ESTABLISH SPATIAL STATISTICS SYSTEM DESIGN FOR POVERTY RISK ESTIMATION

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Highlights: A Poisson log-linear Leroux Conditional Autoregressive model with different neighbourhood weight matrices will be applied to the poverty data to estimate the relative risk of poverty. This estimation allows for the identification of high-risk and low-risk poverty areas. In addition, this method will determine the covariates that significantly contribute to poverty.

Keywords: *Conditional Autoregressive model, neighbourhood weight matrices, relative risk, poverty*

Introduction

Poverty has an impact on economic development, children's development, health, and violence. This study aim is to estimate the poverty risk. Thus the spatial pattern of poverty can be examined. The objectives of this study are to integrate a Poisson log-linear model and the Leroux Conditional Autoregressive model with neighbourhood matrices to predict the relative risk of poverty and determine the potential covariates that contribute to poverty. Household Income and Basic Amenities Survey Report, 2016 by the Department of Statistics Malaysia (DOSM) revealed that Kelantan has the highest incidence of poverty compared to other states in Peninsular Malaysia. In addition, the Unit Perancang Ekonomi Negeri Kelantan (UPEN) informed that Tumpat has the highest number of poor household heads, followed by Bachok, Pasir Mas, Tanah Merah and other districts. This show that areas located on the international and coastal borders are more likely to be poor. However, an area cannot be considered a high-risk poverty area according to the high number of poor household heads as it is likely to happen if the population is large. Thus, to overcome this problem, a spatial statistics system design is adopted.

Content

The response variable of poverty data is the number of poor households counts for each district typically displaying spatial dependence, with observations from areal units close together tending to have similar values than further apart. In spatial analysis, identifying the neighbourhood structure of the data being analysed is essential when conducting tests for autocorrelation data and modelling data at the areal level. A Poisson log-linear Leroux CAR model with contiguity and Delaunay triangulation neighbourhood matrices are fitted to the simulated and real poverty data. A simulation study with different scenarios related to random effects and covariate is conducted. At the same time, the real poverty data for 66 districts of Kelantan are obtained from the e-Kasih database from the Ministry of Women, Family and Community Development. A small number of covariates, which are the demographic characteristics of poor household heads, are available to describe the spatial variation in poverty risk across all districts in Kelantan. The performance of the Poisson log-linear Leroux CAR model with different neighbourhood weight matrices is compared using the deviance information criterion (DIC). Figure 1 shows the methodological framework used in this study.

The Poisson log-linear Leroux CAR model with contiguity and Delaunay triangulation is proved to perform well in simulation and real data. The estimated poverty risk map represents the spatial pattern of poverty risk for 66 districts in Kelantan. The value of risk greater than one show the high-risk area. More areas exhibit elevated risks than decreased poverty risks. Furthermore, the model also highlights the effects of the covariates on poverty. Table 1 shows convincing evidence that a decrease in age, increase in non-formal education and increase in the poor female head of household contribute to an increased risk of poverty in an area. The output from this study can help the authority identify high-risk areas of poverty at a low cost. Furthermore, it assists the authority in identifying the characteristics of the poor head of the household who should be prioritised for support. As a result, the poverty risk in 66 districts in Kelantan can be eradicated.

Figure 1: Methodological Framework

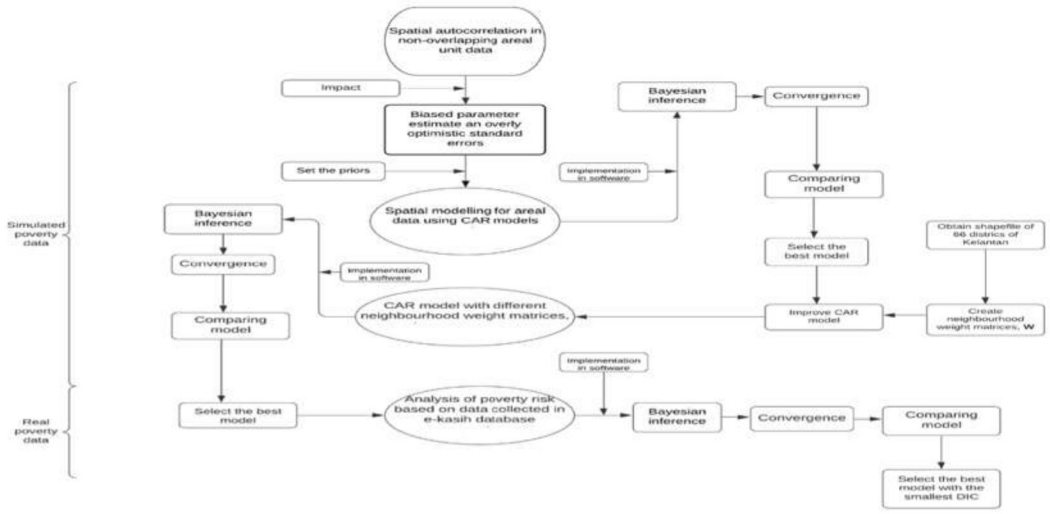

Table 1: Model evaluation

Model	Variable	Relative risk	95% credible interval	DIC
Contiguity	Age	0.936	(0.908, 0.966)	550.623
	Log Female	1.313	(1.273, 1.358)	
	No-education	1.148	(1.089, 1.202)	
Delaunay	Age	0.936	(0.908, 0.966)	550.353
	Log Female	1.313	(1.273, 1.358)	
	No-education	1.148	(1.089, 1.202)	

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