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Analysis of Poverty in Village Level of Indonesia with Small Area Estimation: Case in Bangkalan District

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Analysis of Poverty in Village Level of Indonesia with Small Area Estimation: Case in Bangkalan District

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1. Introduction

A survey produces a sample statistic which is used to estimate a population parameter. Sample statistic in the form of totals, averages or other estimations will capture a phenomenon that happens in a region. Statistics will then be used as a basis for public policy-making. In a developing country like Indonesia, the needs of data for policy-making go until the lowest level of administration. The change in the state administration system from centralization to decentralization also enhances the importance of it.

Data and representative information about an area in the province, districts, or even villages are much needed. Local governments need it as a reference for planning, implementing, monitoring, and evaluating any regional policy programs. For example, in the planning stage, the stakeholders have to determine a plan on which targets that need to be prioritized first. Lack of precise data in the beginning often results in the ineffectiveness of a program implementation.

The needs on lower level of administration are quite difficult to fulfill due to the unavailability of data in the smaller areas, such as data on sub-districts or villages level. The registration data in most provinces in Indonesia might not available until the lower level areas. On the other hand, some of the national surveys conducted by BPS-Statistics Indonesia cannot be used for estimating parameters in smaller areas. This is because of the small number of samples taken in a smaller area so that it does not meet the sample adequacy requirements for the direct estimation. Estimation using a small number of samples will result in a high standard error and its precision is doubted.

Policy program in reducing poverty requires complete and accurate information that goes to the lowest level of a region. Accurate information at a small regional level is a basic need for setting regional targets in determining policy. Elbers, et al. (2007) stated that programs that have a positive impact on poverty alleviation are originated from setting regional targets. In order to achieve the target of SDGS on eradicating poverty, a small area estimation of poverty indicator is absolutely needed in Indonesia.

2. Literature Review

There are two basic models based on the supporting variables, namely the model level area and the unit level model. The model level area is used if supporting variables are obtained from the security data. Meanwhile, the unit level model used if the supporting variable is individual data. Unit level models are richer in information and are able to obtain results more efficient than just using aggregate data for an area (Molina and Rao, 2010). The most complete and up to date supporting data regarding households in Indonesia today are the 2010 Population Census (SP2010). Therefore, the SP2010 is a good supporting information to be used forvarious studies on small areas (Citro, et al., 2007).

Two methods use unit level models in estimating small area is empirical bayes (EB) and the method developed by Elbers, Lanjouw and Lanjouw (ELL). These methods are now of concern regarding a small area and is widely used for research in several countries in the world (Guadarrama, Molina, and Rao, 2016). The ELL method uses the classical approach by estimating the distribution of data with the regression model on generally. Meanwhile, EB is a model that integrates the Bayesian approach and classic. The prior distribution of the empirical bayes method is estimated first through data (Agnessia, 2012).

Small area estimation (SAE) is a method for estimate smaller area by utilizing information from outside the area, within that area itself, and from outside the survey (Longford, 2005). Approach that can be done to obtain small area statistics is through indirect estimation (indirect estimation), namely by utilizing information on other variables related to the observed parameters. This method uses additional information that make it possible to link survey data with administrative data role as additional data by borrowing strength (borrowing strength) in order to obtain a more efficient estimate(Gosh & Rao 1994).

The main problem with SAE is finding predictors that can trusted from small sized samples. This statistical technique is obtained to estimate parameter values for

subpopulations in a survey. That method done using a model based approach (model based) which connecting observed variables from a small area with other information regarding this small area (Rahman, 2008). Variable value of a small area. This is obtained by utilizing data from large area survey results such as census data or cantonal data. Estimates of the characteristics of small areas can also be divided into implicit models and explicit models. The use of implicit models with fixed influence for a small area will becomes inefficient if only a few sample units are used. Therefore it required a basic approach that combined fixed influence with random effects (distinctions between areas), which form a mixed influence model or explicit model.

The small area base model or what is often referred to as the explicit model which includes random area effects are the basic area level model and basic unit model level. The basic area level model is based on the availability of supporting data which only exists for certain area levels. The basic unit level model is a models with supporting data available are individually relevant with response data. In addition, there are also capable small area models handles special cases and is a capable general model includes other small area models, namely general linear mixed models. The small area model that is widely used is a special case of general mixed linear model that combines fixed and random area effects. Parameter of the model can be expressed as a linear combination of the effects of the mixture (Rao, J. N. K and Ghosh, 1994).

The variables used in this study are the same variables in the Susenas and Population Census, except for the average household expenditure variable that is only contained in the Susenas. These variables are selected based on monetary and non-monetary variables in determining poverty incidence as in the research of Persaud (2005), Haughton J., and Khandker (2009) and BPS non-monetary indicators in the Study of Determining the Criteria of the Poor Population (SPKPM), namely :

1. Average per capita expenditure per month
2. School status of the head of the household
3. The highest education of household heads
4. Working status of the head of the household
5. Field of business of the head of the household

6. Defecation facilities

7. Home lighting sources

8. Floor

9. Household internet access

10. Number of household members

3. Methodology

3.1 Data

The location chosen in this study is Bangkalan Regency in East Java Province which has 281 villages. The data used in this study are from the 2016 National Socioeconomic Survey (SUSENAS), and the 2010 Population Census (SP). The variables used in this study are available in the SUSENAS and SP data, except for the variable of the average household expenditure that is only contained in the SUSENAS.

3.2 Nested Error Linear Regresion Model

Battese and Fuller (1982) proposed this model to estimate the characteristics of a small area. This model is a special form of the Generalized Linear Mixed Model which includes fixed effects and random effects. The model is written as follows:

$$Y_{dj}=x'_{dj}\beta+u_d+e_{dj}; \quad j=1,\ldots,N_d, \quad d=1,\ldots,D$$

where

y_{dj} - the characteristic that is observed from the small area of the *d-jth* unit

x_{dj} - vector of supporting variables from the *j-th* unit to the *d-th* unit containing *k* variables

β - unknown parameter vector from the model

u_d - random effect area that is normally distributed

e_{dj} - random error that is normally distributed

The value of the parameter is estimated using the Restricted Maximum Likelihood (REML) method. This method is the development of the Maximum likelihood (ML) when the value is biased. REML is a ML that transforms the dataset first so that it can reduce the bias that can be formed when the data is not transformed

3.3 ELL Method

The first concern is to develop an accurate empirical model of y_{dj}, namely household expenditure per capita j in cluster sample d. A linear approach to conditional distribution y_{dj}.

$$\ln y_{dj} = E\left[\ln y_{dj} | x_{dj}\right] + u_{dj} = \mathbf{x}_{\mathbf{dj}}^{'}\boldsymbol{\beta} + u_{dj}$$

where

y_{dj} - the characteristic that is observed from the small area of the *d-jth* unit

$\mathbf{x_{dj}}$ - vector of supporting variables from the *j-th* unit to the *d-th* unit containing *k* variables

$\boldsymbol{\beta}$ - unknown parameter vector from the model

u_d - random effect area that is normally distributed

e_{dj} - random error that is normally distributed

ELL Method is a new method that is developed to estimate the level of welfare and inequality at lower aggregation levels such as sub-districts or villages. The process starts from using the household expenditure model from survey data to estimating household welfare and then applying it to the census data that does not contain information about household expenditure or income.

ELL Method consists of three stages. In the first stage, census and survey data are checked for suitability. Only variables with the same definition and distribution are allowed to be used in the second or modeling stage. At the modeling stage, regression is run for the expenditure model and describes random components that cannot be explained by the model. Furthermore, the third stage is known as the simulation stage. Simulation phase uses model parameters and repeat randomization on different random components for bootstrapping

household expenses. The estimated level of household welfare is then aggregated at different levels.

Users of this manual should always refer to the research from Elbers, Lanjouw and Lanjouw (2001). ELL Method is a method that can be used for poverty mapping by implementing the estimated expenditure function. Cluster is a term for the level of aggregation in survey and census datasets.

3.4 Empirical Bayes (EB)

$$\xi: \; Y_{dj}=\mathbf{x}'_{\mathbf{dj}}\boldsymbol{\beta}+u_d+e_{dj}; \qquad j=1,\ldots,N_d, \quad d=1,\ldots,D$$

$$u_d \sim \text{iid } N(0,\sigma_u^2),$$

$$e_d \sim \text{iid } N(0,\sigma_e^2),$$

where

y_{dj} - the characteristic that is observed from the small area of the *d-jth* unit

$\mathbf{x_{dj}}$ - vector of supporting variables from the *j-th* unit to the *d-th* unit containing *k* variables

$\boldsymbol{\beta}$ - unknown parameter vector from the model

u_d - random effect area that is normally distributed

e_{dj} - random error that is normally distributed

The estimation steps are as follows.

1. Data Preparation

   The data used in this method is the same as the data used also in the ELL method, namely the 2017 SUSENAS and SP2010 data. It is suggested to be able to obtain openness between methods. But in the EB method the household units that are sampled in the survey are called 'samples', while the household units in the census are called 'samples'.

2. Estimated release coefficient from survey data and model simulation.

   This stage is carried out the same in the second and third methods of the ELL. This supports to obtain the best model that has the same independent variables in the ELL method and the EB method. The independent variable between the EB and ELL methods was carried out for the transparency model used in the second method. After estimation, a nested linear regression model is used. This estimation uses the variables that are in the best model estimation results using the OLS method in the previous process.

3. Decompose the error from the estimation results of the equation with nested error linear regression into a component of random area effects and model errors.

   Estimated regression coefficients from survey data will be linked to census data. Meanwhile, in the regression model there are always variations that are not reflected in the regression coefficients. These variations are random error components. Therefore, it is necessary to know the variation of random error components so that they are able to represent the real situation. These random component variations can be decomposed into cluster effects (ud) and household effect components (dj).Calculate the direct estimate of poverty indicators for each village for the National Socio Economic Survey data (Susenas).

4. Calculate indirect estimates of poverty indicators for each village for Census data.
   a. Estimation of unknown parameter θ from the distribution of vector y transformations using sample data $y_s$using ML or REML (steps 3 and 4).
   b. Predictions y_r through the regression model obtained from (a).
   c. Take randomly vector $y_r^{(l)}$ with L is the number of simulations, description l=1, ...,L.
   d. Combine each vector $y_r^{(l)}$ number L with sample data y_s to form a population vector (or census) vector$y_r^{(l)} = \left(\left(y_s^{'}, \left(y_r^{(l)}\right)\right)'\right)$ l 1, ..,L. By using elements from $y_r^{(l)}$ for the dth area, $y_d^{(l)} = \left(\left(y_{ds}^{'}, \left(y_{dr}^{(l)}\right)\right)'\right)'$ calculates the parameters you want to know from a small area.

The Monte Carlo approach to EBP d is obtained by averaging the values of small area parameters for populations from simulations as many as L.

$$P_d = \frac{\sum_{j=1}^{Nd} P_j}{N_d}$$

where

P_d - proportion of poor households in the village to-*d*

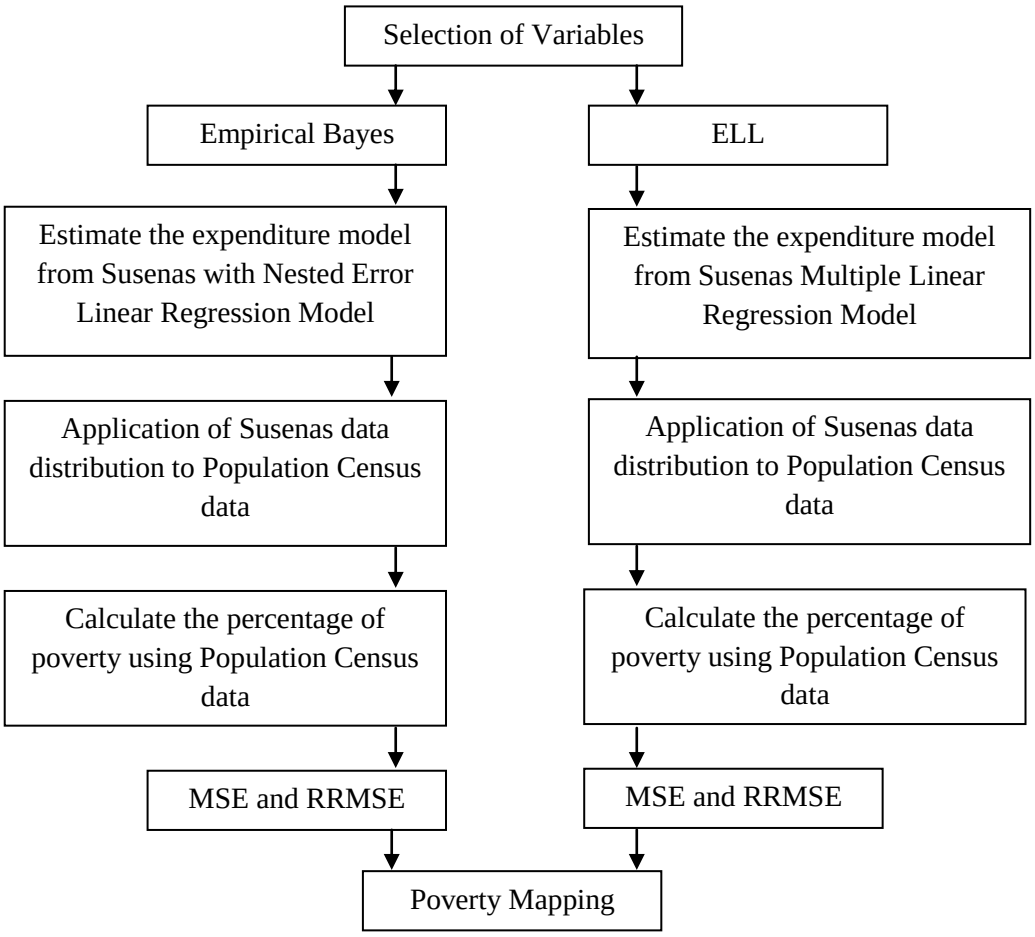
P_j - indicator of poor or poor households, 0 if per capita household expenditure > poverty line and 1, if per capita household expenditure > poverty line

3.5 Poverty Measurement

Poverty measurement, in Todaro and Smith (2004) a country can be said to be poor if it is below the poverty line. In the BPS concept, macro poverty indicators are obtained using the household expenditure approach. The amount of expenditure (in IDR) to meet the minimum basic needs of food and non-food is called the poverty line. Residents who have an average monthly per capita expenditure below the poverty line are categorized as poor people. The poverty line that is used as a basis for categorizing whether or not a poor household consists of the Food Poverty Line (NFPL) and Non-Food Poverty Line (NFPL).

The poverty estimation procedure in the research is to apply the ELL method developed by Elbers, Lanjouw, and Lanjouw (2003) and empirical bayes which refers to the procedure developed by Molina and Rao (2011). Both methods will be used to estimate poverty at the village level. Poverty estimation uses the ELL method and empirical bayes uses two data sources, namely the 2017 SUSENAS and the 2010 SP. The use of SUSENAS data aims to get the most updated results on the current poverty situation. Meanwhile, the population census contributes the most complete supporting information about all individuals in a village. Supporting information is an important component in small area estimation that has "borrowing strength" or borrowing strength from supporting data. With supporting information, effective sample sizes can be increased so as to be able to estimate population characteristics at the small area level.

Figure 1. Stage of Empirical Bayes and ELL Method to Estimate Poverty Indicator



4. Result & Analysis

4.1 Estimation of Percentage of Poor Households in Bangkalan District

4.1.1 ELL method

Estimated Equation of Expenditures from Survey Data

The selection of variable is done from 9 SPKPM variables to obtain a combination of variable that are able to produce the best models. The best model is one that is able to fulfill the regression assumptions and produce the largest R^2 value. Based on the results of X variable selection included in the model, the best model with five X variables is obtained. The X variable combination that produces the best model is the main business field of the household head, the number of household member, the type of floor used, the status of the school household head, and highest education of household head. The estimated regression coefficient for the household model is

$$\ln \widehat{\_expenditure} = 14.2417 - 0.229 * \widehat{business\ field} - 0.233 * floor - 0.616 * school - 0.386 * education - 0{,}121 * number$$

P-value F-test = 0.0000

* significant $\alpha = 5\%$

where

expenditures - natural logarithms of per capita expenditure of households

business field - head of household's main business field

number - number of household member

floor - type of house floor used

school - head of household's school status

education - head of household's last education

Based on the simultaneous test of the equation above, with a *p-value* is less than 0.05, it indicates that at a significance level of 5 percent the explanatory variables jointly influence the response variable. In other words, among the head of household's main business field variables, head of household's school status, head of

household's education, the number of household members, and the type of floor there is at least one variable that significantly influences the household per capita expenditure variable. Meanwhile, in partial testing, all explanatory variables have p-values less than 0.05. This shows that at a significance level of 5 percent, the category of agricultural business field, never attended school, the highest level of primary school education, and the type of less feasible floor significantly different than the reference category. Meanwhile, the number of household member variable significantly influences the household expenditure per capita variable

Assumption testing is carried out on the household expenditure equation. There are three assumptions tested, namely normality, multicollinearity and homoscedasticity. For normality and multicollinearity are fulfilled. But there is problem with heteroscedasticity. The unfulfilled homoscedasticity assumption causes the regression coefficient estimator to be no longer efficient in both small and large samples (asymptotically). In addition, the resulting variance will underestimate (overestimate) or overestimate (overestimate). The underestimate or overestimate variance needs to be overcome by a method that is able to overcome the heteroscedasticity.

Therefore, to overcome the violation of the homoscedasticity assumption is to estimate robust standard error at each coefficient. After fulfilling the assumptions of normality, non-multicollinearity, and homoscedasticity in the model, it can be interpreted to estimate the coefficient of the equation.

Based on the equation above, the coefficient of business field -0.22293 shows that households whose heads working in agriculture have per capita expenditure 20.5 percent lower than non-agriculture. The floor type coefficient used is -0.233, which shows that houses with less decent floor types have per capita household expenditure of 20.8 percent lower than those using appropriate floor types. The school status coefficient of -0.615 shows that households with a household head who have never attended school have 45.4 percent lower per capita expenditure than households with a household head who have / are still in school. The final education coefficient of the household head is -0,386, indicating that households whose head only attain primary education have 32.1 percent lower per capita household expenditure compared to the head of a household with a final education above elementary school. Meanwhile, the coefficient on the number of household member is -0.121, indicating that every

increase of one member of household will be followed by 12.1 percent decrease of the household expenditure per capita.

Calculation of Percentage of Poor Households on Population Census Data

The estimated value of per capita expenditure for households in the 2010 SP data will be used to calculate the percentage of poor households in each village. The estimated value of household expenditure per capita is obtained by multiplying the estimated regression coefficient in the SUSENAS data with the variable on census data. By using bootstrap resampling, the percentage of poverty obtained for the district level is 18.4 percent.

4.1.2 Empirical Bayes Method

Estimated Equation of Expenditures from Survey Data

In empirical bayes, the expenditure model formed is the same as the best model obtained in the ELL method. However, the regression used is a nested error linear regression model with the estimated equation as follows:

$$\ln \widehat{\_expenditure} = 14.117 - 0.141 * \widehat{business\ field} - 0.233 * floor - 0.616 * school - 0.386 * education - 0{,}121 * number$$

where

expenditures - natural logarithms of per capita expenditure of households

business field - head of household's main business field

number - number of household member

floor - type of house floor used

school - head of household's school status

education - head of household's last education

Based on simultaneous testing of the above equation, with a p-value of less than 0.05, it indicates that at a significance level of 5 percent the explanatory variables jointly influence the response variable. Meanwhile, in partial testing, all explanatory variables have p-values less than 0.05. This shows that at the 5 percent level of significance, the category of agricultural business fields, which had never attended

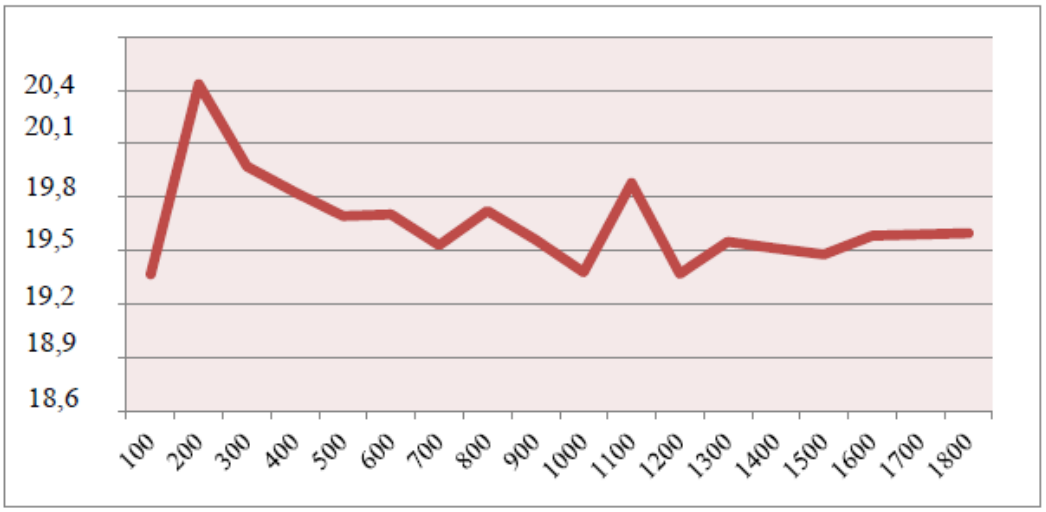
school, the highest level of primary school education, and the type of flooring that was not appropriate, were significantly different from the reference category. Meanwhile, the number of household variable significantly influences the household expenditure per capita.

Based on the equation using nested error linear regression, the coefficient of business value (-0,141) shows that households whose heads work in agriculture have a per capita expenditure 13.2 percent less than heads working in non-agriculture. The floor type coefficient used is -0.136, indicating that a house with a floor type that is less feasible has a per capita household expenditure of 12.8 percent lower than that using a decent floor type. The KRT school status coefficient of -0.536 indicates that households with a household head who have never / never attended a school have per capita expenditure 41.5 percent lower than households with a household head who have / are still in school. The final education coefficient of the household head is -0,362, indicating that households with a household head with a primary education have 30.4 percent lower per capita household expenditure compared to a household head with an education level above primary school. Meanwhile, the coefficient on the number of household is -0.109, indicating that every increase in one number of household, household expenditure per capita will decrease by 10.9 percent.

Simulation of Calculation of Percentage of Household Poverty

Parameters from the SUSENAS distribution that were previously estimated, are used to estimate per capita household expenditure in the Census data. By implementing the Monte Carlo method, per capita household expenditure can be calculated on the SP data. The number of simulations performed is to obtain convergent estimation results.

Figure 2. Simulation of the Percentage of Poor Households in Bangkalan Using the Empirical Bayes Method, 2017



In the figure above, it can be seen that the district level estimation of the percentage of poor people varies considerably depending on the number of iterations performed. One of the purposes of doing simulations using the carlo method is so that the conditional distribution that has been previously estimated is able to provide a consistent value. Table 1 shows that in the 1998 simulation, the percentage of poor people in Bangkalan District was consistent at 19.54 percent. This value indicates that the empirical bayes method is able to predict the percentage of poor people in Bangkalan Regency well. This is because the estimated value of the percentage of poor people produced in the empirical bayes method has a small deviation with the percentage of the poor population from the actual Susenas 2017 data.

Comparison of the Results of the Empirical Bayes Method and the ELL Method

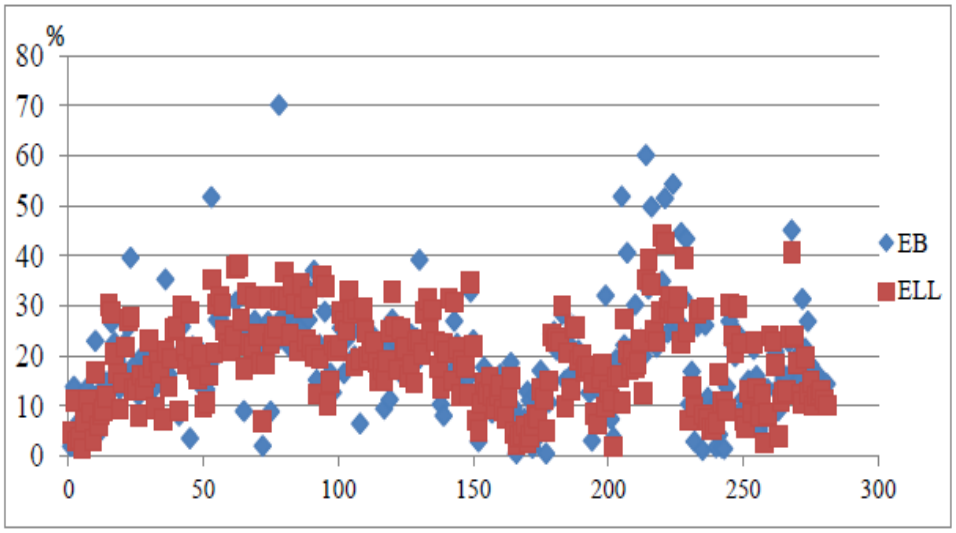
After calculating the estimated percentage of household poverty in the empirical bayes and ELL methods with the steps previously described, a comparison of results is made. The results compared between the two methods are the estimated value of the presentation of poor households at the village level, the aggregation of the percentage of poor households at the district level, MSE and RRMSE for village level estimates, and village level poverty mapping.

4.1.3 Percentage of Poor Households at Village Level

The estimated value of the percentage of poor households at the village level using the EB and ELL methods is in Appendix 6. In the EB method, the village that has the highest percentage of poor households is in Desa Kanegarah by 70 percent and the lowest is Mlajah Village by 9 percent. Likewise in the ELL method, villages that had the highest percentage of poor households at the village level were in Kokop Village at 43.96 percent and the lowest was Tanjung Jati Village at 1.42 percent.

In Figure 3, it can be seen that there are indeed differences in estimation results between the two methods, but not far enough. That can be shown from the results of the Pearson correlation coefficient of 0.733 and significant with a p-value less than 0.05. The Pearson correlation coefficient results indicate that villages that have a high percentage of poverty in the EB estimation results also have a high percentage of poverty in the ELL estimation results.

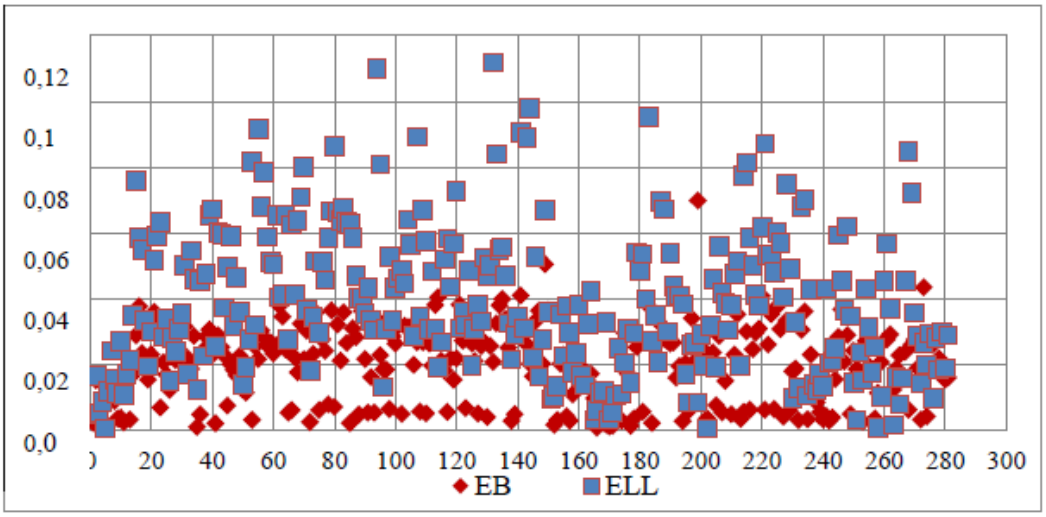
Figure 3. Estimation of Percentage of Poor Households in Village Level in Bangkalan District, 2017



4.1.4 Precision Review

A good review both method, EB and ELL methods, are carried out with regard to the MSE and RRMSE values. In Appendix 8, it can be seen that both the EB method and the ELL method have small MSE bootstrap values. This shows that the estimation results obtained through both methods are good and reliable.

Figure 4. MSE Results from the Estimated Percentage of Poor Households in the Village Level in Bangkalan Regency, 2017



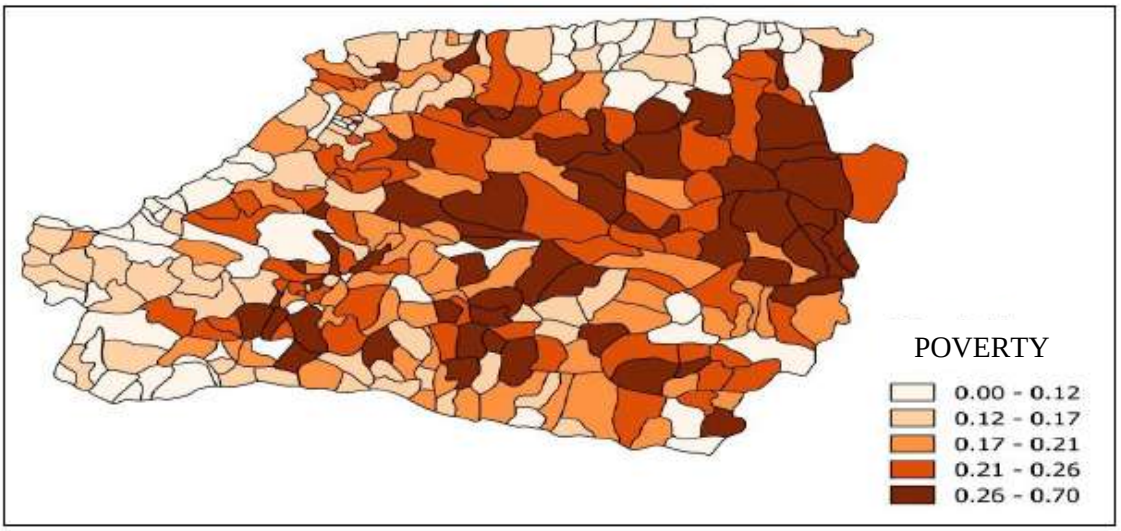
4.1.5 District Level Aggregation

The percentage of poor households between the results of calculations using the EB, ELL method, and the actual SUSENAS data does not differ much. Estimation results generated through the EB method are 19.53 percent. This value is almost the same as the value obtained from the 2017 SUSENAS actual data which is 19.3 percent. This shows that the estimation using the EB method is able to produce a percentage of poverty in Bangkalan Regency in 2017 that is no different than that obtained through direct estimation. Meanwhile, the value generated through the ELL method is 18.41 percent. It underestimates when compared to the value obtained from SUSENAS actual data. However, the deviation of the value from the ELL method with the value from the direct estimation of the actual SUSENAS data also does not differ much, only about 1 percent.

4.1.6 Poverty Mapping

Poverty mapping is done from the estimation results using the empirical bayes method. The estimated percentage of household poverty at the village level can be seen in Figure 5. The villages with the highest percentage of poor households are Kanegarah, Dabung and Mandung. Meanwhile, the villages with the lowest poverty are Larangan Timur and Burneh Mlajah. Villages with the highest percentage of poor households tend to cluster and be close together.

Figure 5. Mapping of Village-Level Poverty in Bangkalan District Using the EB method, 2017



5. Conclusion

This paper finds that the general characteristics of the poor population in Bangkalan Regency are working with agricultural businesses, having low education, and have 6-8 member of household. Parameter estimation using small area estimation for village level is able to produce poverty estimators with small MSE and RRMSE. The estimation at the district level are able to produce a small deviation when compared to the poverty indicator resulted from the official statistics. The ELL method is closer to the results obtained through the 2017 Susenas actual data compared to the ELL method. The EB method on average has a smaller MSE bootstrap and RRMSE value than the ELL method.

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APPENDIX

Appendix 1. Multiple Linear Regression Result with Robust Standard Error

F (5, 737)	90,81
Prob F	0,000
R squared	0,36

Variable	**Coefficient**	**Robust Std. *Error***	**T**	**P >|t|**
Ln_capita				
Business field	-0,2293	0,0383656	-5.98	0,000
Number of household	-0,1209	0,009157	-13,2	0,000
Type of floor	-0,23321	0,0442661	-5,27	0,000
School status	-0,6159	0,0709067	-8,69	0,000
Education	-0,3862	0,0660884	-5,85	0,000
Constants	14.24695	0,067639	211.41	0,000

Source: Output Stata 13

Appendix 2. Normality, Heteroscedasticity and Multicollinearity

One-sample Kolmogorov-Smirnov test against theoretical Distribution Normal (std_resid)

Smaller group	D	P-value	Corrected
Std_resid:	0.0265	0.353	
Cumulative:	-0.0147	0.724	
Combined K-S:	0.0265	0.675	0.65

Source: Output Stata

Breusch-Pagan Godfrey test for heteroskedasticity

Variables: resid

chi2(1) = 34.35

Prob > chi2 = 0.0000

Source: Output Stata

Multicollinearity

Variable	**VIF**
School status	3,26
Education	2,95
Business Fields	1,19
Type of floor	1,09
Number of household	1,02

Source: Output Stata

Appendix 3. Simultaneous and Partial Test of *Nested Error Linear Regression*

Likelihood ratio

p-value = 0.000

Wald test

	Value	Std.*Error*	DF	t-value	p-value
Xs(Intercept)	14.117264	0.06938977	666	203.44878	0.0000
Xsxs_bener_1industry	-0.140999	0.03613611	666	-3.9018	0.0001
Xsxs_bener_1floor	-0.136175	0.04512193	666	-3.01794	0.0026
Xsxs_bener_1school_att1	-0.536702	0.06067335	666	-8.84577	0.0000
Xsxs_bener_1edu1	-0.362438	0.05441450	666	-6.66069	0.0000
Xsxs_bener_1art	-0.109245	0.00857008	666	-12.74726	0.0000

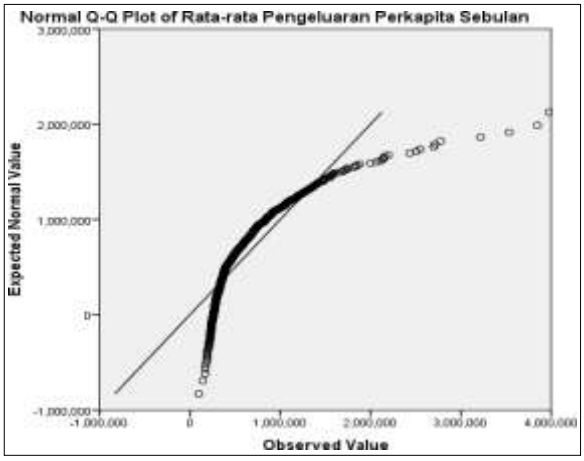
Source: Output R

Appendix 4. Normality Test with Kolmogorv Smirnov

D = 0.0298, p-value = 0.5224
Alternative hypothesis: two-sided

Source: Output R

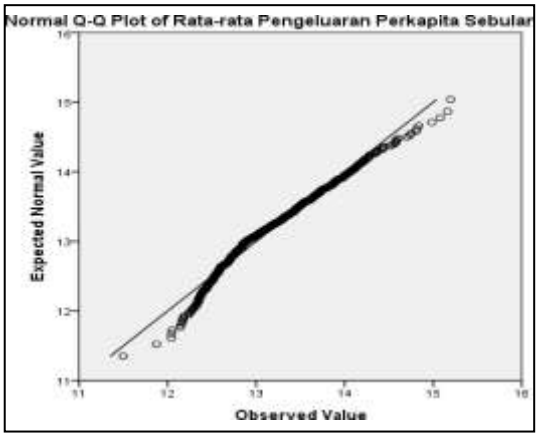
Appendix 5. Q-Q plot on Monthly per Capita Expenditure



A. Before ln transformation

Source: *Output* SPSS

B. After ln transformation



Source: *Output* SPSS

Appendix 6. Estimation Result of the Percentage of Poor Households at village level in Bangkalan, 2017

No.	District	EB	ELL
1	Tajungan	1.94	4.78
2	Gili Barat	13.84	11.00
3	Banyu Ajuh	5.28	3.05
4	Kamal	6.89	3.56
5	Tanjung Jati	4.89	1.42

No.	District	EB	ELL
6	Kebun	10.96	6.85
7	Gili Timur	13.55	11.18
8	Gili Anyar	11.41	8.57
9	Tellang	4.89	3.22
10	Pendabah	22.93	16.57
11	Kesek	4.46	6.05
12	Pangpong	12.40	8.53
13	Sukolilo Barat	13.63	9.11
14	Sukolilo Timur	14.71	11.81
15	Bunajih	29.44	30.22
16	Bringin	26.61	28.62
17	Ba'engas	22.71	20.45
18	Morkepek	19.26	16.50
19	Labang	13.40	9.35
20	Jukong	17.32	14.63
21	Sendang Laok	22.71	21.76
22	Sendang Dajah	25.71	27.22
23	Petapan	39.60	27.73
24	Tebul	17.80	13.21
25	Kwanyar Barat	15.61	13.22
26	Pasanggrahan	12.06	8.07
27	Karanganyar	19.67	16.14
28	Batah Barat	16.00	13.21
29	Batah Timur	18.86	15.89
30	Duwek Buter	22.62	23.07
31	Pandanan	20.71	17.83
32	Karang Entang	13.76	9.50
33	Janteh	20.91	19.06
34	Dlemer	18.72	16.57
35	Ketetang	17.27	7.34
36	Morombuh	35.26	20.78

37	Sumur Kuning	16.44	13.81
38	Paoran	20.29	19.48
39	Gunung Sereng	25.83	25.20
40	Pangpajung	19.57	25.59
41	Patereman	8.08	8.96
42	Kolla	25.75	29.87
43	Paeng	19.42	21.18

No.	District	EB	ELL
44	Neroh	18.87	18.42
45	Serabi Timur	3.55	28.68
46	Serabi Barat	21.84	21.52
47	Patengteng	18.69	17.20
48	Langpanggang	17.22	15.68
49	Suwaan	20.94	20.03
50	Modung	13.48	10.02
51	Brakas Dajah	13.28	10.66
52	Karanganyar	16.64	16.17
53	Manggaan	51.71	35.27
54	Glisgis	19.50	20.59
55	Pakong	27.13	30.41
56	Alaskokon	27.86	31.86
57	Gigir	26.60	30.16
58	Ko'olan	21.69	25.06
59	Pangeran Gedungan	23.12	22.58
60	Panjalinan	23.17	21.22
61	Rosep	22.79	24.02
62	Kampao	30.77	37.60
63	Lombang Laok	26.12	37.91
64	Lombang Daya	24.38	27.29
65	Karpote	8.93	17.40
66	Blegaoloh	18.13	32.52
67	Karang Gayam	21.57	22.39
68	Lomaer	20.97	21.97
69	Bates	27.02	31.76
70	Karang Panasan	22.48	24.16
71	Karangnangka	19.86	18.54
72	Blega	2.02	7.03
73	Nyor Manis	19.26	18.33
74	Alasraja	26.82	31.77

75	Kajan	8.89	22.54
76	Galis Dajah	22.17	24.21
77	Durin Barat	22.68	25.64
78	Kanegarah	70.13	31.06
79	Batokaban	27.61	31.65
80	Durin Timur	31.46	36.79
81	Pakes	26.79	31.38

No.	District	EB	ELL
82	Bandung	21.78	24.20
83	Konang	28.44	34.02
84	Senasen	26.14	30.29
85	Campor	22.76	21.02
86	Sambiyan	28.74	34.27
87	Cangkarman	26.11	29.67
88	Genteng	33.91	23.19
89	Pekadan	27.20	31.76
90	Kajuanak	21.07	21.88
91	Paterongan	36.96	20.08
92	Galis	15.23	12.28
93	Paka'an Laok	22.21	19.52
94	Kranggan Timur	33.77	35.78
95	Separah	28.81	33.93
96	Paka'an Daya	13.53	10.35
97	Longkek	16.50	14.89
98	Banyubunih	12.63	22.11
99	Daleman	21.65	21.05
100	Tellok	21.31	21.91
101	Blateran	25.60	28.64
102	Kelbung	16.47	26.92
103	Tlagah	23.29	25.06
104	Lantek Timur	27.52	32.91
105	Lantek Barat	24.78	28.60
106	Banjar	19.93	18.16
107	Bangpendah	28.21	29.25
108	Sadah	6.49	19.29
109	Sorpa	27.18	29.33
110	Pacentan	26.61	25.03
111	Baipajung	21.09	19.75
112	Tanah Merah Laok	22.39	20.58

113	Kranggan Barat	23.85	22.76
114	Pangeleyan	20.25	18.71
115	Padurungan	17.38	15.24
116	Petrah	18.69	17.34
117	Tanah Merah Dajah	9.41	15.21
118	Dumajah	21.07	18.81
119	Patemon	11.25	25.04

No.	District	EB	ELL
120	Tlomar	27.25	32.74
121	Kendaban	23.22	25.86
122	Jangkar	19.76	17.23
123	Pettong	16.55	25.33
124	Landak	22.21	21.37
125	Rongdurin	20.58	21.45
126	Batangan	19.38	16.01
127	Dlambah Dajah	24.27	18.40
128	Dlamba Laok	18.17	14.61
129	Mrecah	23.49	22.85
130	Buddan	39.18	23.10
131	Poter	22.85	20.51
132	Basanah	29.88	28.64
133	Alang Alang	30.04	31.38
134	Kemoneng	24.31	25.06
135	Soket Laok	27.83	29.21
136	Bajeman	22.43	22.81
137	Tambin	18.79	17.72
138	Soket Daya	10.30	13.61
139	Keteleng	8.04	22.35
140	Jaah	20.88	20.87
141	Bancang	30.78	31.56
142	Masaran	16.85	15.00
143	Pacangan	26.92	30.72
144	Pocong	22.43	21.49
145	Tragah	15.57	12.09
146	Karang Leman	20.81	18.82
147	Dukotambin	17.51	17.73
148	Jaddung	15.47	12.17
149	Banyu Bese	32.78	34.67
150	Pamorah	23.09	21.88

151	Junganyar	12.22	7.19
152	Socah	2.93	5.17
153	Buluh	13.67	10.50
154	Jaddih	17.68	14.61
155	Sanggra Agung	15.89	12.53
156	Parseh	13.50	15.73
157	Bilaporah	8.59	12.11

No.	District	EB	ELL
158	Keleyan	13.19	9.53
159	Petaonan	15.44	12.26
160	Dakiring	16.31	13.99
161	Pernajuh	12.39	9.20
162	Ujung Piring	11.64	7.69
163	Sembilangan	14.54	11.86
164	Kramat	18.57	15.52
165	Mertajasah	9.71	4.67
166	Mlajah	0.49	2.31
167	Kemayoran	7.27	3.91
168	Pangeranan	2.13	4.43
169	Demangan	7.42	6.07
170	Kraton	12.86	2.71
171	Pejagan	11.10	3.87
172	Bancaran	1.59	6.24
173	Sabiyan	12.02	7.95
174	Gebang	3.91	7.62
175	Jambu	17.02	13.28
176	Langkap	14.99	11.49
177	Burneh	0.51	5.07
178	Benangkah	10.73	15.04
179	Alas Kembang	24.20	24.19
180	Binoh	24.82	22.82
181	Perreng	21.16	23.49
182	Pangolangan	23.05	22.83
183	Sobih	28.35	30.07
184	Tonjung	15.06	9.83
185	Kapor	22.53	20.61
186	Arok	15.97	13.21
187	Pandan Lanjang	25.94	25.77
188	Batonaong	19.59	25.59

189	Glagga	21.13	19.19
190	Ombul	19.69	20.21
191	Balung	19.35	17.15
192	Lajing	18.08	17.83
193	Tengket	12.60	17.87
194	Arosbaya	3.05	14.58
195	Karang Duwak	18.11	8.31

No.	District	EB	ELL
196	Dlemer	13.31	6.43
197	Mangkon	12.73	15.55
198	Berbeluk	16.50	18.21
199	Cendagah	32.00	9.79
200	Karang Pao	14.54	12.87
201	Makam Agung	7.33	11.07
202	Plakaran	3.64	1.94
203	Buduran	19.27	15.74
204	Tambegan	15.76	15.94
205	Togubang	51.80	10.70
206	Lerpak	22.15	27.46
207	Geger	40.54	20.80
208	Batobella	18.80	17.42
209	Tegerpriyah	21.71	20.34
210	Campor	30.19	17.68
211	Kompol	21.42	18.51
212	Kampak	23.23	23.03
213	Kombangan	19.98	12.59
214	Dabung	60.09	35.25
215	Katol Barat	33.36	39.09
216	Banyoneng Laok	49.78	34.40
217	Banyoneng Dajah	23.27	24.89
218	Lembung Gunung	21.71	22.80
219	Amparaan	23.97	28.64
220	Kokop	34.92	43.96
221	Tlokoh	51.51	42.53
222	Durjan	24.58	29.44
223	Mano'an	27.24	31.79
224	Mandung	54.32	28.74
225	Bandang Laok	24.34	28.68
226	Tramok	26.83	31.73

227	Katol Timur	44.52	22.75
228	Banda Soleh	31.51	39.59
229	Dupok	43.37	24.70
230	Batokorogan	10.42	7.06
231	Planggiran	16.85	13.80
232	Tagungguh	2.92	9.76
233	Bandang Daya	25.90	28.55

No.	District	EB	ELL
234	Bungkeng	27.65	29.28
235	Larangan Timur	1.18	8.28
236	Tambak Pocok	26.10	29.42
237	Bumi Anyar	11.61	7.31
238	Paseseh	9.06	5.47
239	Telaga Biru	9.65	5.50
240	Tanjung Bumi	1.72	6.55
241	Macajah	4.30	16.37
242	Tlangoh	1.73	10.65
243	Banyu Sangkah	1.42	10.62
244	Aengtabar	13.80	9.16
245	Klapayan	26.89	30.11
246	Bangsereh	22.53	24.01
247	Kelbung	19.84	20.56
248	Saplasah	24.42	29.93
249	Gunelap	9.03	22.55
250	Tanagura Timur	11.51	7.29
251	Tanagura Barat	10.92	5.70
252	Banyior	15.05	12.91
253	Klabetan	10.79	8.66
254	Gangseyan	21.29	22.61
255	Maneron	15.94	13.52
256	Sepuluh	5.11	8.09
257	Prancak	8.52	12.25
258	Labuhan	7.17	2.68
259	Lembung Paseser	13.33	8.42
260	Tolbuk	23.21	24.00
261	Ra'as	22.58	22.91
262	Muarah	20.85	18.29
263	Polongan	8.98	3.86
264	Karang Asem	14.14	11.11

265	Bantean	15.55	12.42
266	Bragang	15.90	12.91
267	Lergunong	22.67	23.70
268	Panyaksagan	45.11	40.62
269	Larangan Glintong	23.60	24.04
270	Manonggal	19.91	18.52
271	Larangan Sorjan	15.32	12.37

No.	District	EB	ELL
272	Tenggun Daya	31.32	10.62
273	Bulung	21.44	19.75
274	Trogan	26.88	12.66
275	Ko'ol	18.16	14.92
276	Tobaddung	14.52	10.14
277	Mrandung	15.77	12.05
278	Buluk Agung	15.95	12.31
279	Bator	14.98	13.16
280	Klampis Barat	14.59	11.24
281	Klampis Timur	14.34	10.16

Source: Output R

Appendix 7. MSE of the Estimation of Poor Households at District Level in Bangkalan, 2017

No	District	MSE ELL	MSE EB
1	Tajungan	0.004422	0.001943
2	Gili Barat	0.0162	0.014998
3	Banyu Ajuh	0.005076	0.001038
4	Kamal	0.008642	0.006081
5	Tanjung Jati	0.000365	0.008306
6	Kebun	0.011586	0.01474
7	Gili Timur	0.024059	0.014522
8	Gili Anyar	0.015224	0.008751
9	Tellang	0.011237	0.003315
10	Pendabah	0.027016	0.003597
11	Kesek	0.01044	0.002113
12	Pangpong	0.016993	0.014215

13	Sukolilo Barat	0.021045	0.003009
14	Sukolilo Timur	0.034706	0.01684
15	Bunajih	0.075714	0.02864
16	Bringin	0.058445	0.037558
17	Ba'engas	0.054724	0.023292
18	Morkepek	0.033272	0.018172
19	Labang	0.019267	0.01514
20	Jukong	0.029831	0.022905
21	Sendang Laok	0.051374	0.035834

No	District	MSE ELL	MSE EB
22	Sendang Dajah	0.058893	0.032596
23	Petapan	0.063167	0.006719
24	Tebul	0.028232	0.020466
25	Kwanyar Barat	0.033626	0.016681
26	Pasanggrahan	0.014841	0.012057
27	Karanganyar	0.027804	0.030675
28	Batah Barat	0.023704	0.02103
29	Batah Timur	0.030358	0.024472
30	Duwek Buter	0.035141	0.022351
31	Pandanan	0.050152	0.031407
32	Karang Entang	0.016795	0.021653
33	Janteh	0.05453	0.018449
34	Dlemer	0.045872	0.028454
35	Ketetang	0.012295	0.000839
36	Morombuh	0.045264	0.00452
37	Sumur Kuning	0.022329	0.024004
38	Paoran	0.047462	0.028302
39	Gunung Sereng	0.065119	0.030408
40	Pangpajung	0.067153	0.022659
41	Patereman	0.025325	0.001902
42	Kolla	0.059942	0.02868
43	Paeng	0.059451	0.025113
44	Neroh	0.037028	0.022536
45	Serabi Timur	0.049552	0.007232
46	Serabi Barat	0.058853	0.019895
47	Patengteng	0.031645	0.018182
48	Langpanggang	0.046398	0.016398
49	Suwaan	0.035892	0.022366
50	Modung	0.013735	0.020508
51	Brakas Dajah	0.01885	0.011174

52	Karanganyar	0.027492	0.027719
53	Manggaan	0.081471	0.002968
54	Glisgis	0.031923	0.025326
55	Pakong	0.091569	0.021459
56	Alaskokon	0.067892	0.030158
57	Gigir	0.078552	0.027905
58	Ko'olan	0.058672	0.025624
59	Pangeran Gedungan	0.051161	0.026531

No	District	MSE ELL	MSE EB
60	Panjalinan	0.050278	0.023204
61	Rosep	0.065327	0.025722
62	Kampao	0.040192	0.037609
63	Lombang Laok	0.040924	0.034336
64	Lombang Daya	0.065115	0.024445
65	Karpote	0.027366	0.005117
66	Blegaoloh	0.062292	0.005926
67	Karang Gayam	0.040968	0.021896
68	Lomaer	0.06369	0.017344
69	Bates	0.070662	0.032232
70	Karang Panasan	0.08003	0.021358
71	Karangnangka	0.036463	0.030029
72	Blega	0.017921	0.002288
73	Nyor Manis	0.034384	0.022977
74	Alasraja	0.051212	0.035622
75	Kajan	0.029296	0.005946
76	Galis Dajah	0.051113	0.027404
77	Durin Barat	0.045421	0.023981
78	Kanegarah	0.058299	0.007622
79	Batokaban	0.066702	0.036317
80	Durin Timur	0.086344	0.006856
81	Pakes	0.066258	0.031938
82	Bandung	0.063707	0.020936
83	Konang	0.067469	0.035693
84	Senasen	0.063113	0.026331
85	Campor	0.062693	0.00198
86	Sambiyan	0.058313	0.030801
87	Cangkarman	0.046854	0.028055
88	Genteng	0.040095	0.004609
89	Pekadan	0.040044	0.036127

90	Kajuanak	0.035149	0.021409
91	Paterongan	0.043002	0.005178
92	Galis	0.033142	0.015974
93	Paka'an Laok	0.030188	0.005158
94	Kranggan Timur	0.110029	0.033574
95	Separah	0.080767	0.022637
96	Paka'an Daya	0.012896	0.018295
97	Longkek	0.030409	0.018269

No	District	MSE ELL	MSE EB
98	Banyubunih	0.052652	0.006162
99	Daleman	0.033195	0.028403
100	Tellok	0.043146	0.026197
101	Blateran	0.046027	0.031718
102	Kelbung	0.048314	0.004717
103	Tlagah	0.044519	0.031564
104	Lantek Timur	0.063956	0.031051
105	Lantek Barat	0.056349	0.031364
106	Banjar	0.02846	0.019715
107	Bangpendah	0.089107	0.026585
108	Sadah	0.034595	0.005432
109	Sorpa	0.066988	0.026593
110	Pacentan	0.057482	0.004813
111	Baipajung	0.030439	0.026116
112	Tanah Merah Laok	0.048241	0.02003
113	Kranggan Barat	0.030695	0.037949
114	Pangeleyan	0.019083	0.040329
115	Padurungan	0.026615	0.020959
116	Petrah	0.051791	0.018011
117	Tanah Merah Dajah	0.058138	0.005334
118	Dumajah	0.043529	0.021669
119	Patemon	0.05664	0.015171
120	Tlomar	0.072539	0.021648
121	Kendaban	0.030834	0.038021
122	Jangkar	0.036088	0.026985
123	Pettong	0.031805	0.006456
124	Landak	0.048298	0.027662
125	Rongdurin	0.019547	0.026166
126	Batangan	0.030586	0.020904
127	Dlambah Dajah	0.037945	0.004893

128	Dlamba Laok	0.03293	0.025421
129	Mrecah	0.052367	0.026654
130	Buddan	0.046638	0.003769
131	Poter	0.050057	0.025416
132	Basanah	0.111856	0.020567
133	Alang Alang	0.084044	0.032331
134	Kemoneng	0.054895	0.0378
135	Soket Laok	0.055559	0.039745

No	District	MSE ELL	MSE EB
136	Bajeman	0.046779	0.033685
137	Tambin	0.032361	0.024868
138	Soket Daya	0.021429	0.002625
139	Keteleng	0.028915	0.004646
140	Jaah	0.03436	0.030544
141	Bancang	0.090669	0.040783
142	Masaran	0.030891	0.031242
143	Pacangan	0.088875	0.025995
144	Pocong	0.097808	0.019983
145	Tragah	0.02181	0.016232
146	Karang Leman	0.052517	0.033118
147	Dukotambin	0.016033	0.036177
148	Jaddung	0.027551	0.020029
149	Banyu Bese	0.066858	0.050379
150	Pamorah	0.035905	0.036244
151	Junganyar	0.009144	0.009097
152	Socah	0.009955	0.001379
153	Buluh	0.013003	0.00292
154	Jaddih	0.035042	0.019966
155	Sanggra Agung	0.022342	0.022699
156	Parseh	0.037765	0.004002
157	Bilaporah	0.029422	0.002609
158	Keleyan	0.017288	0.010603
159	Petaonan	0.023217	0.016137
160	Dakiring	0.037827	0.014739
161	Pernajuh	0.016453	0.018914
162	Ujung Piring	0.013446	0.014727
163	Sembilangan	0.031995	0.014685
164	Kramat	0.042074	0.017042
165	Mertajasah	0.003054	0.009484

166	Mlajah	0.005687	0.000537
167	Kemayoran	0.01105	0.004794
168	Pangeranan	0.011683	0.002068
169	Demangan	0.032778	0.001525
170	Kraton	0.003046	0.000911
171	Pejagan	0.005076	0.001052
172	Bancaran	0.010239	0.002167
173	Sabiyan	0.024716	0.009568

No	District	MSE ELL	MSE EB
174	Gebang	0.010727	0.002685
175	Jambu	0.020309	0.029454
176	Langkap	0.030418	0.017136
177	Burneh	0.014178	0.001049
178	Benangkah	0.029192	0.003326
179	Alas Kembang	0.053948	0.025054
180	Binoh	0.048421	0.027094
181	Perreng	0.05331	0.005474
182	Pangolangan	0.039613	0.038853
183	Sobih	0.095095	0.037504
184	Tonjung	0.026723	0.001951
185	Kapor	0.03464	0.033994
186	Arok	0.020685	0.027347
187	Pandan Lanjang	0.069331	0.031936
188	Batonaong	0.06709	0.027634
189	Glagga	0.029851	0.02707
190	Ombul	0.053707	0.026203
191	Balung	0.043794	0.026441
192	Lajing	0.040563	0.015787
193	Tengket	0.040745	0.01929
194	Arosbaya	0.038232	0.002492
195	Karang Duwak	0.016873	0.020202
196	Dlemer	0.00813	0.005835
197	Mangkon	0.025761	0.033908
198	Berbeluk	0.026377	0.020782
199	Cendagah	0.008139	0.06977
200	Karang Pao	0.028857	0.02624
201	Makam Agung	0.019453	0.023997
202	Plakaran	0.000183	0.003409
203	Buduran	0.031757	0.018575

204	Tambegan	0.045714	0.023489
205	Togubang	0.01893	0.007352
206	Lerpak	0.055865	0.028477
207	Geger	0.041546	0.005114
208	Batobella	0.038525	0.014747
209	Tegerpriyah	0.030217	0.03051
210	Campor	0.037804	0.004633

No	District	MSE ELL	MSE EB
211	Kompol	0.047427	0.022763
212	Kampak	0.051208	0.035072
213	Kombangan	0.019417	0.003246
214	Dabung	0.077403	0.005371
215	Katol Barat	0.081248	0.029866
216	Banyoneng Laok	0.058455	0.006028
217	Banyoneng Dajah	0.05017	0.024387
218	Lembung Gunung	0.041164	0.029472
219	Amparaan	0.037772	0.030672
220	Kokop	0.061404	0.040599
221	Tlokoh	0.087022	0.006045
222	Durjan	0.053137	0.025848
223	Mano'an	0.05302	0.035166
224	Mandung	0.047891	0.006177
225	Bandang Laok	0.059862	0.037515
226	Tramok	0.056834	0.030636
227	Katol Timur	0.040338	0.003849
228	Banda Soleh	0.074691	0.033099
229	Dupok	0.049031	0.005765
230	Batokorogan	0.009417	0.01766
231	Planggiran	0.032785	0.018551
232	Tagungguh	0.012745	0.002811
233	Bandang Daya	0.067999	0.030266
234	Bungkeng	0.069946	0.035985
235	Larangan Timur	0.010258	0.003117
236	Tambak Pocok	0.04277	0.022814
237	Bumi Anyar	0.013723	0.015231
238	Paseseh	0.012189	0.008224
239	Telaga Biru	0.017002	0.005201
240	Tanjung Bumi	0.013049	0.00298

241	Macajah	0.042974	0.004163
242	Tlangoh	0.020287	0.002778
243	Banyu Sangkah	0.020746	0.003569
244	Aengtabar	0.0249	0.015262
245	Klapayan	0.059159	0.028198
246	Bangsereh	0.045112	0.036572
247	Kelbung	0.036225	0.02068

No	District	MSE ELL	MSE EB
248	Saplasah	0.061814	0.028776
249	Gunelap	0.034588	0.004653
250	Tanagura Timur	0.014253	0.024084
251	Tanagura Barat	0.002998	0.018384
252	Banyior	0.023494	0.022841
253	Klabetan	0.015057	0.002433
254	Gangseyan	0.042817	0.026889
255	Maneron	0.031097	0.019332
256	Sepuluh	0.017445	0.002275
257	Prancak	0.025122	0.003341
258	Labuhan	0.000551	0.01113
259	Lembung Paseser	0.010047	0.02045
260	Tolbuk	0.045117	0.027069
261	Ra'as	0.056602	0.02737
262	Muarah	0.036897	0.028978
263	Polongan	0.0013	0.012081
264	Karang Asem	0.015818	0.018635
265	Bantean	0.007653	0.022632
266	Bragang	0.015632	0.015399
267	Lergunong	0.045276	0.023662
268	Panyaksagan	0.084879	0.005999
269	Larangan Glintong	0.072144	0.025828
270	Manonggal	0.03564	0.027358
271	Larangan Sorjan	0.028274	0.018682
272	Tenggun Daya	0.013945	0.002974
273	Bulung	0.026456	0.043331
274	Trogan	0.019743	0.003947
275	Ko'ol	0.029187	0.018736
276	Tobaddung	0.009448	0.025758
277	Mrandung	0.027908	0.019339

278	Buluk Agung	0.018237	0.021643
279	Bator	0.029703	0.020289
280	Klampis Barat	0.018688	0.015123
281	Klampis Timur	0.028665	0.015887

Source: *Output* R

Appendix 8. RRMSE of the Estimation of Poor Households at District Level in Bangkalan, 2017

No	District	RRMSE EB	RRMSE ELL
1	Tajungan	2.27228	1.391174
2	Gili Barat	0.884884	1.157084
3	Banyu Ajuh	0.610079	2.335936
4	Kamal	1.13181	2.611302
5	Tanjung Jati	1.863705	1.345421
6	Kebun	1.107738	1.571362
7	Gili Timur	0.889367	1.387385
8	Gili Anyar	0.819863	1.439738
9	Tellang	1.177364	3.292072
10	Pendabah	0.261569	0.991946
11	Kesek	1.030559	1.688865
12	Pangpong	0.961496	1.52822
13	Sukolilo Barat	0.402483	1.592414
14	Sukolilo Timur	0.882194	1.577438
15	Bunajih	0.574839	0.910529
16	Bringin	0.728294	0.844703
17	Ba'engas	0.672032	1.14392
18	Morkepek	0.699913	1.105492
19	Labang	0.918253	1.484552
20	Jukong	0.873807	1.180564
21	Sendang Laok	0.833546	1.041628
22	Sendang Dajah	0.702231	0.891546
23	Petapan	0.206991	0.906349
24	Tebul	0.803714	1.271944
25	Kwanyar Barat	0.827391	1.387095
26	Pasanggrahan	0.910476	1.509587

27	Karanganyar	0.8904	1.033118
28	Batah Barat	0.906361	1.165489
29	Batah Timur	0.829461	1.09651
30	Duwek Buter	0.660925	0.812568
31	Pandanan	0.855718	1.256009
32	Karang Entang	1.06939	1.364163
33	Janteh	0.649573	1.225166
34	Dlemer	0.901086	1.292562

No	District	RRMSE EB	RRMSE ELL
35	Ketetang	0.167762	1.510665
36	Morombuh	0.190682	1.023837
37	Sumur Kuning	0.942412	1.082034
38	Paoran	0.829144	1.118366
39	Gunung Sereng	0.675101	1.012636
40	Pangpajung	0.76918	1.012657
41	Patereman	0.539719	1.776097
42	Kolla	0.657673	0.819654
43	Paeng	0.816017	1.151208
44	Neroh	0.795543	1.044661
45	Serabi Timur	2.395567	0.77616
46	Serabi Barat	0.645833	1.127307
47	Patengteng	0.721459	1.034247
48	Langpanggang	0.743638	1.373737
49	Suwaan	0.714192	0.94584
50	Modung	1.062367	1.169625
51	Brakas Dajah	0.795974	1.287948
52	Karanganyar	1.000539	1.0254
53	Manggaan	0.105351	0.809275
54	Glisgis	0.816102	0.867752
55	Pakong	0.539946	0.99508
56	Alaskokon	0.623331	0.817831
57	Gigir	0.627999	0.929281
58	Ko'olan	0.738007	0.966572
59	Pangeran Gedungan	0.704513	1.001718
60	Panjalinan	0.657432	1.05668
61	Rosep	0.703726	1.064078
62	Kampao	0.630262	0.53319
63	Lombang Laok	0.709417	0.533624
64	Lombang Daya	0.641301	0.935055

65	Karpote	0.80107	0.950728
66	Blegaoloh	0.424617	0.767477
67	Karang Gayam	0.686009	0.904
68	Lomaer	0.628017	1.148697
69	Bates	0.664446	0.836975
70	Karang Panasan	0.650105	1.170926
71	Karangnangka	0.872557	1.029951

No	District	RRMSE EB	RRMSE ELL
72	Blega	2.367928	1.904258
73	Nyor Manis	0.787029	1.011616
74	Alasraja	0.703725	0.712309
75	Kajan	0.867358	0.759364
76	Galis Dajah	0.746688	0.933837
77	Durin Barat	0.682795	0.831209
78	Kanegarah	0.12449	0.777372
79	Batokaban	0.690225	0.81601
80	Durin Timur	0.263188	0.798705
81	Pakes	0.667087	0.820288
82	Bandung	0.664336	1.042985
83	Konang	0.664295	0.763515
84	Senasen	0.620772	0.829393
85	Campor	0.195506	1.191178
86	Sambiyan	0.610658	0.704642
87	Cangkarman	0.6415	0.729551
88	Genteng	0.200203	0.863464
89	Pekadan	0.698793	0.630069
90	Kajuanak	0.694437	0.856859
91	Paterongan	0.194699	1.032715
92	Galis	0.82986	1.482487
93	Paka'an Laok	0.323374	0.890097
94	Kranggan Timur	0.542588	0.927072
95	Separah	0.52223	0.837593
96	Paka'an Daya	0.999686	1.097203
97	Longkek	0.819175	1.171133
98	Banyubunih	0.621516	1.037812
99	Daleman	0.778437	0.865534
100	Tellok	0.75952	0.948043
101	Blateran	0.695683	0.749089

102	Kelbung	0.417002	0.81651
103	Tlagah	0.762825	0.84196
104	Lantek Timur	0.64031	0.768445
105	Lantek Barat	0.714681	0.829998
106	Banjar	0.704512	0.92897
107	Bangpendah	0.577988	1.02054
108	Sadah	1.135589	0.964216

No	District	RRMSE EB	RRMSE ELL
109	Sorpa	0.59998	0.882443
110	Pacentan	0.260721	0.957867
111	Baipajung	0.766266	0.883381
112	Tanah Merah Laok	0.621599	1.067242
113	Kranggan Barat	0.81679	0.769771
114	Pangeleyan	0.991703	0.738328
115	Padurungan	0.832989	1.070479
116	Petrah	0.718055	1.312436
117	Tanah Merah Dajah	0.7761	1.585261
118	Dumajah	0.698649	1.109176
119	Patemon	1.094844	0.950446
120	Tlomar	0.539938	0.822635
121	Kendaban	0.839746	0.679026
122	Jangkar	0.83133	1.102545
123	Pettong	0.485492	0.704065
124	Landak	0.748846	1.028395
125	Rongdurin	0.786002	0.651798
126	Batangan	0.746038	1.092371
127	Dlambah Dajah	0.288202	1.058667
128	Dlamba Laok	0.877487	1.242069
129	Mrecah	0.695021	1.001481
130	Buddan	0.156693	0.934885
131	Poter	0.697703	1.090854
132	Basanah	0.479964	1.167768
133	Alang Alang	0.598566	0.923848
134	Kemoneng	0.799767	0.934943
135	Soket Laok	0.716353	0.806948
136	Bajeman	0.818257	0.948201
137	Tambin	0.839248	1.01519
138	Soket Daya	0.497422	1.07558

139	Keteleng	0.847746	0.760824
140	Jaah	0.837015	0.888186
141	Bancang	0.656102	0.954097
142	Masaran	1.048986	1.171722
143	Pacangan	0.598927	0.97044
144	Pocong	0.630225	1.455294
145	Tragah	0.818277	1.221523

No	District	RRMSE EB	RRMSE ELL
146	Karang Leman	0.874499	1.217672
147	Dukotambin	1.086254	0.714165
148	Jaddung	0.914831	1.363886
149	Banyu Bese	0.684724	0.745801
150	Pamorah	0.824511	0.866024
151	Junganyar	0.780498	1.329962
152	Socah	1.26731	1.929879
153	Buluh	0.395312	1.086007
154	Jaddih	0.79921	1.281281
155	Sanggra Agung	0.948146	1.192916
156	Parseh	0.468579	1.235424
157	Bilaporah	0.594672	1.41642
158	Keleyan	0.780662	1.379684
159	Petaonan	0.822732	1.242832
160	Dakiring	0.744348	1.390219
161	Pernajuh	1.109996	1.394231
162	Ujung Piring	1.042556	1.507892
163	Sembilangan	0.833444	1.508191
164	Kramat	0.702981	1.321646
165	Mertajasah	1.002947	1.183362
166	Mlajah	4.730102	3.264597
167	Kemayoran	0.952361	2.688465
168	Pangeranan	2.135155	2.439908
169	Demangan	0.52631	2.982652
170	Kraton	0.234649	2.036553
171	Pejagan	0.292186	1.840983
172	Bancaran	2.927771	1.621602
173	Sabiyan	0.813793	1.977525
174	Gebang	1.325231	1.359203
175	Jambu	1.00835	1.073115

176	Langkap	0.873284	1.517907
177	Burneh	6.349282	2.348548
178	Benangkah	0.537484	1.136015
179	Alas Kembang	0.654071	0.960178
180	Binoh	0.663182	0.964276
181	Perreng	0.349639	0.982927
182	Pangolangan	0.855151	0.871792

No	District	RRMSE EB	RRMSE ELL
183	Sobih	0.683102	1.025523
184	Tonjung	0.293323	1.662988
185	Kapor	0.818349	0.903048
186	Arok	1.035497	1.088742
187	Pandan Lanjang	0.688926	1.021761
188	Batonaong	0.848563	1.012182
189	Glagga	0.778649	0.900336
190	Ombul	0.82211	1.146698
191	Balung	0.840342	1.220234
192	Lajing	0.694957	1.129571
193	Tengket	1.102302	1.129569
194	Arosbaya	1.636753	1.341084
195	Karang Duwak	0.784839	1.56313
196	Dlemer	0.573903	1.402279
197	Mangkon	1.446524	1.032169
198	Berbeluk	0.873705	0.891872
199	Cendagah	0.825439	0.921516
200	Karang Pao	1.114093	1.319918
201	Makam Agung	2.113374	1.259928
202	Plakaran	1.604005	0.697307
203	Buduran	0.707261	1.132179
204	Tambegan	0.972464	1.341332
205	Togubang	0.165527	1.285854
206	Lerpak	0.76186	0.860735
207	Geger	0.176405	0.979944
208	Batobella	0.645933	1.126739
209	Tegerpriyah	0.804566	0.854623
210	Campor	0.225452	1.099731
211	Kompol	0.704358	1.176539
212	Kampak	0.806178	0.982596

213	Kombangan	0.285166	1.10679
214	Dabung	0.121957	0.789259
215	Katol Barat	0.518041	0.72919
216	Banyoneng Laok	0.15597	0.702833
217	Banyoneng Dajah	0.67109	0.899906
218	Lembung Gunung	0.790761	0.889865
219	Amparaan	0.730639	0.678597

No	District	RRMSE EB	RRMSE ELL
220	Kokop	0.577008	0.56369
221	Tlokoh	0.150941	0.693616
222	Durjan	0.654078	0.782998
223	Mano'an	0.688421	0.724318
224	Mandung	0.144686	0.761448
225	Bandang Laok	0.795764	0.853093
226	Tramok	0.65237	0.751336
227	Katol Timur	0.13935	0.882827
228	Banda Soleh	0.577373	0.690317
229	Dupok	0.175064	0.896475
230	Batokorogan	1.275342	1.374522
231	Planggiran	0.808312	1.312075
232	Tagungguh	1.815715	1.156698
233	Bandang Daya	0.671704	0.913367
234	Bungkeng	0.686066	0.903255
235	Larangan Timur	4.731469	1.22321
236	Tambak Pocok	0.578708	0.702954
237	Bumi Anyar	1.063012	1.602534
238	Paseseh	1.000922	2.018351
239	Telaga Biru	0.747364	2.370759
240	Tanjung Bumi	3.173557	1.744003
241	Macajah	1.500435	1.266351
242	Tlangoh	3.046657	1.337394
243	Banyu Sangkah	4.206854	1.356259
244	Aengtabar	0.895216	1.722678
245	Klapayan	0.62448	0.807792
246	Bangsereh	0.848818	0.884614
247	Kelbung	0.724824	0.925723
248	Saplasah	0.694656	0.830686
249	Gunelap	0.755401	0.824738

250	Tanagura Timur	1.348294	1.637667
251	Tanagura Barat	1.241647	0.960596
252	Banyior	1.004205	1.187278
253	Klabetan	0.457156	1.41694
254	Gangseyan	0.770214	0.915182
255	Maneron	0.872271	1.304315
256	Sepuluh	0.933432	1.632627

No	District	RRMSE EB	RRMSE ELL
257	Prancak	0.678416	1.293871
258	Labuhan	1.471403	0.875873
259	Lembung Paseser	1.072802	1.190436
260	Tolbuk	0.708867	0.885032
261	Ra'as	0.732674	1.038462
262	Muarah	0.81645	1.050224
263	Polongan	1.224007	0.934081
264	Karang Asem	0.965428	1.13204
265	Bantean	0.96746	0.704359
266	Bragang	0.780451	0.968459
267	Lergunong	0.67854	0.897813
268	Panyaksagan	0.171699	0.717233
269	Larangan Glintong	0.680972	1.117289
270	Manonggal	0.830758	1.019361
271	Larangan Sorjan	0.892178	1.359327
272	Tenggun Daya	0.174124	1.111949
273	Bulung	0.970899	0.82356
274	Trogan	0.233734	1.109872
275	Ko'ol	0.753734	1.145054
276	Tobaddung	1.10532	0.958588
277	Mrandung	0.881821	1.386364
278	Buluk Agung	0.922352	1.09703
279	Bator	0.950856	1.309617
280	Klampis Barat	0.842863	1.216228
281	Klampis Timur	0.878973	1.666412

Source: Output R