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# Reflecting on the past: Long-term spatial persistence of fertility behaviour from the First to the Second Demographic Transition in England and Wales

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## *Introduction*

Examining fertility on the sub-national instead of national level often reveals striking regional differences and strong spatial clustering in fertility and family formation patterns (Coale and Watkins 1986). Research shows that such spatial clusters can persist over decades (Lesthaeghe and Neels 2002; Lesthaeghe and Lopez-Gay 2013; Klüsener and Goldstein 2016). The aim of this paper is to investigate whether similar long-term patterns of fertility behaviour exist in England and Wales. First, we identify leading areas of demographic innovations from 1861 to recent times in England and Wales. Demographic innovations are defined according to Innovation Diffusion Theory (Rogers 2010) as a new demographic behaviour such as the fertility decline in England and Wales starting in the last quarter of the 19th century that diffuses through the population. Another example for an innovative demographic behaviour is the rise of cohabitation and childbearing within cohabitation starting in the 1970s. In a second step, we construct spatial econometric models in order to investigate if these areas of innovation exhibit long-term spatial persistence. Since individuals are connected and interact within space, they tend to share common knowledge, values and adopt new behaviours at a similar time (Casterline 2001). Hence, close by regions are likely to display significant spatial clustering of fertility behaviour and its correlates. We expect that forerunner regions of new demographic behaviour during the First Demographic Transition (FDT) are to be found forerunners during the Second Demographic Transition (SDT).

## *Literature Review*

Previous research has found that in certain countries some demographic patterns exhibit spatial continuity over decades. In the case of Germany, spatial clusters of high non-marital childbearing exist over more than a century dividing Germany into East and West. Scholars have often ascribed these differences to the division of Germany after 1945. But Klüsener and Goldstein (2016) show how a set of historical developments contributed to a divide already starting in the early 19th century. These developments led to varying economic, cultural, legal, and political evolutions in both parts of Germany and the divide persists until recent times. Research on France, Belgium, Switzerland and Spain confirms the existence of long-term spatial clusters of innovative demographic behaviour (Lesthaeghe and Neels 2002; Lesthaeghe and Lopez-Gay 2013). Regions where fertility declined early during the FDT around 1900 in Belgium were more likely to be the forerunners of rising cohabitation and non-marital childbearing starting in the 1970s. Lesthaeghe and Neels (2002) explain

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this persistence of spatial patterns by long-standing regional sub-cultures, e.g. language, secularisation and voting patterns. We expect to find similar results for England and Wales.

*Data and Method*

The *Population Past* project provides historical geographical data at the Registration Sub-Districts level for 1861 and 1911 (Total Marital Fertility Rates (TMFR), Illegitimacy Ratios, celibacy and age at marriage) which are used as FDT indicators. Current geo-referenced data for Local Authority Districts (2011) is provided by the *nomis* platform of the Office for National Statistics and retrieved from the 2011 Census of England and Wales. This data is used to construct SDT indicators (Total Fertility Rates [TFR], Non-marital Ratios [NMR]).

Global Moran's I[3] will be calculated for all variables of interest. A value close to 0 indicates spatial randomness also called spatial autocorrelation and a value close to 1 strong spatial clustering. Spatial clustering reveals that units with similar values are close to each other. To analyse the data, we will construct spatial econometric models to predict SDT indicators by indicators related to FDT. In a first set of models, we only include the mentioned FDT indicators and evaluate how well those models perform in predicting spatial patterns of the SDT. In a second set of models, we also add variables which are more commonly used in the literature to explain SDT phenomena such as secularisation, female education and labour force participation, or male unemployment. We then compare the different sets of variables and assess their performance for predicting SDT indicators.

*Results and Discussion*

Descriptive maps illustrate that strong spatial clustering is apparent for all considered indicators (Fig. 1). Additionally, Global Moran's I is calculated for all FDT indicators and SDT indicators (Tab. 1).[4] These results further underpin strong spatial autocorrelation observed in the descriptive maps. Hence similar demographic behaviour manifests or clusters in specific areas.

| **FDT and SDT indicator** | **Year** | **Global Moran's I** |
|---|---|---|
| Illegetimacy Ratio | 1861 | 0.605 |
| Total Marital Fertility Rate | 1861 | 0.746 |
| Total Marital Fertility Rate | 1911 | 0.745 |
| Female celibacy | 1861 | 0.403 |
| Prevalence of cohabitation | 2011 | 0.492 |
| Non-Marital Ratio | 2016 | 0.523 |
| Total Fertiltiy Rate | 2018 | 0.238 |

**Table 1.** Global Moran's I for different First and Second Demographic Transition Indicators (sources: own calculation; data: Population Past 2019, Census 2011, ONS 2017; ONS 2019a)

[3] The formula for Global Moran's I: $I = \left(\frac{n}{\sum_i \sum_j w_{ij}}\right) \frac{\sum_i \sum_j w_{ij} z_i z_j}{\sum_i z_i^2}$, where $z_i$ and $z_j$ are observations at location $i$ and $j$ measured in units of deviation from the mean.

[4] Currently, Moran's Is for historical indicators appear higher due to smaller geographic output units compared to the recent data. In a next step, all data will be transformed to 2011 Local Authority districts as one geographical output unit.

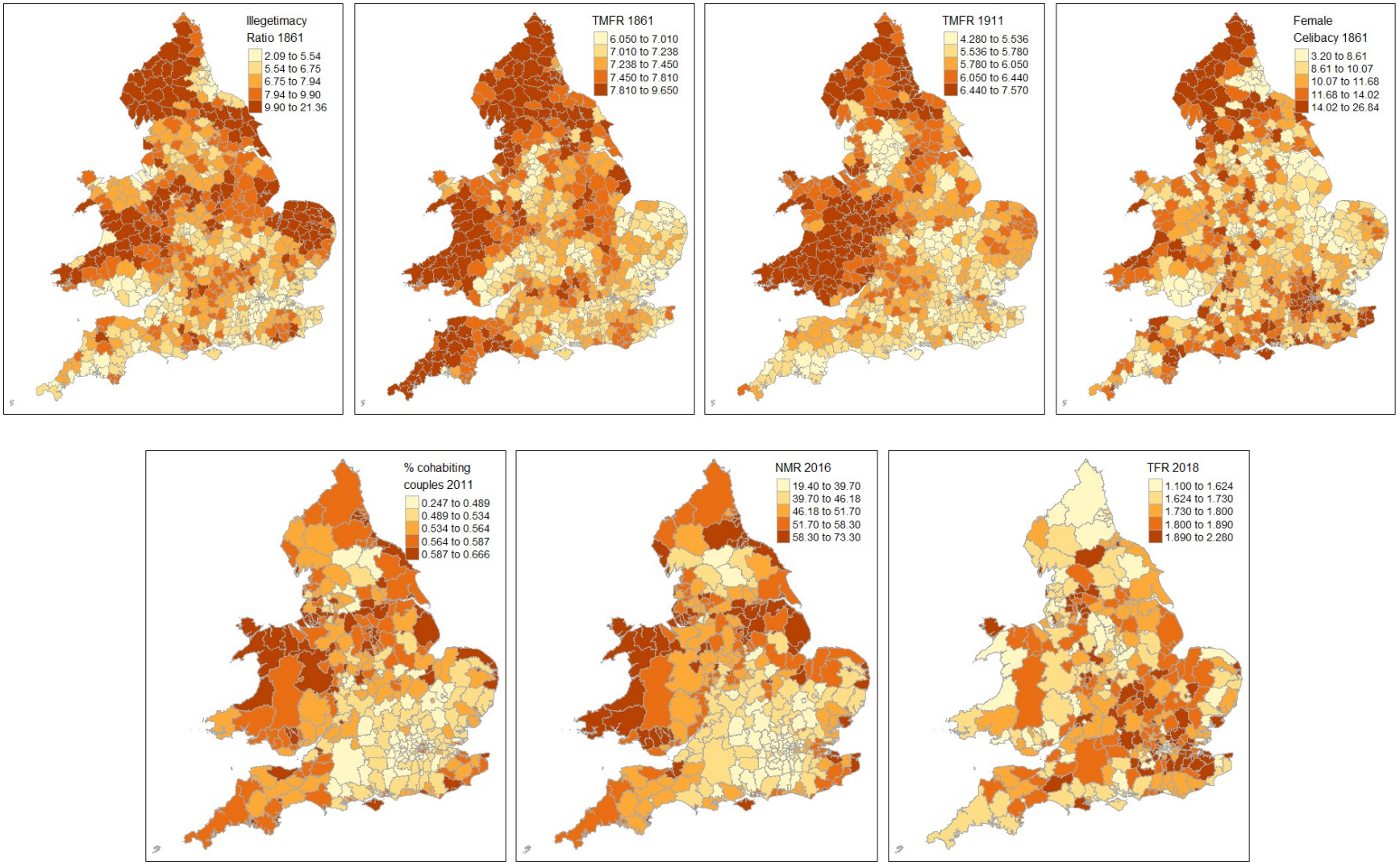


**Figure 1.** Quintile ranges of Illegitimacy Ratio 1861, Total Martial Fertility Rate (TMFR) 1861 and 1911, percentage female celibacy 1861 (number of women never married aged 45-54 of all women aged 45-54), prevalence of cohabiting couples 2011 (all cohabiting couples younger than 35 of all couples younger than 35), Non-marital Ratio (NMR) 2016, Total Fertility Rate 2018 (Sources: Population Past 2018; ONS 2011; ONS 2017; ONS 2019a; ONS 2019b)

The descriptive maps reveal that historical illegitimacy and fertility patterns show remarkable similarities in high spatial clustering compared to current levels of non-marital fertility and prevalence of cohabitation especially in the North East, North West, Yorkshire and Humble and South East of England as well as Wales. These observations are in line with previous findings for Belgium: Those indicators can be considered as non-conformist behaviour at the respective time. However, current Total Fertility Rates (2018) follow a completely different geographic pattern.

For the prediction of SDT indicators using spatial econometric models we expect to corroborate statistically that there are spatial continuities between the FDT and SDT. Such an analysis has the potential to show how reflecting on past demographic developments can enrich our understanding of contemporary and potentially even future spatial fertility and family formation patterns.

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