

# Chapter 101

## Temporal and Spatial Consistency

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### ABSTRACT

*One of the major problems challenging time series research based on stock and flow data is the inconsistency that occurs over time due to changes in variable definition, data classification and spatial boundary configuration. The census of population is a prime example of a source whose data are fraught with these problems, resulting in even the simplest comparison between the 2001 Census and its predecessor in 1991 being difficult. The first part of this chapter introduces the subject of inconsistencies between related data sets, with general reference to census interaction data. Various types of inconsistency are described. A number of approaches to dealing with inconsistency are then outlined, with examples of how these have been used in practice. The handling of journey to work data of persons who work from home is then used as an illustrative example of the problems posed by inconsistencies in base populations. Home-workers have been treated in different ways in successive UK censuses, a factor which can cause difficulties not only for researchers interested in such working practices, but also for those interested in other aspects of commuting. The latter set of problems are perhaps more pernicious, as users are less likely to be aware of the biases introduced into data sets that are being compared. In the second half of this chapter, we make use of a time series data set of migration interaction data that does have temporal consistency to explore how migration propensities and patterns in England and Wales have changed since 1999 and in particular since the year prior to the 2001 Census. The data used are those that are produced by the Office of National Statistics based on comparisons of NHS patient records from one year to the next and adjusted using data on NHS patients re-registering in different health authorities. The analysis of these data suggests that the massive exodus of individuals from major metropolitan areas across the country that has been identified in previous studies is continuing apace, particularly from London whose net losses doubled in absolute terms between 1999 and 2004 before reducing marginally in 2005*

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*and 2006. Whilst this pattern of counterurbanisation is evident for all-age flows, it conceals significant variations for certain age groups, not least those aged between 16 and 24, whose migration propensities are high and whose net redistribution is closely connected with the location of universities. The time series analyses are preceded by a comparison of patient register data with corresponding data from the 2001 Census. This suggests strong correlation between the indicators selected and strengthens the argument that patient register data in more recent years provide reliable evidence for researchers and policy makers on how propensities and patterns change over time.*

## **INTRODUCTION**

As described in the earlier chapters of this book, there are a variety of interaction data sets, originating from different sources. These cover different aspects of human mobility, and have been collected in different ways and for different purposes. In some cases – such as the decennial census – questions are purposefully asked of respondents for the primary intention of gathering information about that particular topic. In other cases – such as with many administrative sources – data have been gathered for a primary purpose (health service administration, for example), and flow data have subsequently been derived from them as a secondary benefit. A common aspect of many of these data sets is that they form part of a time series, whether on a decennial basis in the case of the census, or on a more frequent basis in the case of administrative data sets. In the first half of this chapter, we consider the various causes of inconsistency in time series interaction data sets and review the various ways in which researchers cope with the challenges that inconsistency presents, specifically when handling census data, and use home-working for illustration. Thereafter, the second half of the chapter, we take advantage of a consistent set of administrative data to examine time series trends in migration since the last census.

## **CAUSES OF INCONSISTENCY**

On its own, each interaction data set provides a valuable cross-sectional view of the population, and

can be used to answer a rich variety of research questions. However, this richness is greatly increased by the ability to compare similar data sets over time. Rather than looking at the extent and magnitude of patterns at any particular point of time, we can look at the ways in which they have changed over the course of a decade or longer. However, in order to do this, it is necessary to consider the extent to which data sets change over time. There are a number of ways in which change can occur and these affect different types of data to varying extents.

Firstly, the geography may change. At a small area level, this is inevitable, as ward boundaries must change over time; in the UK, a number of statutory bodies have a duty to review ward boundaries within local authorities in order to ensure that councillors each represent a roughly equal number of electors. There are separate bodies that do this for England, Wales, Scotland and Northern Ireland. At an even smaller level – that of the output area or enumeration district – change is also inevitable in some areas as local construction projects (housing estates, changes of land usage, new infrastructure projects, *et cetera*), affect the small area population distribution. Whilst boundary change has been a continual process over the two centuries during which censuses have been taken in the UK, it is only relatively recently that small area boundary changes have been significant for the purposes of census comparison, as it is only in the computer-based era that results have been collated and published at this level (Gregory & Ell, 2005).

At a larger geographic scale, local authority boundaries are subject to occasional change following changes to local government structure.

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