The Determinants of Fertility in the Second Polish Republic
A Macro Level Analysis

Bartosz Ogórek

Faculty of Humanities, Pedagogical University of Cracow, ul. Podchorążych 2, 30-084 Kraków, Poland

Introduction

The debate about whether fertility diversity in interwar Poland was a typical East-West division and which socio-economic and cultural determinants were crucial for shaping this situation began in the 1930s (Iglicka 1994). Contemporary authors as well as later studies attributed differences in fertility to the unequal economic development in a rather speculative manner. This explanation coincided with the contrast between industrialized and modern "Poland A," west of the Vistula River, and backward "Poland B," in the east. Conversely to the cases of Czechoslovakia, Hungary or Bulgaria (Fialova et al. 1990; Botev 1995; Béla 2002; Roupa 2012) the fertility of the Polish population has not been carefully investigated yet.

Most notably, the population of the Second Polish Republic shows remarkable internal heterogeneity in both fertility itself and its potential determinants. Thus, research on the interwar demography of Poland could add important arguments to the more general discussion on the causes and course of the historical decline in fertility in Europe.

Research Problem

Due to the lack of studies on the spatial distribution of fertility decline in interwar Poland, the basic objective of this research is to **identify and describe fertility patterns on the sub-national level**.

Secondly, the levels of fertility are scrutinized in relation to a set of **determinants** that roughly corresponds to the classical **adaptation vs diffusion debate** (Carlsson 1966).

Since the analysed population is characterized by a remarkable heterogeneity of household arrangements and family forms (Szoltysek 2015), the question arises about **the role of family systems in the fertility transition**. More complex family forms could hinder the development of the new fertility trends (Mason 2001).

Finally, the geographical context is taken into account following the intuition that over a vast area of **study the meaning of the specific variables and their effect on fertility levels can differ**. This applies most notably to the phenomena that could serve as proxies for the diffusion processes.

Data and Methods

All the data used for the study was extracted from the official publications of the Main Statistical Office of the II Polish Republic (*Główny Urząd Statystyczny [GUS]*) to measure the analysed phenomena on the sub-national level in 241 districts (*powiaty*). The dependent variable of GFR represents the local fertility levels while the set of independent variables reflects their determinants according to the adaptation and diffusion perspectives, as well the family systems.

Two modeling approaches were used and compared to determine the main fertility decline drivers in the analysed population – a standard OLS procedure and Geographically Weighted Regression. GWR is a statistical technique that allows for variations in relationships between predictors and outcome variables over space to be measured within a single modelling framework (Fotheringham et al., 2003; Wheeler & Páez, 2010).

Due to the high variability in the sizes of districts an adaptive bandwidth was chosen as it provides optimal size for the local regressions based on the density of spatial points across areas and ensures sufficient (and constant) local information for each local calibration (Fotheringham et al. 2003; Gollini et al., 2013). Relying on the optimisation procedure for the Gaussian kernel function with both CV and AIC approaches, the number of 20 nearest neighbours was chosen to bear the highest weights in the local models.

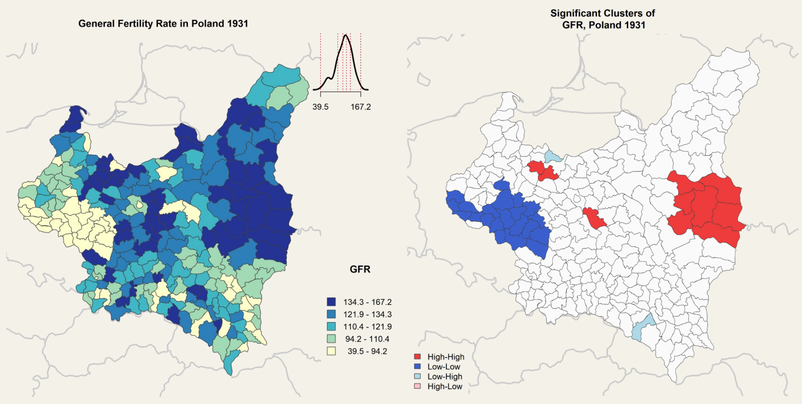

Figure 1. Spatial distribution of the dependent variable by quantile ranges (left) and Local Indicators of Spatial Autocorrelation by cluster type (right). Note: LISA analysis based on First Order Queen neighbourhood matrix

The distribution of the GFR represents the spatial heterogeneity of fertility decline (Figure 1). The apparent but simplistic East-West divide finds partial confirmation in the LISA analysis, although some of the districts diverge from that pattern. The global Moran's I reaches a highly significant value of 0.511. Surprisingly, the potential traces of the legal, administrative and cultural differences, that could be attributed to the period of partitions, are hardly present in the GFR levels, as the within-partition Theil Index of inequality equals 0.024 and the between one is 0.003

The East-West divide of the country can be traced among many economic and social aspects of the analysed population (Figure 2), especially those that reflect the levels of modernisation (Percentage of population in mining and industry, Percentage of illiterate), but also cultural one (Percentage of Polish speaking population) and the one proxying the household systems (Percentage of multifamilial farm units). On the other hand, some variables oppose this traditional geographic distribution – most notably the percentage of woman active on the non-agricultural labor market, the percentage of votes for socialist parties and the percentage of the Jewish population (as a religious denomination).

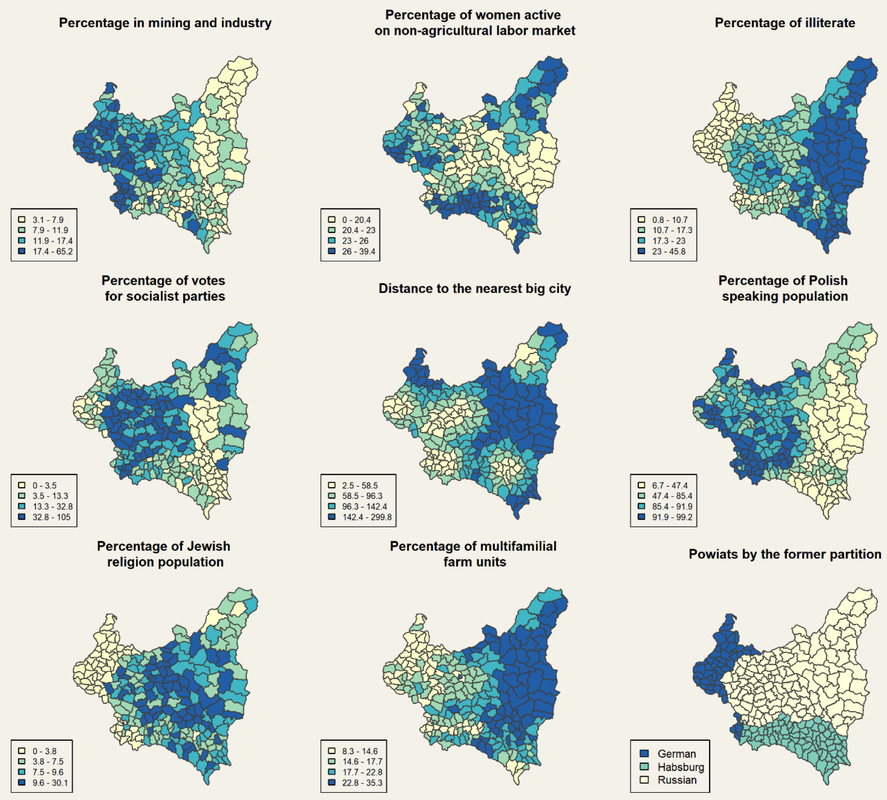

Figure 2. Spatial distribution of the independent variables by quantile ranges. Note: Percentage of votes for socialist parties as for 1928 elections. A big city is understood as the urban settlement of more than 100 000 inhabitants

Results

The results of the OLS regression (Table 1) yields significant and substantial effect for both structural (Percentage of population in mining and industry, Percentage of illiterate, Percentage of woman active on non-agricultural labor market) and diffusion variables (Percentage of Jewish and Polish speaking population, Distance to the nearest big city). The strong and positive impact of the household complexity on the GFR is only marginally significant. These results however have to be treated with caution as the model residuals are highly spatially autocorrelated. The GWR results confirm the doubts about the potential bias in the linear model. Both, interquartile ranges and F3 statistics prove the non-stationarity of some main variables. Interestingly, these are most of the diffusion related characteristics (Percentage of votes for socialist parties, Distance to the big city, Percentage of Polish speaking population). The significant local parameter estimates from the GWR model are presented on Figure 3.

Table 1. The comparison of the OLS and GWR model results. Dependent variable – GFR

Variable	OLS		VIFs	GWR (adaptive [20], gaussian kernel)					F3
	Estimate	SE		Min.	I Q	Median	III Q	Max.	Statistic
(Intercept)	114.234	17.845***	-	25.596	123.394	142.283	165.385	220.993	1.348.
Percentage in mining and industry	-0.476	0.190*	1.889	-1.117	-0.615	-0.252	-0.003	0.647	0.876
Percentage of women active on the non-agricultural labor market	-1.519	0.383***	1.351	-4.250	-2.075	-1.557	-1.049	-0.375	1.758**
Percentage of illiterate	0.842	0.293**	4.377	0.216	0.892	1.167	1.568	2.807	1.136
Percentage of votes for socialist parties	0.020	0.095	1.674	-0.732	-0.478	-0.096	0.147	0.281	3.153***
Distance to nearest big city	0.062	0.029*	1.439	-0.288	-0.059	0.015	0.092	0.257	3.837***
Percentage of Polish speaking population	0.220	0.090*	3.233	-0.553	-0.035	0.076	0.296	1.092	2.498***
Percentage of Jewish religion population	-1.324	0.399**	1.714	-3.601	-2.601	-1.667	-1.087	0.005	1.177
Percentage of multifamilial farm units	0.745	0.423.	2.320	-2.172	-0.477	0.187	0.635	1.348	0.836
R-squared	0.282			0.622					
Adjusted R-squared	0.257			0.497					
AIC	2182.992			2053.359					
AICc	2183.949			2122.284					
Residuals' Moran's I	0.440 ***			0.169 ***					

Note: sigificance levels: * 0.01, ** 0.01, * 0.05, . 0.1**

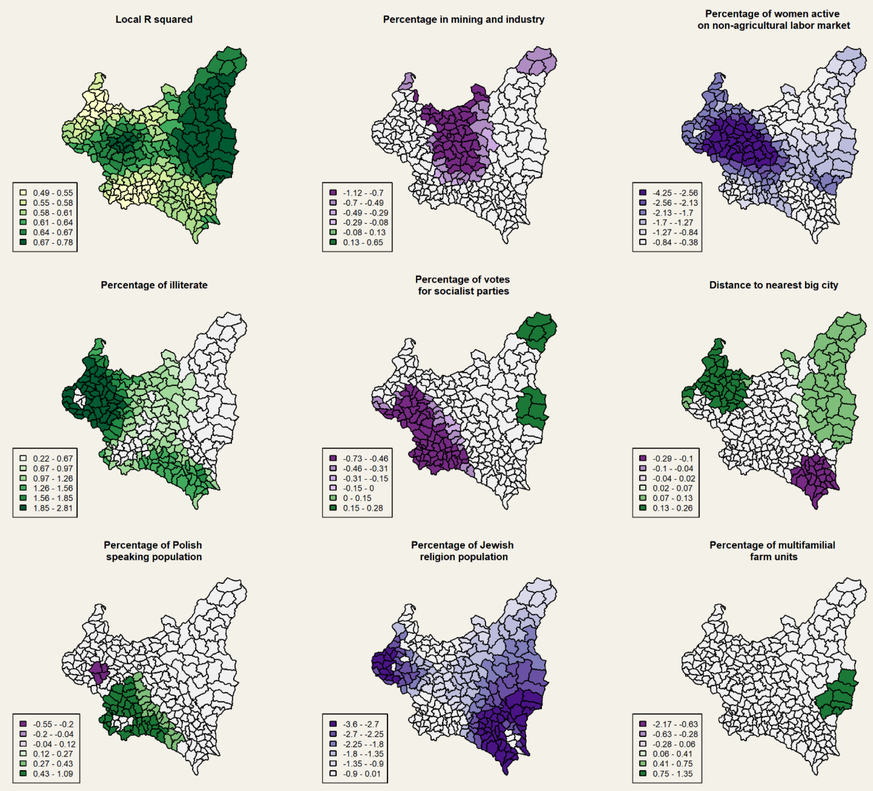

Figure 3. Spatial distribution of the significant local parameter estimates from the GWR. Note: significance defined at 0.1 level

Conclusions

The general distribution of fertility in interwar Poland follows an East-West division, with two contrasting clusters – the high fertility in the East (Wolynia and Polesia) and low fertility in the West (Wielkopolska and Łódź regions).

Despite the fact that both structural and cultural **determinants** turned out to significantly affect fertility levels, those **associated with diffusion processes are more context-specific**. While the effects of modernisation differ locally only in magnitude, **the ones related to secularisation, spread of innovation and communication are more polarised, driving the fertility levels to opposite directions depending on the geographic settings**.

Surprisingly, **the very effect of the household systems on fertility decline seems, at most, mediocre**.

Research on the contemporary populations shows a **superiority of the GWR method over linear models** when analysing sub-national fertility over large areas (Işik and Pinarcioğlu 2006; Vitali and Billari 2015). This study proves that it is true also for **historical populations** undergoing their first demographic transition.

References

1. Carlsson, G. (1966). The decline of fertility: innovation or adjustment process. *Population studies*, *20*(2), 149-174.
2. Fotheringham, A. S., Brunsdon, C., & Charlton, M. (2003). *Geographically weighted regression* (pp. 159-183). West Atrium: John Wiley & Sons, Limited.
3. Gollini, I., Lu, B., Charlton, M., Brunsdon, C., & Harris, P. (2013). GWmodel: an R package for exploring spatial heterogeneity using geographically weighted models. *arXiv preprint arXiv:1306.0413*.
4. Iglicka, K. (1994). Terytorialne przemiany płodności w Polsce w latach 1931-1988. *Monografie i Opracowania/Szkoła Główna Handlowa*, (384).
5. Işik, O., & Pinarcioğlu, M. M. (2006). Geographies of a silent transition: A geographically weighted regression approach to regional fertility differences in Turkey. *European Journal of Population/Revue europeenne de demographie*, *22*(4), 399-421.
6. Mason, K. O. (2001). Gender and family systems in the fertility transition. *Population and Development Review*, *27*, 160-176.
7. Szołtysek, M. (2015). Rethinking East-Central Europe: family systems and co-residence in the Polish-Lithuanian Commonwealth. Bern, Switzerland: Peter Lang AG.
8. Vitali, A., & Billari, F. C. (2017). Changing determinants of low fertility and diffusion: A spatial analysis for Italy. *Population, Space and Place*, *23*(2), e1998.
9. Wheeler, D. C., & Páez, A. (2010). Geographically weighted regression. In *Handbook of applied spatial analysis* (pp. 461-486). Springer, Berlin, Heidelberg.

Contact Information

Bartosz Ogórek Institute of History and Archival Science, Pedagogical University of Cracow, ul. Podchorążych 2, 30-084 Kraków, Poland

Email: bartosz.ogorek@up.krakow.pl