast, our findings for the relationship between marital dissolution and attitudes to divorce suggest that individuals, at least those in their first marriage, are not selected into divorce and separation on the basis of their attitudes. Instead, an adaptation effect is present, whereby those who experience marital dissolution realign their attitudes to divorce in the light of their own personal experiences. This is especially the case for those who have been divorced and are now cohabiting with another partner. New insights for Britain provided by this work included a persistent gender difference in divorce attitude whereby women are more favourable towards divorce than men. We also demonstrated strong educational differentials in attitude to divorce which remain even after the respondent’s own marital status is taken into account. In addition, the BHPS reveals some small but persistent regional differences in divorce attitude which, according to our knowledge, have not previously been found.

This work demonstrated how taking a multilevel modelling approach is more flexible than SEM for dealing with the complex pattern of attrition and intermittent non-response found in the BHPS, and other panel studies. By including respondents who were later lost to the survey either through attrition or wave non-response we substantially increased the available sample size for the multi-level analysis. We also considered the methodological issues arising from the multilevel modelling of an ordinal outcome and compared the results obtained using quasi-likelihood, Bayesian Markov chain Monte Carlo (MCMC) and adaptive quadrature estimation methods. We used MLwiN for the first two methods and gllamm for the third, and found that random effects are likely to be underestimated using quasi-likelihood estimation methods, whereas the MCMC estimates were in agreement with those obtained using adaptive quadrature, but took a fifth of the time to produce the results.

Methodological question: *How do corrections for measurement error via confirmatory factor analysis affect substantive conclusions?*

SEM is a useful framework for studying attitude stability and change because of its flexible treatment of measurement error via confirmatory factor analysis. Corrections for measurement error in the concepts of substantive interest, generally reduces the probability of Type II errors because measurement error attenuates effect sizes and yields less precise estimates of structural parameters. By fitting a ‘true intra-individual change’ structural equation model to BHPS data, we found that switching allegiance from the Conservative to Labour party between 1992 and 1994 was followed by significant shifts to the left amongst this group of voters. Some change in left-right position was observed between 1992 and 1996 for those defecting from the Conservatives to the Liberal Democrats, though this group had returned to their 1992 positions by 1997. While the absolute magnitudes of these shifts were not large, the fact that left-right position had such an over-riding influence on party popularity means that even small shifts in this position can have sizeable impacts on the popularity ratings and vote share of the main parties. We also found that people who are more knowledgeable about politics develop their political preferences in rather different ways than less knowledgeable respondents. While politically knowledgeable respondents are strongly influenced by the ‘distance’ of each political party from their own position on prominent policy issues, less politically knowledgeable respondents appear largely unaffected by changes in the ‘distance’.

In this part of the project, we also applied multiple indicator latent growth curve models to political attitude data from the BHPS to explore value change on the ‘socialist/laissez-faire’ core value dimension between 1991 and 2001. The population model showed almost no change in mean attitude over this ten year period, although there was significant individual variation around this flat trajectory. In addition to fitting models for the

population as a whole, we also examined core value change amongst individuals as a function of their party support in 1991. Our results supported the hypothesis that the 1990s was a period of ideological convergence, with supporters of the Labour and Conservative parties moving toward the centre from the left and right wing poles, respectively. We then evaluated the effect of value change at the individual level on subsequent vote choice. There is little evidence to suggest, however, that value change at the individual level had much subsequent influence on vote choice in the 2001 general election.

**Methodological Question:** *How do different error covariance specifications influence substantive parameters of interest in autoregressive models?*

We fitted a series of cross-lagged panel models to investigate the relationship between retrospective perceptions of the macro economy and ‘left-right’ economic values using data from the 1997-2001 BEPS. A cross-lagged model, also referred to as a bivariate autoregressive model, is one in which two outcomes, X and Y, are measured at repeated intervals over time. The model regresses each outcome at time t on its lagged measure at time t-1 and the lagged measure of the other outcome at time t-1. This type of model is useful for addressing questions of reciprocal causality. The substantive models we estimated in this part of the project were deliberately selected to demonstrate the importance of correcting for random and systematic errors in the measurement of concepts, and specifying an appropriate covariance structure between error variances and the disturbance terms in the structural equations. This work demonstrated how different approaches to modelling the error variances and covariances can substantially alter the substantive inferences an analyst might make. For instance, the influence of stable unobserved

variables on each outcome over time induces correlations between the disturbance terms of the endogenous variables. Failing to account for these covariances generally leads to over-estimates of the magnitude of the stability parameters and under-estimates of the magnitude of the cross-lagged parameters, a pattern confirmed in our own analyses. The ability of the SEM framework to estimate non-recursive models, which include covariances between error terms in different structural equations, means that this approach has some advantages relative to block recursive approaches such as Graphical Chain Modeling.

## **Selected publications**

- Berrington, AM, Smith, PWF and Sturgis, P (2006) An overview of methods for the analysis of panel data. *ESRC National Centre for Research Methods Briefing Paper*.
- Sturgis, P (2003) Party allegiances and core political value change. *ESRC Research Methods Programme Working Paper No 5*.
- Berrington, AM (2004) Perpetual postponers? Women’s, men’s and couple’s fertility intentions and subsequent fertility behaviour. *Population Trends*, 117, 9-19.
- Sturgis, P and Tilley, J (2004) Political sophistication and issue voting: an intra-individual level analysis. *ESRC Research Methods Programme Working Paper No 15*.
- Berrington, AM, Hu, Y, Ramirez-Ducoing, K and Smith, PWF (2005) Multilevel modelling of repeated ordinal measures: an application to attitude towards divorce. *Southampton Statistical Sciences Research Institute Applications and Policy Working Paper M05/10 and ESRC Research Methods Programme Working Paper No 26*.

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