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Estimation Gross Enrolment Rate of Higher Education in Bangka Belitung Island using Small Area Estimation

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Abstract

Quality education up to the highest level, especially in developing countries is the goal of sustainable development. One of the statistical indicators used to measure the success of education development at the universities education is the Gross Enrollment Rate - Higher Education (APK-PT). However, Statistics Indonesia (BPS) as the data provider can only provide APK-PT data up to the provincial level. In fact, local governments at both the provincial and district levels need more detailed data to make policies for higher quality education. According to BPS, the APK-PT Indonesia in 2019 is 30.28. This means that only 30.28 percent of the population aged 19-23 years are actively pursuing higher education. Therefore, estimation using the small area estimation method is used to obtain APK-PT at the district level. The Province of Bangka Belitung Islands is a research locus because it has the lowest APK-PT in Indonesia in 2019. This research uses the National Socio-Economic Survey (SUSENAS) 2019 data and PODES 2018 data. The results show that the Small Area Estimation (SAE) approach is Empirical Best Linear Unavailable Predictors (EBLUP) type Fay-Harriot Model is suitable for estimating APK-PT of Bangka Belitung Islands Province at district level.

Keywords: *AKP-PT; Quality Education; SAE*

Introduction

Ensuring the quality of education that is appropriate for all is one of the world's development agendas. In the Sustainable Development Goals, educational equality, especially for developing countries, is a priority goal. This is because not all countries, especially in developing countries, can provide opportunities for education up to the college level.

The Gross Enrollment Rate (GER) is one of the statistical indicators used to measure the educational attainment of a country. GER is the ratio between students at a certain level of education and the population of school age and expressed as a percentage. Currently, APK Indonesia is worrying about being at the college level (APK-PT). APK-PT is calculated from the total population aged 19-23 years (college age) compared to students who are currently attending university. According to the Central Statistics Agency, the National APK-PT is 30.28 in 2019. This means that the participation of the population taking higher education is only one third of the total school age population (19-23 years). When viewed at the provincial level, the Bangka Belitung Islands are the province with the lowest APK-PT in

Indonesia, which is 14.27 in 2019. Previously, the province with the title "Negeri Serumpun Sebalai" was also the lowest in terms of access to education at the level higher education in 2017 and 2018.

The low educational participation at the college level indicates the need for serious handling by local governments. Several factors contributed to this, namely facilities, access and education costs. Not all districts have higher education facilities, so it requires additional costs to access higher education institutions in other districts. In addition, geographically, the Bangka Belitung Islands Province consists of several islands with the two largest islands namely Bangka Island and Belitung Island. Therefore, access for residents of suburban regencies must be by sea or air. This also leads to high travel costs.

Literature Review

SAE is a small area parameter estimation technique that utilizes information from within the area itself, outside the area, and from the results of surveys or other censuses (Longford, 2005). SAE was chosen because besides being able to be used for small area level estimates, it is also able to reduce the standard error by a small amount (Hidiroglou, 2007). In SAE, there are two commonly used models, namely implicit and explicit models. The implicit model is used based on the sampling design used in the direct estimation process. Furthermore, an explicit model is used based on the random area effect of small areas obtained by the diversity of the accompanying variables. Explicit models include EBLUP and Empirical Bayes (EB) (Rao, 2003).

In making policies related to education that are right on target, local governments need to use valid data. However, currently BPS is only able to present the APK-PT indicator at the provincial level due to sample limitations. Therefore, an estimation method is needed to be able to obtain the APK-PT indicator at the Regency / City level in the Province of Bangka Belitung Islands. Thus, it is hoped that the estimated data can help local governments make policies to deal with problems related to low education.

A solution to this problem is to use the Small Area Estimation (SAE) method to obtain an estimate of APK-PT at the Regency / City level of the Bangka Belitung Islands Province.

Methodology

The data used in this research for the estimation of APK-PT is Survei Sosial Ekonomi Nasional (Susenas) 2018. The auxiliary variables are taken from the 2018 Podes Data for Bangka Belitung Islands Province.

SAE-EBLUP using companion variable data to build a model. EBLUP is a parameter estimation model using General Linear Mixed (GLM) which is designed for continuous variables and is less suitable for binary data. The general form of the GLM model is:

$$\hat{\theta} = X\beta + Zv + e$$

where:

$\hat{\theta}$ = random vector from the observed response variable of size n x 1

X = matrix (n x p) of the predictor variable whose elements are known

β = unknown and unobservable fixed parameter vector of size p x 1

Z = matrix (n x q) of the predictor variable whose elements are known

v = random vector of unknown and unobservable parameters q x 1

e = unobservable random error vector of size nx1

The Fay-Herriot model for the basic area level model (Rao, 2003) is as follows:

$\hat{\theta}_i = x_i^T\beta + v_i + e_i$, i=1,2,....,m

$= \theta_i + e_i$

where:

x_i = vector px1 area level companion variable

v_i = small area random effect

e_i = sampling error

The Fay-Harriot model is then used in parameter estimation using the EBLUP approach. When σ_v^2 is known, EBLUP becomes the Best Linear Ungawai Predictor (BLUP) estimator as follows:

$\tilde{\theta}_i^{BLUP} = \gamma_i\hat{\theta}_i + (1\text{-}\gamma_i)\, x_i^T\tilde{\beta}$

where:

$\hat{\theta}_i$ = direct estimate of the ith area (i = 1, ..., m)

m = number of areas

$\gamma_i = (\frac{\sigma_v^2}{\varphi_i+\sigma_v^2})$

σ_v^2 = variance of area random effect

φ_i = MSE$(\hat{\theta}_i) = \frac{si^2}{ni}$

s_i = standard deviation from the ith area

n_i = number of samples of the ith area

x_i = variable accompanying area it-i

$\hat{\beta}$ is the regression coefficient estimated by the Generalized Least Square (GLS):

$$\hat{\beta} = \hat{\beta}(\sigma_v^2) = \left[\sum_{i=1}^{m}\frac{x_i x_i^T}{\varphi_i+\sigma_v^2}\right]^{-1}\left[\sum_{i=1}^{m}\frac{x_i\hat{\theta}_i}{\varphi_i+\sigma_v^2}\right]$$

The Relative Standard Error is a measure of the convergence of the resulting estimates. Score RSE is obtained from the ratio of the square root value of MSE to the estimated value of the response variable. It's getting smaller the RSE value of an estimator against other RSE means the better the estimator. Score RSE is obtained by the following calculations:

$\text{RSE}_i = \frac{\sqrt{MSE_i}}{\hat{\theta}_i}$ X 100%

Result and Discussion

The direct estimation of APK-PT at the Regency/ City level was carried out using Susenas 2018. The results showed that Pangkalpinang City had the highest APK-PT rate in the province of Bangka Belitung Islands, which was 29.77 percent. The lowest APK-PT value is owned by West Bangka Regency at 7.84 percent. The following are the results of the direct estimation along with the Relative Standard Error which are presented in Table 1.

Based on Table 1, the average RSE value is quite large, namely 26.08 percent (above 25 percent). This is due to the limited sample of SUSENAS in each district / city. Therefore, the data will be estimated using Small Area Estimation to obtain a lower RSE.

Before using the Small Area Estimation method, first the normality test was carried out on the APK-PT at the district / city level. Based on the results of the normality test using the Kolmogorof-Smirnov test, the Kolmogorof-Smirnov statistical value was obtained of 0.930 and a p-value of 0.341. Because the p-value is more than 0.05, it can be concluded that the direct estimation data for the APK-PT at the regency / city level in Bangka Belitung Islands Province is normally distributed. So that in this case the SAE method EBLUP approach can be used.

Furthermore, the selection of the accompanying variables was taken from the 2018 PODES data. The companion variables that had the highest and statistically significant correlation were the number of economic facilities in the form of minimarkets / supermarkets (X1) with a Pearson correlation value of

0.94; the number of private colleges / universities (X2) with a Pearson correlation value of 0.73; and the number of private commercial banks (X3) with a Pearson correlation value of 0.67.

The results showed that the SAE method EBLUP approach with REML procedures resulted in the estimated value of APK-PT at the district / city level in Bangka Belitung Islands Province which had better accuracy than the direct estimation results and ML procedures. This can be seen from the Figure 1.

Table 1.

Direct Estimates of APK-PT, RSE, and Number of Sample Households

Regency/City	APK-PT	RSE	Number of sample households
Bangka	9.6	24.92	55659
Belitung	13.38	25.38	53167
Bangka Barat	7.84	34.48	53129
Bangka Tengah	10.25	24.63	50571
Bangka Selatan	13.34	25.85	40489
Belitung Timur	9.18	31.81	35992
Pangkalpinang	29.77	15.53	32168

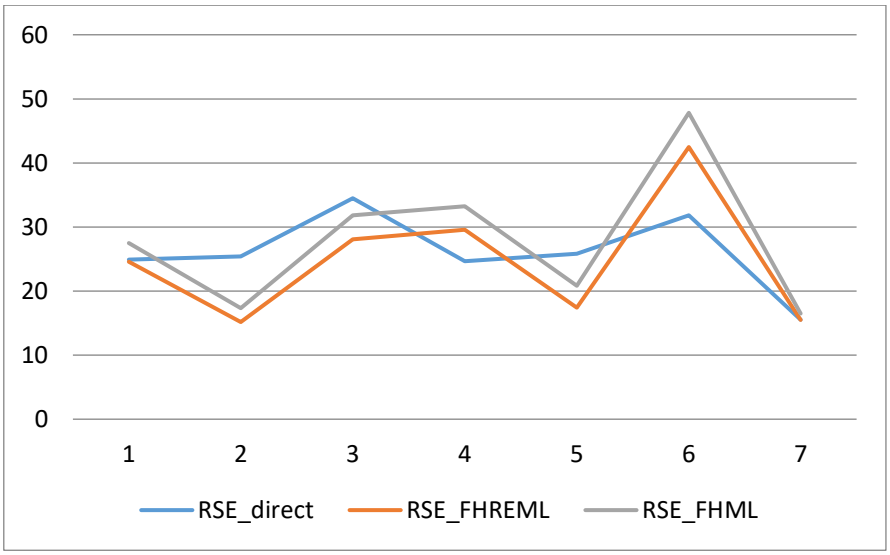

Figure 1.

Comparison of RSE between direct estimation and SAE method

Conclusion

Based on the results of the study, it can be concluded that the use of SAE estimation by the Fay Harriot REML method matches the APK-PT data compared to the direct estimation and the SAE method of Fay Harriot-ML with the lowest RSE value, namely 24.68 percent.

References

Hidiroglou, M. (2007). Small-Area Estimation: Theory and Practice. In Proceedings of the Survey Research Methods Section, 3445-3456.

Longford, N.T. (2005). Missing Data and Small Area Estimation: Modern Analytical Equipment for the Survey Statistician. New York: Springer Science+Business Media, Inc.

Rao, J. (2003). Small Area Estimation. United States of America: John Wiley & Sons, Inc.

Perguruan Tinggi Provinsi Papua melalui Small Aera Estimation, 104-109.

Subandriyo, B., Ikhsan, E., Muchlishoh, S. (2019). Estimasi Angka Partisipasi Kasar