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Andrie Kisroh Sunyigono*, Isdiana Suprapti, Nurul Arifiyanti
Department of Agribusiness, Faculty of Agriculture, University of
Trunojoyo Madura, East Java, Indonesia

*) Correspondence email: andriekisroh@trunojoyo.ac.id

Inter-market Variability of Smallholder Beef Cattle Farming in East Java Indonesia

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ABSTRACT

Indonesia has failed to achieve meat self-sufficiency; meanwhile, East Java is among the centers of beef cattle with a relatively high contribution in terms of GDP and employment. Therefore, this study aims to identify and analyze the market structure of the beef cattle commodity chain by considering the concentration ratio, Gini Index, as well as barriers to exit and entry. The study was conducted in Malang Regency and Sapudi Island, with 164 respondents, which consisted of calf suppliers, farmers, traders, and slaughterhouses. Furthermore, the analytical tools used include descriptive, concentration ratio, Gini Coefficient, and analysis of barriers to entry and exit. Based on the results, the market structures in the beef cattle commodity chain in terms of its input market was perfect competition, while the intermediate and output market was oligopoly. These results were confirmed by the concentration ratios of calf suppliers and farmers, which were lower than the ratios of traders and slaughterhouses. Although the market structures were different, their Gini Coefficients are almost similar because a value of 0.2 showed an equitable distribution. Additionally, the barriers to entry into the market were high investment with a large number of import and market problems. Meanwhile, the barriers to exit the market were a large number of potential demands, high investment, and a source of income.

Keywords: Beef cattle, Concentration ratio, Market structure, Smallholder farmers

INTRODUCTION

In Indonesia, beef cattle population is focused in two provinces, namely East and Central Java (Directorate General of Livestock and Animal Health Services, 2017). In 2019, East Java was the largest beef producer with a total of 99.1 thousand tons, followed by West Java with 80.2 thousand tons (Statistics Indonesia, 2020c). This condition showed that the government's policy needs to focus on the three provinces to increase the population. Therefore, the growth of the beef cattle population in East, West, and Central Java can significantly affect its population nationally.

The beef cattle production share of East Java among 2001-2009 was 21.4% of national production, followed by West and Central Java, as well as Jakarta with shares of 18.4%, 14.4%, and 3.0%, respectively. Furthermore, in 2010-2019, East Java shares 20.9% of the national production, which showed a decrease in production during these periods. There was also a decrease in the share of West Java from 18.4% to 15.2% and Central Java from 14.4% to 11.9%. However, the contribution of these provinces is still high, with approximately 48% (Statistics Indonesia, 2020b).

It showed that the region with a large beef cattle population is not automatically the center of meat production. Although Jakarta and West Java are the main producers of meat, they have no large beef cattle. The proportion of beef production of Jakarta and West Java was 18.12%, and the beef cattle population was only 2.63% of the national population (Statistics Indonesia, 2020b; Directorate General of Livestock and Animal Health Services, 2017). These provinces import beef cattle from other regions such as East and Central Java, together with Lampung.

Meanwhile, the demand for beef cattle in Jakarta and West Java tends to increase by approximately 11% per year. These provinces need almost 250,000 and 220,000 beef cattle per year, respectively. From 1990 to 2003, the number of beef cattle imported to West Java was 42.49%, while Jakarta was 25.74%. These values showed that consumers were concentrated in the provinces. Therefore, the government was triggered to make a policy concerning beef cattle importation to meet the demand due to the lack of supply of beef locally.

Indonesia still imports beef cattle, because approximately 80% of the beef cattle industry is dominated by smallholder farmers (Ashari, 2018). In terms of the economics of scale, the beef cattle smallholder farmers also have 2 to 3 heads. Furthermore, the characteristics of smallholder farmers that have low bargaining position, low income, and lack production technology (Sunyigono, Suprapti, & Arifiyanti, 2020). In 2013, statistics showed 5 million farmers with 12.3 million beef cattle (Statistics Indonesia, 2014).

The same condition also happens in East Java, where the province has a significant contribution in providing beef cattle and meat, however, it cannot meet national demand. The main challenge faced by the beef cattle smallholder farmers is due to the implementation of the traditional production system (Purnomo, Kurnianto, Riskiawan, & Destarianto, 2019). This is because most farmers feed the beef cattle based on the habits of their ancestors, which affected the low rate of average daily gain. The large farmers also face a similar problem. However, larger farmers have the problem of continuous production, with a low bargaining position.

The illustration above showed that the beef cattle smallholder farmers face a complicated problem. Furthermore, there are no sufficient economic incentives for the farmers and calf suppliers because of the low economies of scale, while the productivity and efficiency of the beef cattle industry are low (Nuhung, 2015).

Meanwhile, the Structure Conduct Performance (SCP) paradigm is based on the neoclassical microeconomic theory, which focuses on the comparison between perfect

competition and monopoly markets. One of the basic argumentations in the SCP paradigm is that market structure affects conduct and further determines market performance. The interaction affects the performance and the competitiveness of the market, which consider the potential benefits of consumers and society as stated in Figure 1 (Banson, Nguyen, & Bosch, 2018).

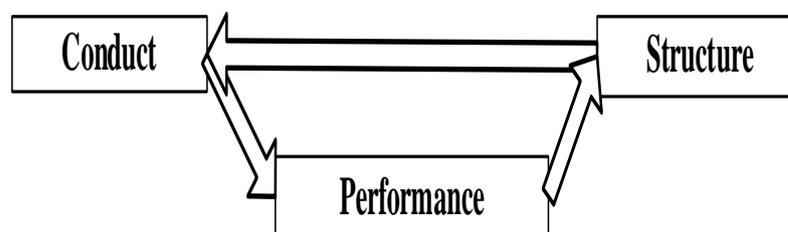


FIGURE 1. THE MARKET STRUCTURE, CONDUCT, AND PERFORMANCE RELATIONSHIP
SOURCE: BANSON, NGUYEN, & BOSCH, (2018), ADAPTED

The components of the market structure consist of market share (Alfaro, 2020), marketing channels, marketed volumes, degree of market concentration (Sutter, Webb, Kistruck, Ketchen & Ireland, 2017), size, production scale, and existence or non-existence of barriers to entry (Yang, Zhang & Wang, 2017). It also consists of the number and size of sellers and buyers, the degree of product differentiation, the presence or absence of barriers to entry of new actors, the configuration of cost components, the degree of firms' vertical integration from raw materials to retailers, and the possibility of product diversification. The most common tools to measure market power are concentration ratio, Hirschman Herfindahl Index (HHI), and Gini coefficient (Kvalseth, 2018).

Market conduct represents the firms' behavioral pattern in adapting to the market condition. In addition, it has no theoretical framework for market analysis because human behavior is not easily identified and quantified; therefore, variables are explained in a descriptive manner (Dodo & Umar, 2015).

Furthermore, market conduct is associated with price policy and its implementation, explicit and implicit cooperation, related products produced by firms, price efficiency, opportunity to produce and develop the new product, and investment (Tan, Ridwan, Nesti & Sartika, 2019). Meanwhile, the relationship between market conduct and firms is price-searchers. Based on this relationship, the price-searcher firms have higher market power than price-taker firms. However, a competitor can be forced to exit the market through some output and price policies.

The performance of the market can be identified through its contribution to economic growth, which is usually measured by the concept of productive and allocative efficiency. Furthermore, it can be identified in terms of the new invention, degree of fairness, and job creation. Institutional performance has a significant impact on economic and social resources (Amam, Jadmiko & Harsita, 2020).

Market performance is measured by considering price, efficiency, profitability rate, technical progress, production quantity, and occupation (Rostamnia & Rashid, 2019). Other indicators include the level of market integration, the relationship between charge transfer

and inter-market price differences, and the relationship between seasonal prices and storage costs to demonstrate the market's competitiveness over time (Adam & Tabrani, 2014).

Moreover, one of the related studies is the financial analysis of the input market in Semin-Gunung Kidul, which stated that a calves farm in dryland farming is eligible to run break-even point (BEP) on six head of calves (Handayanta, Rahayu& Sumiyati, 2016). This only discussed the condition of the input market; meanwhile, the study of beef cattle fattening activity in Bojonegoro regency described that the smallholder farmers' business was profitable and efficient. The farmer is at the break-even point when the beef cattle grow to approximately 86.09 Kg (Lestari, Baga & Nurmalina, 2015). Subsequently, there was another study that discussed the output market, which was meat marketing. The result of this study showed that the beef supply chain started from the slaughterhouse to the beef distributors, followed by the retailers, and ends at the consumers (Hastang, Sirajuddin, Mappangaja, Darma, & Sudirman, 2015).

The novelty of this study is the comprehensive analysis of several markets along the chain of smallholder beef cattle commodity. The input markets consist of calves, feed, medicine, and intermediate, which comprises the business relationship among beef cattle traders horizontally and vertically, while the output market deals with beef and its by-product. Since this kind of comprehensive analysis is still limited, the structure and performance of its markets need to be identified. Therefore, the policymaker possibly set policy that has strong backward and forward linkage in the beef cattle commodity chain.

In this study, the comprehensive analysis carried out was used as a guide in the beef cattle commodity chain based on the position, roles, and opportunity to support each other. Furthermore, it is important to identify the structure of the input, intermediate, and output markets to gain high performance.

RESEARCH METHOD

The location of this study was in East Java Province with several considerations. First, it has the highest population of beef cattle in East Java, with its proportion approximately 28% of the national population (Statistics Indonesia, 2020c). Second, the share of the beef cattle industry to the gross regional domestic product was relatively high with approximately 2% a year (Statistics of Jawa Timur Province, 2020). Subsequently, the industry also provides a lot of job opportunities. The selected regions are Malang Regency and Sapudi Island. According to the Beef Cattle Research Institute of Grati-East Java, the intensive smallholder farmers were located in the District of Turen (Malang) and Sapudi Island (Sumenep). Meanwhile, the beef cattle smallholder farmers in Malang carried out intensive business (Petrokimia, 2012); while the farmers in Sapudi Island also raised superior species of Madura beef cattle (Kutsiyah, 2012). In this study, the population used were smallholder farmers that have intensive activities and networking in the beef cattle commodity chain.

Two types of data were used in this study; moreover, the primary data were from input and calf suppliers, beef cattle farmers, traders, and slaughterhouses. The respondents were interviewed using questionnaires. Also, the secondary data were from several institutions,

while data on beef cattle were collected from the Indonesian Ministry of Agriculture. Subsequently, the consumption level of meat, milk, and egg was gathered from the Annual Report of Animal Husbandry Office of East Java. The sample size of the smallholder farmers was determined using the Yamane Formula (Adam, 2020). The sample size of the smallholder farmers (n) was 81, the population (N) was 418, and the level of precision (e) was 0.1. The number of calf suppliers, traders, and slaughterhouses was determined by using the snowball sampling technique. The number of respondents is shown in Table 1.

TABLE 1. NUMBER OF RESPONDENTS

District/ Sub-District	Type of Respondent										Total
	Calf Supplier	Farmer	Trader				Slaughterhouse				
			Village	Sub-District	District	Province	Village	Sub-District	District	Province	
MALANG											
Turen	14	51	3	1			4				73
GodangLegi	1							1			2
Bululawang								2			2
Wajak	20										20
Dampit	1										1
Donomulyo	2										2
Malang	9			1				1			11
Kalipare	3										3
Ngajum	5										5
Tangkel	2										2
Pujon					1						1
Bumiayu								1			1
SAPUDI											
Gayam	3	20	1	1				1			26
Nonggunong	2	10		1							13
JAKARTA											
Bekasi							1				1
Depok										1	1
Total	62	81	4	4	1	1	4	6	0	1	164

Descriptive analysis was used as an analytical tool to explain the profile of the beef cattle industry in East Java. Furthermore, the concentration ratio (CR) was used to determine the level of market concentration in different sub-markets, which consists of input, intermediate, and output markets. The formulation of CR is (Kvalseth, 2018):

$$CR = \sum_{i=1}^r S_i \quad (1)$$

$i = 1, 2, 3, \dots, r$

where CR was concentration ratio, S_i was the percentage of market share of actor- i , and r was the number of larger actors.

Based on the Herfindahl-Hirschman index (H) and the 4-firm concentration ratio (CR4), market condition are as follows: Un-concentrated Markets: $H < 0.15$ or $CR4 < 0.55$,

Moderately Concentrated Markets: $0:15 \leq H \leq 0:25$ or $0:55 \leq CR4 \leq 0:75$, Highly Concentrated Markets: $H > 0:25$ or $CR4 > 0:75$ (Kvalseth, 2018).

Lorenz Curve and Gini Coefficient were used with the formula (Dai, Qin, Chen, & Guo, 2018):

$$G = 1 - \sum_{i=1}^n (T_i - T_{i-1})(F_i + F_{i-1}) \quad (2)$$

$i = 1, 2, 3, \dots, n$

where G was the Gini coefficient, T_i was the cumulative proportion of actors, F_i was the cumulative proportion of the traded value of beef cattle in IDR, and n was the number of actors.

The Gini Coefficient has a value that ranges from 0 to 1, where 0 indicates that there is no concentration, and one indicates the concentration is full. In this study, the three indicators to identify barriers to entry and exit to market include: 1) legal barriers, which consist of patents, franchise, and legal regulatory activities, 2) technical barriers to trade in the areas of technical, labeling, and quality standards (Fontagné & Orefice, 2018), and 3) superior resources in terms of the condition of capital, access to information about price, demand and supply, and condition of primary resources.

RESULT AND DISCUSSIONS

Beef Cattle Population in East Java

In East Java, beef cattle population rises with a growth rate of approximately 4.5% per year. Figure 2 shows the beef cattle population in East Java from 2001 - 2017. The extreme phenomenon happened in 2003, while the beef cattle population decreased by 24%. This was due to the increasing intensity of slaughtering activity to meet the high demand for meat; however, the rate of calves' production remained low.

The beef cattle population started increasing from 2007, and the highest growth rate of 25.1% occurred in 2008. Government programs for meat self-sufficiency influenced this increase. Similarly, the beef cattle population also increased by 23.9% in 2011; however, the population extremely decreased from 4,957,478 to 3,586,709 heads in 2013, with approximately 27.7%. This condition was in line with Central Java as the second center beef cattle population in Indonesia after East Java. In 2013, the population decreased by 26.88% (Statistics Indonesia, 2020a) due to the implementation of the government's policy to reduce calves and beef cattle importation. Therefore, the slaughtering of local beef cattle, including productive cows needs to meet the demand.

In 2010, government programs on increasing the production of livestock were implemented. In this program, several activities that were carried out include the provision of 1,273,528 dosages of livestock cement from the target of 1,450,000. The government also tried to increase the population of calves by artificial insemination program for almost 727,248 heads and realization of acceptors of artificial insemination for approximately 1,060,650 heads (East Java Animal Husbandry Services, 2010). Furthermore, the growth rate

of beef cattle production in 2004-2014 was 5.05%, while the beef cattle population was 3.91%, which led to a future deficit of the beef cattle population (Statistics Indonesia, 2020a); Statistics Indonesia, 2020b). This showed that Indonesia needs to increase its beef cattle import. From 2014-2019, the population growth rate of beef cattle tends to increase by approximately 14.1%.

Figure 2 showed that the growth rate of the beef cattle population tended to fluctuate in the past two years; this was caused by several problems such as 1) weak political support and policies for the development of the cattle industry, 2) management of cattle development which tends to naturally lack new development, 3) development planning for the cattle industry is often difficult to be implemented and far from the target set due to unavailability of valid data for standard planning. Moreover, several studies have shown that the meat self-sufficiency target has not been achieved, 4) a large proportion of smallholder livestock (98%) also makes it difficult for the government to develop large farms, 5) the characteristics of small enterprises that are still subsistence, lack land, seeds, feed, and capital, 6) lack of coordination among related stakeholders (Nuhung, 2015).

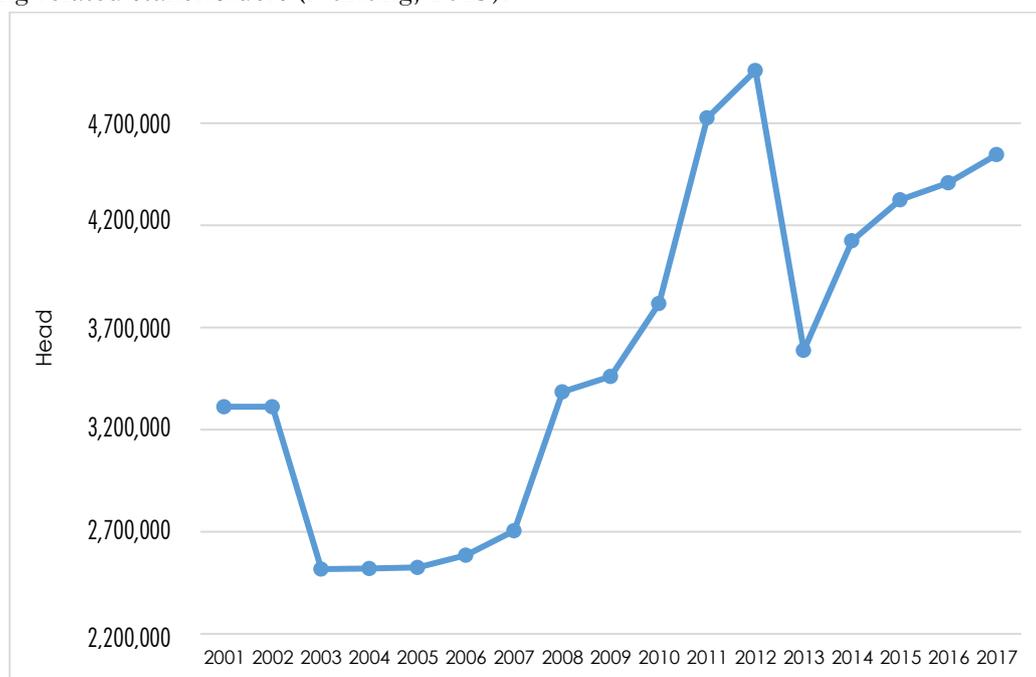


FIGURE 2. BEEF CATTLE POPULATION IN EAST JAVA, 2001-2019
SOURCE: STATISTICS INDONESIA, (2020A)

Furthermore, it is necessary to prioritize the policy to solve the above evenly distributed problems in all lines starting from the upstream (input providers), livestock business, and downstream sectors (post-harvest and marketing). Therefore, it is beneficial to group beef cattle development areas based on forage source, beef cattle base, and regional hierarchy according to service capacity level to support beef cattle development (Susanti, Priyarsono, & Mulatsih, 2017).

Meat Consumption in East Java

The consumption of meat, egg, and milk in East Java tends to increase from 2006 to 2010, as shown in Figure 3. Furthermore, the average consumption growth rate of livestock products was 9.4% per year. This different phenomenon occurred in 2008 with a negative growth rate of livestock consumption of approximately -6.8%. This decrease in consumption of meat, egg, and milk was due to the pandemic of swine flu which scared the consumers away from consuming eggs and chicken. Similarly, the increase in the price of gasoline in 2008 also affected the growth rate of livestock consumption. However, the growth rate of beef consumption remained positive in 2008 at about 23.5%.

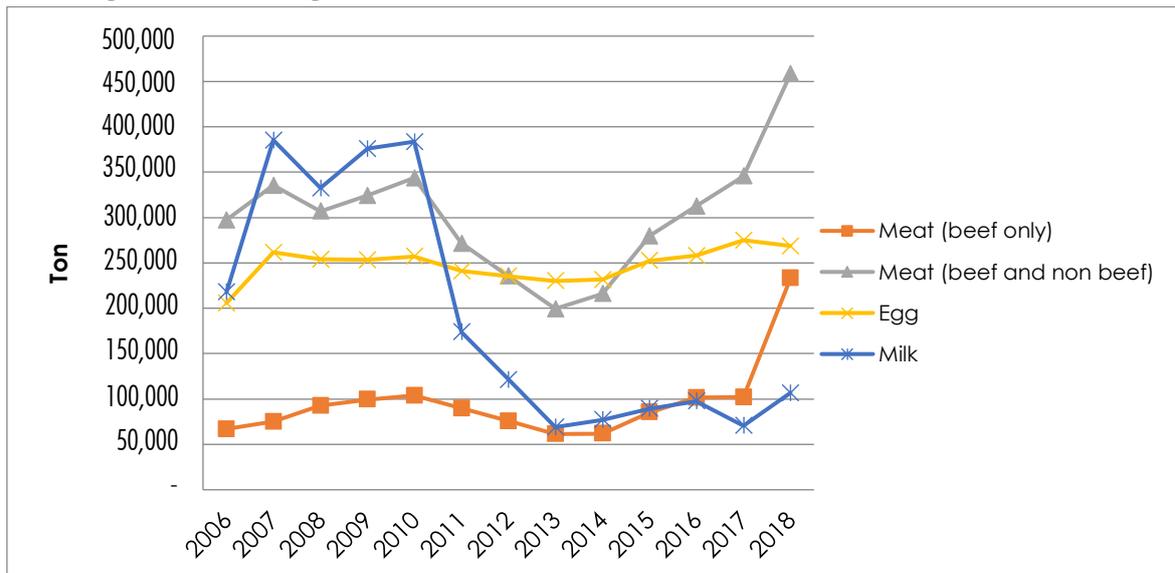


FIGURE 3. CONSUMPTION OF MEAT, MILK, AND EGG IN EAST JAVA
 SOURCE: FOOD SECURITY AGENCY, (2019)

From 2006 - 2010, the average growth rate of meat was 11.9%, while in 2006, the consumption was 66,782 tons which increased to 103,809 tons in 2010. This positive growth rate occurred because of two factors, namely the increasing population forced the demand for basic needs such as meat to increase. Also, the increase in per capita income contributed to the high consumption of meat. This result is in line with Rustinsyah (2019), which discovered that the demand for beef tends to increase throughout the year. Meanwhile, a positive situation gave the farmers the new market of beef cattle and its by-product. In addition, the government strategies to encourage beef cattle farmers are through the development of farmers groups with good managerial and entrepreneurial aspects.

The comparison between Figures 2 and 3 showed that beef consumption is greater than beef cattle population growth. In 2018, the development of beef consumption in households in East Java was 0.64 Kg per Cap per Year (Centre for Data and Information System of Agriculture, 2019). One of the factors that influence beef consumption is the increase in population and per capita income, which significantly impact beef consumption growth (Widiyati, Widodo, Masyhuri & Suryantini, 2011). Another study also stated that income and meat prices partially have a significant effect on beef consumption (Hasanah, Lubis, & Khadijah, 2018).

Analysis of Concentration Ratio in Input, Intermediate, and Output Markets

Analysis of concentration ratio in the input, intermediate, and output markets was carried out using the value of beef cattle in a specific market. The four largest determinants from each market include calf suppliers, farmers, traders, and slaughterhouses, while their market concentration ratio (CR4) is shown in Table 2.

TABLE 2. CONCENTRATION RATIO IN THE INPUT, INTERMEDIATE, AND OUTPUT MARKET

Item	Calf Supplier	Farmer	Trader	Slaughterhouse
Number of participants	62	81	10	11
Value of beef cattle for 4 largest participants (000 IDR)	138,000	208,500	806,250	1,116,043
Total value of beef cattle (000 IDR)	1,062,375	1,762,600	1,357,100	2,017,052
CR4 (%)	12.99	11.83	59.41	55.33

The CR4 of the input supplier that represents the input market was 12.99%, which showed that there is an un-concentrated industry. Similarly, CR4 of beef cattle farmers was 11.83% which indicated an un-concentrated market. This showed that input and intermediate markets are competitive. Furthermore, the calf suppliers and the farmers in this market have insufficient power to induce the price because farmers work individually and there is no strong organization. However, Ayele, Zemedu, & Gebremdhin, (2017) stated that the CR4 for the beef cattle market in Dugda District, Ethiopia was 93%, which indicated a strong oligopoly market type. This showed that the beef cattle market was inefficient and non-competitive.

For traders in all levels such as a village, sub-district, regency, or province, the CR4 was 59.41%. This showed that the type of market in beef cattle trading was strongly oligopolistic. Meanwhile, the traders have strong power to influence the market mechanism. This result is similar to a study conducted in Kupang - East Nusa Tenggara that analyzed the CR4 from the beef cattle market in 2014 - 2017, which showed that the CR4 value is within 50.9% - 70.8%. This indicated that the market concentration provides some benefits to the farmers or market players since it affects the prices (Roy, Ratya, Nuhfil & Wahib, 2018).

At the slaughterhouses level, the CR4 value was 55.33%, showing that the processing sector tends to be an oligopolistic market. This indicated that the slaughterhouses have big bargaining power in the market to determine the price and terms of sale. A previous study by Chen, Polemis, & Stengos, (2018) stated that there is a causative relationship between a market structure which is represented by a CR4, and total-factor productivity. Also, an industry that has a good bargaining position possesses a strong position. Therefore, they determine the important aspects such as volume product, price, and regulation.

Analysis of Gini Coefficient and Lorenz Curve

The Gini coefficient was used to measure the concentration of different sub-market in the beef cattle commodity chains. It also showed whether concentration or non-concentration exists in each sub-market. Furthermore, the Lorenz curve was used to make the explanation clearer. The value of beef cattle was used to measure the Gini coefficient and draw the Lorenz curve.

Table 3 showed that the calf suppliers in the input market have a Gini coefficient of 0.249, which indicated relatively equitable distribution. Furthermore, there were 62 calf suppliers with the same economic condition and several calves of approximately three heads. This showed that there are no dominant calf suppliers in this market.

TABLE 3. GINI COEFFICIENT OF ACTORS IN BEEF CATTLE COMMODITY CHAIN IN EAST JAVA

Item	Calf Supplier	Farmer	Trader	Slaughterhouse
Number of participants	62	81	10	11
Gini Coefficient	0.249	0.276	0.253	0.207

In the farmer sub-market, the Gini coefficient was 0.276, and there were no significant differences among the beef cattle farmers. This showed that the equity in the distribution value of beef cattle is relatively low among farmers compared to other determinants in the beef cattle commodity chain. However, a study conducted in Kenya obtained a different result with a high Gini coefficient of 0.65. This indicated that beef cattle markets have high concentrations, which showed the inequality in the markets (Onduso, Onono & Ombul, 2020).

Furthermore, the intermediate sub-market had a Gini Coefficient of 0.253. This showed that the value of traded beef cattle of ten traders was relatively the same, and there were no dominant traders with more sales.

The Gini Coefficient of slaughterhouses was 0.207, and there were 11 participants with equitable distribution. Meanwhile, the smaller Gini coefficient was caused by similarity in the value of beef cattle traded at the slaughterhouse level. This result is similar to a study by Alvaredo (2011), which stated that when the top group of the population has a very small income distribution, the rest of the population have relatively the same income.

The Lorenz curve of input, intermediate, and output markets in the smallholder commodity chain is shown in Figure 4. In the farmer sub-market, the area between the Lorenz curve, which is in blue, and the equitable distribution line in the red line appears wider than other sub-markets. This showed that the farmer sub-market is relatively unequitable distributed compared to other sub-markets. Based on the raw data, there were 13 farmers with beef cattle lower than IDR 10 million, while others had more than IDR10 million. Furthermore, 41% had a value of beef cattle of more than IDR 20 million.

The slaughterhouse sub-market had the narrowest area between the equitable distribution line and the Lorenz curve. In line with the Lorenz curve, the Gini coefficient was approximately 0.207 in this sub-market. These two indicators showed that the slaughterhouse sub-market is more unequitable distributed than others.

Barriers to Entry and Exit to the Input, Intermediate, and Output Markets

There were several barriers to entry to all of the beef cattle sub-markets. According to the respondents, the seven barriers to entry are production technology, capital, price, the impact of imports, marketing, competition, and economies of scale. However, each determinant has diverse main barriers.

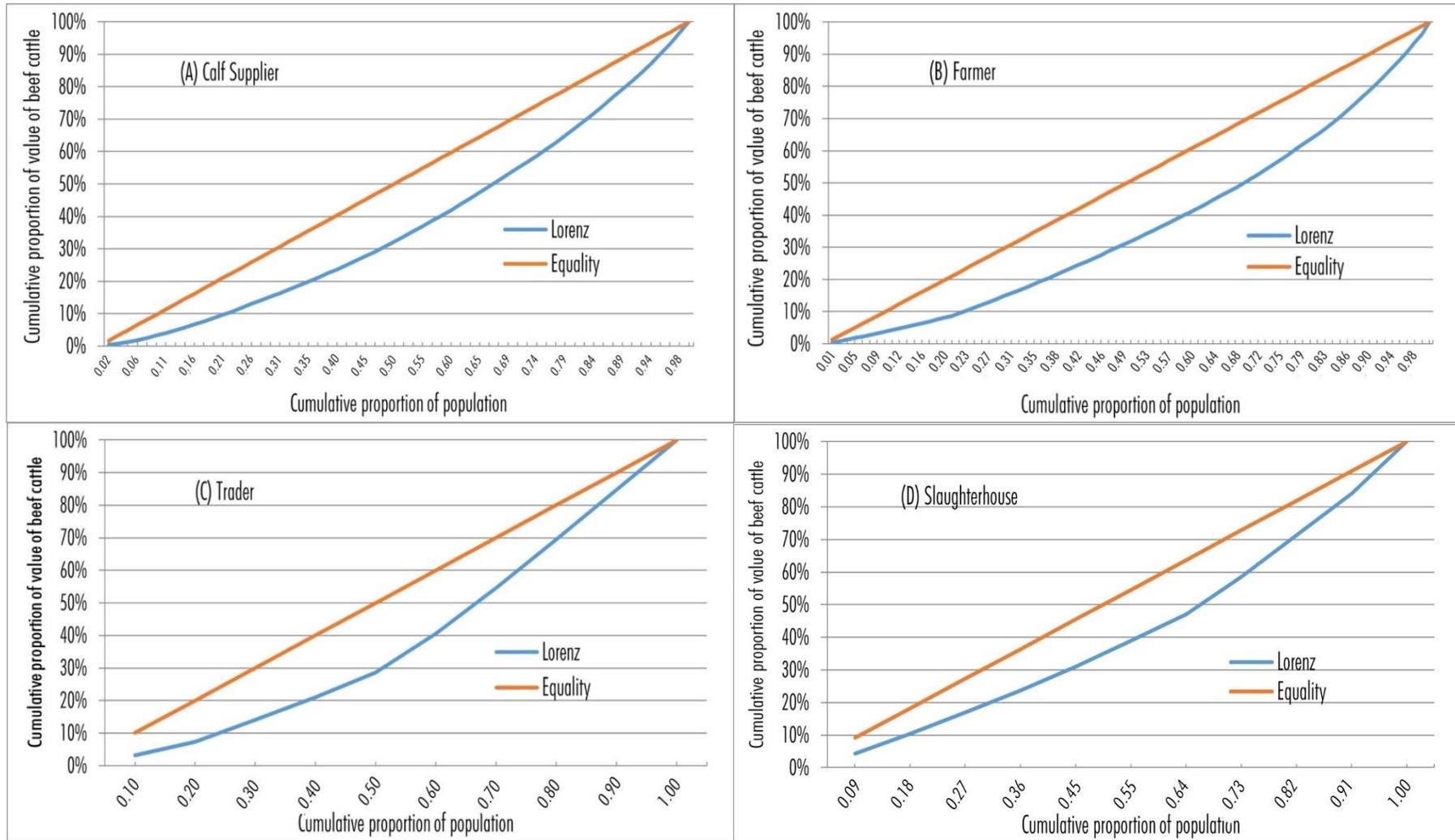


FIGURE 4. LORENZ CURVE IN INPUT, INTERMEDIATE AND OUTPUT MARKETS IN EAST JAVA

The barriers to entry faced by calf suppliers include production technology (mentioned by 42% of calf supplier respondents), large capital investment (34%), and limited economics of scale (15%). For the farmer, barriers to entry are the low price of beef cattle (38%), large capital investment (28%), and marketing problems (20%). Furthermore, traders have problems with large capital investment (50%), large importation (20%), and strong competition (10%). Slaughterhouses also faced the same barriers with traders but had problems with marketing activity. This result is similar to a study by Yuzaria & Rias (2017), where the major barriers to entry were high investment and marketing value. However, a study conducted in Kenya showed that the barriers to entry beef cattle market also include lack of information on sources of livestock for trade, price setting of the beef cattle, high capital, and poor trade practices (Onduso *et al.*, 2020).

Barriers to exit from the beef cattle industry include large capital invested, large potential demand, contract, job opportunity, family income, and availability of forage. Although all determinants faced the same barriers to exist, the main barriers are large potential demand for meat. This makes the determinants remain in the beef cattle market, and a huge capital is invested by farmers to buy beef cattle, feed, medicine, and managerial cost.

CONCLUSION AND RECOMMENDATION

Conclusion

Based on the results, the market structures of the beef cattle commodity chain in terms of the input market were perfect competition, while the intermediate market and the output market were oligopolies. These were shown by the lower concentration ratio of calf suppliers and farmers compared to the ratio of traders and slaughterhouses. Although the market structures were different, the Gini coefficient was almost the same, with approximately 0.2, which indicated an equitable distribution. Furthermore, the barriers to entry into the market were a high investment, large import volume, and market problems. Meanwhile, barriers to exit the market were a large number of potential demands, high investment, and sources of income.

Recommendation

The government needs to provide a program to increase the bargaining position of calf suppliers and farmers to have the negotiating capacity with other determinants. Furthermore, the government needs to encourage and facilitate the organization of strong farmers' associations or cooperatives. To support the local beef cattle industry, a review of the beef cattle import policy is required. This is carried out to ensure that import has no adverse effects on beef cattle prices for the farmers.

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