Adjustment of Unemployment Based on Small Area Estimation in Korea

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The National Statistical Office(NSO) takes the Economically Active Population Survey(EAPS) of people who are more than 15 years old and residents in 30,000 sample households every month in order to collect necessary basis data and make a plan hiring policy of the country investigating economical characteristics such as employment, unemployment etc.. The survey consists of an interview or a computer interview, and the results published in the form of 15 large areas such as 6 large cities and 9 provinces on the end of every next month.

The target of NSO's EAPS is 15 large areas in Korea, where small-area units are not the target area reflected in a sample survey design. Therefore if we estimate small-area statistics from the sample survey design based on the large area, we can not obtain adequate precision because sample size in small areas is not large enough. Our purpose is to adjust direct estimates of small areas through the area-specific model and secure the reliability of estimates. For this after investigation of stratification, sample assignment and the level of clustering, auxiliary information to adjust direct estimates of small areas were considered.

In this paper, direct estimates of the number of unemployed persons made out from the EAPS in each small area were adjusted using design-based and model-based indirect estimation methods. We tried to adjust the small-area EAPS estimates using the auxiliary information coming from census and administrative records. The EAPS direct estimates were adjusted by hierarchical Bayes Multi-level model(HBMM) and hierarchical Bayes generalized linear model(HBGLM). The precision and efficiency of estimates were compared with those of composite estimates in calculating standard errors and coefficient of variation(CV) of small-area estimates in HBMM and HBGLM.
To apply borrow strength from related areas monthly EAPS data were separated into two groups such as SI and GUN areas, and each area was classified by 6 categories of sex(male, female)-

age(15-24, 25-34, 35+). Unemployment indices of each cell were used as auxiliary information for small area estimation. We used 1995 Census and 2000 Resident Resistration Population(RRP) as auxiliary information to calculate unemployment index. Here SI and GUN mean administrative divisions belonged to large areas.

Contents of this research are consisted as following. First section presents composite estimation and hierarchical Bayes model frameworks with multi-level model and generalized linear model. Second section illustrates our methodology by employing monthly EAPS data in some SI-GUNs of Korea. In third section, we also investigate the adequacy of our model using a variety of model checks facilitated by MCMC implementation. And finally we give some comments and conclusion remarks.

REFERENCE

Albert, J.H.(1988), "Computational Methods Using a Bayesian Hierarchical Generalized Linear Model", *Journal of the American Statistical Association*, 83, 1037-1044

Ghosh, M., Natarajan, K., Stroud, T.W.F., and Carlin, B.P.(1998), "Generalized Linear Models for Small-Area Estimation", *Journal of the American Statistical Association*, 93, 273-282

Ghosh, M., and Rao, J.N.K.(1994), "Small Area Estimation: An Appraisal", *Statistical Science*, 9, 55-93

Rao, J.N.K.(1999), "Some Recent Advances in Model-Based Small Area Estimation", *Survey Methodology*, 25, 175-186

Spiegelhalter, D., Thomas, A., Best, N., and Gilks, W.(1996), BUGS 0.5, *Bayesian Inference Using Gibbs Sampling Manual*. MRC Biostatistics Unit, Institute of Public Health, Robinson Way, Cambridge CB22SR

You, Y., and Rao, J.N.K.(2000), "Hierarchical Bayes Estimation of Small Area Means Using Multi-Level Models", *Survey Methodology*, 2, 173-181

RESUME

Composite estimation and hierarchical Bayes estimation are used to adjust direct estimates of small areas presumed directly under large area survey design. Hierarchical Bayes inference using multi-level model and generalized linear model is implemented via Markov chain Monte Carlo integration techniques-in particular, using the Gibbs sampler. We compare hierarchical Bayes estimates with composite estimates obtained from whole data structure and check usefulness of hierarchical estimates which adjusted from auxiliary information of age-sex categories in each small area. Using some monthly data of unemployment estimated directly from the Economically Active Population Survey(EAPS) of Korea, we suggest that hierarchical Bayes model frameworks can be used for adjustment of small area estimates with high variation between and within areas.