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Exploration of Potential Regional Resources for Beef Cattle Farming Development in Java, Indonesia

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ABSTRACT: National beef production in Indonesia from year to year has been always low compared with the consumer demand, thus it still depend on imports. The purposes of this study were: (1) to identify factors related to the regional resources which support the development of cattle farming, (2) to determine the potential resources for the development of beef cattle farming, and (3) to improve beef cattle development strategy based on the potential resources. The location taken were two provinces in Java, namely East Java Province and Special Region of Yogyakarta. Time series data from 2007 to 2012 as variables in this study were taken as each 7 and 4 regency as the samples. These data were analyzed by Multiple Regression Model using Ordinary Least Square method. The stationary test was done before using time series data by unit root tests of Augmented Dickey-Fuller (ADF). Dependent variable in the model was beef cattle population in each regency per year. Meanwhile the independent variables were population, number of farmers, price of cattle, number of cattle slaughtered, number of cattle that exit from region , number of cattle that enter to region, rice production, corn production, soybean production, cassava production in each region per year and dummy location. The results of this research showed that enhancement of corn and soybean production in a region was potential resource to increase the population of beef cattle. Moreover, the beef cattle price per kg of live weight and number of beef cattle slaughtered in a region need to be considered as the factors for strategies in developing beef cattle farming. Location has significant effect on the beef cattle development.

Keywords: Development, beef cattle farming, regional resources, Java

INTRODUCTION

Indonesia is an agricultural country because 85% of the population had livelihood as farmers, with an average ownership of arable land below 0.5 ha especially in Java. Farmers generally have a livestock including beef cattle with small scale 1-3 Animal Unit (AU), as an activity that was complementary and supplementary to the crops farming with the aim to increase their farm income. According to Stur, *et al*., (2013) livestock production in developing countries can be an important pathway for rural communities to get out of poverty. Based on data from the Ministry of Agriculture of the Republic of Indonesia (Suswono, 2012; Directorate General of Livestock and Animal Health, 2008 and 2013), the national consumption of beef for Indonesian society had been continuing to increase from 2007 to 2012 that is 396.00 to be 508.90 thousand tons or an average of 5.26% per year. In the same period, national production has only increased of 4.61% per year while imports of beef by an average of 36.98% per year. Therefore, the development of beef cattle was good employment opportunities for farmers in the rural. The opportunity was supported by the nature of Indonesia that were geographically and demographically has a wealth of natural resources that were believed to have comparative and competitive advantages for beef cattle business (Rauf, *et al*., 2014). However, there were still various kinds of constraints in development of beef cattle farming such as capital, technology and human resource capabilities (Rouf, *et al*., 2014; Priyanto, 2011; Widiati, 2006). The main reason of the various constraints were the dynamics of agriculture resources such as soil types, climate conditions, rainfall, social and cultural conditions of the population and others. The dynamics of the use of resources that could improve crop yields will

have impact on the increase the supply of animal feed as an important resource for the livestock development (Teklewold, *et al.* 2013).

This study tried to seek an alternative to improve smallholder beef cattle based on the potential resources of the region to support the existing government programs. Accumulation of regional resources can provide greater inputs for production than the individual approach farmers with limited land, capital and labor. It was needed to support previous research which suggests that one strategy to develop of the beef cattle farming industry in Indonesia was encouraging of investors to develop forage industry as feed suppliers which has processed with touch of technology to make it easier for farmers to access in large quantities and low prices (Widiati, 2014). Administratively, a region can be village, sub-district, district or regency, and city which have extensive agricultural land resources and population as labor forces as well as consumer for goods and services. Furthermore, population was also the owner of capital on the region. County-level yield data can be used in applied crop insurance policy in place of farm level (Gerlt, S. *et al.* 2014).

A production process of agricultural including beef cattle farming in a region can be described in the following function (Penson, *et al*., 2002):

$Y = f(A, L, I, M)$ …….……...……. (1)

Where: Y = output or product, is a function of A = area/ and for various activities of farming, L= labor, I = investment/capital and M = management or technology.

Agricultural resources such as crops and beef cattle are interrelated, dependent, and supporting to each other. Therefore, the availability of resources in a region is very important to be studied in an effort to increase the population and production of beef cattle.

MATERIALS AND METHODS

The Province of East Java and Special Region of Yogyakarta (DIY) which were as regional suppliers of beef cattle represented as sample location. Furthermore was taken 7 regencies of the 29 regencies in East Java and four regencies or of all in DIY. This study were using time series data collected for 2007-2012 (6 years) for every sample regions that was available completely from relevant institutions related to the research, that were the Central Bureau of Statistics, Abattoirs office, Department of Animal Husbandry, and the Department of Agriculture in each regency. The existence of beef cattle development in an area can be measured from the increase in beef population from year to year as dependent variable that was included on the multiple linear regression model as shown as equation 2.

$$BCP_{it} = \beta_o + \beta_1 Pop_{it} + \beta_2 NF_{it} + \beta_3 PC_{it} + \beta_4 CS_{it} + \beta_5 CEx_{it} + \beta_6 CE_{ni}\, t + \beta_7 RProd_{it} + \beta_8 CrProd_{it} + \beta_9 SProd_{it} + \beta_{10} CsProd_{it} + \alpha 1D_{it} + e_{it} \quad \text{.....(2)}$$

The notations were:

BCP_{it}	= beef cattle population as the dependent variable in the region i in year t (head);
β_o	= intercept
$\beta_1, \beta_2, \beta_3 \ldots\ldots \beta_{10}$	= regression coefficient of independent variable of $X_{1t}, X_{2t}, X_{3t} \ldots\ldots X_{10t}$
Pop_{it}	= population in region i, in the year of t (person);
NF_{it}	= the number of farmers in region i, and year t (household) ;
PC_{it}	= price of cattle in region i, and year t (IDR/kg live weight) ;
CS_{it}	= the number of cattle slaughtered in region i, and year t (head/year);
CEx_{it}	= the number of cattle that exit from region i, and year t (head/year)
CEn_{it}	= number of cattle that enter to region i, and year t (head /year);
$RProd_{it}$	= rice production in region i, and year t (ton/year);
$CrProd_{it}$	=corn production in region i, and year t (ton/year);
$SProd_{it}$	= soybean production in region i, and year t (ton/year);
$CsProd_{it}$	= cassava production in region i, and year t (ton/year);

$\alpha_1 D_{it}$ = dummy of location, 1 = in region i for East Java province, in year t;
0 = in region i for Special Region of Yogyakarta in year t;
e_{it} = error term, i = 1,2, ... .11; region to 1,2,3, ... 11
t = 1,2, ... 6; year to 2007, 2008, ..., 2012

Estimation and validation of the model started from the correction of the time series data by using tests such as stationer, co-integration, and residual tests. The stationer tests considered herein are unit root tests of Augmented Dickey-Fuller (ADF). The occurrence of co-integration, if there was a long-term relationship between independent and dependent variables using Johansen Co-integration test through the trace statistics. The existence of independent variables that are mutually co-integrated needed to be corrected with Error Correction Model / ECM (Greene, 2003; Gujarati, 2003). Furthermore, the coefficient of Regression estimated by using Ordinary Least Square method (OLS). The stationary test of time series data was used to make the variance became constant according to OLS assumptions, because there was a possibility of lag intercorrelation that might affect inconsistency of variance. The accuracy of the model was tested using a hypothesis test consists of a coefficient of determination (R^2), Overall test (F test) and partial test (t test). All of the above tests was done with the help of a computer using *Eviews* 6th.

RESULTS AND DISCUSSION

Beef cattle farming and its supporting resources in Java, Indonesia

Java is one of island, including the large islands in Indonesia which was inhabited by 138.794 million people (44.74%) and having plains area of 192,257,000 ha (7.23%) (Central Bureau of Statistics, 2013). While, East Java province has the largest population of beef cattle, which was in 2012 reached 5,019,445 heads, with population of 37.56 million of people and 1,913,213 ha of agricultural land, followed by DIY which has beef cattle population of 414,381 heads, with a population of 3.71 million people and 132,987 ha of agricultural land. East Java Province and DIY had a dense population, but population of beef cattle can still above the national average of Indonesia. Beef cattle breeding that produce bulls as a supplier of beef was usually cultivated by farm households. Generally, farmers in Java grow crops to meet the needs of staple food such as rice, corn, soybeans, peanuts, cassava and be accompanied its byproducts that used as animal feed. While outside of Java are still many forests and plantations, especially oil palm has a byproduct as a source of quality livestock feed. Nevertheless, generally the type of crop orientation is largely determined by the existing agro-ecologies in a region (Silvia and Matus, 2014).

The population of cattle and beef production in each region has fluctuated (Table 1). In 2011 there was a striking increase in livestock population, because in that year there are government assistance programs that distribute cows to farmers. However, to make a beef cattle development strategy requires the supporting factors as a basic for further policy.

Table 1. The population of cattle and beef production in east Java, DIY and Indonesia

Year	Population of beef cattle					
	East Java		DIY		Indonesia	
	Amount (heads)	increase (%)	(heads)	increase (%)	(million heads)	increase (%)
2007	2,705,605		257,836		11,515	
2008	3,384,902	25.11	269,927	4.68	12,257	6.44
2009	3,458,948	2.19	285,043	5.60	12,760	4.10
2010	3,745,453	8.28	290,949	2.07	13,582	6.44

2011	4,727,000	26.21	375,844	29.17	14,824	9.14
2012	5,019,445	4.87	414,381	2.54	15,981	7.80
Average (%)		13.33		8.81		6.78

Beef production

Year	East Java		DIY		Indonesia	
	(tons)	Increase (%)	(tons)	increase (%)	(tons)	Increase (%)
2007	81,538		4,927		339,479	
2008	85,173	4.46	4,628	-6.07	392,511	15.62
2009	107,768	26.53	5,384	16.34	409,310	4.28
2010	109,016	1.16	5,690	5.68	436,452	6.63
2011	112,447	0.39	5,747	1.00	485,333	6.73
2012	114,749	1.41	5,991	4.24	505,777	1.84
Average (%)		8.19		5.29		8.77

Source: Directorate General of Livestock and Animal Health, 2008 and 2013.

Factors that influence to the development of beef cattle population

Based on the results of the unit root test, ***at*** the level of stationary there are three independent variables are stationary, namely the CEx, CEn and CsProd (ADF Prob <0.05). The data that are not stationary in order to become stationary , then it differentiated at the first difference level in the unit root analysis showed that all of independent variables have been stationary (ADF Prob <0:01). The data that are not stationary before the first difference level, there are possibility of co-integration which are the long-term relationships between independent and dependent variables. Therefore it was necessary to the co-integration testing considered herein using Johansen Co-integration test. The result of Johansen Co-integration test, there are three variables that are not mutually co-integrated, namely BCP with independent variables of CS, CsProd and SProd in which the value of Trace statistic was less than the critical value at 5% confidence level (P <0.05). Other independent variables were co-integrated with each other therefore in the short term there may be disequilibrium so that necessary to correction, in this research using the error correction model (ECM). Based on the ECM analysis showed that all independent variables have a residual value of significance level P <0:01 so that the ECM model were valid and the data can be used for further analysis. Ouedraogo and Bako (2014) have also conducted models of analysis of time series data using these methods.The regression analysis of the data that had been corrected was shown in Table 2.

Table 2. Results of regression analysis of the factors that influence to the development of beef cattle population.

Variable	Coefficient	Std. Error	t-value	Prob.
C	2.4313	2.2815	1.0657	0.2925
Pop	-0.1048	0.1657	-0.6325	0.5304
NF	0.0087	0.0088	0.9860	0.3296
PC	0.5907	0.1910	3.0895	0.0035***)
CS	-0.1523	0.0844	-1.8042	0.0782*)
CEx	0.0391	0.0233	1.6804	0.1001

CEn	0.0332	0.0370	0.8994	0.3734
RProd	-0.1275	0.1190	-1.0712	0.2900
CrProd	0.3623	0.0976	3.7119	0.0006***)
SProd	0.1234	0.0357	3.4587	0.0012***)
CsProd	-0.0492	0.0414	-1.1899	0.2406
Dummy location	0.5618	0.2371	2.3693	0.0224**)
R-squared	0.8856	F-statistic		30.2566
Adjusted R-squared	0.8564	Prob(F-statistic)		0.0000
Number of observation	66			

Source: Results of data analysis

From Table 2 it could be observed that the adjusted R^2 = 0.8556 by F test (P <0.001), it meant that the independent variables together could explain 85.56% to the development of beef cattle population, while the rest were described other factors that was not included in this model. Partially, the price of beef (PB), corn production (CrProd)), soybean production (SProd) had positive influence to the development of beef cattle population with significant level of P <0.01, and the dummy of location (D) with P < 0.05, meanwhile, slaughtering of cattle (SC) in an area had negative effect of P <0.1. Beef prices (BP) based on live weight gave a positive response to the increase in population, thus the cattle pricing policy that was greater than the cost of production should be considered in an effort to increase of production and population of beef cattle in Indonesia. Corn and soybean production had a significant positive effect on the development of beef cattle in the region. The rice production had not significant effect, although the rice plant produced straw as potential feed for beef cattle. This is because the rice productions were generally need to be managed intensively which labor intensive, thus there was no more time left to raise the cattle. Corn and soybean production had a significant positive effect on the development of beef cattle in the region. The rice production had not significant effect, although the rice plant produced straw as potential feed for beef cattle. This is because the rice productions were generally need to be managed intensively which labor intensive, thus there was no more time left to raise the cattle. Production of rice straw in Indonesia is only about 33% for animal feed, 50% were burned and 17% for the industry (Shaphan 2008 in Herawati, 2013). The production of corn, soybeans and rice would be followed by a byproduct in the form of straw as cattle feed. The protein content in soybean straw was the higest (16.6%), followed by the content in corn straw (7.7%) and rice straw (4.10%). Morever among those 3, corn straw was the most preferred by beef cattle (Emma, 2011 ; Hartadi, *et al*. 2005).The number of cattle slaughtered had negative significant effect on the cattle population in an area (P<0.1). Therefore, to develop the beef cattle population in a region that the quota of slaughtering should be set in accordance with the number of cattle population. Furthermore, dummy location had significant differences which meant that each location had different pattern of beef cattle development.

CONCLUSIONS

The development of beef cattle in Java should be directed to areas that suitable for corn and soybean crops. Furthermore, the price of beef per kg of live weight which was an incentive instrument for beef cattle farmers can be used as a basis for policy making in order to encourage the development of beef cattle farming, likewise beef cattle slaughtering in a region. Overall, the availability of resources in each region should be considered in the development planning of beef cattle farming.

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