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Spatial Interaction of the Economy and Public Services Between Makassar City and the Urban Areas of Gowa Regency, South Sulawesi Province, Indonesia

Linda Ardi[1*], Slamet Trisutomo[2], Abdul Rahman[3]

[1]Regional Development and Planning Study Program Student, Planning Management, Graduate School Hasanuddin University,
lindaardi051@gmail.com

[2] Lecturer of Development and Regional Planning Study Program, Postgraduate School of Hasanuddin University,
trisutomo@gmail.com

[3]Lecturer of Development and Regional Planning Study Program, Postgraduate School of Hasanuddin University,
rahmanrasyid@eng.unhas.ac.id

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ABSTRACT: Two or more cities that are close to each other, even though they were separate and independent cities, can benefit from the synergy of interactive city growth. This study aims to analyze the forms of economic, spatial interactions, and public services between Makassar City and Gowa Regency urban areas. Global spatial autocorrelation was used with the Global Moran's I statistics to see the linkages of the economy and public services in Makassar City and Gowa Regency. The results of the Morans I test resulted in a global moran index of 0.456 and 0.325 for public facilities. Significance test results can be seen Z (I) for GRDP data = 3.6674> Z0.99 = 2.575 and Z (I) fasum = 2.6894> Z0.99 = 2.57. From the results of the statistical analysis, it is concluded that there is a close spatial dependence with a significance of 99% on the GRDP value and inter-regional public services between Makassar City and Gowa Regency urban areas.

KEYWORDS: Spatial Pattern, Moran's I.

I. INTRODUCTION

The growth of an area is influenced by many factors. Apart from the endowment resources (natural resources owned by an area), demographic differences, regional economic performance, and spatial factors also influence the success of a region's growth (Yanti 2014). An area, in essence, cannot be claimed as the success of the area itself. The growth of an area will be greatly influenced by the development of the surrounding area. In this case, the distance and infrastructure factors will affect the intensity of interaction between regions. Nearby areas will have stronger linkages and interactions than regions that are far apart (Tobller I law). Interrelated relations or spatial interactions between regions cannot be ignored in influencing the success of development (Tan et al. 2016). Two or more cities that are close to each other, even though they were separate and independent cities, can benefit from the synergy of interactive city growth (He et al. 2013). The forms of spatial interaction are shown by the existence of inter-regional linkages. There are several types of linkages, including transportation, communication, natural resources, economic, social, public services, and institutional links (Rustiadi & Panuju 2011). Based on the existing conditions, this study aims to analyze the forms of economic spatial interactions and public services between Makassar City and urban areas of Gowa Regency.

II. RESEARCH METHODS

The fact that Makassar is the largest metropolitan city in Eastern Indonesia and is the capital of the South Sulawesi Province. One of the sub-urban areas of the Makassar metropolitan is Gowa Regency, in this study limited 11 subdistricts from 18 subdistricts in accordance with the maminasatta urban area plan, namely (Somba opu sub-district, Bontomaranu sub-district, Palangga sub-district, Bajeng sub-district, Bajeng sub-district, Barombong sub-district, Manuju District, Pattalasang District, Parangloe District, Bontonompo District, and South Bontonompo District).

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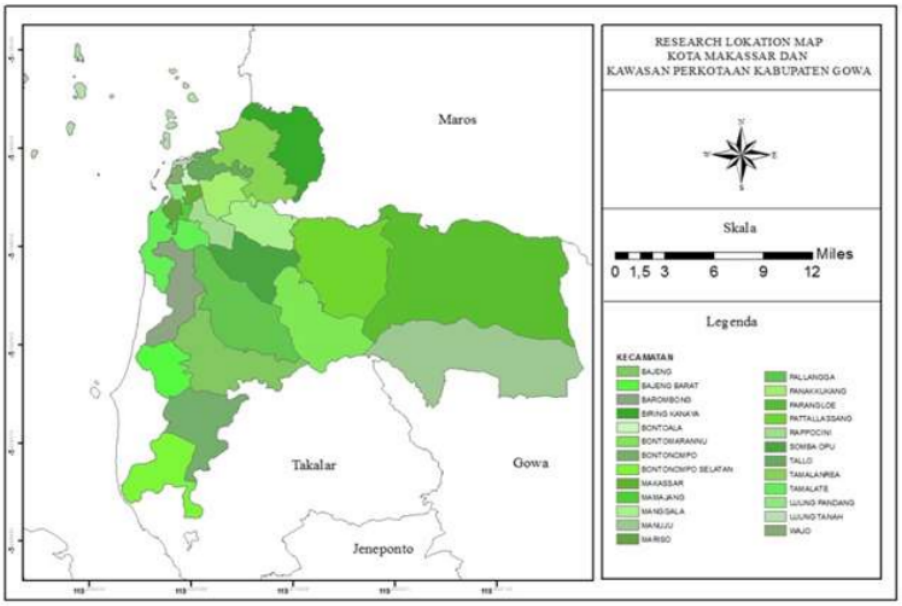

Fig 1: Research Location

This study uses secondary data sourced from the 2018 Statistics Indonesia (BPS) in Makassar and Gowa Regency. Economic data used are district GRDP data estimated at the district level, and public service data used is the number of public facilities in Makassar City and urban areas of Gowa Regency, Global spatial autocorrelation is used with its Global Moran's I statistics to see the linkages between the economy and public services in Makassar City and urban areas of Gowa Regency (Yanti 2014). Moran's Global Index is formulated as follows :

$$I = \frac{N\sum_i^N\sum_j^N W_{ij}(Y_i-\bar{Y})(Y_j-\bar{Y})}{\sum_i^N\sum_j^N W_{ij}(Y_i-\bar{Y})^2} \qquad (1)$$

Y_i = observation value in region i
Y_j = observation value in region j
$\bar{Y}$ = average observation

W_{ij} = weighting the relationship between regions i and j
N = number of analysis units

Wij weighting, which is the spatial weight of the matrix, has a rule of value 1 if the location between location I and location j are close to each other, while the value is 0 if the location between location I and j are far apart.

The Moran's I Index value is in the range (-1.1). If I is significantly positive, there will be a grouping of regions that have the same characteristics. Meanwhile, if I is significantly negative, there will be a grouping of regions with different characteristics. Meanwhile, if I is zero, then there is no spatial attachment between regions. Hypothesis testing for the Moran Index is as follows:

i. Hypothesis H0: There is no spatial autocorrelation
H1: There is spatial autocorrelation
ii. Level of significance: a
iii. Test Statistics:

$$\boldsymbol{Z\,(I) = \frac{I-E(I)}{\sqrt{Var\,(I)}} \approx N(0,1)} \qquad (2)$$

With

$$\mathbf{E}(I) = -\frac{1}{n-1} \quad (3)$$

$$Var\,(I) = \frac{n^2 S_1 - nS_2 + 3S_0^2}{(n^2-1)S_0^2} - (E(I))^2 \quad (4)$$

$$S_0 = \sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij} \quad (5)$$

$$S_1 = \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}(W_{ij} + W_{ij})^2 \quad (6)$$

$$S_2 = \sum_{i=1}^{n}\left[\sum_{j=1}^{n} W_{ij} + \sum_{j=1}^{n} W_{ji}\right]^2 \quad (7)$$

Test Criteria :

Reject H0 at the significance level an if *Z(I)* > *Z*1-*Z*1-□ □with *Z*1-□ is (1-a) quantile from the standard normal (Wuryandari 2014).

To see the general tendency of grouping and characteristics of each region, Moran Scatterplot is used, which is a visual representation in the form of a four-quadrant graph for each unit of analysis that is calculated (Nisa 2017).

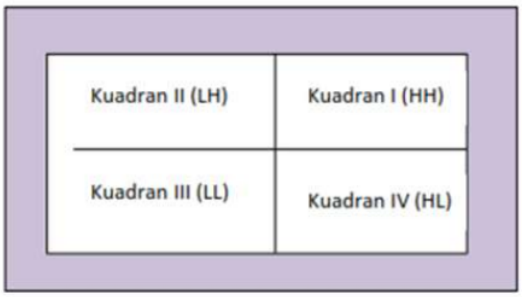

Fig 2: Moran's Scatterplot

Moran Scatterplot consists of four quadrants, which indicate four possible groupings that occur. Each quadrant is limited by a line of averages and averages. Regions are said to have high characteristics if the values are above average. Conversely, a region has low characteristics if the value is below average. a) Quadrant I, consisting of regions with high characteristics surrounded by areas with high characteristics (HH, high-high clustering). b) Quadrant II, consisting of regions with low characteristics surrounded by areas with high characteristics (LH, low high clustering). c) Quadrant III, consisting of regions with low characteristics surrounded by areas with low characteristics (LL, low-low clustering). d) Quadrant IV, consisting of areas with high characteristics surrounded by areas with low characteristics (HL, high-low clustering)

General Description of the Economy of Makassar City and Urban Areas of Gowa Regency

In the growth of a region or country, there are indicators used to measure the growth rate. Gross regional domestic product (GRDP) is one indicator. Economic growth at the regional level, such as provinces, districts/cities, and even districts. Based on BPS Makassar City data in 2018, the nominal GDP of Makassar City is 160.207.659.28 million Rupiah. Then estimated to the district level with the method of household consumption approach is presented in table 1 (Fajar 2006).

Table 1: GRDP for Each Subdistrict of Makassar City in 2018

No	District	Subdistrict Nominal GDP (Million IDR)
1	Mariso	6.387.468.75
2	Mamajang	6.515.791.76

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3	Tamalate	21.448.212.89
4	Rappocini	17.882.894.19
5	Makassar	9.062.387.28
6	Ujung Pandang	3.068.173.29
7	Wajo	3.324.606.85
8	Bontoala	6.055.932.25
9	Ujung Tanah	3.755.572.43
10	Kep. Sangkarrang	1.535.839.40
11	Tallo	14.874.314.61
12	Panakukkang	15.840.773.79
13	Manggala	15.495.746.38
14	Biringkanaya	22.778.608.02
15	Tamalanrea	12.181.337.39

Source: ([BPS] BPS of Makassar City 2018).

Based on table 1 it can be seen that the highest PDRB in Makassar City in 2018 is Biringkanaya Subdistrict, followed by Tamalate Subdistrict and Rappocini Subdistrict and the smallest PDRB in 2018 is Kep. Sangkarrang Subdistrict.

Based on BPS Gowa Regency PDRB data in 2018 amounting to 19.063.888.90 million rupiahs, which is then estimated at the subdistrict level. Sub-District Nominal GRDP in urban areas of Gowa Regency based on the Household Consumption Approach is presented in table 2.

Table 2: GRDP for Each Subdistrict in Urban Areas of Gowa Regency in 2018

No	Subdistrict	Subdistrict Nominal GDP (Million IDR)
1	Bontonompo	1.059.632.68
2	Bontonompo Selatan	767.736.80
3	Bajeng	1.725.058.04
4	Bajeng Barat	618.004.18
5	Palangga	3.166.441.20
6	Barombong	1.005.945.49
7	Somba opu	4.313.371.95
8	Bontomaranu	883.457.50
9	Pattalasang	602.088.52
10	Parangloe	461.905.31
11	Manuju	376.436.91

Source: ([BPS] BPS of Makassar City 2018).

Based on table 2 it can be seen that the highest PDRB in the urban area of Gowa Regency in 2018 is Somba Opu Subdistrict, and the smallest PDRB in 2018 is Manuju Subdistrict.

General Description of Facilities and Infrastructure of Makassar City and Gowa Regency

The function of city services can be seen from the number of facilities and infrastructure available in each urban area (Samli 2012). Infrastructure facilities are divided into educational facilities, health facilities, worship facilities.

1. Educational Facilities

Based on BPS data in 2018, Makassar City has 1619 educational facilities spread evenly in 15 subdistricts consisting of kindergartens (TK) to the level of high school. There are 508 kindergartens, 613 public and private elementary schools, 248 public and private junior high schools, 162 high schools, and 88 vocational high schools. Data on education facilities per district in Makassar City is presented in table 3.

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Table 3: Education Facilities for Each Subdistrict of Makassar City in 2018

No	Subdistrict	Educational Facilities								
		TK	SD	MI	SMP	MTS	SMA	MA	SMK	Sum
1	Mariso	9	23	5	6	2	5		2	**52**
2	Mamajang	19	27	1	9	2	11	1	4	**74**
3	Tamalate	46	49	11	15	10	9	3	17	**160**
4	Rappocini	51	51	1	21		16	1	11	**152**
5	Makassar	25	41	4	19		11		6	**106**
6	Ujung Pandang	22	32	1	19		11	1	2	**88**
7	Wajo	7	13	1	5	3	4	3	1	**37**
8	Bontoala	17	23	7	14	6	8	5	6	**86**
9	Ujung tanah	6	14	6	5	3	5	3	1	**43**
10	Kep. Sangkarrang	3	7		6					**16**
11	Tallo	26	49	6	14	6	5	2	3	**111**
12	Panakukkang	59	74	3	19		13		13	**181**
13	Manggala	65	44	6	17	5	13	1	6	**157**
14	Biringkanaya	105	58	18	15	9	10	9	11	**235**
15	Tamalanrea	48	36	2	15	3	9	3	5	**121**

Source: ([BPS] BPS of Makassar City 2018).

From the table above, it can be seen that the highest number of educational facilities in Makassar City in 2018 is Biringkanaya District, and the smallest educational facility in 2018 is Kep. Sangkarrang.

Based on BPS data of Gowa Regency in 2018, urban areas of Gowa Regency have 716 educational facilities that are evenly distributed in 11 districts consisting of 246 TK units, 311 public and private elementary schools, 96 state and private junior high schools, 48 high schools and 15 high schools Vocational. Data on education facilities per district in the urban area of Gowa Regency is presented in table 4.

Table 4: Educational Facilities for Each Subdistrict of Urban Area in Gowa Regency in 2018

No	Subdistrict	Educational Facilities								
		TK	SD	MI	SMP	MTS	SMA	MA	SMK	Sum
1	Bontonompo	18	28	4	5	4	1	2	2	**64**
2	Bontonompo selatan	8	20	9	3	3	1	2	0	**46**
3	Bajeng	30	37	6	9	5	7	2	3	**99**
4	Bajeng barat	13	16	3	3	1	1	0	0	**37**
5	Palangga	50	39	7	7	5	3	1	1	**113**
6	Barombong	17	16	0	3	0	1	0	0	**37**
7	Somba opu	68	50	3	17	7	13	5	8	**171**
8	Bontomaranu	15	19	0	4	1	2	0	0	**41**
9	Pattalasang	14	16	2	6	1	2	1	1	**43**
10	Parangloe	7	17	1	4	1	2	1	0	**33**
11	Manuju	6	16	2	6	1	1	0	0	**32**

Source: ([BPS] BPS of Gowa Regency 2018).

From the table above, it can be seen that the highest number of educational facilities in the urban area of Gowa Regency in 2018 is Somba Opu District, and the smallest educational facility in 2018 is Manuju district.

2. Medical Facility

Makassar City health facilities are divided into general hospitals, maternal and child hospitals, health centers, clinics and polindes, and posyandu. Based on Makassar City BPS data (2019), the number of health facilities in Makassar City in 2018 in 25 hospitals, 25 maternal and child hospitals, 46 health centers, 182 clinics, and 1010 posyandu. Data on health facilities per district in Makassar City is presented in table 5.

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Table 5: Health Facilities for Each Subdistrict of Makassar City in 2018

No	Subdistrict	Medical Facility				
		Hospitals	Maternal & Child Hospitals	Health Centers	Posyandu	Clinic
1	Mariso	1		3	72	6
2	Mamajang	2	2	2	40	9
3	Tamalate	3		4	90	25
4	Rappocini	4	5	4	121	28
5	Makassar	1	2	3	92	13
6	Ujung pandang	3	6	1	32	13
7	Wajo	1	1	2	35	3
8	Bontoala		2	2	55	2
9	Ujung tanah	1	1	2	50	3
10	Kep. Sangkarrang			2		
11	Tallo			3	85	4
12	Panakukkang	2	2	4	81	23
13	Manggala	1	2	5	83	16
14	Biringkanaya	3	1	4	108	16
15	Tamalanrea	3	1	5	66	21

Source: BPS Makassar City (2018) ([BPS] BPS of Makassar City no date).

From the table above, it can be seen that the highest number of Medical facility in Makassar city in 2018 is Rappocini District, and the smallest Medical facility in 2018 is Kep.Sangkarrang district.

Based on BPS data, urban health facilities in Gowa Regency are divided into hospitals, maternity hospitals, puskesmas, auxiliary puskesmas and polyclinics, and posyandu. In 2018 there were 2 public hospitals, 16 puskesmas, 516 posyandu, 75 auxiliary puskesmas, and 18 poskesdes. Data on health facilities per district in the urban area of Gowa Regency is presented in table 6.

Table 6: Health Facility for Each Sub-District in Urban Area of Gowa Regency in 2018

No	Subdistrict	Health Facility				
		Hospitals	Puskesmas	Posyandu	Auxiliary Puskesmas	Poskesdes
1	Bontonompo		1	53	12	1
2	Bontonompo Selatan		1	41	8	1
3	Bajeng	1	2	69	11	1
4	Bajeng Barat		1	32	5	1
5	Palangga		2	82	11	6
6	Barombong		2	46	5	2
7	Somba opu	1	2	67	3	4
8	Bontomaranu		1	34	4	
9	Pattalasang		2	41	4	1
10	Parangloe		1	25	5	1
11	Manuju		1	26	7	

Source: ([BPS] BPS of Gowa Regency 2018).

From the table above, it can be seen that the highest number of Medical facilities in the urban area of Gowa Regency in 2018 is Somba Opu District, and the smallest Medical facility in 2018 is Manuju district.

3. Worship Facility

Based on Makassar City BPS data (2019), the number of worship facilities in Makassar City in 2018 was 1462 units, consisting of 1225 mosques, 129 churches, 1 temple, 15 wihara, and 92 klenteng. Data on worship facilities per district in Makassar City is presented in table 7.

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Table 7: Facilities of Worship for Each District of Makassar City in 2018

No	District	Worship Facility				
		Mosque	Church	Temple	Wihara	Klenteng
1	Mariso	45	4		1	
2	Mamajang	38	8			
3	Tamalate	133	3			
4	Rappocini	146	12		1	
5	Makassar	39	7			
6	Ujung Pandang	24	23		6	
7	Wajo	27	3		7	1
8	Bontoala	24	3			1
9	Ujung Tanah	34	1			
10	Kep. Sangkarrang					
11	Tallo	82	4			90
12	Panakukkang	121	27			
13	Manggala	150	3			
14	Biringkanaya	245	22			
15	Tamalanrea	117	9	1		

Source: BPS Makassar City (2018) ([BPS] BPS of Makassar City no date).

Based on BPS data 2018 worship facilities in urban areas of Gowa Regency were 901 consisting of 886 Mosques, 15 Churches. Data on worship facilities per district in the urban area of Gowa Regency is presented in table 8.

Table 8: Worship Facilities for Each District in Urban Areas in Gowa Regency in 2018

No	Subdistrict	Worship Facilities				
		Mosque	Church	Temple	Wihara	Klenteng
1	Bontonompo	69	1			
2	Bontonompo Selatan	61				
3	Bajeng	212	1			
4	Bajeng Barat	46				
5	Palangga	102				
6	Barombong	49				
7	Somba opu	148	6			
8	Bontomaranu	50	7			
9	Pattalasang	55				
10	Parangloe	52				
11	Manuju	42				

Source: ([BPS] BPS of Gowa Regency 2018).

Analysis of the Form of Spatial Interaction Between Makassar City and Urban Areas of Gowa Regency

In this research, the calculation of global autocorrelation with Moran's statistical statistics uses geode software. The spatial weighting matrix is also called a matrix that describes the strength of the interaction between locations using Rook contiguity, that is, the observation area is determined based on the sides that intersect, and angles are not taken into account.

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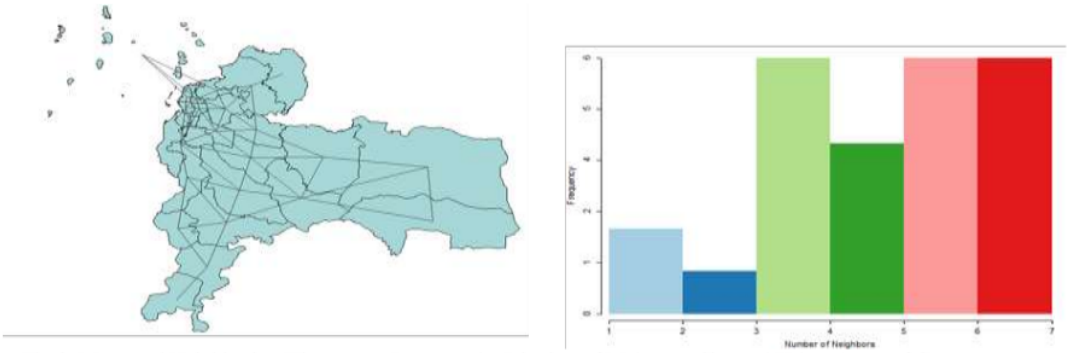

Fig 3: Maps and Neighboring Histograms Between the Districts of Makassar City and Urban Areas of Gowa Regency

Morans I test results presented in table 9 for GRDP produce global moran index values of 0.456 and 0.325 for public facilities. Moran index values for both GRDP and public facilities are in the range -1 <*I* <1 which indicates a positive spatial autocorrelation (Lutfi 2019). This is an early indication of the spatial relationship between the urban areas of Gowa Regency and Makassar City.

Table 9: The Results of the Moran's Index Calculation Using Geoda Software

No	Data	Moran's Index	Information
1	GRDP	0.456	Positive spatial autocorrelation
2	Public Facilities	0.325	Positive spatial autocorrelation

Then the significance test with the normal approach is performed to determine whether there is a sparse autocorrelation or not using a = 1%, which gets the results as in table 10. The hypothesis test is as follows:

Hypothesis H0: There is no spatial autocorrelation
H1: There is spatial autocorrelation

Test Criteria:

Reject H0 at the significance level a if $Z(I) > Z1- Z1-\square$ with $Z1-\square = Z_{0,99} = 2.575$.

Table 10: Significance Test Results Using Geode Software

No	Data	I.Moran	E(I)	Standard Deviation	Z (I)
1	GRDP	0.456	-0.0417	0.1356	3.6674
2	Public Facilities	0.325	-0.0417	0.137	2.6894

From the calculation results can be seen Z (I) for GRDP data = 3.6674 > Z0.99 = 2.575 and Z(I) Public facilities = 2.6894 > Z0.99 = 2.57. So that H0 is rejected or can be concluded at the 99% significance level, there is a spatial autocorrelation of economic and public services between urban areas of Gowa Regency and Makassar City. A district/city does not stand alone in developing its economy but is influenced by economic activity in the surrounding area (Lutfi 2019).

The grouping of patterns of relationships that are formed due to spatial interactions with the GRDP between regions in Makassar City and urban areas of Gowa Regency in 2018 is detailed as follows:

1. Groups of regions with a high economy surrounded by regions with a high economy are also Biringkanaya, Tamalanrea, Panankukang, Manggala, Tallo, Makassar, Rappocini Districts.
2. Groups of regions with a high economy surrounded by areas with the low economy are Mamajang, Mariso, Bontoala, Ujung Tanah, Kep. Sangkarrang, Somba Opu

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3. Groups of regions with a low economy surrounded by areas with a low economy are Barombong, Pattalasang, Ujung Pandang, Palangga, Wajo, Bajeng, Bajeng Barat, Bontomaranu, Parangloe, Manuju, South Bontonompo Districts.
4. The group of regions with a high economy surrounded by areas with the low economy is Tamalate District.

The grouping of patterns of relationships formed due to spatial interactions of public services between regions in Makassar City and urban areas of Gowa Regency in 2018 is detailed as follows:

1. Groups of areas with high public services surrounded by areas with high public services are Biringkanaya, Tamalanrea, Tallo, Panakukang, Manggala, Somba Opu, Palangga, Tamalate, Rappocini Districts.
2. Groups of areas with high public services surrounded by areas with low public services are Mamajang, Makassar, Barombong, Pattalasang Districts.
3. Groups of areas with low public services surrounded by areas with low public services are Ujung Tanah District, Kep. Sangkarrang, Wajo, Bontoala, Ujung Pandang, Mariso, Parangloe, Manuju, Bontomaranu, West Bajeng, Bontonompo, Bontonompo Selatan.
4. The group of areas with high public services surrounded by areas with low public services are Bajeng District.

III. CONCLUSIONS

Based on the results, it can be concluded that:

1. From the results of the statistical analysis, it is concluded that there is a close spatial dependence with a significance of 99% on the GRDP value and inter-regional public services in Makassar City and Gowa Regency urban areas. This is consistent with the theory put forward by Daldjoeni 1987 that the potential for interaction between regions can be applied if the conditions of the regions being compared fulfill certain requirements, namely socio-cultural, socio-economic similarity, topography, facilities, and infrastructure that connect between regions.
2. Grouping the pattern of relationships formed due to spatial interaction with GRDP and public services between regions in Makassar City and urban areas of Gowa Regency grouping in all quadrants, but the largest grouping both in GRDP values and public services is in quadrant III, namely the region group with characteristics low surrounded by areas with low characteristics as well.

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