

LOCATION QUOTIENT OR LQ, A SIMPLE QUANTIFYING METHOD TO ASSESS COMPARATIVE ADVANTAGES. A Concept. A Case Reference on Cattle in Indonesia

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Abstract

This paper is aimed to socialize the use of Location Quotient or LQ as an alternative method to quantify comparative advantages of commodities. It is a simple and a useful method to understand the existing potential of particular regions and the meaning of information gained from that analysis for planning and or development program. A practical case analysis was applied on the potentials of cattle in Indonesia under 26 provinces (Central Bureau Statistics, 2001). This method will be meaningful if the other related data are considered, for example land resources, economic density as the main ecological requirement and cattle development indicator respectively. Discussions and cautions are noted in using this method. Suggested, this method can be further developed properly and can be used widely for agricultural and non-agricultural commodities.

Key words: Location Quotient or LQ, Quantitative method, Regional potentials, Comparative advantages

Introduction

Comparative advantages of agricultural products have been discussed in many ways either in research, operational service, seminars, symposium and many other opportunities in order to make a proud of a given region as the centre of production, which continuously attempted to give more and more economic contribution and growth. To encourage the spirit of development in efforts to achieve comparative advantages, the East Java province promote a motto “one village one product”. Other regional governments have different approach.

Competitive market, expressed in local currency equivalents will give indication of products for which a country has comparative advantage and defined as the ability to produce output at lower opportunity cost than its trading partners. Within a model of free trade, a country will specialize in the production and export of goods in which it has comparative advantage, generating foreign exchange to import of goods in which it does not have comparative advantages (Hess and Ross, 1995).

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When a region has potential particular resources which may attractive for industrial investment that such region concerns with economic growth or how to offset a decline in employment with new economic activity may then want information on:

(a) what commodity the region has and does not have (b) the extent to which each commodity is under or over represented in the region to the nation or what commodity does the region have less than its fair share and in which one, more than its fair share, (c) the extent to which the region’s imports can be reduced by production within its area (how much import substitution might be possible), (d) the extent to which the output of its exports (viewed as points of strength) can be justifiably expanded for export trade enhancement. To help providing back ground information on one or more of those interrelated questions, the location quotient is a tool often implied (Isard, *et al.*, 1998)

Materials and Method

Definition

- a) **Comparative advantages**, involve the study (understanding) of single commodity (product) in different locations: regions, zones in terms of production, productivity economic value advantages which are specifically owned by a given location temporarily or permanently. In this paper cattle production is the object of calculation of the method used. Detailed study may need historical analysis to trace the process of a given commodity development in respect to the ways in which a given commodity is interrelated in society.
- b) **Location Quotient or LQ** is a device for making corporations inters regional economic parameters. For example to compare for a given region Y its percentage share of its nation’s employment in activity i with it share of the nation’s total employment. LQ formula follows Miller and Blair (1985), Komariah (1985), Isard, *et al.* (1998), and its modifications (Ashari 1999; Ashari, 2002). LQ calculation is to find the potentials of resources (animal species, ecological land basis) of the region.

$$\text{Location Quotient (L.Q)} = \left\{ \frac{X_{iR} / X_R}{X_{iN} / X_N} \times \dots \times \dots \right\}$$

$$(LQ-1) \times LQ-2 \times \dots \times LQ-n$$

1,2,...n (resources 1, 2 ...)

- X_{iR} - output commodity i in a region R
- X_R - output sub-sectoral in a region R
- X_{iN} - output commodity i in national N level.
- X_N - output sub-sectoral X in national N level.

LQ values > 1,0 - surplus area
 = 1,0 - self supplied area
 < 1,0 - supplied area.

- c) **Coefficient of localization**, addition to the L.Q., the coefficient of localization has been employed on a number of occasions to see the concentration of product. To construct it: (1). Each region of the nation calculate its percentage share in industry or sub sector i and its percentage of total national variables, (2) for each region take differences between the two percentages, (3) compute the sum over take the difference all regions either the plus differences, or negative ones, and divided by 100.

$$CI (\%) = \left\{ \frac{X_{iR}}{X_R} - \frac{X_i(N)}{X(N)} \right\} : 10$$

CI - coefficient of localization
 X_{iR} - output commodity i in a region R
 X_R - output sub-sectoral in a region R
 X_{i(N)} - output commodity i in national N level
 X(N) - output sub sectoral X in national N level

Take the plus values for regional product concentration (surplus).

- d) **Economic density** is an average value (ration) of number of stock (species or production) per one thousand human populations. Care should be taken with the interpretation of as many animals reared under a sharing management. Thus economic density of rearers' animals will be different from economic density figures. The rate of animals owned (by farmers) will be differing slightly. This term is actually a measure term in real target development, the same as income per capita, production (kg/quintal) per capita. In livestock development this term is more relevant in measuring the target rather than population growth figures as usually presented particularly in statistics.
- e) **Livestock unit calculation.** LU factor values are : cattle and D. cattle = 0.7, buffalo = 0.8, goat = 0.07 (Etawah grade goat – Java, Bali, Lampung, NTB), sheep = 0.06, V.chicken = 0.001, Laver = 0.002, broiler = 0.0015 and duck = 0.002, cited from Ashari *et al.* (1999)
- f) **Source of data.** To find the performance of calculation, census data of households 1983 and 1993 were used (CBS, 1984, 1994).

Results and Discussion

Livestock resources: population, economic density and LQ of Livestock Unit (LU)

The regional distribution of animals, measured by the relative number of animals kept in a region has one disadvantage – it does not show whether animal husbandry is really important for that region. In an area with a greater extent of agricultural lands, generally there will be kept a greater number of domestic animals than in a region with only a smaller agricultural area. Such a situation is given when comparing animal husbandry in Java-Bali with, say, in out those areas (Kalimantan, Maluku). But the sparsely populated areas have potential economic scale of animal raising due to extensive grazing of animals on native pasture, bush land, estate crop, excessive fallow land agro ecosystems, which may allow smaller burden of labour to provide feed staff. Cut and carry systems (mostly practiced in highly populated areas) are farmers' and cultural burden to better socio-economic animal farming. Therefore to give a better measures of the importance of livestock existence, Location Quotient or LQ, economic density, Livestock Unit (LU) calculation, Coefficient of localization figures have been worked out by relating the number of animals to human population, agro ecosystem land areas in that region to national level. The results are very interesting.

The national livestock population (heads and LU), economic density and LQ of livestock population in year 2000 are shown in Appendices 2, 3 and 4. In general the population of animals (cattle, dairy cattle, sheep, goats, village chicken, broilers, layers and ducks) are most likely related to the agricultural land resources and human population, characterized as small holders) in Indonesia are concentrated in Java and Bali, except buffaloes. And play an important and integral role in the rural economy of Indonesia. Chickens are noted as the major population, and then followed by goats, cattle, sheep, buffaloes ducks and dairy cattle (Appendix 1). If they are calculated in Livestock Unit (LU), cattle are nationally recorded as the major animal, followed by goats, sheep, chicken, buffalo, dairy cattle and ducks (Appendix 2).

Table 1 shows the way to make a conclusion on the production status of regions in relation to the existing cattle population and other species contribution. In using LQ, care must be pointed on the background of a region, not merely based on the existing potential of a particular commodity. Therefore in seeing the importance or advantages of a given commodity of a region, the share of that region cannot be purely considered based on the value of LQ to say as the centre of national production contribution. Other devices (measures) as complements of LQ method must be used: both economic density and coefficient of localization, as also already discussed by Ashari (2002) in using LQ as a complement of Shift – Share Analysis. A risk of miss use calculation may be raised or contributed from the value of numerator which may show higher values from small or less potential resources. On

the other hand, smaller LQ values may be obtained from large potential resources (see cases of Jambi, Bengkulu compared to South Sulawesi and South East Sulawesi on Table 1). See also this type of discussion in Ashari (2002). And the same results also occurred (shown) on the regional share (Coefficient of Localization). So that corrections are needed, using economic density and the average national share production contribution. On the national share (of cattle production in LU – Table 1 – column 7), the South Sulawesi value shows a value 6.51 %; this value is above the average of 3.85 % to the total value (1.00 %).

As conclusions the national concentrations of cattle production as national comparative advantages are: Aceh, West Sumatera, Central Java, East Java, Bali and NTB. All these regions have combination characteristics of (1) $LQ > 1$ with reasonable economic density, and or (2) have high national production contribution (share) (3) with plus relative coefficient of localization.

Land resources

Land resources as the ecological environment needs of farm animals, based on CBS (2001), the author classify into six major land uses as the following: (1) wet lands (mainly rice field/wet land framings) (2) dry field (dry land farming) (3) temporarily fallow lands – those are the irregularly cultivated (4) the bush lands (bush vegetation) (5) pastoral lands and (6) the estate crop plantations, either small holders or large enterprises. The national profiles of land uses based on provincial figures are shown in Appendix 2. The following are the LQ values of those resources. The LQ values > 1 , indicates potential resources nationally (except DKI Jakarta and Bali), which may offer more space for development programs. The mollification of LQ of cattle (component 1) X LQ of land resources (component 2) as LQ combination shown in Table 2. Values of more than 1 or less than 1 may be obtained from combination of different LQ component values. The status of regions in relation to LQ combination values is summarized (after corrections included) in the following table.

Table 1. Profile of regional cattle concentration and meaning of importance (advantages)

No	Province	Cattle population		Economic Density	Livestock population (LU)	National share (%) of LU based		Coef of localisation		Concentration of Resources			
		Heads	LU			Cattle	l.stok	LQ	LQ	$\frac{LQ}{>1}$	$\frac{LQ}{<1}$	Ec	De
1	Aceh	698,489	488,942	174.1	1,212,227	6.33	4.24	1.49	2.08	+	+	+	+
2	North Sumatera	247,781	173,447	22.6	942,924	2.25	3.30	0.68	-1.05	+	-	-	-
3	West Sumatera	429,336	300,535	101.5	638,164	3.89	2.23	1.74	1.66	+	+	+	+
4	Riau	144,678	101,275	30.6	271,082	1.31	0.95	1.38	0.36	+	+	+	+
5	Jambi	142,054	99,438	59.2	257,329	1.29	0.9	1.43	0.39	+	+	+	+
6	Sumsel	420,617	294,432	54.2	662,933	3.81	2.32	1.64	1.49	+	+	+	+
7	Bengkulu	79,180	55,426	56.4	155,145	0.72	0.54	1.32	0.17	+	+	+	+
8	Lampung	375,115	262,581	56.4	825,842	3.40	2.89	1.17	0.51	+	+	+	+
9	DKI Jakarta	0	0	0.0	497,204	0	1.7	0.00	-1.70	+	-	-	-
10	West Java	174,697	122,288	4.0	3,055,334	1.58	10.69	0.15	-9.10	+	-	-	-
11	Central Java	1,317,341	922,139	42.7	2,654,209	11.94	9.28	1.28	2.65	+	+	+	+
12	Yogyakarta	206,714	144,700	66.5	309,264	1.87	1.08	1.73	0.79	+	+	+	+
13	East Java	3,312,015	2,318,411	95.9	3,824,108	30.01	13.3	2.24	16.63	+	+	+	+
14	Bali	529,074	370,352	169.3	486,425	4.79	1.70	2.82	3.09	+	+	+	+
15	NTB	376,526	263,568	98.5	850,590	3.41	2.98	1.15	0.44	+	+	+	+
16	NTT	485,329	339,730	123.4	2,276,956	4.40	7.96	0.55	-3.57	+	+	+	+
17	West Kalimantan	151,598	106,119	40.5	731,638	1.37	2.55	0.54	-1.19	+	+	+	+
18	Central Kalimantan	45,326	31,728	25.2	198,389	0.41	0.69	0.59	-2.28	+	-	-	-
19	South Kalimantan	143,416	100,391	48.3	499,650	1.30	1.75	0.74	-0.45	+	-	-	-
20	East Kalimantan	50,070	35,049	20.6	359,897	0.45	1.26	0.36	-0.81	+	-	-	-
21	North Sulawesi	276,524	193,567	98.0	833,419	2.51	2.92	0.86	-0.00	+	+	+	+
22	Central Sulawesi	234,444	164,111	113.5	1,082,296	2.12	3.79	0.56	-1.66	+	+	+	+
23	South Sulawesi	718,139	502,697	92.2	3,082,459	6.51	10.78	0.60	-4.28	+	+	+	+
24	South East Sulawesi	300,341	210,239	169.5	801,896	2.72	2.81	0.97	-0.08	+	+	+	+
25	Maluku	97,938	68,557	49.5	1,752,786	0.89	6.13	0.14	-5.24	+	-	-	-
26	Papua	80,462	56,323	37.5	328,982	0.73	1.15	0.63	-0.42	+	-	-	-
INDONESIA		11,037,204	7,726,043	53.7	28,591,197	1.00	1.00			+			

Table 2. LQ of land ecological resources

No	Province	Wet land		Dry land		Tem.fellow		Bush		Nat.pasture		Estate crops	
		All	>1	All	>1	All	>1	All	>1	All	>1	All	>1
1	Aceh	<u>1.1</u>	+	<u>1.6</u>	+	0.7		0.4		<u>2.3</u>	+	<u>1.1</u>	+
2	North Sumatera	<u>1.2</u>	+	<u>1.0</u>	+	0.5		0.4		0.8		<u>1.9</u>	+
3	West Sumatera	<u>1.1</u>	+	<u>1.3</u>	+	0.3		<u>1.1</u>	+	0.5		<u>1.2</u>	+
4	Riau	0.3		<u>1.0</u>	+	<u>1.1</u>	+	0.4		0.2		<u>2.1</u>	+
5	Jambi	0.5		<u>1.0</u>	+	0.5		0.6		0.1		<u>2.1</u>	+
6	Sumsel	0.8		0.8		0.8		0.9		0.3		<u>1.7</u>	+
7	Bengkulu	0.7		<u>1.4</u>	+	<u>1.2</u>	+	0.7		0.2		<u>1.2</u>	+
8	Lampung	<u>1.2</u>	+	<u>1.9</u>	+	0.4		0.2		0.2		<u>1.6</u>	+
9	DKI Jakarta	1.2		4.4		0.1		0.0		0.0		0.0	
10	West Java	<u>3.6</u>	+	<u>1.9</u>	+	0.1		0.3		0.3		0.5	
11	Central Java	<u>4.6</u>	+	<u>2.1</u>	+	0.0		0.1		0.5		0.2	
12	Yogyakarta	<u>2.8</u>	+	<u>2.9</u>	+	0.0		0.5		0.0		0.0	
13	East Java	<u>3.9</u>	+	<u>2.3</u>	+	0.0		0.2		0.7		0.2	
14	Bali	<u>2.2</u>	+	<u>1.9</u>	+	0.1		0.1		0.0		<u>1.5</u>	
15	NTB	<u>2.1</u>	+	<u>1.3</u>	+	0.8		<u>1.1</u>	+	<u>1.0</u>	+	0.2	
16	NTT	0.4		<u>1.2</u>	+	<u>1.7</u>	+	0.5		6.1	+	0.4	
17	West Kalimantan	0.5		0.6		<u>1.9</u>	+	0.9		0.1		<u>1.2</u>	+
18	Central Kalimantan	0.5		0.6		<u>2.8</u>	+	0.2		0.96	+	<u>1.2</u>	+
19	South Kalimantan	<u>1.6</u>	+	0.8		<u>1.9</u>	+	0.3		<u>2.4</u>	+	0.8	
20	East Kalimantan	0.3		0.5		<u>2.6</u>	+	0.9		0.3		0.8	
21	North Sulawesi	0.7		<u>2.0</u>	+	0.5		0.4		0.6		<u>1.5</u>	+
22	Central Sulawesi	0.5		0.7		<u>1.4</u>	+	0.7		<u>1.5</u>	+	<u>1.4</u>	+
23	South Sulawesi	<u>2.0</u>	+	<u>1.2</u>	+	0.6		0.6		<u>2.6</u>	+	0.8	
24	South East Sulawesi	0.4		<u>1.2</u>	+	<u>1.3</u>	+	0.6		<u>1.6</u>	+	<u>1.2</u>	+
25	Maluku	0.0		<u>1.2</u>	+	0.5		<u>1.4</u>	+	<u>1.6</u>	+	<u>1.2</u>	+
26	Papua	0.0		0.1		0.6		<u>3.1</u>	+	0.7		0.1	

Remarks: DKI Jakarta and Bali are excluded for the LQ values of wet–dry lands and estate crops respectively. In LQ value > 1, indicates potential agro ecological land resources.

Table 3. LQ combination values and development status of regions

No	LQ values		LQ combination	Development status of regions
	Cattle	Agro eco. Lands		
1	> 1	> 1	> 1	Intensification regions
2	> 1	< 1	> 1	Intensification regions
3	> 1	< 1	< 1	Intensification regions
4	< 1	< 1	> 1	Developing regions
5	< 1	< 1	< 1	Supporting regions
6	< 1	> 1	> 1	Developing regions
7	< 1	> 1	< 1	Developing regions

As simple an example is a case of West Java status. In calculation, the LQ of cattle of this region is <1 (Appendix 3, the LQ of agricultural lands (both wet land

and dry land) are more than 1. But the values of final LQ in both potential land resources are less than 1. In recommendation, concluded that West Java is a potential developing region for national cattle development. Therefore in the recommendations for development status of regions, conclusions must be obtained either from the final (combination) LQ values and or from the contribution of the LQ of each component.

Recommendation of development

Recommendation consists of priority areas of intensification, developing and supporting areas that are characterized by potential resources of animal resources and agro ecological lands.

Table 4. LQ of cattle x LQ of land ecological resources

No	Province	Wet land	Dry land	Tem. Fellow	Bush	Nat. pasture	Estate crops
1	Aceh	1.63	2.44	1.06	0.58	3.49	1.64
2	North Sumatera	0.80-	0.69	0.35	0.27	0.56	1.30
3	West Sumatera	1.88	2.27	0.45	1.99	0.83	2.01
4	Riau	0.44	1.35	1.52	0.52	0.21	2.88
5	Jambi	0.74	1.48	0.73	0.90	0.20	2.95
6	South Sumatera	1.30	1.26	1.30	1.47	0.49	12.71
7	Bengkulu	0.87	1.81	1.53	0.97	0.32	1.56
8	Lampung	1.42	2.25	0.47	0.20	0.25	1.91
9	DKI Jakarta	0.0	0.00	0.00	0.00	0.00	0.00
10	West Java	0.53	0.28	0.01	0.05	0.05	0.08
11	Central Java	5.92	2.67	0.02	0.17	0.67	0.22
12	Yogyakarta	5.10	4.96	0.08	0.83	0.00	0.00
13	East Java	8.68	5.19	0.11	0.35	1.55	0.56
14	Bali	6.27	5.47	0.14	0.33	0.00	4.10
15	NTB	2.41	1.50	1.00	1.31	1.20	0.20
16	NTT	0.19	0.66	0.93	0.28	3.35	0.21
17	West Kalimantan	0.27	0.33	1.01	0.49	0.05	0.65
18	Central Kalimantan	0.27	0.37	1.66	0.13	0.57	0.71
19	South Kalimantan	1.17	0.58	1.44	0.25	1.81	0.58
20	East Kalimantan	0.11	0.17	0.96	0.34	0.09	0.29
21	North Sulawesi	0.56	0.17	0.46	0.30	0.50	1.27
22	Central Sulawesi	0.26	0.41	0.80	0.38	0.82	0.81
23	South Sulawesi	1.20	0.74	0.36	0.37	1.57	0.47
24	South East Sulawesi	0.43	1.99	1.29	0.56	1.59	1.18
25	Maluku	0.00	0.17	0.07	0.20	0.24	0.17
26	Papua	0.00	0.12	0.41	1.96	0.42	0.07

Based on LQ, Economic density and coefficient of localization, the following matrix shows national development recommendation for cattle:

Table 5. Matrix of recommendation of cattle national development

No	Province	Wet land	Dry land	Tem. fellow	Bush	Nat. pasture	Estate crops
1	Aceh	++	++	++		++	++
2	North Sumatera	+	+				+
3	West Sumatera	++	++		++		++
4	Riau		+	+			+
5	Jambi		+				+
6	South Sumatera	+	+	+	+		+
7	Bengkulu		+	+			+
8	Lampung	+	+				+
9	DKI Jakarta						
10	West Java	+	+				
11	Central Java	++	++				
12	Yogyakarta	+	+				
13	East Java	++	++			+#	++*
14	Bali	++	++				
15	NTB	++	++	++	++	++	
16	NTT		+	+		+	
17	West Kalimantan			+			+
18	Central Kalimantan			+		+	+
19	South Kalimantan	+		+		+	
20	East Kalimantan			+			
21	North Sulawesi		+				+
22	Central Sulawesi			+		+	+
23	South Sulawesi	++	+			+	
24	South East Sulawesi		+	+		+	+
25	Maluku		+		+	+	+
26	Papua				+		

Remarks: * : the sugar cane estate, integrated with rice field farming,
 # : national park grazing
 ++ : intensification regions
 + : developing regions
 without + : supporting regions

Conclusions

1. Location Quotient or LQ is a simple analysis method of interregional differences and potential. If it is emphasize in the production and spatial concentration, it may use the base a measure of geographic ecosystem area (in

terms of ha) to see which regions are over and under represented in comparative advantages.

2. The use of LQ can be meaningless when it is used alone. The use of other tools can be of value. In this example the inclusion of economic density (in livestock parameters), coefficients of localization are applied with considering national share and potential resources.

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