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Outworking of the Second Demographic Transition: national trends and regional patterns of fertility change in Poland, and England and Wales, 2002-12

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Abstract. One of the main indicators of the Second Demographic Transition is the decline of fertility to below the replacement level (2.1 births per woman). The onset of the Second Demographic Transition in Europe spread across Western Europe in 1960s and subsequently diffused to other parts of the continent. In Eastern Europe a fall in total fertility rates below replacement level was recorded at the beginning of 1990s and was associated by some researchers with the collapse of the communist system and the introduction of a market economy. At present countries of Eastern Europe record the lowest values of Total Fertility Rate (at 1.3-1.4) while a fertility recovery has been observed in Northern and Western Europe. Regional, sub-national differences in fertility within particular countries associated with uneven dispersal of changes linked with the Second Demographic Transition, especially between urban, suburban and rural areas, are known to exist, but are less well articulated. This paper offers a comparative study of changes in spatial patterns of selected fertility indicators between Poland and England and Wales, part of the United Kingdom, at the beginning of 21st century. Despite apparent differences at the national level, the paper identifies similarities in the spread of Second Demographic Transition from core to peripheral areas and presents of a reduction in the demographic divide between Western and Eastern Europe.

1. Introduction

One of the most important contemporary demographic challenges in Europe is that fertility has fallen below replacement level, generally accepted as 2.1 births per woman (Trovato, 2007; Myrskyla et al., 2009). This decline, when combined with other demographic and societal changes (e.g. increased life expectancy and later age at marriage or cohabitation), is contributing to increases in the proportions of older age cohorts (population ageing). The Second Demographic Transition (SDT) theory, first proposed by Dutch demographers nearly 30 years ago (Van de Kaa, 1987, 2003; and Lesthaeghe and Meekers, 1986), argues that the classic changes in fertility and mortality do not stabilize to a zero growth rate, but are followed by fertility well below replacement level. Three main factors have contributed to this fertility decline: structural changes (e.g. industralization, urbanization and the development of the service sector); cultural changes (e.g. increased autonomy of individuals, secularization, contestation of traditional values and dispersion of liberal and pluralistic values); and technological developments (e.g. the methods and means of birth control and the spread of information technology) (Van de Kaa, 1994).

A number of other trends also characterise reproduction of the population in the modern era: delayed marriage and the weakening of its importance in favour of cohabitation and Living-Apart-Together couples (LATs) (Duncam and Phillips, 2012), higher separation and divorce rates (Flowerdew and Al-Hammad, 2004), an increase in births outside marriage (in Britain the Office for National Statistics (ONS, 2013) predicts the proportion of children born outside of marriage will be 50% by 2016), changes in the model family and household structure (Bengston, 2004), decreased numbers of unplanned births (Westoff, 1976; Macintyre and Cunningham-Burley, 1993) and the spread of voluntary childlessness (Gillespie, 2000). The cumulative effect of these changes is greater diversity and complexity of household structures, including more individuals with fragmented familial relationships, increased proportions of single households and families without children. Van de Kaa (2003) defines the transformation of the model family as a move from the king-child with parents to the king-pair with a child, which is the result of changes in the hierarchy of needs and increasing age of mothers at birth. The main indicators of the SDT are total and age-specific fertility rates, the mean age of mothers at childbearing (including age at birth of first child), the proportion of births outside marriage and the rate of union dissolution.

The aim of this paper is to explore differences and similarities in the spatial patterns of selected SDT indicators in respect of Eastern and Western European countries at the beginning of 21st century. Although trends in SDT indicators are reasonably well understood at the national scale, we focus on undertaking a sub-national, regional analysis in two countries that entered the SDT at different times, namely Poland, and England and Wales. Poland represents the region of Eastern Europe where rapid decline in TFR since the fall of communism has resulted in one of the lowest fertility rates in Europe, while England and Wales from North-Western Europe was a forerunner in experiencing the changes connected with SDT in the 1960s but following a fertility recovery in recent years currently records the highest level of TFR. The fall of state socialism in Poland in 1989 is widely regarded as having prompted the country's total fertility rate plummeting from 2.1 in 1989 to 1.2 in 2003, which resulted from the removal of the state from its role as employer and provider of services and of social benefits leading to more difficult reconciliation of work and family (Kotowska et al, 2008: 822). A more nuanced explanation of this fertility decline has emerged in recent years that recognises “the significance of personal networks for individual fertility-related decision-making” (Bühler and Frątczak, 2007:16) and that “Polish women are highly pragmatic when delaying parenthood” (Mishtal, 2012). The reasons for delaying motherhood are at least in part congruent with those associated with historically low fertility levels pertaining under the SDT in northern and Western Europe. Matysiak (2009:

266) argues that “employment … is a preferred precursor when women plan how to reconcile their intentions to work and to have children”.

Poland and England and Wales are at contrasting stages of the SDT and reveal and quantify differences in the sub-regional spatial pattern of fertility decline in countries where this fell below replacement level earlier compared with those lagging behind. This comparative analysis allows us to indicate the directions of regional changes in fertility levels between urban, suburban and rural areas in the near future. Despite apparent differences at the national level between Poland, and England and Wales, this paper seeks similarities in the spread of the SDT from core to peripheral areas and evidence of a reduction in the demographic divide between Western and Eastern Europe.

2. Second Demographic Transition and Fertility Differences in Europe

The demographic developments associated with the SDT appeared in Western and Northern European countries in the 1960s and underwent rapid dispersal, although their onset, diffusion and intensity were temporally or spatially differentiated. They arrived later in Central and Eastern European countries after the political and economic transformation in the 1980s initiated the transition to democratic market economies in 1989. Here they were connected with a reduction in the social functions of the state and by households increasingly gaining responsibility for their own financial situation. Labour market growth led to greater competition between household members for engaging in economic activity vis à vis family formation and childrearing, thereby increasing the opportunity costs of motherhood. Proponents of the SDT theory have recently emphasized the role of international migration by younger, working-age migrants to countries of North America and Western Europe in compensating for negative natural growth caused by the decline in fertility (Lesthaeghe and Neels, 2002; Van de Kaa, 2003; Sobotka, 2008).

Countries of Central and Eastern Europe, especially those in an expanded European Union, have contributed to UK population growth through immigration and have themselves experienced negative net migration and the lowest level of natural population growth in the world. Political and economic transformation in these states when coupled with a trend for women to postpone first and any subsequent births to their late 20s or 30s (Billari and Kohler, 2004; and Sobotka, 2004) have accelerated the decline in fertility and natural increase. Some foresee eventual convergence of demographic processes in European countries despite current diversity in reproductive behavior (Coleman, 2001; and Wilson, 2001), whereas others see this diversity of family models as the stable end state of the SDT (Reher, 2004).

Growing acceptance of the SDT concept has contributed to the development of research on fertility behaviour in various countries (e.g. Lesthaeghe and Neidert, 2006; and Rotariu, 2006). However, there is relatively little published research comparing specific countries and examining the sub-national, regional spatial dispersion of the SDT and spatial variation of reproductive behaviour within countries (De Beer and Deerenberg, 2007). Compton (1991) attributed this to a less obvious relationship between fertility and geographical space compared with migration and mortality, where differentials may respectively be associated with uneven economic development and variable environmental conditions. Decisions on procreation are shaped to a greater extent by the interplay of behavioural factors, such as social status, education, nationality or religion reflecting people's socio-economic situation rather than place of residence. Although the differences in fertility rates do not affect differences in age and sex structure of the population, this measure is shaped by social and cultural differences (e.g. higher levels of fertility among immigrants from abroad or those who are married). Therefore, the regions with a higher proportion of foreign born residents or regions with more traditional cultural patterns will be characterized by higher fertility (Duchêne, et al., 2004). These authors distinguished two sets of factors influencing the level of fertility: those affecting individuals (education, economic activity, religion and nationality); and specific regional conditions, such as the availability of institutional forms of care and education for children, job opportunities for women, the availability and price of housing, the environment and prevailing attitudes about family life.

Hank (2002) similarly classifies the reasons for differences in reproductive behaviour into two groups: those associated with economic opportunities and constraints; and those related to socio-cultural structures. The former category includes the degree of urbanization, the local labour market, differences in unemployment (Naz, 2000; and Gautheir and Hatzius, 1997), the structure of employment and access to services related to child care. Hank's second category includes fertility determinants of the social environment and the existing differences in the attitudes, norms and values towards the family and childrearing. Several authors have explained national differences in fertility by reference to socio-demographic factors (Noin and Chauviré, 1991 (France); Faus-Pujol, 1991 (Spain) and Karjalainen, 1991 (Finland).

Diversity in the spatial patterns of reproductive changes linked to the SDT is also evident at the sub-national, regional level. Lesthaeghe and Neels (2002) found that 'early adopter' regions in respect of the first (classical) demographic transition were also forerunners in displaying features of the SDT. Previous studies have indicated lower TFRs in urban compared with rural areas (e.g. Kulu, 2005; and Boyle et al., 2008) in countries with different

levels of economic development (Michielin, 2004 (Italy); Weeks et al., 2004 (Egypt); De Broe and Hinde, 2006 (Guatemala); and Liu, 2005 (China). Further geographically focused research highlighted a higher level of fertility and older age of mothers at birth living in suburban areas rather than in urban centres (Kulu and Boyle, 2008). However, the diffusion of the urban lifestyle as a result of migration, social integration and increased spread of new technologies has blurred these differences (Kotowska et al., 2008). Steinführer and Haase (2007) explored demographic change in large urban areas and their surroundings and recorded an increase in the number of single households in central cities, despite an overall decline in population and urbanization processes. The spread of information and new attitudes to procreation started from metropolitan centres, sometimes reaching the suburban areas and rural areas (Bongaarts and Watkins, 1996). Faulkner (2005) has shown that in Australia rising fertility depends on increasing distance from the metropolitan centre and higher rates of fertility decline in urban centres over time consolidates differences between urban, suburban and rural areas.

Fertility was below replacement level in all European Union member states in 2012: among non-EU countries in Europe only Iceland and Turkey had a TFR approaching this level (2.0 and 2.1 respectively). Countries where fertility decline occurred later generally experienced it more rapidly and to a greater extent. Table 1 summarizes selected fertility and SDT indicators for three regional groupings of countries in Europe (UN division) showing the minimum and maximum values and the year in which these values were attained during the period 2000-12 together with the regional averages. Countries of Nnorthern and Western Europe currently have the highest total fertility rates, which have increased in recent years due mainly to the introduction of family policy and the creation of conditions enabling men and women to combine childrearing with furthering their career aspirations (Kurek, 2011). The average age of mothers at childbirth and percentage of births outside marriage are higher in this group of countries compared with both other regions. Iceland features with the highest TFR and births outside marriage and the mothers in Liechenstein had the highest average age at childbirth. Countries in Southern Europe experienced fertility decline to below the replacement level in the 1970s/1980s. The average age of mothers in Spain exceeds 31 years, which is determined by strong relationships between generations as well as late pattern of transition to adulthood associated with late leaving parental home, which in turn is partly due to unfavourable ratio of property prices to earnings and cultural norms (Billari, 2005). The share of births outside marriage is relatively low compared with countries in other parts of Europe. The fertility rate in Central and Eastern European countries declined sharply after 1990 and reached a minimum (1.2) in 1999. Since 2000 these

countries have been characterized by the lowest level of fertility and the low average age of mothers at childbirth, by an average of some three years. Central and Eastern European countries were also characterized by a relatively low rate of births outside marriage in relation to Western and Northern Europe: the figures range from 15.8% in Poland to 59.7% in Estonia.

This paper presents a comparative study of fertility patterns on a local authority scale in two countries from two of these groups that are at different stages of progress through the SDT, namely in Poland, and England and Wales. The analyses explore differences in SDT indicators at the sub-national, including the relatively late age at marriage in the western and north-western areas of Poland and persistence of the classic North-South divide in England and Wales, which persists despite greater uniformity in fertility patterns overall.

3. Data and Methods

Data for these analyses were obtained from national statistics offices and are derived from the country's birth registration procedures. The analysis in Poland was carried out for the districts (powiaty) created in 1999: they correspond to Local Administrative Unit 1 level. The units of analysis in England and Wales are also local authorities (LAs), although significant changes in this geography have occurred over the period 2002-12 (ONS, no date). The 110 areas in England and Wales comprised 68 unitary authorities (UAs), 34 counties and 8 former metropolitan counties: these are referred to as LAs in the interests of brevity. The difference in geographical units between Poland and England and Wales reflects the availability, or more specifically the non-availability, of the fertility indicators for the same LAU units in the British and Polish cases. The analytical results focus on key indicators associated with the SDT (total fertility rate, age-specific fertility rates, mean age of childbearing and illegitimate births) initially from a national perspective. We then drill down to the LAU level to provide as close a comparison between these countries as the data sources will allow. Both countries classify their LA units used into urban and rural categories, although there are differences between the methods.

4. Fertility in Poland and England and Wales

Total Fertility Rate (TFR)

Three phases are distinguished in the TFRs of Poland and England and Wales (1960-2012) (see Figure 1). From 1960-1971 TFR was above generation replacement level in both

countries, although it was higher in England and Wales than Poland. During the second period (1971 to 1990) TFR remained stable and above replacement level in Poland, but fell below 2.1 in England and Wales. The situation reversed in the 1990s with recovery of TFRs in England and Wales and a significant drop in Poland, although both remained below replacement level. Fertility declined rapidly in Poland after 1990 from year to year by almost 4% reaching a low point at 1.2 births per 1000 women aged 15-49 in 2003. Subsequently it rose to 1.4 in 2009 and then fell back to 1.3 births per 1000 women of childbearing age in 2012. The 66,000 increase in births in 2009 compared with 2003 could be the result of realization of postponed births, the improvement of the Polish economy after joining the European Union and the introduction of some elements of family policy. The subsequent reduction may be associated with the economic crisis, deterioration of the financial situation of some Polish families and end of the period of birth deferral. Following the decline in total fertility in England and Wales that concluded in 1978 there was a slight rise to 1.9 in 1980 and thereafter the rate continued within a narrow range (1.7 to 1.8) until 2002 when a slow rise towards replacement level started in the first decade of the 21st century.

Age-specific Fertility Rate (ASFR)

Comparison of the age-specific fertility rates between Poland and England and Wales reveals a high degree of differentiation. Highest fertility occurred in women aged 20-24 between 1982 and 1998 in Poland, but this age group then experienced the largest drop in fertility rate (63%) up to 2012. Peak fertility was in the 30-34 years age group in England and Wales and the 25-29 year group in Poland in 2012 (Figure 2). Since 2005, fertility in the 20-24 year group is lower than both the 25-29 and 30-34 years groups. The fertility rate among women aged 25-29 recorded a decrease of 17% since 1999. At the same time there were increases in fertility of 52% and 55% for women aged 30-34 and 35-39 years respectively. While in the period 1990-2000 there has been a decline in fertility in all age groups (the largest in the group of 15-19 and 20-24 years - almost 48%), so in the first decade of the 21st century decrease occurred in only the three youngest groups (15-19, 20-24, and 25-29), whereas in the 30-34 and 35-39 cohorts there were increases of 46% and 58% respectively. Increased fertility in the three older age groups was rather less pronounced in England and Wales since 2000 at 30%, 54% and 65% respectively. Figure 2 shows the progressive 'ageing' of peak fertility age group for 1982, 1990, 2000 and 2012. This became older and the difference between Poland, and England and Wales reduces between 1982 and 2000, but then increases in 2012.

Extra-marital Birth Rate (EMBR) and Age of Childbearing

The share of extra marital births (Figure 3a) is also symptomatic of changes in reproductive behaviour associated with the SDT. Starting from almost identical percentages of births outside marriage in 1960 (5.0%), Poland, and England and Wales subsequently followed different paths. In Poland, the percentage of remained around 5% until 1985 whence it commenced a slow but steady rise to just over 22% in 2012. The so-called 'swinging 60s' in England and Wales was associated with greater sexual freedom and an immediate rise in the percentage of illegitimate births from the start of that decade has continued and increased its pace. The share of such births in 2012 was approaching 50 percent of the total. An increase in the mean age of childbearing is another trait of the SDT and Figure 3b shows the national trends in England and Wales and Poland since 1960. Following a decline in the mean age echoing the baby boom era, a rise in the mother's age was accompanied a slight separation in the trend lines between these countries. Year-on-year changes are relatively minor, but from the low point in 1974 in both England and Wales and Poland there were rises of 3.4 and 3.2 years respectively up to 2012. The increase in England and Wales after 1973 was reasonably steady, whereas in Poland there was rather more year-on-year variability until first decade of the 21st century, although subsequently the upward trend was fairly consistent.

Drawing this section to a close and in preparation for examining sub-national fertility patterns, we investigate the dynamics of these SDT indicators in urban and rural areas between 2002 and 2012 (Table 2). The percentage increase in TFR was higher in rural compared with urban LAs in England and Wales (19.9% and 16.0% respectively), although the rises in both types were statistically significant. Urban powiaty in Poland experienced an increase in TFR (11.9%) whereas rural ones underwent a small decrease (-2.2%), but both were statistically significant. Examination of age specific fertility rates for two age cohorts (25-29 and 30-34) in urban and rural areas reveal differences between the two countries. Small non-significant percentage increases in the fertility rate for the 25-29 cohort in Poland, and England and Wales occurred, whereas there were substantial rises in both groups of powiaty and in urban LAs in England and Wales in the older cohort (there was a small percentage fall in ASFR 30-34 in rural LAs in England and Wales). Rural LAs in England and Wales continued to catch up with their urban counterparts with respect to the percentage of births outside marriage, ending the period with a mere 2 percentage point difference: the increases in both types were statistically significant. The percentage increases in the proportion of births outside marriage in both groups of powiaty were substantially higher than in England and Wales, although the 2012 rates in Poland were half of the equivalent figures in England and Wales: the increases in both countries they were statistically significant. This

reflects the progressive spread of this SDT trait into Polish society, although the rate remains still substantially lower than in England and Wales.

5. Sub-national differences in fertility

This section explores the same set of key indicators at the LA scale in Poland and England and Wales with the exception of mean age of childbearing, which is unavailable for the British LAs. It presents both a descriptive analysis of the spatial patterns of these indicators for 2002 and 2012 as well as their dynamics over this period. A quintile classification method was used and changes in spatial autocorrelation are examined using global and local Moran's I statistics (Anselin, 1995; and Getis, 2008). Moran's I quantifies global spatial autocorrelation defined simply as the clustering of similar data values across a set of geographical units and local spatial autocorrelation as localised clusters of units with similar values in respect of the variable or variables under investigation. The local Moran's I analysis focuses on the percentage difference of the SDT fertility indicators 2002-12 at the LA scale.

Total Fertility Rate

The less urbanized eastern Polish territories, previously characterised by a relatively high fertility rate, recorded a significant drop during the 2000s while an increase in fertility occurred in western Poland (Figure 4). All districts in 2012 recorded fertility rates below 2.0 and one district even showed a TFR less than 1.0. Some 56.7% of districts (215 out of 379) experienced increased fertility over the decade. The highest increases occurred within large urban areas (e.g. Warsaw - 19.7% and adjacent districts - Legionowski by 33.5% and Pruszkowski by 26.0%; Katowice - 22.6%; and Mysłowice - 28.8%), as well as spa centres located at the seaside (Świnoujście - 29.9% and Sopot - 28.6%). The largest reductions in fertility occurred in areas where relatively high levels had previously prevailed (north- and south-eastern Poland). It should be noted that imperfect data on the number of women of childbearing age arising from permanent and temporary migration potentially causes some distortion in the analysis of changes in fertility (e.g. when births are registered abroad).

Some LAs in central and northern England and in west Wales with TFRs below 1.6 in 2002 had moved to a higher quintile by 2012, although two in west Wales remained stubbornly in the lowest class. Areas with relatively high TFR in 2002 were mainly some of the smaller urban LAs scattered across England together other more rural counties along the border between England and Wales. TFR increased in all of the 110 LAs over the period 2002-12,

and it rose by at least a third in 11 areas with a 56.9% rise from 1.3 to 2.0 in Ceredigion in West Wales and 35.8% in Wokingham UA to the west of London. Rutland UA in the East Midlands was the only area that underwent a fall in TFR from 2.0 to 1.9 (-4.4%). In general terms LAs in the upper two quintiles formed a discontinuous swathe across central and southern England with some outliers elsewhere, whereas the lowest percentage rises were in southern and central Wales and a scatter of UAs across England.

Age-specific Fertility (ASFR)

The highest volume of fertility in the 25-29 years age group occurred in powiaty in eastern and south-eastern Poland (maximum value of 148 births per 1,000 women) and lowest values were recorded in the north and west (Figure 5). The number of districts with fertility over 100 births per 1,000 women decreased from 119 to 102 and the highest values were in central and central-west Poland, while the so-called areas of "Eastern Wall" recorded a decline (Figure 5a). The maximum values were lower than a decade ago, 149 births per 1,000 women in 2002 compared with 127 in 2012. In the years 2002-2012, 174 districts reported an increase in fertility in this age group, which was associated with a shift in the peak fertility from the age group 20-24 to 25-29 years. The largest increase occurred in the central and western Poland (up to 45%). The maximum ASFR for the 30-34 years cohort rose from 49 to 91 births per 1,000 women over the 10 year period and only 30 powiaty failed to experience increased fertility in this age group.

The distribution of LAs in England and Wales in the lowest quintile of the 25-29 years ASFR were similarly scattered in 2002 and 2012 (Figure 5b), although with some concentration in south-eastern England: most of the areas were in the lowest class in both years. High fertility for women aged 25-29 years was also scattered across England and Wales in 2002, although with evidence of preference for small urban LAs. By 2012, there is some suggestion of higher levels of fertility in this age group occurring in non-metropolitan urban UAs, such as Blackburn with Darwin, Luton, Middlesborough, Slough and Thurrock. Three of the 110 LAs in England and Wales experienced a fall in fertility rate for women aged 25-29 years with the largest fall in The Vale of Glamorgan UA (-23.6 births per 1,000 women). ASFR increased by at least a third for women in this age group in five areas (Ceredigion, Herefordshire, Isle of Anglesey, Reading and Slough). The number of LAs with more than 100 births per 1,000 women aged 30-34 years increased from 14 to 94 over the period 2002-2012; and the maximum values were respectively 120.0 and 150.0. The largest increases in fertility for women in this cohort were in a scatter of urban LAs across England and Wales, including the following non-metropolitan UAs with a rise of over 40%: Blackpool, Ceredigion, Durham, Plymouth, Portsmouth, Stoke-on-Trent and Torbay (Figure 5b).

Extra-marital Birth Rate (EMBR)

There is a clear and consistent division in Polish powiaty in respect of the percentage of births outside marriage: those in western and northern Poland have higher percentages compared with the eastern and south-eastern area where the figures remain relatively low (Figure 6a). Overall the percentage of such births ranged between 6% and 50% in 2012, which was wider than in 2002. This division is partly the consequence of cultural differences and nuptiality patterns expressed as a Hajnal line. To the west of the line, marriage rates and thus fertility are comparatively low and a significant minority of women married late or remained single while to the east of the line early marriage has been the norm with high fertility. However, in regions with a high proportion of births outside marriage there is a strong correlation with the fertility of teenagers, suggesting that at least some women giving birth out of wedlock at a young age enter into marriage after childbirth.

There might be a presumption that the LAs in England and Wales with the highest rates of extra-marital births would be in the metropolitan and cosmopolitan south-east. However, in both 2002 and 2012 many of these LAs were in the lowest quintile of the classification. Those at the upper end of the range were in north and south Wales and parts of northern England. The number of LAs with more than 50% of births outside marriage increased from 22 to 64 over the period 2002-2012; and the rate exceeded 66.7% in seven areas with a maximum of 72.3% in Blaenau Gwent, South Wales. The lowest changes in EMBR were in the metropolitan LAs, such as Inner and Outer London, Manchester and Newcastle-upon-Tyne, and one UA (Reading) experienced an insignificant 0.3% fall. In contrast the highest increases occurred in large, often rural, areas in a broad swath across Wales, southern England and the Midlands (Figure 6b). Increases in the EMBR of over 40% were recorded in Cheshire (48.2%), Devon (57.9%), Dorset (40.7%), Rutland UA (66.5%), Shropshire (41.1%) and South Gloucestershire UA (44.8%). This suggests that a process of ‘catch-up’ has been going on during the 2000s and that extra-marital births are not exclusively an urban phenomenon in England and Wales.

Analysis of spatial clustering

The global Moran’s I statistic has been calculated for TFR, EMBR and ASFR for the 25-9, 30-34 and 35-39 age cohorts (Figure 7). Positive and negative Moran’s I values respectively indicate a degree of spatial clustering and dispersion. The TFR shows greater spatial clustering in Poland compared with an absence of clustering and dispersion in England and Wales. In Poland all the Global Moran’s I values for the fertility rate indicators are close together around 0.5 throughout the period, which suggests that this level of moderate

clustering is well established and relatively unchanging during the decade. The equivalent results for LAs in England and Wales show some separation: there is clear evidence of spatial clustering for 35-39 ASFR (Moran's I values approaching 1.0) and the downward trend of Moran's I values for the 30-34 age specific fertility rate suggests spatial clustering has reduced in this cohort. There is strong evidence of spatial clustering for the percentage of births outside marriage in both countries, and there is an upward trend in England and Wales.

The local Moran's I statistic provides a way of identifying areas of spatial autocorrelation and has been calculated with respect to the percentage difference in the SDT fertility indicators for 2002 and 2012. In Figure 8 the designation 'HH' (High-High) denotes areas whose neighbours also have high values on the SDT indicator in question, whereas 'LL' (Low-Low) signifies the reverse: these are clusters with positive spatial autocorrelation (i.e. similar values). The other categories, Low-High and High-Low, signify negative spatial autocorrelation. In Poland HH clusters in TFR are observed in metropolitan areas of Warsaw, Krakow, Lodz, Poznan and Upper Silesia polycentric agglomeration. The high percentage differences in TFR recorded in large cities and their districts can be explained by the development of housing associated with increased availability of bank loans and the ongoing process of suburbanistation which might relate to increased fertility (see Vobecka and Piguet, 2012; Kulu and Boyle, 2007). Several LL clusters are recorded in eastern and south-eastern Poland, suggesting decrease in TFR, which may be associated with international migration after the enlargement of EU (as these areas of Poland experienced significant population losses according to National Statistical Office (2013)). In the cases of 25-29 and 30-34 ASFR the number and the size of clusters was smaller compared to TFR while for births outside marriage there were LL clusters in north-western and western Poland. Predominantly rural areas of central-western Poland show some HH clusters, indicating an increase in percentage difference between the years 2002 and 2012.

There is less evidence of spatial autocorrelation in the LAs in England and Wales. There is a cluster of LL areas in South Wales, an area that has undergone significant industrial restructuring, where the percentage difference in TFR between 2002 and 2012 was low. There are isolated clusters of HH areas for the ASFR cohorts: for ASFR 25-29 years the cluster lies to the west of London (Bracknell Forest, Slough and West Berkshire); and Nottingham UA forms a cluster of one area for ASFR 30-34 years. West Berkshire was also one of a set of LAs with LL vales in respect of ASFR for the 30-34 years age group. Inner and outer London form a LL cluster in respect of the difference in EMBR between 2002 and 2012, which suggests that the rate in such births in this area may have reached a peak.

6. Discussion and Conclusions

Eurostat seeks to harmonise statistical information between European countries, but some inconsistencies remain when attempting to compare countries at sub-regional levels. Demographic statistics are presented differently with varying levels of detail for the constituent countries of the UK and vary not only over time but also for a changing collection of LAs. The analysis presented here has attempted to steer a course of consistency within and between England and Wales, and Poland wherever possible, but there remain some instances where a perfect comparison is not feasible from the available statistics. Nevertheless, we have produced a comparison of key demographic indicators associated with the SDT between countries from the Northern/Western and Eastern/Central regions, both nationally and more significantly at a sub-national, regional scale.

Fertility has reduced in both countries since the 1960s, although measures to support childrearing under the pre-1989 socialist regime in Poland meant that the level of decline was relatively low and possibly remained at an artificially high level as in other Central and Eastern European countries. There has been a modest recovery in TFR in England and Wales during the first decade of the 21st century, with perhaps the hint of a faltering recovery starting in Poland in 2008. However, it seems unlikely that either country will buck the global trend for lower fertility and postponed childrearing as we move through the century. The findings of our quantitative analysis of regional spatial patterns of SDT fertility indicators innovatively examines trends in spatial autocorrelation over a 10 year period and reveals that Poland shows every sign of catching up with England and Wales in respect of most SDT indicators. The results of the analysis show that these key fertility indicators can be used to trace the geographical dispersion of the SDT. This is perhaps most clearly illustrated by women's postponement of childbearing until their early 30s, which has recently emerged in Poland, but was clearly present at the turn of the century in England and Wales. Spatial clustering of relatively high fertility has shifted from the 30-34 year to the 35-39 year age group in England and Wales during the period 2002-12, whereas there is moderate spatial clustering in each of the age cohorts examined in Poland.

Cultural factors are likely to remain importance sources of differentiation, which is clearly indicated by the percentage of births outside marriage, which is lower in Poland because of the strength of the Catholic religion. The global Moran's I analysis provides evidence of increased spatial clustering in this characteristic in both countries. SDT characteristics are spreading from core urban and metropolitan regions to areas lower down the settlement hierarchy in both countries, although the results presented here indicate a time lag between

the two groups of countries represented by the presented case studies. Rural areas in England and Wales are in many cases now showing similar characteristics of the SDT that were observed previously in urban areas, whereas the disparities between city (town) and countryside remain stronger in Poland. However, the legacy of occupation by other countries and changing boundaries during the 20th century continue to exert an influence over contemporary demographic patterns in Poland. In summary this paper has identified similarities in the spread of Second Demographic Transition from core to peripheral areas and has provided evidence of a reduction in the demographic divide between Western and Eastern Europe.

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	Total Fertility Rate	Births outside marriage	Mother's age at childbirth
Northern and Western Europe			
Austria	1.33 (2006)	*38.33*	28.40 (2001)
England and Wales	1.94	47.50	29.80
Germany	1.33 (2006)	*31.14*	*28.90*
Iceland	2.23 (2009)	66.90 (2012)	*29.10*
Liechtenstein	*1.50*	*18.23*	32.40 (2012)
Switzerland	*1.46*	12.40 (2003)	*30.00*
Region mean	1.66	43.33	30.69
Southern Europe			
Former Yugoslav Republic of Macedonia	*1.58*	*12.08*	26.60 (2001)
Portugal	*1.40*	45.60 (2012)	*28.70*
Spain	1.23 (2000)	*30.97*	31.60 (2012)
Turkey	2.10 (2012)	2.60 (2010)	*27.70*
Region mean	1.43	24.01	29.76
Central and Eastern Europe			
Bulgaria	*1.40*	*51.69*	25.10 (2001)
Czech Republic	1.15 (2000 & 2001)	*35.92*	*27.50*
Estonia	1.69 (2007)	59.700 (2011)	*27.10*
Poland	*1.31*	15.80 (2003)	*27.60*
Slovenia	*1.37*	*50.85*	30.10 (2010 & 2011)
Region mean	1.25	36.66	28.86

Notes:

Countries shown are those within the three regional groupings with minimum and maximum figures for the indicators in period 2000-2012.

Figures in italics complete the table and are averages for the countries listed NOT minima or maxima.

Figures for England and Wales as one of the case studies are also included.

Source: Eurostat

Table 1: Fertility and Second Demographic Transition Indicators in selected European countries, 2000-12.

		England and Wales		Poland	
		Urban	Rural	Urban	Rural
Total Fertility Rate	2002	1.69	1.66	1.09	1.38
	2012	1.96	1.99	1.22	1.35
	% difference	16.00*	19.90*	11.90*	-2.20*
25-29 Fertility Rate	2002	96.31	110.62	79.90	88.19
	2012	97.98	114.86	80.75	88.58
	% difference	1.70	3.80	1.00	0.40
30-34 Fertility Rate	2002	84.26	91.26	47.89	50.09
	2012	94.87	88.18	69.90	66.99
	% difference	12.60*	-3.40*	46.00*	33.70*
Births outside marriage (%)	2002	46.33	40.29	18.06	13.85
	2012	52.90	50.70	26.18	22.77
	% difference	14.10*	25.80*	45.00*	64.40*

* Significant at p = 0.05 using Mann-Whitney test

Table 2: Quantitative Analysis of Fertility and Second Demographic Transition Indicators in Urban and Rural Local Authorities in Poland, 2000-2010, and England and Wales, 2002-12.

Figure captions:

Figure 1: National Total Fertility Rate in Poland, and England and Wales, 1960-2012.

Figure 2: National Age-specific Fertility Rate in Poland, and England and Wales, 1982, 1990, 2000 and 2012.

Figure 3: National Extra-marital Birth Rate and Mean Age of Mothers at Childbirth in Poland, and England and Wales, 1960-2012.

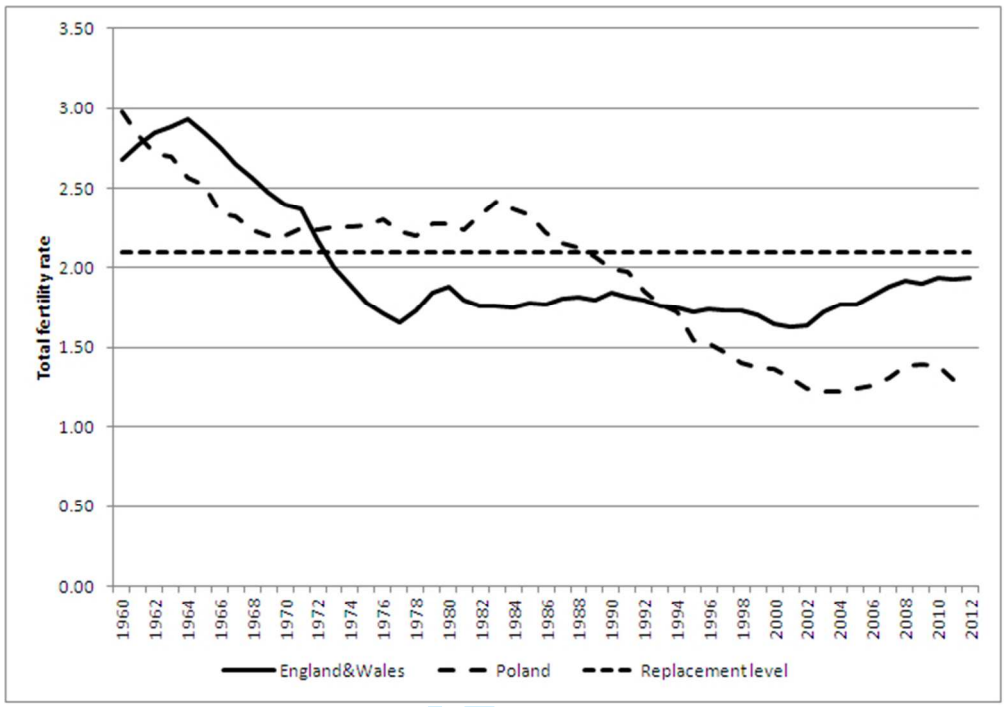
Figure 4: Sub-regional (local authority) Total Fertility Rate in Poland, and England and Wales, 2002-12.

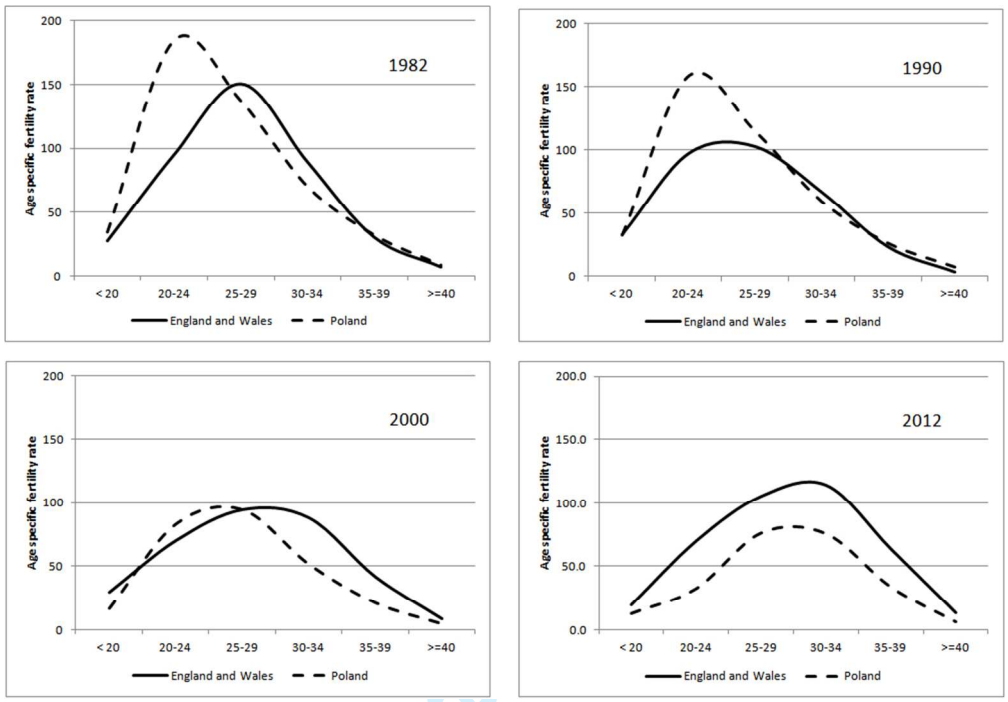
Figure 5: Sub-regional (local authority) 25-29 Age-specific Fertility Rate in Poland, and England and Wales, 2002-12.

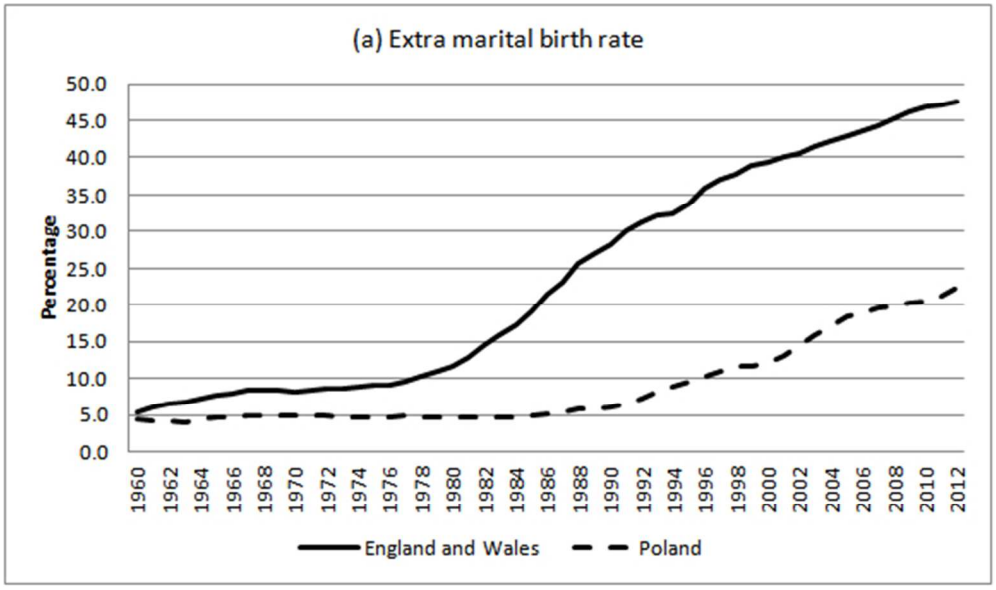
Figure 6: Sub-regional (local authority) Extra-marital Birth Rate in Poland, and England and Wales, 2002-12.

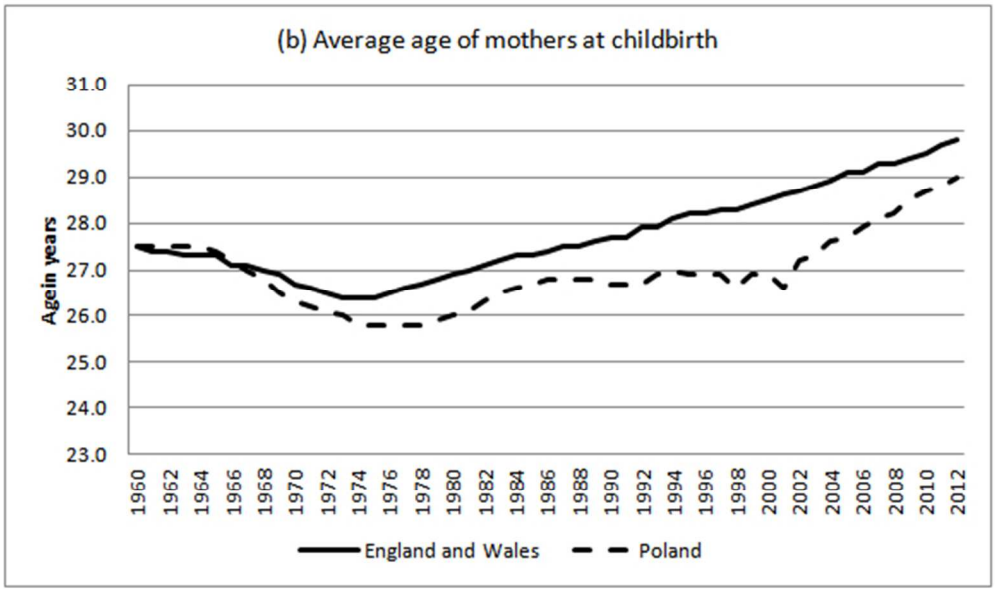
Figure 7: Global Moran's I analysis of Second Demographic Transition fertility indicators for local authority areas in Poland, and England and Wales, 2002-12.

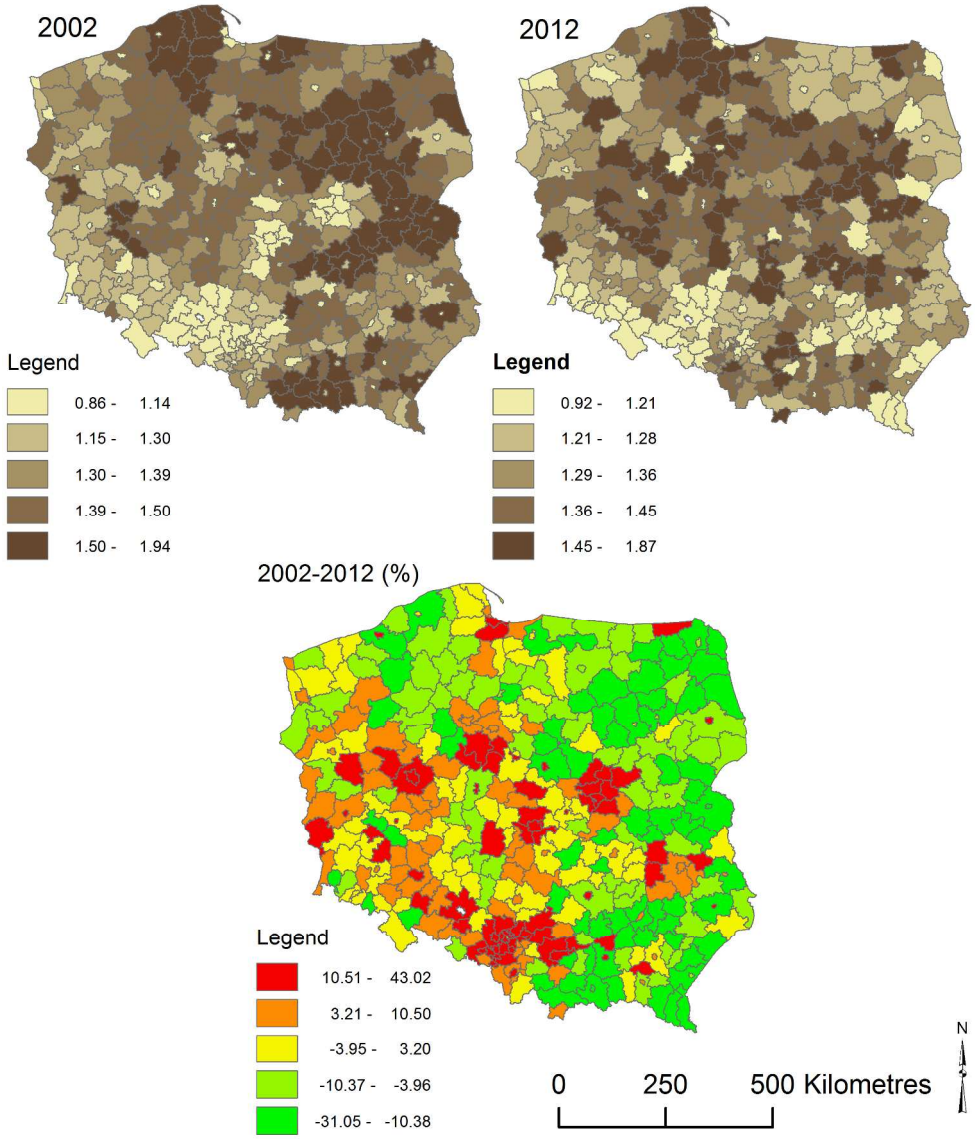
Figure 8: Local Moran's I outlier analysis of percentage difference in Second Demographic Transition fertility indicators for local authority areas in Poland, and England and Wales, 2002-12.

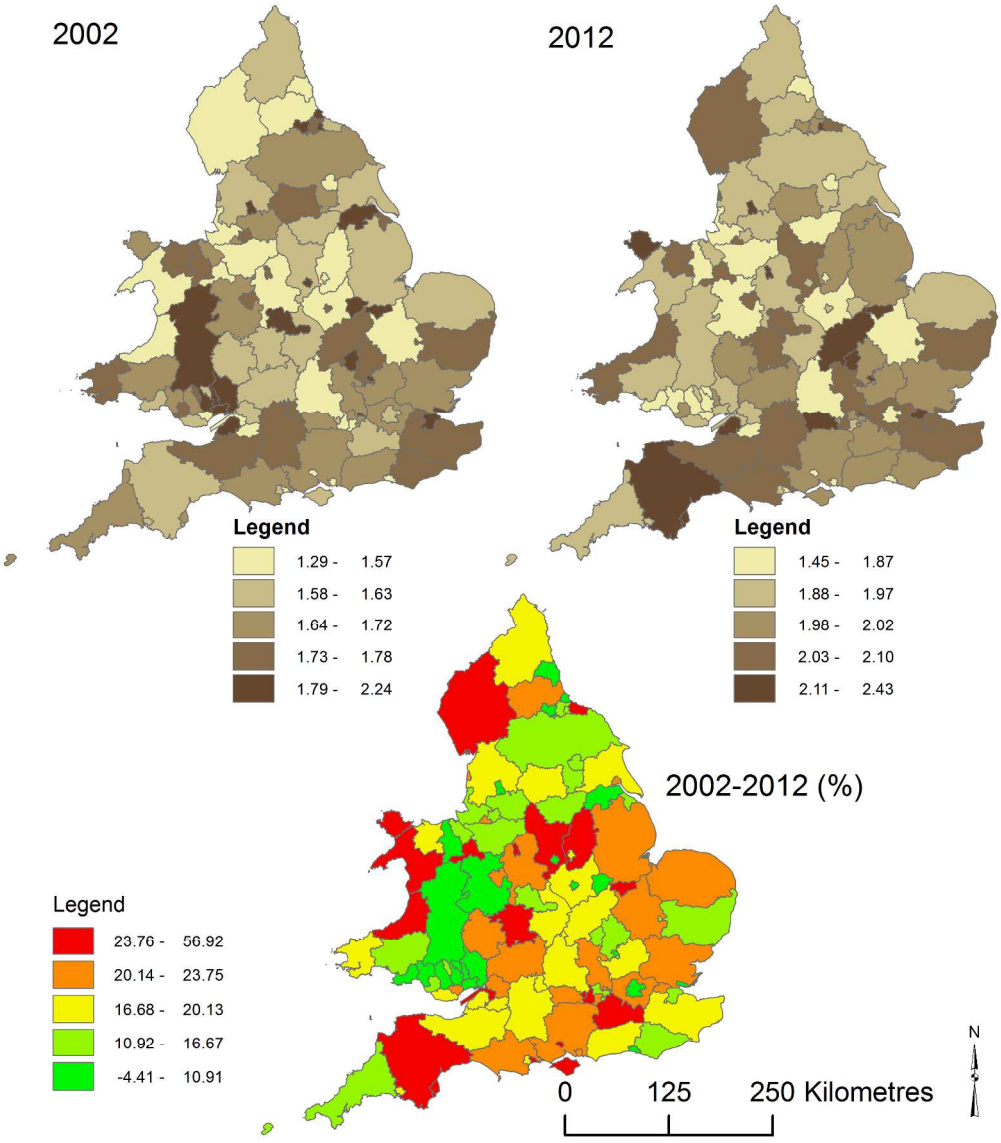


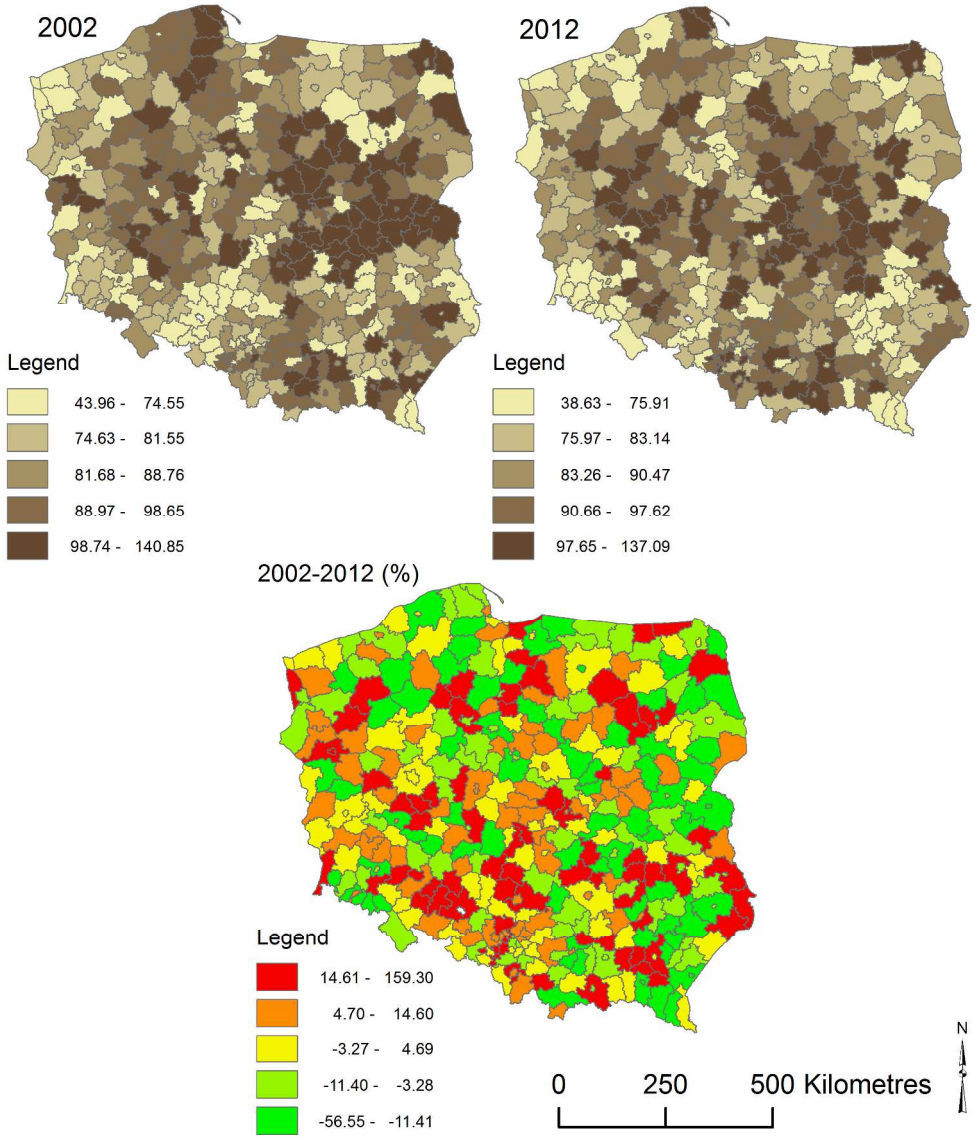


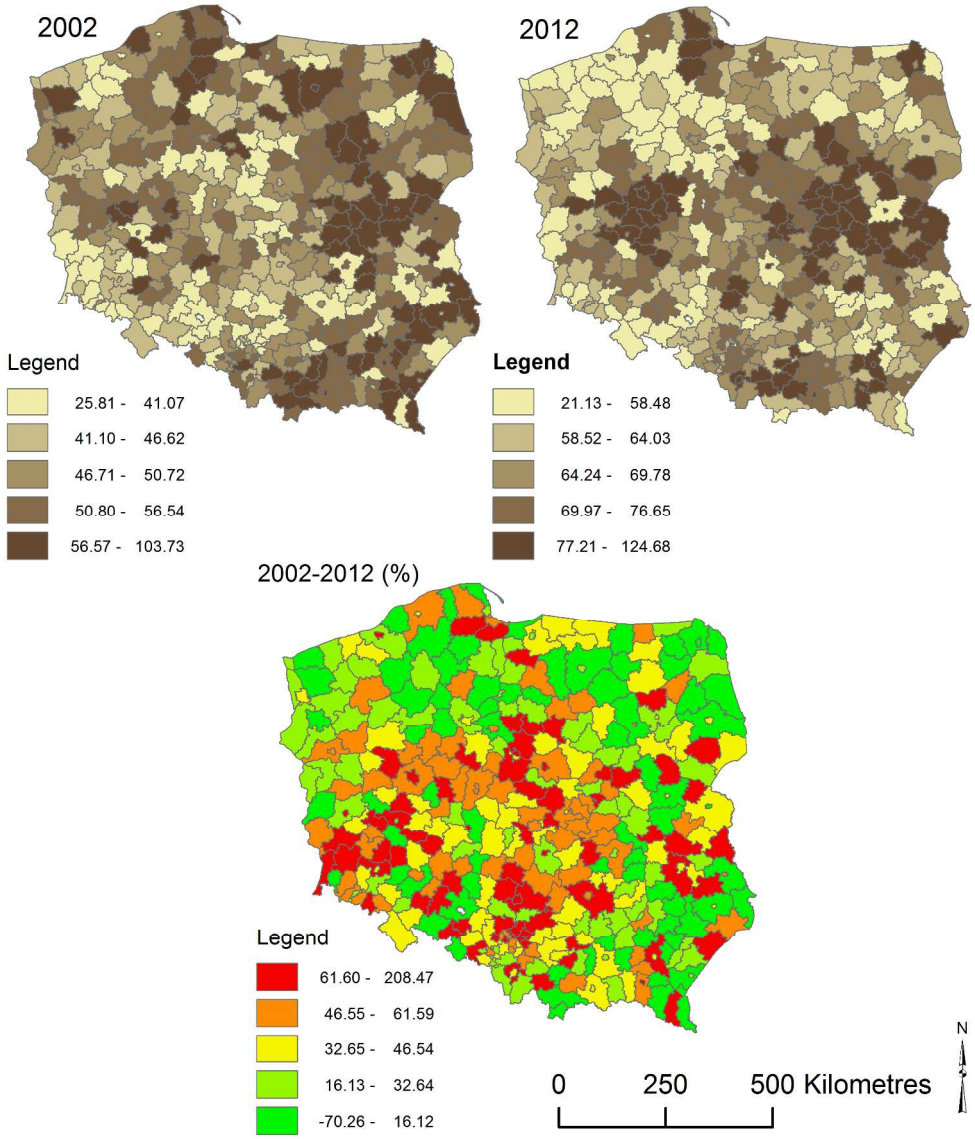

(a) Extra marital birth rate
Percentage
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
England and Wales
Poland

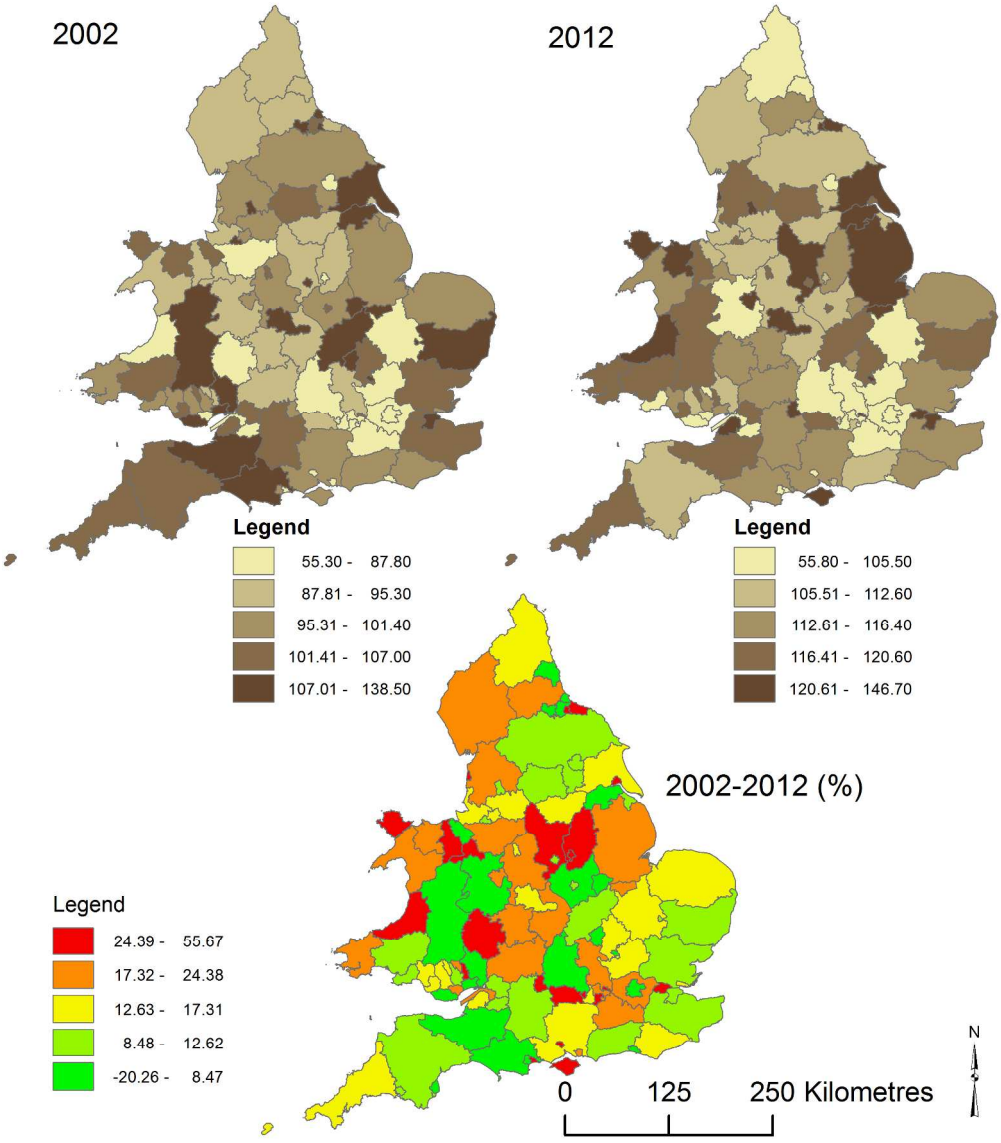

(b) Average age of mothers at childbirth
Agein years
31.0
30.0
29.0
28.0
27.0
26.0
25.0
24.0
23.0
1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
England and Wales
Poland

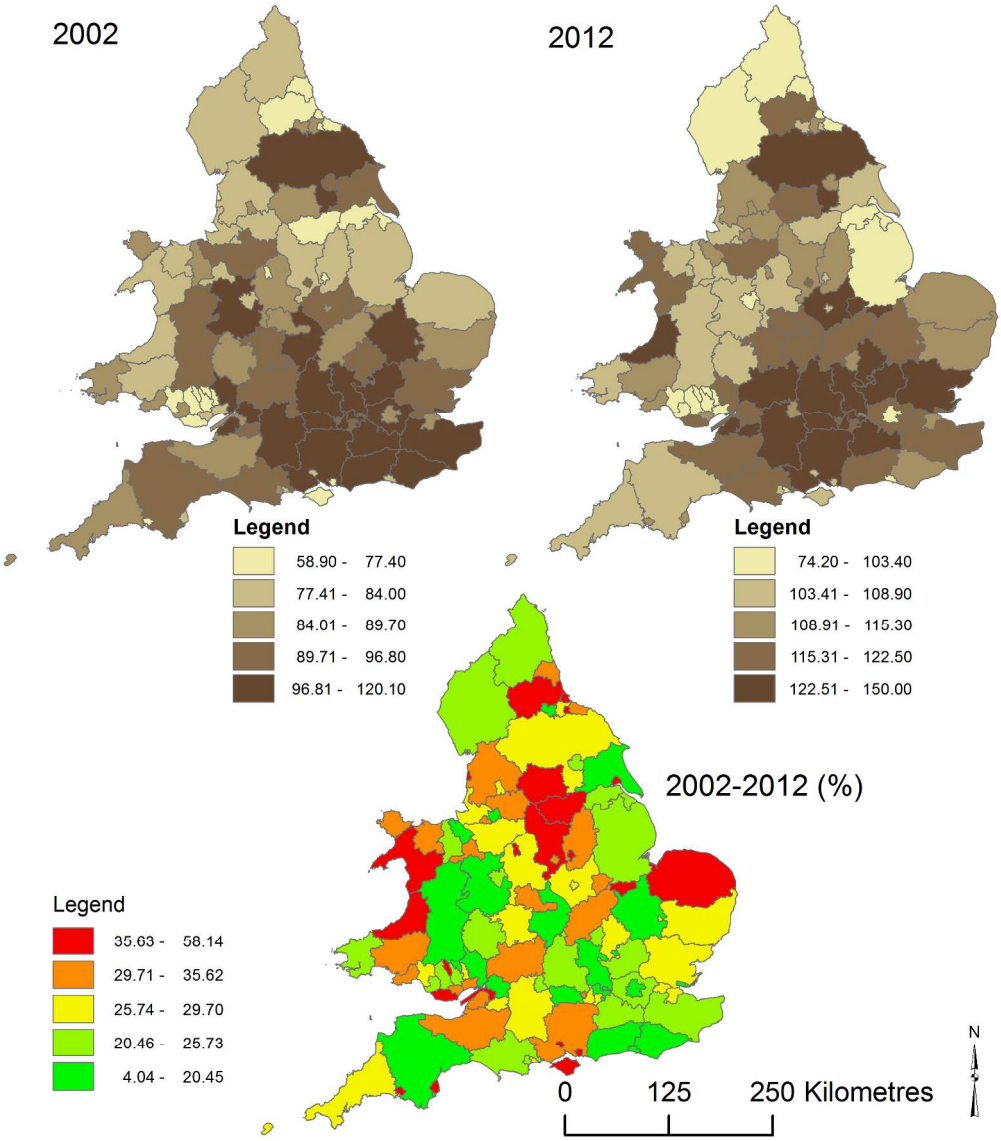

2002
Legend
0.86 - 1.14
1.15 - 1.30
1.30 - 1.39
1.39 - 1.50
1.50 - 1.94
2012
Legend
0.92 - 1.21
1.21 - 1.28
1.29 - 1.36
1.36 - 1.45
1.45 - 1.87
2002-2012 (%)
Legend
10.51 - 43.02
3.21 - 10.50
-3.95 - 3.20
-10.37 - -3.96
-31.05 - -10.38
0 250 500 Kilometres
N

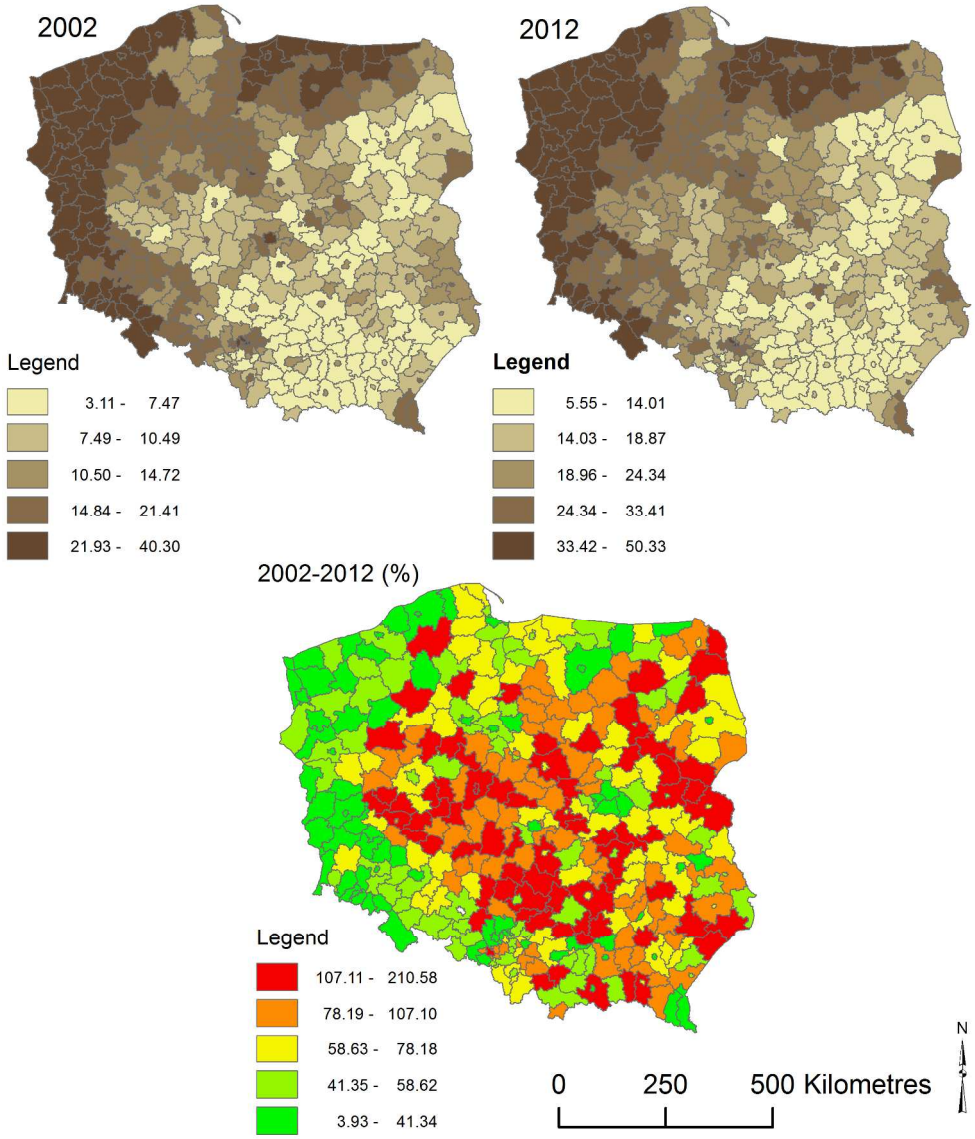

2002
Legend
1.29 - 1.57
1.58 - 1.63
1.64 - 1.72
1.73 - 1.78
1.79 - 2.24
2012
Legend
1.45 - 1.87
1.88 - 1.97
1.98 - 2.02
2.03 - 2.10
2.11 - 2.43
2002-2012 (%)
Legend
23.76 - 56.92
20.14 - 23.75
16.68 - 20.13
10.92 - 16.67
-4.41 - 10.91
N
0 125 250 Kilometres

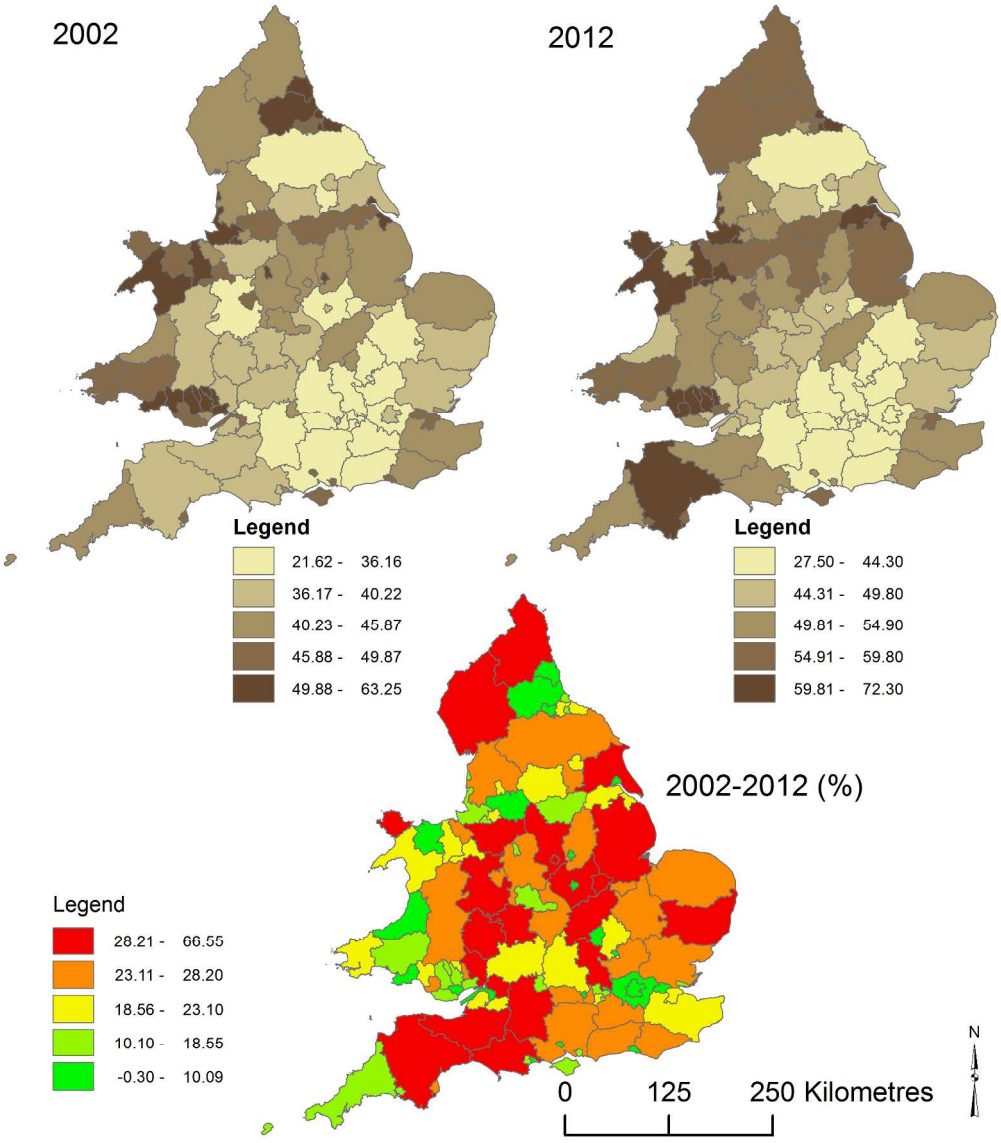

2002
Legend
43.96 - 74.55
74.63 - 81.55
81.68 - 88.76
88.97 - 98.65
98.74 - 140.85
2012
Legend
38.63 - 75.91
75.97 - 83.14
83.26 - 90.47
90.66 - 97.62
97.65 - 137.09
2002-2012 (%)
Legend
14.61 - 159.30
4.70 - 14.60
-3.27 - 4.69
-11.40 - -3.28
-56.55 - -11.41
0 250 500 Kilometres
N

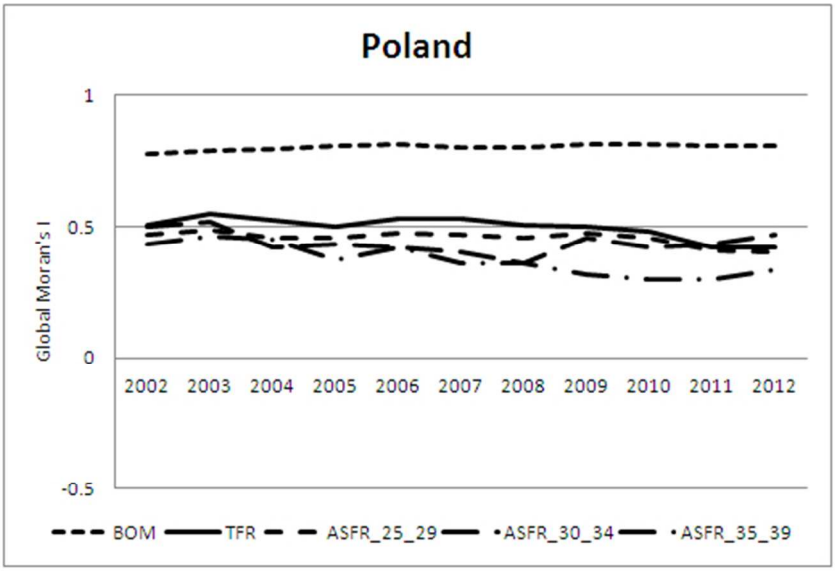

2002
Legend
25.81 - 41.07
41.10 - 46.62
46.71 - 50.72
50.80 - 56.54
56.57 - 103.73
2012
Legend
21.13 - 58.48
58.52 - 64.03
64.24 - 69.78
69.97 - 76.65
77.21 - 124.68
2002-2012 (%)
Legend
61.60 - 208.47
46.55 - 61.59
32.65 - 46.54
16.13 - 32.64
-70.26 - 16.12
0 250 500 Kilometres
N

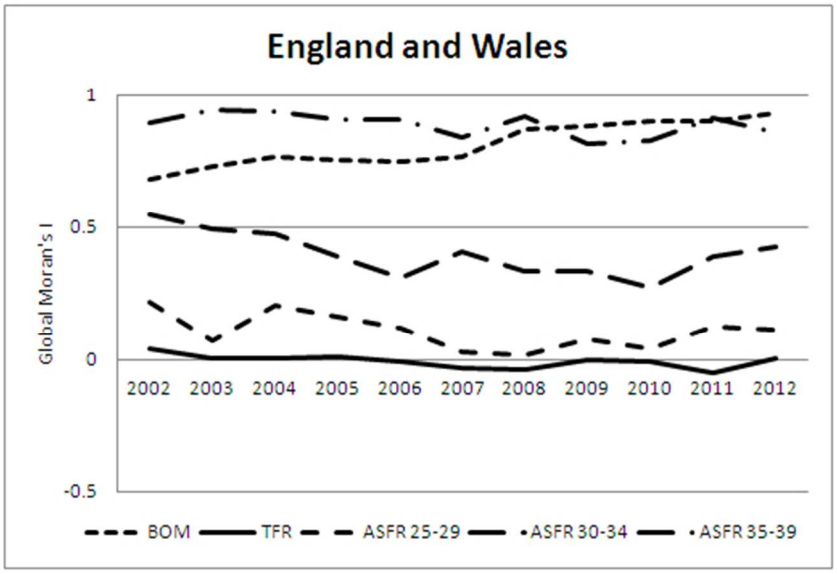

2002
2012
Legend
55.30 - 87.80
87.81 - 95.30
95.31 - 101.40
101.41 - 107.00
107.01 - 138.50
Legend
55.80 - 105.50
105.51 - 112.60
112.61 - 116.40
116.41 - 120.60
120.61 - 146.70
2002-2012 (%)
Legend
24.39 - 55.67
17.32 - 24.38
12.63 - 17.31
8.48 - 12.62
-20.26 - 8.47
N
0 125 250 Kilometres

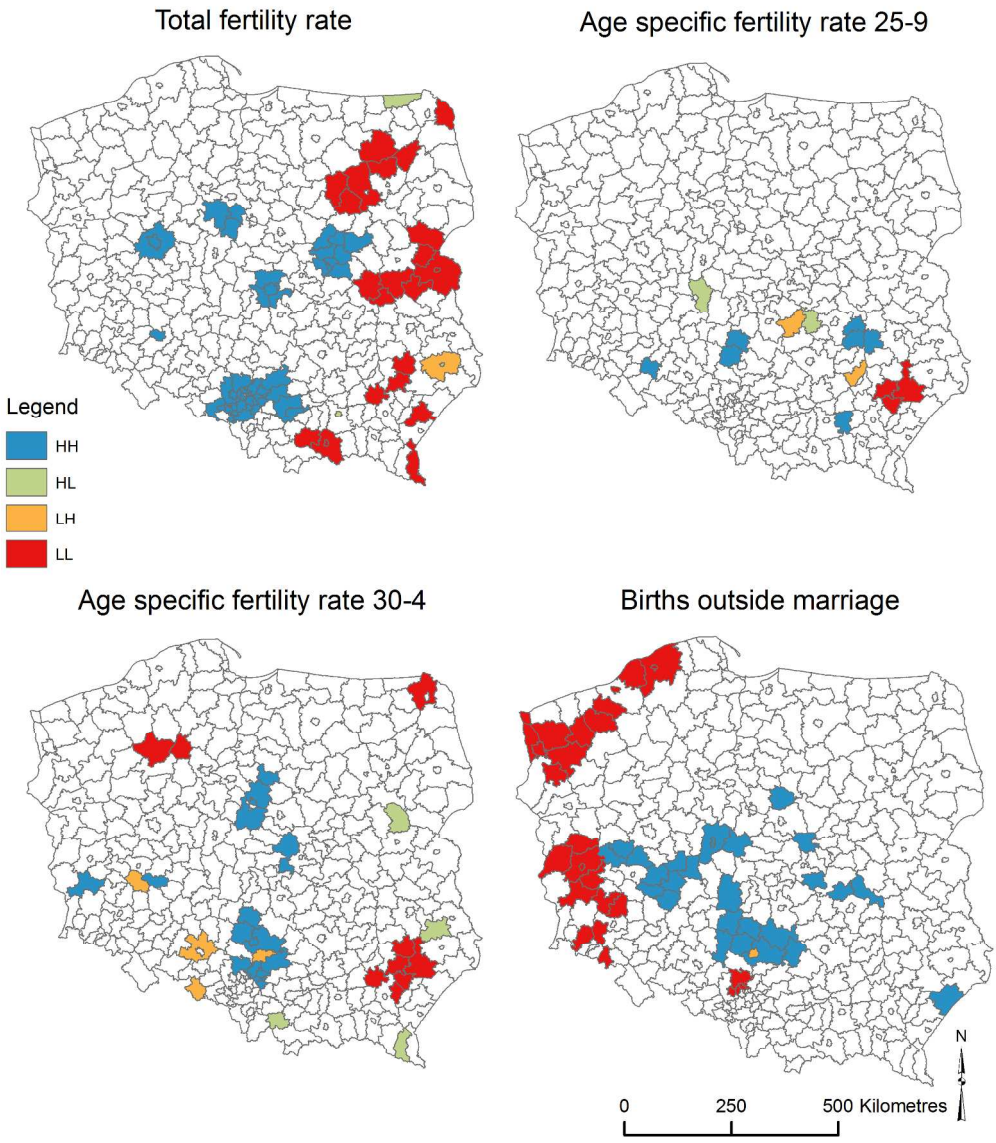

2002
2012
Legend
58.90 - 77.40
77.41 - 84.00
84.01 - 89.70
89.71 - 96.80
96.81 - 120.10
Legend
74.20 - 103.40
103.41 - 108.90
108.91 - 115.30
115.31 - 122.50
122.51 - 150.00
2002-2012 (%)
Legend
35.63 - 58.14
29.71 - 35.62
25.74 - 29.70
20.46 - 25.73
4.04 - 20.45
0 125 250 Kilometres
N

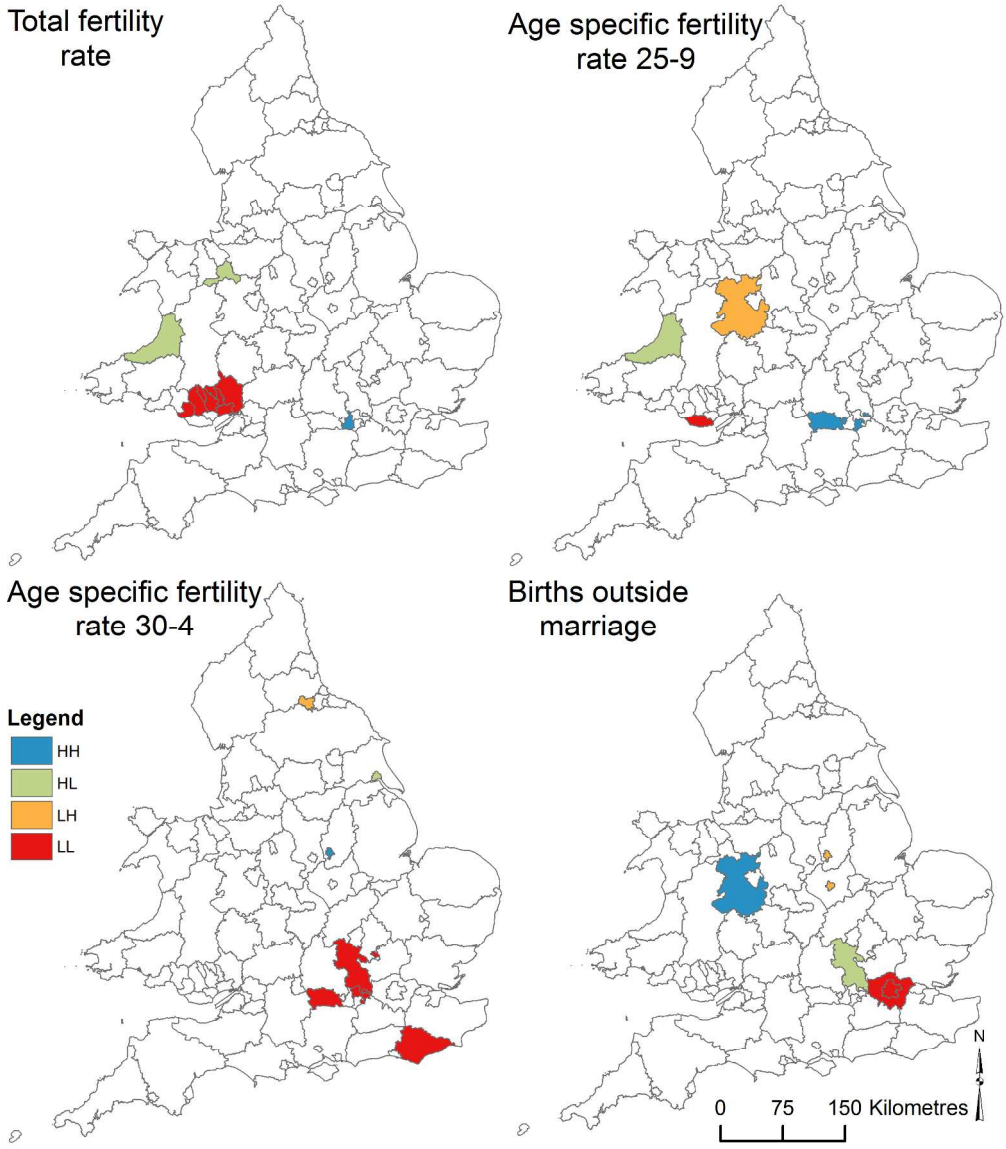

2002
Legend
3.11 - 7.47
7.49 - 10.49
10.50 - 14.72
14.84 - 21.41
21.93 - 40.30
2012
Legend
5.55 - 14.01
14.03 - 18.87
18.96 - 24.34
24.34 - 33.41
33.42 - 50.33
2002-2012 (%)
Legend
107.11 - 210.58
78.19 - 107.10
58.63 - 78.18
41.35 - 58.62
3.93 - 41.34
0 250 500 Kilometres
N


2002
Legend
21.62 - 36.16
36.17 - 40.22
40.23 - 45.87
45.88 - 49.87
49.88 - 63.25
2012
Legend
27.50 - 44.30
44.31 - 49.80
49.81 - 54.90
54.91 - 59.80
59.81 - 72.30
2002-2012 (%)
Legend
28.21 - 66.55
23.11 - 28.20
18.56 - 23.10
10.10 - 18.55
-0.30 - 10.09
0 125 250 Kilometres
N


Poland
1
0.5
0
-0.5
Global Moran's I
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
BOM
TFR
ASFR_25_29
ASFR_30_34
ASFR_35_39


England and Wales
1
0.5
0
-0.5
Global Moran's I
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
BOM
TFR
ASFR 25-29
ASFR 30-34
ASFR 35-39


Total fertility rate
Age specific fertility rate 25-9
Legend
HH
HL
LH
LL
Age specific fertility rate 30-4
Births outside marriage
N
0
250
500 Kilometres


Total fertility rate
Age specific fertility rate 25-9
Age specific fertility rate 30-4
Births outside marriage
Legend
HH
HL
LH
LL
N
0 75 150 Kilometres