SOCIO-ECONOMIC DETERMINANTS OF REGIONAL MORTALITY IN LATVIA

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Abstract. *Considering the accumulated results of academic studies in the fields of longevity and mortality, it is difficult to deny the existence of some relations between specific socio-economic factors and regional population mortality. This study aims to evaluate the determining effects of the regional socio-economic preconditions and associated policy actions on the standardised population mortality in Latvia, while paying special attention to gender divide and spatial context of the regions in question. In order to achieve this goal, author conducts indirect standardisation of regional mortality data. After testing the standardised data for spatial autocorrelation, a model-based assessment of the possible impact factors is carried out using a proven geographically-weighted regression model. Model estimation results allow author to conclude, that income and employment are two key determining factors for the regional population mortality. However, for males, these factors, as well as spatial context, are much more relevant, while female mortality appears to be more dependent on other contextual factors not included in the scope of this study. Municipal budget spending in the selected policy areas have demonstrated to have little effect on the regional mortality for both genders.*

Key words: *standardised mortality rate, socio-economic demography, spatial data analysis, geographically weighted regression.*

Introduction

Debate on the importance of the causal relations between specific sets of socio-economic factors and regional longevity and mortality issues has been reappearing with noteworthy regularity within both academic and political communities. While the local social and economic conditions have long been considered among core determinants of regional population change, the overall attention to this particular area of demographic research has been notably growing throughout the European Union (EU) over the last few decades.

Such surge of attention may be partially explained by the increased availability of quantitative and qualitative data on the population health and mortality, as well as the associated socio-economic conditions and other underlying factors on the regional and local (sub-regional) territorial levels. This interest is being fuelled even further by the ever-increasing availability of new methodologies for analysis and representation of such data, including latest developments of the geographically weighted econometric models and Geographic Information Systems (GIS).

The notion of strong links between socio-economic preconditions and mortality on the regional level may be challenged by the assumption that majority of the demographic parameters (like age, sex, birth rate, mortality etc.) and the associated population processes are natural and genetically inherited factors influenced by the environmental conditions at best. However, the main question remains – whether the socio-economic factors and associated policy actions (being exogenous to the natural demographic processes) can actually influence individuals' lifestyle and healthcare choices on the regional level, or even go beyond that – indirectly altering the pseudo-exogenous mortality causes?

Already in 2006, in the paper "Population health, mortality and life expectancy in Latvia: trends, factors, perspectives" ("*Iedzīvotāju veselība, mirstība un mūža ilgums Latvijā: tendences, faktori, perspektīvas"*) Juris Krumins has identified and discussed some significant disparities in standardised mortality rate values among the various districts of Latvia (see Krumins, 2006). Furthermore, the recent study on regional mortality differences in Germany carried out by Eva Kibele at the University of Groningen (see Kibele, 2012) has clearly demonstrated that the regional / area contexts are linked with people's health and longevity even after accounting for important individual-level characteristics and the historical East-West Germany dichotomy. Kibele has also theorised that the strength of the effects of those individual-level factors may as well depend on context factors.

Following the aforementioned studies, and relying upon substantial empirical evidence in Latvia, author believes that noteworthy demographic implications of socio-economic conditions, as well as associated policy actions, are undeniable and, therefore, deserve an in-depth research involving analysis of the underlying causalities and controlling for the direct and lagged spatial effects. With this in mind, the aim of this study is set to evaluate and measure the effects of socio-economic conditions and associated policy actions on the standardised regional mortality.

In order to achieve this goal, in the following sections of this paper author identifies the available data on regional mortality and the socio-economic conditions / policy actions which may have a determining effects on the variation in regional mortality, defines the methodological toolset necessary for the quantitative and spatial analysis of these data and discusses the main results produced by the aforementioned analytical instruments.

Data and methodology

Extensive research has been carried out on the regional level in Latvia, proving the presence of significant heterogeneity of both socio-economic and demographic indicators among regions and municipalities of the country (see Zvidrins, 2009, or Krisjane, 2006). Complementing previous study, a new calculation of the regional standardised mortality ratio (SMR) has been carried out within the framework of this study, using the results of the latest national population and housing census of 2011 and focusing on the municipal administrative level.

With the publication of 2011 population census results in Latvia, a whole new set of regional and municipal-level demographic data have become available for further study and analysis. Unfortunately, these data still did not include the sufficiently detailed mortality indicators with regional cross-section. This fact highlighted a need and opportunity for developing new standardised regional mortality indicators. Upon evaluating the available statistical data, author has selected a well-proven Indirect standardisation technique, which is widely described in the literature and has been applied in many studies for the analysis of demographic processes of small areas. Age and gender structure of the entire country has been set as a standard for this recalculation.

In order to improve the precision of acquired standardised regional mortality indicators for the particularly small municipalities (in terms of population count) author uses year of the census (2011) as a base year, as well as calculates and uses average and / or weighted average (for the

period 2008-2014) values of several statistical parameters used in the standardisation process: number of annual deaths in municipalities, countrywide mortality rate, number of deaths by age and gender groups in the country (CSB 2016). Further, author uses average annual population of each municipality as weights applied in the recalculation process. Data set produced as a result of the standardisation process have been later expanded by adding the spatial information, which facilitates its graphical representation and spatial analysis opportunities.

Figure 1 below, shows the distribution of the standardised mortality rate (SMR) among the local municipalities of Latvia in 2011 (with national average mortality used as standard). In order to ensure the reliability of the data for particularly small areas, 2008 – 2014 regional population and mortality data were used in the standardisation process.

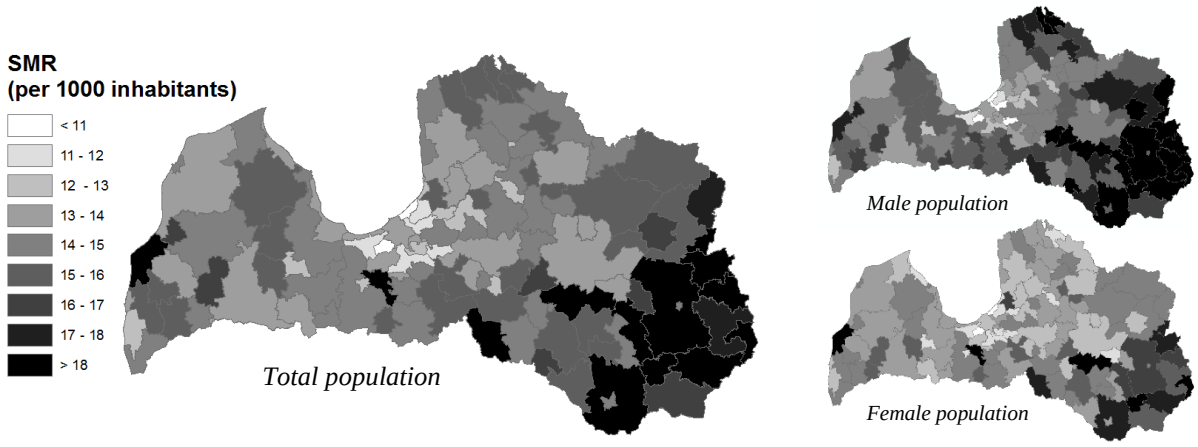

Figure 1. **Standardised mortality rate in Latvian municipalities in 2011.**
Source: Author's calculations, Central Statistics Bureau data.

After visual inspection of the maps presented in the Figure 1 and considering the relatively small size of the local municipalities in question, it becomes obvious that the SMR figures of the local municipalities in Latvia demonstrate some degree of spatial autocorrelation. This phenomenon may be described in simpler terms as high values tending to be located near other high values, while low values tend to be located near other low values, thus exhibiting positive spatial autocorrelation (see Voss et al, 2006).

The spatial autocorrelation as a phenomenon may be caused by either spatial spillovers of the indicator under study (i.e. clustering of high SMR values around the area associated with particular health risks) or by the preceding spillovers of its impact parameters (i.e. from/to the neighbouring regions. In order to factor the spatial spillovers between the municipalities into the econometric analysis, one needs to quantify the spatial relations by using some form of the spatial weights matrix (W) as explained by Ward and Gleditsch (2008, p.13) or Anselin (2003).

In order to precisely measure the SMR spatial autocorrelation and account for the spatial context factors in the further model-based analysis, author employs previously developed square spatial connectivity weights matrix (see Dahs, 2014a). The role of municipality's spatial location and the overall spatial autocorrelation of SMR in Latvia is measured using a local Moran's I test described in detail by Luc Anselin (see Anselin, 1995).

Figure 2 shows Moran Scatterplots for the local SMR values, while highlighting the outlying observations, hot/cold spots and trend-setters in the spatial structure.

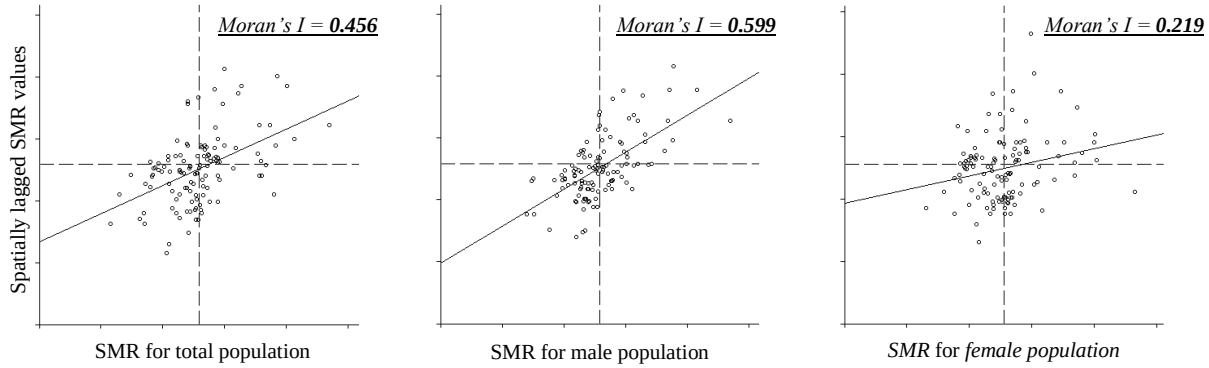

Figure 2. **Moran's scatter plots of the total population SMR values of Latvian municipalities in 2011.**
Source: Author's calculations, Central Statistics Bureau data.

Significant positive results of the Moran's I test (particularly for the male population) allow Author to assume that the intended model-based assessment of the socio-economic and policy factors' impact on regional mortality in Latvia should be carried out using the proven and tested geographically weighted regression models, and specifically - by employing the Spatial Lag Model (SLM) as the main analysis tool. The structure and application of SLM for regional demographic research has been extensively described by Chi and Zhu (Chi, G. & Zhu, J., 2008) and successfully approbated for the purposes of regional demographic research in Latvia by the author (Dahs, 2014b).

Analogous to the previous studies, the number of possible regional SMR impact parameters to be used in the model is limited by the amount of data available on municipal level. Data employed in this study has been acquired from the Central Statistics Bureau (CSB) database and the State Regional Development Agency (SRDA) 2012 report (see SRDA, 2012).

Taking into account the aforementioned data availability issues, Author has chosen two main regional economic indicators – average collected Personal income tax per municipality and local unemployment rate to be used in the model. Due to the specifics of the Latvian tax system, which foresees the collection of Personal income tax in accordance with the individual's declared place of residence, this indicator serves as a good representation of the average personal income level of the local residents in each particular municipality. Local unemployment rate accounts for average population economic activity and the availability of jobs.

Three main lines of municipal budget spending, associated with the national social and welfare policy, are used in the model in order to verify the existence of any links between local policy interventions and the SMR – healthcare spending per capita; social support spending per capita and culture / recreation spending per capita.

In order to account for variations in mortality rates between the two major ethnic groups, author has expanded the model by included two additional impact parameters - share of ethnic Latvian population and share of ethnic Russian population in each municipality under study.

Results and discussion

Table 1 provides the consolidated and structured SDM estimation results, showing the modelled effects of the selected regional socio-economic and policy factors on the standardised mortality rate in the municipalities of Latvia in 2011. Standard error values are provided in brackets.

Table 1

Effects of regional socio-economic and policy factors on standardised mortality rate in the municipalities of Latvia in 2011: SLM estimation results

Parameter	Standardised mortality rate (‰)		
	Total population	***Male population***	***Female population***
Collected income tax per capita	-0.00636 *** (0.00145)	-0.00801 *** (0.00169)	-0.00404 * (0.00169)
Local unemployment rate	0.15242 *** (0.04335)	0.21959 *** (0.05184)	0.09891 * (0.04845)
Mun. healthcare spending per capita	0.00804 (0.01008)	0.00113 (0.01172)	0.01001 (0.01193)
Mun. social support policy spending per capita	0.00214 (0.00287)	-0.00047 (0.00334)	0.00422 (0.00339)
Mun. culture and recreation spending per capita	-0.00459 ' (0.00332)	-0.00414 (0.00387)	-0.00435 ' (0.00393)
Share of ethnic Latvian population (%)	2.24673 (1.95057)	3.912764 (2.266523)	0.81955 (2.30977)
Share of ethnic Russian population (%)	3.52329 ' (2.38277)	6.17783 * (2.76966)	1.88484 (2.82011)
ρ (spatially lagged SMR)	*0.08498* '	*0.17747* **	*0.03369*
R^2	*0.60046*	*0.69626*	*0.31941*

*Significance codes: 0 ' *** ' 0.001 ' ** ' 0.01 ' * ' 0.05 ' ' ' 0.1 ' ' 1.*

Source: Author's estimations, CSB and SEA data.

First, both the Moran's I test and the significance of ρ value in the model estimation results indicate that the male population mortality in Latvia has a noteworthy spatial autocorrelation. This can be explained by several reasons including the spatial spill-overs of the predetermining socio-economic factors, negative endogenous influences / environmental conditions and the spatial distribution of Russian ethnic group (which has demonstrated a higher male mortality rate).

Second, the average collected income tax per capita and unemployment indicators included in the model have proven that the overall income and employment factors are the key determinants for the regional mortality in male population and play important role in shaping female mortality. Such finding is not surprising, and is well supported by the observed minimal effects of the regional government spending for healthcare and social support. Combined with the first observation on spatial autocorrelation, this allows to theorise that in specific areas of the country, high personal income level is crucial for ensuring the necessary level of healthcare, quality of life and other endogenous conditionalities necessary for a longer lifespan. Such assumption supports the findings of previous studies carried out by Latvian authors (e.g. see Krumins, 2006).

Third, regional female mortality has shown a much smaller rate of spatial dependency and only moderate reaction to income and employment factors. A somewhat significant positive reaction to the government spending in the areas of culture and recreation has also been observed for the female population. These results suggest, that regional female mortality in Latvia is generally a more complex process than the male mortality, and is determined by a series of

exogenous factors, possibly including the historical specifics of the given region, like economic specialisation (see Dahs 2014b), and the existing long-term social / environmental conditions theorised by many authors for a long period of time (e.g. see Johansson, 1991).

Conclusions

Spatial analysis and model estimation results allow author to conclude, that personal income and employment remain to be the key determining factors for the regional population mortality in Latvia, as high personal income level is crucial for ensuring the necessary level of healthcare, quality of life and other conditions facilitating longer and healthier life of an individual.

However, these economic factors, in conjunction with the spatial context effects, appear to be much more relevant for male population, indicating their higher vulnerability to risk and stress factors induced by economic hardships, as well as the pre-existing spatial spill-overs of these negative aspects. Presence of other spatially-distributed negative endogenous influences, as well as the uneven spatial distribution of Russian ethnic group within the country should also be considered in further research.

Female mortality, on the other hand, appears to be less spatially concentrated and partially determined by exogenous factors not directly linked with the social and economic context. Presence of higher female mortality figures in some isolated rural areas suggest the role of several other impact factors not covered by this study, including but not limited to the historical industrial, social or environmental specifics of the particular areas.

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