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Developmental Model of Structural Equation using Spatial Approach in the Case of Dengue Fever in Bone South Sulawesi

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ABSTRACT

Spatial Structural Equation Modeling (SEM spatial) is a quite effective method in analyzing spatial data that has a major effect namely spatial dependency and spatial heterogeneity. Dengue fever is a global health problem nowadays and the future due to the increasing number of the patients. The case of dengue fever is a spatial data. So that if it was still used Structural Equation Modeling (SEM) in analyzing. There were some assumptions that were not met. They were independence and error of homogeneity. So, invalid parameter estimation was obtained. The general objective of this study was to develop a structural equation by using spatial approach in the case of dengue fever in Bone Regency, the Province of South Sulawesi. The findings show that: Estimator of structural equation modeling by involving weight spatial is described as follows:
$\hat{\gamma}_w = \left(X'\Lambda'\Sigma_d^{-1}\Lambda X\right)^{-1} X'\Lambda'\Sigma_d^{-1}\Lambda(\tilde{A}\tilde{y}_w)$ with.
$\Sigma_d = \Lambda\sigma^2_{\varsigma_1}\Lambda' + \Theta_\varepsilon$ $\quad A = I - \rho W_1$

The best spatial structural equation modeling in the case of dengue fever in Bone is:
$DHF_i = -0.509 - 0.348\sum_{j=1.i\neq j}^{n} w_{ij}\,\eta_{i\mathrm{i}} + 1.830\ \mathrm{environment}_i - 1.038\ \mathrm{behaviors}_i$
High and low case of dengue fever in Bone is influenced by the environmental factor and the behavior.

Key Words: SEM, Spatial, Dengue

INTRODUCTION

Structural Equation Modeling (SEM) is a statistical modeling technique that is very common and used widely in various scope of science that combines several aspects such as regression analysis. The path diagram and factor analysis (Bollen. KA (1989) Kline. RB (2005), Kusnendi (2008) One of the important reasons to use SEM is able to estimate the relationship between variables that are multiple relationships and able to describe causal relationships between variables that cannot be explained on the regression analysis regular so it can be known how well an indicator variable represents the latent variable.

Research by using Structural Equation Modeling (SEM) has been carried out. Among others were Cho. Park. and Joo (2011). They examined the factors influencing consumer loyalty (High School Students in Korea) on the side of the street food vendors. Kilian *et al* (2011) examined the relationship between work clinical status and psychiatric hospitalization in patients with schizophrenia by receiving rehabilitation program either Individual Placement or Support (IPS) or conventional in Europe.

Structural Equation Modeling (SEM) in the use of observation data has limitations if the location is as a unit of observation such as the number of disease occurrence in the region. The number of criminal events in the region and so on (Anselin L. 1988. Arbia G. 1996). The data is spatial data as it not only contains information about the attributes of what is measured or calculated but it also includes the location where the measurement/

computation is done. Spatial data has a major effect namely spatial dependency and heterogeneity. Spatial dependency effects on the dependency error while spatial heterogeneity hedges to the heteroscedasticity so if Structural Equation Modeling (SEM) is still used as a tool of analysis on spatial data. Then the assumption is not met. Namely the independence of the error and homoscedasticity so it can cause the invalid parameter estimaton (Anselin L. 1988. Kospeld R. 2010. Lesage JP 1999).

A model that considers about the latent variable and the spatial dependency is first developed by Congdon. He investigated the SEM spatial with latent variable in the area of deprivation and social fragmentation associated with the suicide in the city of London (Congdon P. 2008. 2011).

The model developed by Congdonused approach point (GWR). That is the geographical location of a region based on the coordinate position of longitude and latitude.

The model that would be developed in this research is a spatial structural equation modelling with approach area. Approach area in addition to take the distance into account. It can also take other factors into account that affect the spatial variation in a case being observed.

Modeling SEM Spatial with approach area would be applied in the cases of dengue fever. Because of the data of dengue cases. There will be a spatial effect because theoretically if one district is an endemic area of dengue fever of course the vector of dengue disease is the Aedesaegyptimosquito that will move to other districts. Where directly in contact or though not intersect but there is a mobilization of DHF patients from the endemic districts to other districts (Djunaedi D. 2006).

METHODOLOGY

Research Site

The location of this research is in Bone regency, the Province of South Sulawesi.

Type of the Research

This research is a developmental model of structural equation. The step of the spatial structural equation modeling development consists of two phases: the first is theoretical model development. And the second is model application.

Analysis Unit

The unit of analysis in this research is sub district in Bone Regency as many as 27 sub districts.

Procedures of Collecting Data

In collecting the secondary data (environmental. behavioral. resource. health care. and infrastructure). It was done on the program of the Ministry of Health in Bone Regency. Data on the state of the temperature and air inertia. They were obtained in Meteorology. Climatology and Geophysics in Maros Regency. The data used in this research was the secondary data taken from January 2011 to December 2011.

Data Analysis

Modeling developmental analysis of structural equation by using spatial approach used the program of: Excel 2007. ArcView GIS 3.2. GeoDa. and Bootstrap with SmartPLS software (Chin WW. 1999. Efron B & Tibshirani RJ. 1993). In the parameter of the estimation on PLS. test statisticis not obtained yet so that bootstrap is needed to be done advocated by Efron; Tibshirani. 1993. ie: of B=50. B=100. B=200. B=300. To B=500. However if the original estimation of PLS and estimation of bootstrap have already convergent. So no need to do up to B=500.

RESULTS

Parameter Estimation of Spatial Structural Equation Modeling

Spatial structural equation modeling is a technique that brings the framework of the structural equation model into a weight structural equation model as described as follows:

$$\hat{\gamma}_w = \left(X'\Lambda'\sum_{d}^{-1}\Lambda X\right)^{-1} X'\Lambda'\sum_{d}^{-1}\Lambda\left(\tilde{A}\tilde{y}_w\right)$$

with. $\sum_d = \Lambda\sigma_{\varsigma 1}^2\Lambda' + \Theta_\varepsilon$

$A = I - \rho W_1$

Structural Equation Modeling (SEM)

Analysis of structural equation modeling with Partial Least Square (PLS) approach without spatial effects is obtained as the following findings:

Table1. Inner Weight Test in the Incidence of Dengue Fever with Bootstrap Sample

Influence	Orginal Coef.	(Bootstrap n=100)		(Bootstrap n=200)		(Bootstrap n=300)	
		Coef.	T Test	Coef.	T Test	Coef.	T Test
Behaviors → DHF	0.135	0.154	1.587	0.127	2.343	0.124	2.660
Services → DHF	0.488	0.423	4.600	0.475	5.548	0.488	6.773
Infrastructure → DHF	-0.167	-0.196	1.327	-0.170	3.800	-0.166	3.448
Environment → DHF	0.392	0.448	5.473	0.402	6.872	0.386	9.959
Resources → DHF	-0.028	-0.048	1.220	-0.032	0.631	-0.021	1.068
Environmental → Behaviours	-0.560	-0.564	6.002	-0.568	20.39	-0.559	21.245
Environmental → Services	0.790	0.791	9.107	0.791	30.81	0.789	48.09
Resources → Services	-0.148	-0.104	1.387	-0.144	4.16	-0.154	4.995

Models derived from Table 1 are as follows:

$\hat{\eta}_i$= -0.166 ξ_{1i} + 0.386ξ_{2i} + 0.488η_{1i}+ 0.124η_{2i}

DHF_i = -0.166infrastructure+ 0.386environment$_i$+ 0.448services$_i$ + 0.124behaviors$_i$

The complete modeling test results above with SmartPLS program can be seen from the value of R-Square describing the goodness-of-fit of the model. Recommended R-square value is greater than zero. Results of the data processing from this research by using SmartPLS give the value of R-square as shown in Table 2 below:

Table2. Goodness of Fit of R-Square

Variable	*R-Square*
Infrastructure. Environment. Services. Behaviors. Resourcesnnnn → The Occurrence of DHF	0.752
Environment. Resources → Services	0.661
Environment → Behaviours	0.313

Table 2 explains that the donation or the proportion of infrastructure variable. Environment, services, behaviors and resources in explaining the variation around variable of the dengue fever incidence is as much as 0.752 or 75.2 percent. Donation or proportions of the environmental variable resources explain that the variation of the services variable is amount of 0.661 or 66.1 percent. Donation or proportion of the environmental variable explains that the variation of the behavior variable is amount of 0.313 or 31.3 percent.

Spatial Structural Equation Modeling Analysis

Spatial structural equation modeling with a weighted indicator is matrix multiplication of weighting queen contiguity in the central dengue endemic area with all indicators of latent variables. Further analysis with Smart PLS program was to get the weighted value of latent variables. The steps include the following:

1. Spatial Heterogeneity Test

Test to determine the spatial heterogeneity. Breusch-Pagan test (BP-test) was used. Results of the analysis of spatial heterogeneity using software GeoDa is described in Table 3 below:

Table3. Spatial Heterogeneity Diagnostic Result after Weighting

No	Spasial Heterogeneity Test	Value	P-value	Conclusion
1	*Breusch-Pagan* test	5.80	0.577	Ho is accepted
2	*Koenker Bassett* test	1.76	0.880	Ho is accepted

Breusch-Pagan Test is aimed to identify the spatial heterogeneity. The hypothesis is:

Ho:$\sigma_1^2 = \sigma_2^2 = \cdots = \sigma_n^2 = \sigma^2$variance similarity/homoscedasticity)

H_1: minimal adasatu$\sigma_i^2 \neq \sigma^2$ (heterocedasticity)

Table 3 show that the p-value is amount of p=0.577. Its value is greater than the specified error (α=005). It can be concluded that Ho is accepted. It means that the homogeneous variance exists between the sub districts in Bone. Based on these results the modeling analysis cannot use the spatial analysis to the approach point.

2. Spatial Dependency Test

Spatial dependency can be determined by using two methods: Moran's I and Lagrange Multiplier (LM). Results from the analysis of spatial dependency by using GeoDa software can be seen in Table 4 below:

Table4. Diagnostic Results of Spatial Dependency

No	Spatial Dependency Test	Value	P-value	Conclusion
1	Lagrange Multiplier (lag)	5.13	0.023	Ho is rejected
2	Lagrange Multiplier (*error*)	0.04	0.841	Ho is accepted
3	Lagrange Multiplier(SARMA)	1.45	0.068	Ho is accepted

Lagrange Multiplier-Lag test was aimed to identify the relationship between the regions. The hypothesis is:

Ho: $\rho = 0$ (no spatial dependency lag)

Ha: $\rho \neq 0$ (there is spatial dependency lag)

In analyzing the results p-value LM-lag is obtained as amount of p=0.023. Because the value is less than the specified error (α=0.05). It can be concluded that Ho is rejected. It means that spatial dependency lag occurs. So it is necessary to continue to manufacture Spatial Lag Model/Spatial Autoregressive models.

Lagrange Multiplier Error can diagnose the phenomenon of dependency or inter-regional linkages error. The hypothesis is:

Ho: $\lambda = 0$ (no error spatial dependency)

Ha: $\lambda \neq 0$ (there is an error spatial dependency)

The p-value of LM error is 0.841. Because the value is greater than the specified error (α=0.05). Then we can conclude that Ho is accepted. It means that there is no spatial dependency error. It is recommended not to proceed to the manufacture of regression of Spatial Error Model (SEM).

Lagrange Multiplier SARMA could diagnose the phenomenon combined with the dependency or dependency lag error linkages between the regions. The hypothesis used is:

Ho: $\rho.\ \lambda = 0$ (no spatial dependency lag and error)

Ha: $\rho.\ \lambda \neq 0$ (there is spatial dependency lag and error)

From the result analysis of Geoda. Lagrange Multiplier value is obtained for the Spatial Autoregressive Moving Average (LM-SARMA). P-value is got as amount of 0.068 (greater than α=0.05). The conclusion is. Ho is accepted. It indicates that there is no spatial dependency mixture (lag and error). So it is not necessary to manufacture a mixed model as called Spatial Autoregressive Moving Average (SARMA).

3. Analysis of Spatial Structural Equation Modeling of Approach Area with a Weighted Matrix of Queen Contiguity

Results of the analysis with GeoDa software by using the weighted matrix of the queen contiguity. The analysis is obtained as follows:

Table5. Results of Spatial Analysis with Queen Contiguity after Weighting

Variable	Coef.	SE	Z Value	P	R^2Value
W_DHF	0.341	0.157	2.167	0.030	0.90
Constant	0.011	0.060	0.181	0.855	
Infrastructure ($w\xi_1$)	-0.890	0.392	-2.269	0.023	
Environment ($w\xi_2$)	2.265	0.242	9.336	0.000	
Services ($w\eta_1$)	-0.088	0.130	-0.675	0.499	
Behaviors ($w\eta_2$)	-1.049	0.269	-3.894	0.000	
Resources ($w\xi_3$)	0.149	0.343	0.435	0.663	

Description: $w\xi$ = latent variable after weighting

Table 5 explains that the test results obtained from Geoda. Lag coefficient (W_DHF) is amount of 0.341 and p value is 0.030. It is smaller than the coefficient α=0.05. So the significant lag coefficient means that there are linkages between regions. Coefficient of infrastructure after the latent variable weighted is -0.890 and p=0.02. It is smaller than α=0.05. Then the infrastructure latent variable affects the incidence of the dengue fever significantly. Coefficient of latent variable as a weighted environment is 2.265 and p=0.000. It is smaller than α=0.05. Then the environmental latent variable affects the incidence of the dengue fever significantly. The coefficient of latent variable after weighted the resource is 0.149 and p=0.663. It is greater than α=0.05. Then the resource latent variable has no effect on the incidence of dengue fever. Service after the coefficient latent variable is -0.088 and weighted of p-value is 0.499. It is still greater than α=0.05. Then the latent variable of service has no effect on the incidence of dengue fever. Coefficient of latent variable of the behavior after weighted is -1.049 and p=0.000. It is smaller than α=0.05. Then the behavior of latent variable affects the incidence of dengue fever significantly.

$DHF_i=0.341\sum_{j=1.i\neq j}^{n} w_{ij}\,\eta_i 0.890infrastructure_i + 2.265environment_i – 1.049behavior_i$

η_i=The number of DHF incidents in sub districts to-i

W_{ij}= Spatial weighted matrix of queen contiguity.

4. Analysis of the Spatial Structural Equation Modeling of Approach Area with a Weighted matrix of Rook Contiguity

Results of the analysis with GeoDa software by using the weighted matrix of rook contiguity. The analysis is obtained as follows:

Table 6 explains that from the test results of Geoda lag. Coefficient (W_DHF) is obtained as amount of 0.341 and p=0.030. It is smaller than the coefficient of α=0.05. So, significant lag means that there are linkages between the regions. Coefficient of infrastructure after the latent variable is weighted -0.890 and p=0.02. It is smaller than α=0.05. Then the infrastructure latent variable affects the incidence of dengue fever significantly. Coefficient of latent variable as a weighted environment is 2.265 and p=0.000. It is smaller than α=0.05. Then the environmental latent variable significantly affects the incidence of dengue fever. Coefficient of resources after the latent variable is weighted 0.149 and p=0.663. It is still greater than α=0.05. Then the resource latent variable has no effect on the incidence of dengue fever. Service after the coefficient latent variable is -0.088 and weighted of p-value is 0.499. It is greater than α=0.05. Then the latent variable of service has no effect on the incidence of dengue fever. The coefficient of latent variable of behavior after weighted is -1.049 and p=0.000. It is smaller than α=0.05. Then the behavior of latent variable affects the incidence of dengue fever significantly. So the spatial structural equation modeling of approach area with rook contiguity presented as follows:

$DHF_i=0.341\sum_{j=1.i\neq j}^{n} w_{ij}\,\eta_i 0.890infrastructure_i + 2.265environment_i - 1.049behaviors_i$

η_i=The number of DHF incidents in sub districts to-i

W_{ij}= Spatial weighted matrix of rook contiguity

Table 6. Results of Spatial Analysis with Rook Contiguity after Weighting

Variable	Coeff.	SE	Z Value	P	R^2Value
W_DHF	0.341	0.157	2.167	0.030	0.90
Constant	0.011	0.060	0.181	0.855	
Infrastructure ($w\xi_1$)	-0.890	0.392	-2.269	0.023	
Environment ($w\xi_2$)	2.265	0.242	9.336	0.000	
Services ($w\eta_1$)	-0.088	0.130	-0.675	0.499	
Behaviors ($w\eta_2$)	-1.049	0.269	-3.894	0.000	
Resources ($w\xi_3$)	0.149	0.343	0.435	0.663	

Description: wξ = latent variable after weighting

5. Analysis of the Spatial Structural Equation Modeling of Approach Area with a Weighted Matrix of Queen Contiguity Central Endemic Region

Results with GeoDa software by using weighted matrix of queen contiguity central endemic areas. Analysis is obtained as follows:

Table7. Results of the Spatial Analysis with Queen Contiguity Central Endemic Area after Weighting

Variable	Coeff.	SE	Z Value	P	R^2Value
W_DHF	-0.348	0.141	-2.466	0.013	0.91
Constant	-0.505	0.211	-2.411	0.015	
Infrastructure ($w\xi_1$)	-0.752	0.454	-1.656	0.097	
Environment ($w\xi_2$)	1.830	0.282	6.471	0.000	
Services ($w\eta_1$)	-0.072	0.128	-0.568	0.569	
Behaviors ($w\eta_2$)	-1.038	0.263	-3.935	0.000	
Resources ($w\xi_3$)	0.371	0.339	1.095	0.273	

Description: $w\xi$ = latent variable after weighting

Table 7 explains that from the test results of Geoda. Lag coefficient (W_DHF) is obtained as amount of -0.348 and p=0.013. It is smaller than the coefficient α=0.05. So, significant lag means that there are linkages between regions. Coefficient of infrastructure after the latent variable is weighted -0.752 and p=0.097. It is greater than α=0.05. Then the infrastructure latent variable has no effect on the incidence of dengue fever. Latent variable coefficient as a weighted environment is 1.830 and p=0.000. It is smaller than α=0.05. Then the environmental latent variable significantly affects the incidence of dengue fever. Coefficient of resources after the latent variable is weighted 0.371 and p=0.273. It is still greater than α=0.05. Then the resource latent variable has no effect on the incidence of the dengue fever. Service after the coefficient latent variable is -0.072 and weighted the p-value is as amount of 0.569. It is greater than α=0.05. Then the latent variable of service has no effect on the incidence of dengue fever. Coefficient of latent variable in behavior after weighted is -1.038 and p=0.00. It is smaller than α=0.05. Then the behavior of latent variable affects the incidence of dengue fever significantly. So the spatial structural equation modeling of approach area with the queen contiguity in central endemic areas are as follows:

$DHF_i = -0.509 - 0.348\sum_{j=1.i\neq j}^{n} w_{ij}\,\eta_{i}i + 1.830environment_i - 1.038behavior_i$

η_i= The number of DHF incidents in sub districts to-i

DISCUSSION

Infrastructure

Results of the analysis of infrastructure latent variable using weighted matrix of queen contiguity in the central endemic areas after the developmental were obtained as shown in Table 7. The p-value is 0.097. It is bigger than α=0.05. Then Ho is accepted. It means that there is no effect of infrastructure variable on the incidence of dengue fever. While the results of analysis by using SEM infrastructure variable without spatial effects as shown in Table 1 with B=300. The values are obtained and T test is 3.44. It is greater than T table which is 1.96 only. Then Ho is rejected. It means that the infrastructure variable has an influence on the incidence of dengue fever.

Analysis of the effect of infrastructure variable before and after the developmental model differences is obtained. Where before the developmental model infrastructure variable has an influence on the incidence of dengue fever. However after the developmental model infrastructure variable has no effect on the incidence of dengue fever. This can be occurred because of the spatial effects. It can be seen in Table 4 of the Lagrange Multiplier test (lag) with p=0.023 (Anselin 1988. Breusch TS & Pagan. 1980. Getis A (2003). Arbia G. Badi H. 2009). To prove the conclusion that the most valid one between before and after the developmental model it can be seen in the value of R^2 generated. Before the development model the value of R^2 is 0.75 (Table 2) and after the developmental model using weighted matrix of queen contiguity in the central endemic areas. R^2 is obtained as amount of 0.91 (Table 7). Because the value of R^2 after the model development is bigger than before the model development so the most valid conclusion is after developing the model (Chou CP. 1985. Hair *et al*. 2006).

Environment

Results of the analysis of the environmental latent variable using a weighted matrix with queen contiguity in the central endemic areas after the development of a model. The findings were obtained as shown in Table 7. The value of p is 0.000. Less than α=0.05. It means that Ho is rejected. There is an influence of environmental variable on the incidence of dengue fever. While the results of the analysis of the environmental variable by using SEM without spatial effects as shown in Table 1 with B=300. The values were obtained for T test=9.59. It is greater than T table which is only 1.96. Then Ho is rejected. It means that environmental variable has an influence on the incidence of dengue fever.

Analysis of the influence of environmental variable with weighted matrix of queen contiguity in the central endemic areas before and after the development of model. There is no difference. Where before the developmental model environmental variable has an influence on the incidence of dengue fever as well as after the developmental model. Environmental variable has an influence on the incidence of dengue fever. But there is a difference in the value of R^2 generated. This can be occurred because of the spatial effects. It can be viewed in Table 4 to the Lagrange Multiplier test (lag) with p=0.023 (Anselin 1988. Breusch TS & Pagan. 1980. Getis A (2003). Arbia G. Badi H. 2009). To prove the conclusion that the most valid one between before and after the developmental model. It can be seen in the value of R^2 generated. Before the developmental model the value of R^2 is 0.75 (Table 2) and after the developmental model using weighted matrix of queen contiguity in the central endemic areas. R^2 isobtained as amount of 0.91 (Table 7). Because the value of R^2 after the model development is bigger than before the model development so the most valid conclusion is after developing the model (Chou CP. 1985. Hair *et al*. 2006).

Service

Results of the analysis of service latent variable using weighted matrix of queen contiguity in the central endemic areas after the developmental were obtained as shown in Table 7. The p-value is 0.569. It is bigger than α=0.05. Then Ho is accepted. It means that there is no effect of service variable on the incidence of dengue fever. While the results of analysis by using SEM service variable without spatial effects as shown in Table 1 with B=300. The values are obtained and T test is 6.77. It is greater than T table which is 1.96 only. Then Ho is rejected. It means that the service variable has an influence on the incidence of dengue fever.

Analysis of the service latent variable using a weighted matrix with the queen contiguity in the central endemic areas before and after the development of model there is a difference. Where before the developmental model environmental variable has an influence on the incidence of dengue fever but after the developmental model. Environmental variable does not have an influence on the incidence of dengue fever. This can be occurred because of the spatial effects. It can be viewed in Table 4 with the Lagrange Multiplier test (lag) with p=0.023 (Anselin 1988. Breusch TS & Pagan. 1980. Getis A (2003). Arbia G. Badi H. 2009). To prove the conclusion that the most valid one between before and after the development of the model can be seen in the value of R^2 generated Before the development model the value of R^2 is 0.75 (Table 2) and after the development of the model using weighted matrix of queen contiguity in central endemic areas. R^2 is obtained as amount of 0.91 (Table 7). Because the value of R^2 after the model development is bigger than before the model development so the most valid conclusion is after developing the model (Chou CP. 1985. Hair *et al*. 2006).

Behavior

Results of the analysis of behavior latent variable using weighted matrix of queen contiguity in the central endemic areas after the development of a model are obtained as shown in Table 7. The p-value is 0.000. It is smaller than α=0.05. Then Ho is rejected. It means that there is an effect of behavior variable on the incidence of dengue fever. While the results of analysis by using SEM behavior variable without spatial effects as shown in Table 1 with B=300. The values are obtained and T test is 2.66. It is greater than T table which is 1.96 only. Then Ho is rejected. It means that the behavior variable has an influence on the incidence of dengue fever.

Analysis of the effect of behavior variable before and after the developmental model no differences are obtained. Where before the model of development behavior variable has an influence on the incidence of dengue fever. As well as after the model of development. Behavior variable has an effect on the incidence of dengue fever. This can be occurred because of the spatial effects. It can be seen in Table 4 of the Lagrange Multiplier test (lag) with p=0.023 (Anselin 1988. Breusch TS & Pagan. 1980. Getis A (2003). Arbia G. Badi H. 2009). To prove the conclusion that the most valid one between before and after the development of the model can be seen in the value of R^2 generated. Before the developmental model the value of R^2 is 0.75 (Table 2) and after the development of the model using weighted matrix of queen contiguity in the central endemic area. R^2 is obtained as amount of 0.91 (Table 7). Because the value of R^2 after the model development is bigger than before the model development so the most valid conclusion is after developing the model (Chou CP. 1985. Hair *et al*. 2006).

Resource

Results of the analysis of the resource latent variable using a weighted matrix with queen contiguity in the central endemic areas after the development of a model the findings are obtained as shown in Table 7. The value of p is 0.273 less than α=0.05. It means that Ho is accepted. There is no influence of resource variable on the incidence of dengue fever. While the results of the analysis of the resource variable by using SEM without spatial effects as shown in Table 1 with B=300. The values are obtained for T test=1.068. It is smaller than T table which is only 1.96. Then Ho is accepted. It means that resource variable has an influence on the incidence of dengue fever.

Analysis of the influence of resource variable with weighted matrix of queen contiguity in central endemic areas before and after the developmental model there is no difference where before the developmental model resource variable does not have an influence on the incidence of dengue fever as well as after the developmental model. environmental variable does not have an influence on the incidence of dengue fever. But there is a difference in the value of R^2 generated. This can be occurred because of the spatial effects. It can be viewed in Table 4 of the Lagrange Multiplier test (lag) with p=0.023 (Anselin 1988. Breusch TS & Pagan. 1980.. Getis A (2003). Arbia G. Badi H. 2009). To prove the most valid conclusion between before and after the development of the model it can be seen in the value of R^2 generated. Before the developmental model the value of R^2 is 0.75 (Table 2) and after the developmental model using weighted matrix of queen contiguity in the central endemic areas. R^2 isobtained as amount of 0.91 (Table 7). Because the value of R^2 after the developmental model is bigger than before the developmental model so the most valid conclusion is after developing the model (Chou CP. 1985. Hair *et al*. 2006).

CONCLUSION

1. Model estimator of structural equation modelingby involving the spatial weights is described as follows:
   $\hat{\gamma}_w = \left(X'\Lambda'\Sigma_d^{-1}\Lambda X\right)^{-1} X'\Lambda'\Sigma_d^{-1}\Lambda(\tilde{A}\tilde{y}_w)$
   with. $\Sigma_d = \Lambda\sigma^2_{\varsigma_1}\Lambda' + \Theta_\varepsilon$
   $A = I - \rho W_1$
2. The best spatial structural equation modeling for the cases of dengue fever in Bone regency is:DHFi = -0.509 - 0.348$\sum_{j=1.i\neq j}^{n} w_{ij}\,\eta_i$i + 1.830environmenti - 1.038behaviori This model has a value of R2=0.91. which means that 91% of the variation

of dengue cases can be explained by environmental factors and behaviors.

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