Book Section:

Norman, P (2011) Relationships Between UK Sub-national Trends in Infant Mortality and Fertility. In: Stillwell, JCH and Clarke, M, (eds.) Population Dynamics and Projection Methods. Understanding Population Trends and Processes (UPTA), 4 . Springer, Dordrecht , pp. 99-114. ISBN 978-90-481-8929-8

https://doi.org/10.1007/978-90-481-8930-4_5

UPTAP Volume 4 Population Dynamics and Projection Methods

Edited by John Stillwell and Martin Clarke

Relationships between UK subnational trends in infant mortality and fertility

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Introduction

If there are more births than deaths in an area then, due to this positive natural change gain, the area's population will grow; assuming a zero impact of net migration. To determine the relative contributions of each demographic component on population change, a variety of models can be used (Woods and Rees, 1986). Dating back to Stone (1971) but developed and promoted by Rees and colleagues (Rees and Wilson, 1973; 1977; Rees and Convey 1984; Rees, 1986), a 'population accounts' framework ensures that every component of change is explicitly included. A useful model for summarising results is Webb's (1963) population change typology which has been used effectively by Rees and colleagues in a series of influential European reports (see, for example, García Coll and Stillwell, 2000; Kupiszewski *et al.,* 1996).

A more long-term model, the 'demographic transition', with its origins in Thompson (1929) and Notestein (1945), illustrates how differential birth and death rates impact on population change. A distinctive feature of the demographic transition model is that mortality decline is followed after a time by reduced fertility (Woods, 1986a). Whilst there is a consensus on the reasons for mortality decline (for example, improved agricultural yields and nutrition, better personal hygiene, the introduction of preventive medicine and public health, reductions in infectious diseases), explanations for why fertility declined are less clear. Lee (2003) notes that economic theories of fertility propose that couples wish to have a number of surviving children and that if potential parents recognise an exogenous improvement in child survival, then fertility will decline.

In the next section of this chapter the findings are reported of a previous study on timing and patterns of subnational variations in infant mortality trends (as child mortality) in relation to fertility trends in England and Wales during the late 19th and early 20th Century. Then more recent trends are investigated with the study area extended to cover the whole of the UK.

Regional variations in child mortality and fertility during the demographic transition in England and Wales

An extensive study of subnational trends in child mortality and fertility was presented in 1977 by William Brass at a joint conference of the British Society of Population Studies and the Population Study Group of the Institute of British Geographers. 'Regional Demographic Development', a volume edited by John Hobcraft and Phil Rees resulted from this conference including a chapter on this topic by Brass and Kabir (1979). The focus of this work was an evaluation of the evidence of the effects of falling child mortality on fertility. Based on an extensive literature, largely from the medical profession (CICRED, 1975), Brass and

Kabir's expectation was that reductions in child mortality had a "major impact in the establishment of fertility falls" (p.71).

Using rates of child mortality (deaths under five years of age) and general fertility rate, the time period of Brass and Kabir's study was from the 1860s to the 1930s across subnational regions in England and Wales. The analytical approach was not to investigate the association between levels of child mortality and fertility but between trends of levels over time. The percentage changes in five-year intervals were calculated (from non-overlapping moving averages) and then correlated. The question asked by the authors was whether movements over time intervals in the measures tend to be related. The analysis was carried out using measures at the same time point but importantly in this application, with time lags.

To set the scene, figure 1 illustrates demographic rates relevant to both the demographic transition and to Brass and Kabir's study. From around 1875, crude birth rates are falling in parallel to crude death rates. The general trends are interrupted by the First World War after which, during the 1920s, the decline in death rates appears to steady but birth rates continue to fall. The stepped appearance of infant mortality during the 19th Century is because data were not available annually until the twentieth century. From 1900 onwards infant mortality rates fall, largely due to improved living conditions, diet and sanitation (Woodroffe *et al.,* 1993) and the increasing influence of pioneers in public and child health such as George Newman (Dunn, 2005; Newman, 1906; Shelton, 2006).

< Figure 1 about here >

Brass and Kabir (1979) reported the average correlations during their study period with annual time lags within five year periods. Along with moving averages from data overlaps, this was to reduce annual fluctuations and to display patterns more clearly. In Figure 2, a time displacement of zero means that the rates were correlated for the same time period. Where the time displacement is positive this is when the fertility change is later than the mortality change. If fertility reduction occurred following mortality reduction then correlations would increase with increasingly positive time displacement. As can clearly be seen in Figure 2 this is not the case since the correlations are highest with little time displacement and lower correlations with increasing time displacement. Brass and Kabir also found this for longer term time displacements (to over twenty years).

< Figure 2 about here >

Since the maximum correlation was found at effectively no time displacement, Brass and Kabir (1979: 86) concluded there was no detectable "direct influence of child mortality on fertility" and that time-localised correlations of trends in areas were "entirely consistent with the view that causative factors were largely the same for fertility as for child mortality". However, the authors note temporal and spatial *variations* in declines in child mortality due to variations in the type and pace of socio-economic change but *consistency* of the falls in fertility by region. Given the correlations between child mortality and fertility trends, the Brass and Kabir struggle to explain this paradox.

Subnational variations in infant mortality and fertility during 1981 to 2006 in the UK The demographic transition model relates to the historical decline in mortality and fertility in various European countries and currently in many developing countries (Lesthaeghe, 2005). The recognition that differences in living arrangements occur as social attitudes change and that movements of people between countries lead to populations becoming multi-cultural have led to second (Rees, 1997; van de Kaa, 1987) and third demographic transition models being proposed (Coleman, 2006). The demographic and societal characteristics of the second and third demographic transitions such as low marriage rates, rises in divorce and cohabitation rates, a multi-national, multi-ethnic population experiencing relative and absolute ageing due to very low fertility and general and infant mortality rates are all present within the UK (Dunnell, 2007).

Whilst infant mortality rates declined substantially during the 20th Century, infant mortality remains high on academic (Garrett *et al.,* 2006) and public health and policy agendas (Freemantle and Read, 2008) within the UK and elsewhere (Storeygard, 2008). Since the 19th Century, the strong tendency has been for infant mortality rates in urban and mining areas to be higher than those in more rural locations, largely due to adverse living conditions and housing density (Guildea *et al.,* 2005; Lee, 1991). Although to some extent explained by distributions of people by social class, geographic variations in infant mortality have been observed (Botting and Macfarlane, 1990; OPCS, 1978). Over time, the most deprived areas within the UK have had the highest infant mortality rates and the least deprived areas the lowest (Carstairs, 1981; Fitzpatrick and Cooper, 2001; Kmietowicz, 2001). Consistent with Brass and Kabir (1979), Lee (1991) found that the improvements in infant mortality rates continued to be geographically uneven over time (1861-1971). In bringing this time series more up-to-date (1971-2006), Norman *et al.* (2008a) found that whilst infant mortality rates improved overall, not all locations or area types experienced the same amount of improvement with the strong relationship between infant mortality and area deprivation persisting.

The annual number of births fluctuated widely in the UK's countries during the twentieth century (Chamberlain and Gill, 2005). Three main peaks occurred; one after each of the World Wars and the more sustained 'baby boom' period which peaked in 1964. A 'baby bust' followed during the 1970s and whilst there was a slight recovery of fertility rates during the 1980s when the baby boom generation reached childbearing age (an 'echo' of the original boom), fertility rates continued to decline to a record low of 1.63 children per woman in 2001 (Dunnell, 2007). Subsequently, fertility rates have risen in all four countries of the UK. During the last twenty-five years, total fertility rates in Northern Ireland have remained higher than for the UK, but the difference has narrowed. Since the mid-1980s fertility rates for Scotland have been lower than the rest of the UK with rates for Wales higher than for England during the 1990s, but similar since 2001. Subnationally, the fertility decline experienced nationally during the latter part of the 20th Century and the increase in fertility since 2001 are also evident for regions. Fertility trends at local authority level are however much more wide ranging and can differ substantially from regional and national trends (Tromans *et al.,* 2008).

A large literature investigates why fertility rates change over time. Low fertility and postponement of first birth are associated with increased education and the career aspirations and economic independence of women (Rendall and Smallwood, 2003). Changing attitudes in society have led to lower marriage rates and reduced the expectation that people will have children and women's childbearing intentions (Chamberlain and Gill, 2005). Sub-UK and subnational variations occur. Country-specific factors such as the cost and availability of housing and variations in the labour market can affect fertility levels. Local factors such as concentrations of people by social class or ethnic group and the presence of students and armed forces bases will influence fertility (Tromans *et al.,* 2008). With both national and local impacts, the recent upturn in fertility relates in part to increases in immigration with women born outside the UK found to have higher fertility rates (Tromans *et al.,* 2009).

The need for a geographical perspective on our understanding of fertility has been identified since "spatial variations (or the lack of them) can be a useful test of the comprehensiveness of grand theories of population change" (Boyle, 2003: 622). Subsequent research on local fertility levels and trends during the latter part of the 20^{th} and early 21^{st} Centuries does indeed find distinct geographies to fertility within England and Wales (Tromans *et al.,* 2008) and in Scotland (Boyle *et al.,* 2007). Since subnational trends in the declines in infant mortality during the same period are also shown to vary geographically (Norman *et al.,* 2008a), here using UK-wide data for local authorities, Brass and Kabir's (1979) study framework is applied to the period 1981 to 2006.

The average correlations between changes in infant mortality rate and changes in total fertility rates are illustrated in figure 3. There are very weak correlations between infant mortality and fertility, whatever the time displacements between the measures. This would suggest no apparent influence of the change in rates between time-points for one phenomenon having an influence on the other. Figure 4 shows the year by year correlations of infant mortality rate and total fertility rate. This shows a lower correlation for infant mortality for successive years that for fertility. Year by year correlations of infant mortality fluctuates substantially, particularly during the 1980s. Fertility rates appear more consistent over time but the correlations reduce as fertility rates reduce up to 2001 but increase when fertility rates recover up to 2006. When the first and last five years of this study period are compared, generally, the relative position of areas is preserved to a fair extent over time since fertility rates for 1981-05 and 2002-06 correlate ($r = 0.52$, $p < 0.000$) though the relationship is less strong for infant mortality ($r = 0.32$, $p < 0.000$).

< Figures 3 & 4 about here >

Since there is no maximum correlation at zero time displacement here, as in Brass and Kabir (1979), the suggestion that the causative factors may largely be the same for fertility as for child mortality seems unlikely. Nevertheless, there is a high degree of overlap for factors which are associated with differing levels of fertility and mortality, particularly the socio-economic variables (Richter and Adlakha, 1989; Woods, 1986b). Following a recent demonstration of the utility of modelling cross-sectional influences on fertility for areas over time (Boyle *et al,* 2007), ordinary least squares regression models are developed here for both

1991 and 2001 with infant mortality rates and total fertility rates as the dependent variables. In the models, explanatory variables are drawn from the 1991 and 2001 Censuses with the 1991 data adjusted because of boundary changes which occurred between the 1991 and 2001 (Norman *et al.,* 2008b) and so that variable definitions are comparable over time (Norman, 2010). Data are transformed to near normal distributions.

Table 1a shows a range of explanatory variables found to be significant within a regression model with total fertility rate in 1991 as the dependent variable. Higher deprivation (Townsend, 1987) and increased levels of persons of Pakistani or Bangladeshi ethnicity are associated with higher levels of fertility but an increase in the proportion of students and of persons of Chinese ethnicity are associated with lower levels of fertility. Compared with England, fertility is shown by dummy variables to be lower in Scotland, higher in Northern Ireland, but only marginally higher in Wales. Similarly, dummy variables on area type show that semi-rural and urban areas have successively lower fertility levels than rural areas. Table 2a shows that the same effects are still present in 2001 although the difference between semi-rural and rural areas is no longer significant.

To see whether infant mortality is influential on fertility levels, the 1991 infant mortality rate is added to the explanatory variables used in Table 1a. Whilst the effect is positive (i.e. a rise in infant mortality would be associated with a rise in fertility), the variable is not significant in the model (Table 1b). As there may be a time lag before the effect of infant mortality may apply, the model was reproduced but with 1996 total fertility rate as the dependent variable. The influence of infant mortality on fertility was positive but not significant in the model (Table 1c). Tables 2b and 2c have equivalent models for 2001 and for 2006 which show results consistent with those for 1991 and 1996.

Modelling infant mortality rate in 1991 as the outcome, higher deprivation and increased percentages of persons of low social class and persons of Pakistani or Bangladeshi ethnicity are all associated with increased levels of infant mortality (Table 3a). Table 4a shows the equivalent model for infant mortality in 2001. The same variables are found to be significant and with the direction and relative level of effect consistent with the 1991 model. Other factors including the separate input variables within the Townsend deprivation index (unemployment, overcrowded households, non-home ownership and lack of access to a car), qualifications, area type and others individually correlated with infant mortality in directions consistent with the literature but did not make a significant contribution to the regression models.

Various studies have found that increased levels of fertility can lead to higher levels of infant mortality (see for example, Dorsten, 1994 and Talwalkar 1981) rather than *vice versa*. To investigate this here, total fertility rate has been added to the set of explanatory variables reported in Table 3a. In Table 3b, it can be seen that in increased total fertility rate has a small positive impact on infant mortality but this effect is not significant. Since there may be a time delay in fertility level having an effect, the dependent variable is changed to be infant mortality rate in 1996. Table 3c shows that the model is a less good fit than before and that the influence of 1991 fertility is even less significant than with the demographic measures for the same year. In equivalent models for 2001 and for 2006 (Table 3b and 3c), fertility also has a non-significant effect.

< Tables 1–4 about here >

In the models reported here there is no apparent evidence of levels of infant mortality influencing levels of fertility (and *vice versa*). However, there is some overlap in the explanatory variables which affect levels of infant mortality and fertility; an area's level of deprivation as measured by the Townsend index and the percentage of persons of Pakistani and Bangladeshi ethnicity. The final section of this chapter investigates which areas have a similar experience of trends in infant mortality and fertility over time as well as similar socio-economic characteristics. This is achieved by inputting (as z scores) the annual time-series of infant mortality rates and total fertility rates for 1981 to 2006 and the deprivation levels and percentage of persons Pakistani and Bangladeshi ethnicity into a k-means classification (Vickers and Rees, 2006).

A seven 'cluster' solution has resulted in which areas with similar demographic trends 1981-2006 are grouped together. For clarity, the clusters are presented in Figure 5 in two groups: clusters 1, 3, 4, 6, and 7 and cluster 2 and 5. In terms of total fertility rates over the period five clusters of local authorities experience similar trends but at different levels (Figure 5a). Cluster 1 has the lowest fertility of these and cluster 4 the highest fertility (above theoretical 'replacement level' in all years except 2000-2002). Figure 5b shows that clusters 2 and 5 are characterised by rapidly reducing fertility from relatively high rates in the early 1980s. For infant mortality, the relative position of the areas is maintained over time for clusters 4 and 7 which in figure 5c have the lowest and highest infant mortality rates. There is some changing of the relative positions of clusters 1, 3 and 6 but these areas comprise the mid-ground of rates. Figure 5d shows that clusters 2 and 5 start the time period with the highest rates in the UK. Both clusters experience a rapid decline in rates but more fluctuations are evident in cluster 5.

< Figure 5 about here >

In terms of the relationship between infant mortality and fertility trends for clusters, the lowest infant mortality cluster (7) does not have the lowest fertility but generally low infant mortality areas also have low fertility. Clusters 6 and 7 are the least deprived areas and these locations have low infant mortality. Whilst cluster 4 does experience an improvement in infant mortality rates, the rates remain relatively high and it is this cluster which retains relatively high fertility rates. Cluster 4 comprises areas with high percentages of persons of Pakistani or Bangladeshi ethnicity and which became relatively more deprived between 1991 and 2001. Clusters 2 and 5 are the most rapidly changing with rates of infant mortality and fertility declining rapidly through the period and being areas which experienced a marked reduction in the level of deprivation during 1991 to 2001.

The distributions of clusters in London and in Northern Ireland are illustrated in Figure 6. There is a concentration of cluster 1 in inner London. This cluster is characterised by very low fertility but not a low level of infant mortality. This cluster is also found in major urban centres in Scotland's Central Belt and Leeds, for example. Away from inner London, cluster 3 has somewhat higher fertility and higher infant mortality and cluster 4 in North London is a concentration of relatively high fertility and infant mortality rates. This cluster is characterised by high percentages of people of Pakistani and Bangladeshi ethnicities and is grouped with locations such as Birmingham, Oldham, Rochdale and Bradford. Cluster 6 dominates West London and has a medium level of both fertility and infant mortality. Cluster 7 in East London has the second lowest fertility rates and the lowest infant mortality rates. Throughout the UK, areas grouped into cluster 7 include relatively rural and non-deprived areas.

Northern Ireland has areas classified into Clusters 3 and 6 as described above, but otherwise has clusters 2 and 5 which were shown in Figures 2b and 2d to have very distinctive fertility and infant mortality trends with rapid declines in both measures during 1981-2006. Both clusters include accessible, semi-rural areas within commuting distance of urban areas, particularly Belfast. Cluster 5 also includes several more remote, rural areas. Clusters 2 and 5 are only found in Northern Ireland.

< Figure 6 about here >

Postscript

A range of demographic models can be used to highlight the contributions of different components on population change over time. The demographic transition model demonstrates how societies move from high to low mortality and high fertility regimes. An underlying belief is that fertility decline follows mortality decline because people, perhaps subconsciously, no longer feel it necessary to have large numbers of children. A wide literature points towards reductions in fertility as a direct result of falls in infant mortality and this led Brass and Kabir (1979) to investigate the timing relationship of child mortality and fertility for subnational areas in England and Wales in the late 19th and early 20th Centuries. Since changes in child mortality rates were found to be contemporaneous with changes in fertility rates, Brass and Kabir concluded that the causative factors would largely be the same. Paradoxically, they noted geographical variations in child mortality trends but consistency in fertility trends.

In the late 20th and early 21st Centuries for subnational areas across the UK, there is no correlation between changes in infant mortality rates and in fertility rates. Advances in the production of time-series series of socio-economic variables which are consistent in definition and geography over time do mean that influences on infant mortality and fertility can be modelled. There is some credence to Brass and Kabir’s proposition that the same factors might affect both infant mortality and fertility since, for areas, both the level of deprivation and of Pakistani and Bangladeshi ethnicity are influential. However, further and different variables are also significant in affecting levels of each measure. Classifying areas by a combination of their demographic trends and socio-economic characteristics does reveal sets of areas which have similar experiences in their time-series of rates over time which could be informative in understanding trajectories of change. However, with no consistent geographical and timing patterns there is no clear evidence of a direct relationship between trends in infant mortality and fertility.

Acknowledgements

Many thanks to Phil Rees for his unerring support and patient advice over the years. The research reported here is supported by ESRC Research Award RES-163-25-0032, "What happens when international migrants settle? Ethnic group population trends and projections for local areas". The Census data used were obtained via MIMAS' CASWEB and GIS boundary data via EDINA's UKBORDERS, facilities supported by ESRC and JISC. The Census, official Mid-Year Estimates and Vital Statistics for England and Wales, Scotland and Northern Ireland have been provided by ONS, GROS and NISRA and the digital boundary data by OSGB and OSNI. These data are Crown copyright and are reproduced with permission of the Office of Public Sector Information.

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Figure 1: Demographic rates in England and Wales: 1850–1930

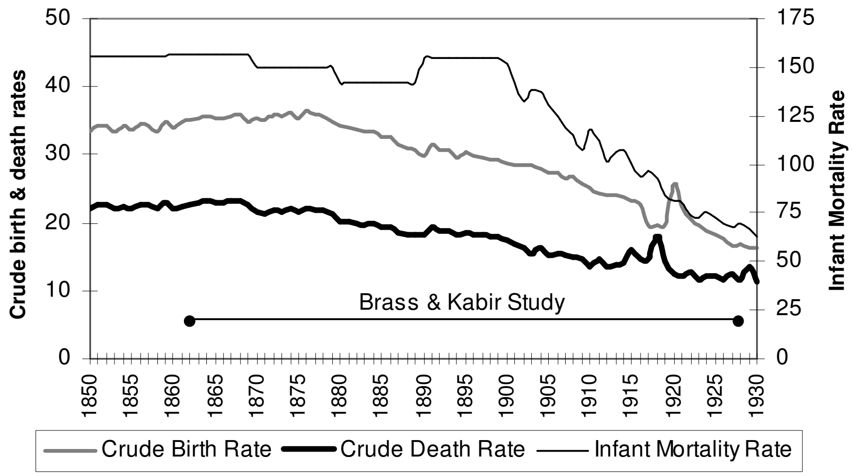
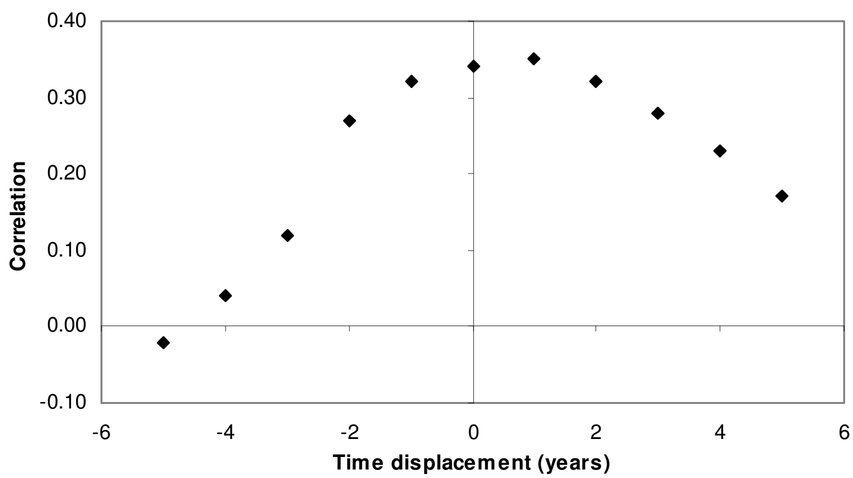


Figure 2: Average correlations between changes in child mortality and general fertility: 1860s-1930s



Source: Brass & Kabir (1979) Table 3.8, p. 81

Figure 3: Average correlations between changes in infant mortality and total fertility: 1981-2006

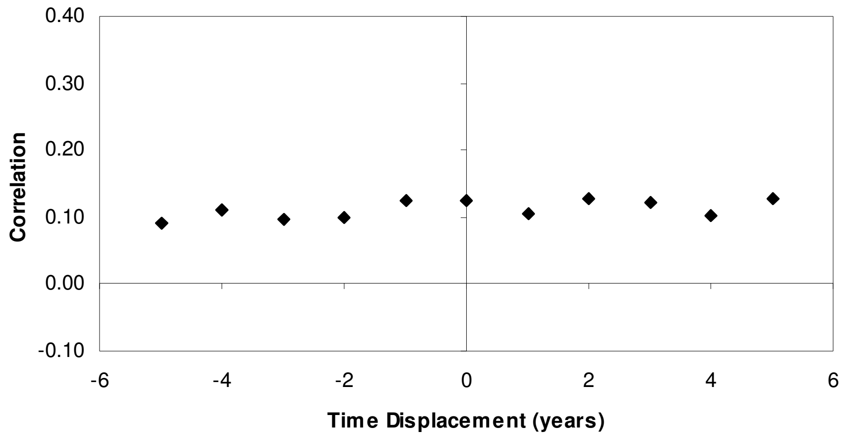


Figure 4: Year by year correlations for infant mortality rates and for total fertility rates: 1981-2006

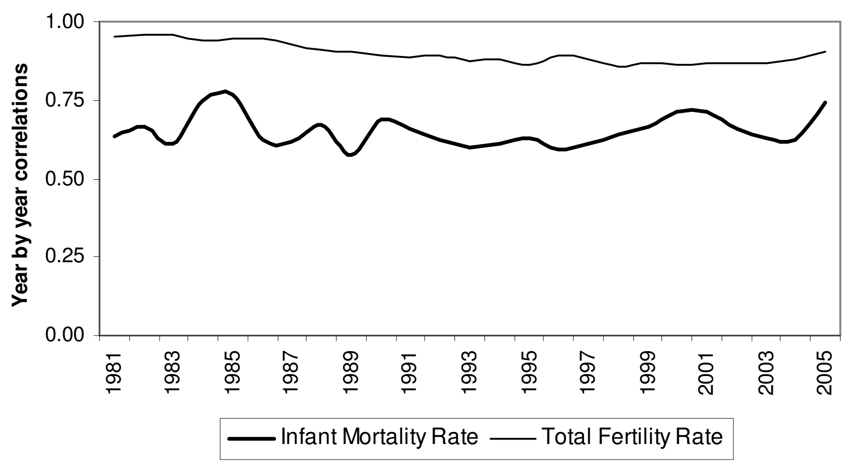


Table 1: Modelled socio-economic influences on 1991 and 1996 Total Fertility Rates

a.) 1991 fertility	R Square	Adjusted R Square	SE
Model summary	0.58	0.58	13.76
Dependent variable: 1991 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	1.196	0.014	0.000
1991 Townsend deprivation index	0.004	0.001	0.000
% Students (log)	-0.072	0.008	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.044	0.004	0.000
% Chinese ethnicity (log)	-0.099	0.012	0.000
Wales	0.024	0.009	0.007
Scotland	-0.064	0.008	0.000
Northern Ireland	0.119	0.012	0.000
Urban	-0.022	0.006	0.001
Semi-rural	-0.014	0.005	0.005

b.) 1991 fertility	R Square	Adjusted R Square	SE
Model summary	0.58	0.57	13.78
Dependent variable: 1991 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	1.185	0.024	0.000
1991 Townsend deprivation index	0.004	0.001	0.000
% Students (log)	-0.073	0.008	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.043	0.004	0.000
% Chinese ethnicity (log)	-0.097	0.012	0.000
Wales	0.024	0.009	0.006
Scotland	-0.064	0.008	0.000
Northern Ireland	0.120	0.012	0.000
Urban	-0.022	0.006	0.001
Semi-rural	-0.015	0.005	0.004
1991 Infant Mortality Rate	0.006	0.010	0.577

c.) 1996 fertility	R Square	Adjusted R Square	SE
Model summary	0.59	0.58	14.10
Dependent variable: 1996 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	1.183	0.024	0.000
1991 Townsend deprivation index	0.004	0.001	0.000
% Students (log)	-0.096	0.008	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.045	0.004	0.000
% Chinese ethnicity (log)	-0.053	0.013	0.000
Wales	0.036	0.009	0.000
Scotland	-0.077	0.008	0.000
Northern Ireland	0.114	0.013	0.000
Urban	-0.023	0.007	0.001
Semi-rural	-0.007	0.005	0.184
1991 Infant Mortality Rate	0.003	0.010	0.735

Least Squares Regressions - Weighted by Persons
Dummy variables for country are relative to England
Dummy variables for area type are relative to Rural

Table 2: Modelled socio-economic influences on 2001 and 2006 Total Fertility Rates

a.) 2001 fertility	R Square	Adjusted R Square	SE
Model summary	0.57	0.56	15.59
Dependent variable 2001 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	1.217	0.019	0.000
2001 Townsend deprivation index	0.004	0.001	0.000
% Students (log)	-0.113	0.010	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.054	0.004	0.000
% Chinese ethnicity (log)	-0.050	0.011	0.000
Wales	0.030	0.010	0.002
Scotland	-0.045	0.008	0.000
Northern Ireland	0.090	0.013	0.000
Urban	-0.024	0.007	0.001
Semi-rural	-0.011	0.006	0.066

b.) 2001 fertility	R Square	Adjusted R Square	SE
Model summary	0.57	0.56	15.57
Dependent variable 2001 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	1.200	0.022	0.000
2001 Townsend deprivation index	0.003	0.001	0.001
% Students (log)	-0.116	0.010	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.052	0.004	0.000
% Chinese ethnicity (log)	-0.046	0.011	0.000
Wales	0.031	0.010	0.002
Scotland	-0.045	0.008	0.000
Northern Ireland	0.090	0.013	0.000
Urban	-0.025	0.007	0.001
Semi-rural	-0.011	0.006	0.055
2001 Infant Mortality Rate	0.013	0.008	0.114

c.) 2006 fertility	R Square	Adjusted R Square	SE
Model summary	0.51	0.50	19.82
Dependent variable 2006 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	1.358	0.028	0.000
2001 Townsend deprivation index	0.003	0.001	0.009
% Students (log)	-0.158	0.012	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.052	0.005	0.000
% Chinese ethnicity (log)	-0.040	0.015	0.006
Wales	0.029	0.013	0.022
Scotland	-0.053	0.011	0.000
Northern Ireland	0.075	0.017	0.000
Urban	-0.010	0.009	0.289
Semi-rural	-0.012	0.007	0.086
2001 Infant Mortality Rate	0.019	0.011	0.076

Least Squares Regressions - Weighted by Persons
Dummy variables for country are relative to England
Dummy variables for area type are relative to Rural

Table 3: Modelled socio-economic influences on 1991 and 1996 Infant Mortality Rates

a.) 1991 Infant Mortality	R Square	Adjusted R Square	SE
Model summary	0.33	0.33	67.87
Dependent variable 1991 Infant Mortality Rate (log)			
	B	SE	Sig.
Constant	1.261	0.133	0.000
1991 Townsend deprivation index	0.014	0.003	0.000
% Low Social Class (log)	0.233	0.046	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.118	0.016	0.000

b.) 1991 Infant Mortality	R Square	Adjusted R Square	SE
Model summary	0.33	0.33	67.94
Dependent variable 1991 Infant Mortality Rate (log)			
	B	SE	Sig.
Constant	1.210	0.177	0.000
1991 Townsend deprivation index	0.015	0.003	0.000
% Low Social Class (log)	0.222	0.052	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.115	0.017	0.000
1991 Total Fertility Rate (log)	0.079	0.181	0.662

c.) 1996 Infant Mortality	R Square	Adjusted R Square	SE
Model summary	0.25	0.24	84.40
Dependent variable 1996 Infant Mortality Rate (log)			
	B	SE	Sig.
Constant	0.953	0.220	0.000
1991 Townsend deprivation index	0.015	0.004	0.001
% Low Social Class (log)	0.304	0.064	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.091	0.021	0.000
1991 Total Fertility Rate (log)	-0.056	0.225	0.803

Least Squares Regressions - Weighted by Persons

Table 4: Modelled socio-economic influences on 2001 and 2006 Infant Mortality Rates

a.) 2001 Infant Mortality	R Square	Adjusted R Square	SE
Model summary	0.36	0.36	90.01
Dependent variable 2001 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	0.741	0.165	0.000
2001 Townsend deprivation index	0.024	0.005	0.000
% Low Social Class (log)	0.339	0.056	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.113	0.019	0.000

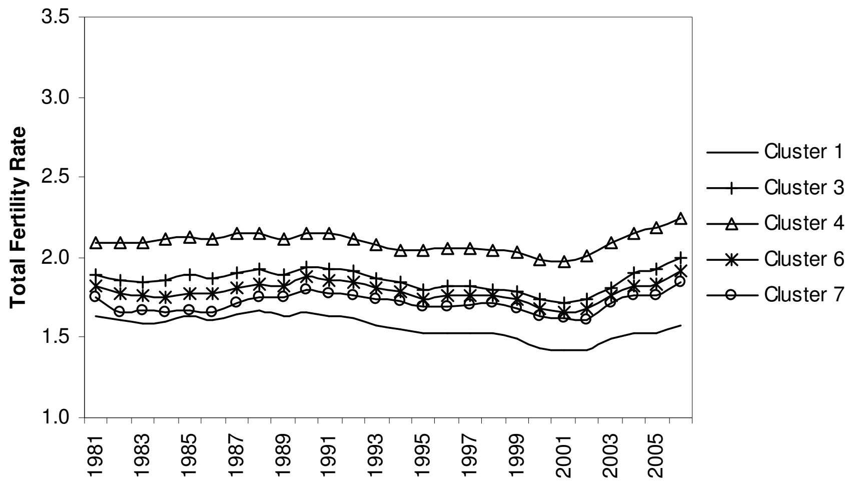
b.) 2001 Infant Mortality	R Square	Adjusted R Square	SE
Model summary	0.37	0.36	89.89
Dependent variable 2001 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	0.939	0.215	0.000
2001 Townsend deprivation index	0.022	0.005	0.000
% Low Social Class (log)	0.370	0.060	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.126	0.020	0.000
2001 Total Fertility Rate (log)	-0.308	0.215	0.151

c.) 2006 Infant Mortality	R Square	Adjusted R Square	SE
Model summary	0.21	0.20	131.21
Dependent variable 2006 Total Fertility Rate (log)			
	B	SE	Sig.
Constant	-0.178	0.314	0.570
2001 Townsend deprivation index	0.007	0.007	0.338
% Low Social Class (log)	0.590	0.088	0.000
% Pakistani or Bangladeshi ethnicity (log)	0.103	0.030	0.001
2001 Total Fertility Rate (log)	0.078	0.313	0.803

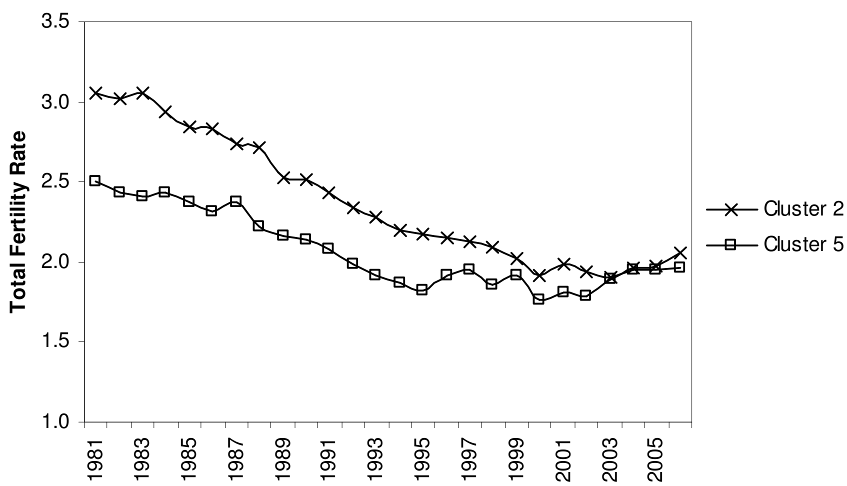
Least Squares Regressions - Weighted by Persons

Figure 5: A k-means classification of UK subnational demographic trends

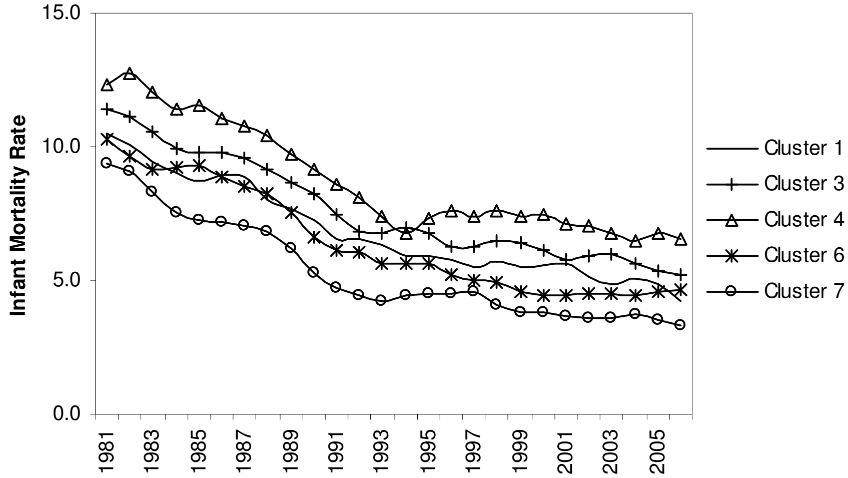
a.) Fertility trends 1981-2006



b.) Fertility trends 1981-2006



c.) Infant mortality trends 1981-2006



d.) Infant mortality trends 1981-2006

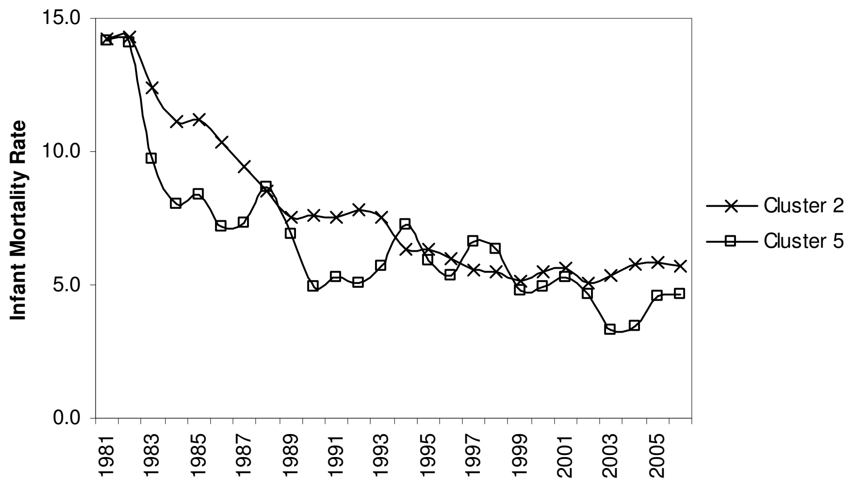


Figure 6: Distribution of clusters in London and in Northern Ireland