Concentration of beef market in East Nusa Tenggara (ENT) Province, Indonesia

D R Nendissa¹,², R Anindita³, N Hanani², A W Muhaimin³ and Y L Henuk⁴*

¹Department of Agribusiness Department, Faculty of Agriculture, University of Nusa Cendana (Undana), Kupang, Indonesia
²Faculty of Agriculture, University of Brawijaya (UB), Malang, Indonesia
³Department of Animal Science, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Indonesia

Email: *profesorhenuk@gmail.com

Abstract. Market concentration is an important indicator to see the market structure and level of competition in beef cattle industry. This study used data of farmers and traders from Kupang Regency, ENT Province, Indonesia to see market concentration, namely, Concentration Ratio(CR4), Hirschman-Herfindahl Index(HHI), Hannan-Key index(CPI), Rosenbluth index(IR) and Entropy index(IE). The results showed that the market concentration of beef cattle at the farmers level was categorized as perfect competition markets and market concentration at the level of traders was categorized as the oligopsonistic competition market. The market structure between farmers and traders in ENT made the income received by farmers is always low that is approaching or not even exceeding production costs. Therefore an accurate and transparent market information system is needed in ENT so that farmers are able to have bargaining power so as to obtain fair profits. Even though the income derived from the sale of cattle is low, the beef cattle farmers still survives in their business because they do their business as a job carried out from generation to generation to support their household economy. Beef cattle farming as a way of life is kept to fulfill the social and cultural demands of society in ENT.

1. Introduction

Beef cattle is one of the potential commodities for development in Indonesia as it is spread throughout the country. The importance role of beef cattle agro-industry in Indonesia can been seen in terms of solving unemployment rates in the rural areas and as a source of producing raw materials to beef processing industry. Development of beef processing industry in Indonesia should be seen as a cooperation network in the form of Triple Helix partnerships among government, farmers and capital owners. Through agro-industry activities, it is expected that farmers enable to obtain value-added products/services, income generation, and further lead to promote regional economic growth and create employment opportunities for rural communities. For many years beef cattle have been played an important role of Indonesian livelihood, especially for people who live in rural and agricultural areas [1]. Indonesia currently has ten provinces which are the centre of beef cattle population, which accounts for 77.85% of the national cattle population. Among them, there are five provinces as the
largest contributor (59.43%) of the national cattle population, namely East Java Province (27.75% or 4.19 million head), Central Java (10.77% or 1.63 million head), South Sulawesi (8.32% or 1.25 million head), West Nusa Tenggara (6.55% or 987.84 thousand heads) and East Nusa Tenggara/ENT (6.04% or 911.39 thousand heads) [2]. The cattle population in Indonesia is currently about 16.6 million head, of which 43% is in Java Island, 25% is in the Eastern Islands, and the remaining 32% is on other islands spread around Indonesia. Java has the highest production and consumption of beef, with 57% of the Indonesia’s population living on this island. Almost 90% of cattle production in Indonesia is produced from smallholder farming systems with about 6.5 million farmers living in the rural areas, and the remaining 10% is from more commercial farmers (<1% of all farmers) and large beef cattle companies whose target market is concentrated in Java island [3]. As one of the centres of beef cattle in eastern Indonesia, ENT province (known as Nusa Tenggara Timur-NTT) is believed to be quite successful in developing beef cattle farms, however development of beef processing industry is not yet achievable [1].

There has always been a gap between supply and demand of beef. Domestic production can only satisfy about 45% of Indonesian demand for beef. To fulfil the demand for meat, the Indonesian Government has been importing meat and live feeder and slaughter cattle and some breeding stock. The high dependency on meat imports, particularly from a single country, Australia, has becomes an issue of concern for Indonesian citizens. The import volume of cattle and beef meat is quite huge, while the export volume is very small [2]. In order to fulfil the need of the highest production and consumption of beef in Java (i.e. DKI Jakarta – Figure 1) [4], beef cattle traders between islands in the province of ENT have been sent beef cattle out of the province on average 50,000 - 70,000 per year during the past five years. The number of beef cattle sent out of ENT was 60,360 and 82.49% from Timor Island, especially Kupang Regency. This regency on average sent beef cattle between 13,000 - 19,600 head or an average of 32.47% of total ENT shipments, an increase of around 1.73% per year [5, 6].

![Figure 1. Distribution system of live cattle from production areas (e.g. ENT) to main consumers areas (i.e. DKI Jakarta) in Indonesia [4]](image)

The beef industry in Indonesia has relatively high concentration between 67 to 71.5% with tight oligopoly market structure so that it affects low productivity and efficiency of meat processing industry in Indonesia [7]. The market structure of the beef industry in Indonesia is strict oligopoly, where average growth of productivity of the four largest company in the industry (CR4) is 62.5%. Concentration, capital intensity and number of business unit have positive significant influence towards productivity, while intensity of import and collusion have negative significant influence towards growth of productivity [8]. In general, the market structure of beef in Indonesia is imperfect as the live cattle and beef markets are classified as a disintegrated market. This structure tends to be oligopsony, i.e., the price is determined by fewer buyers, relative to the sellers. On the other hand, the
beef market structure tends to be oligopoly, i.e., the price is determined by fewer sellers in comparison to the buyers (Figure 2) [4].

![Figure 2. The beef market structure tends to be oligopoly in Indonesia [4]](image)

Increasing demand for beef cattle from outside ENT will provide opportunities and encourage traders between the island and farmers to increase the sale and purchase of beef cattle. The beef cattle trade in Kupang Regency is among the largest and most dynamic. This dynamic occurs because Kupang Regency is close to Kupang City as the provincial capital that has the biggest seaport in ENT, namely Port of Tenau Kupang. The regency has the largest cattle market (i.e. Lili Livestock Market) and the number of traders between islands is relatively more than other regions. In addition, most residents depend on their lives for farming and raising cattle. This condition makes cattle buying and selling transactions between farmers (producers) and traders between islands in Kupang Regency dominate the buying and selling of cattle in ENT province. The sale and purchase transaction of cattle in Kupang Regency is generally influenced by the amount of ownership of cattle kept, the maintenance system and the motivation to sell. The number of cattle ownerships is between 3 - 10 heads per farmer household, the maintenance system is still done traditionally, while business orientation is only to meet the economic needs of the family. The small number of ownerships causes the sales transaction is also relatively small per farmer per year [9, 10]. On the other hand, farmers deal with buyers (inter-insular traders) whose numbers are small and use brokers (brokers) to act as the feet of inter-insular traders. So that the sellers are faced with a very tight competition market structure between sellers but because the number of buyers is small, it is very likely that the cattle buying market will be more concentrated. Market concentration shows how much of the total sales in the market for a commodity is distributed into a number of specific companies. Market concentration is the distribution of the number of products sold between different companies [11]. The concentration of competitive markets as opposed to non-competitive markets will influence market behaviour which then influences inefficient and unfair operations. There are parties who always try to obtain unnatural benefits and there are parties who are disadvantaged. This the study aims to measure the concentration level of the market of sale and purchase of beef cattle by using several methods of measuring market concentration and knowing some of the consequences that occur.

2. Materials and Methods
This study was taken place in the Kupang Regency, ENT Province, Indonesia. Data collecting consists of secondary data and primary data. Secondary data is data on cattle sales by farmers and data on cattle purchases by traders. Sales data is obtained directly from farmers and from related agencies. Purchase data was obtained from the ENT Livestock Service. While primary data is obtained by discussions with farmers and traders. The trader in question is a trader between islands that send cattle...
outside ENT. Measurement of market concentration was carried out using several indicators, namely concentration ratio for biggest four (CR4), Hirschman-Herfindahl Index (HHI), Hannan Kay Index (HKI), Rosenbluth Index (RI) and Entropy Index (EI) [12]. To calculate the market concentration indicator, the market share is calculated. The market share describes market forces that can influence the level of competition in the market. Market share is formulated as:

\[ S_i = \sum_{i=1}^{n} \frac{n_i}{N} \times 100\% \]  

(1)

Where:
- \( S_i \) = company market share to \( i \)
- \( n \) = company sales volume to \( i \) and \( N \) = overall sales volume on the market.

2.1. Measurement of concentration ratio for biggest four (CR4)

The concentration ratio for a certain number of companies (CRn) will provide an overview of the role of companies in the industry. The concentration ratio of the 4 largest companies (CR4) is most often used in measurement (Gwin, 2001), although there are no standard provisions regarding how much should be included in the CRn calculation [13]. Concentration Ratio for Biggest Four (CR4) is an analytical tool to determine the concentration level of the four largest market share of a market area [12]. If the available data is limited, it is enough to know four CR4 companies that have the largest market share. The formula for measuring CR4 is:

\[ CR4 = \sum_{i=1}^{4} S_i \]  

(2)

Where:
- \( S_i \) = Market Share

The main weakness of this indicator is that differences in market structure may not appear on the market, where each of the four largest companies has the same percentage of market share [14]. In addition, CR4 does not consider the entire market, but only a limited number of companies. CR4 classification is related to market structure [11, 13]. The market concentration is categorized as follows:
- Low if 0 < CR4 < 0.40%, perfect competition or monopolistic competition, (which determines whether there is product differentiation).
- Downwards if 0.40 < CR4 < 0.80, the market is oligopsonistic or oligopoly.
- High If the CR4 is ≥ 0.80, the market tends to be an effective monopoly or monopsony.

2.2. Measurement of the Hirschman-Herfindahl Index (HHI)

The calculation of HHI requires a complete knowledge of the overall market share [15] HHI is used as an indicator of the degree of competition in the market. HHI as one of the analytical tools aims to determine the degree of concentration of purchases / sales from a market area, so that it can know the general picture of the balance of bargaining power between the seller and the buyer [11;14]. HHI is very well used in measuring market concentration, especially in merger company measurements [16]. Measuring HHI is the sum of the squared results for each market share (Si) of the company/beef cattle seller, and can be formulated as follows:

\[ HHI = \sum_{i=1}^{n} S_i^2 \]  

(3)

Where, \( S_i \) = market Share to \( i \)
The HHI criteria [11] classified in concentration:
- High if HHI is between 1,800–10,000, monopoly market
- While if the HHI is between 1,000-1,800, the market is oligopoly
- Low if the HHI is between 0–1,000, the competition market is perfect.

2.3. Measurement of Hannan-Kay Index (HKI)
This analysis is the sum of the weighted market share of all companies in the industry, which are formulated as follows:

\[ HKI(\alpha) = \sum_{i=1}^{n} Si\alpha \]  

(4)

Where \( \alpha \) is a parameter whose value \( >0 \), but \( \neq 1 \)

The HKI formula is a general model of HHI. If the value on HKI is 2 then HKI (2) becomes the same as HHI. However, when the value of \( x >2 \), then when compared to HHI, HKI (\( x >2 \)) gives greater weight to companies that are larger and smaller in weight to smaller companies. However, when \( x <2 \) then when compared to HHI, HKI (\( x <2 \)) gives greater weight to smaller ownership and smaller weight to larger companies [17].

2.4. Measurement of the Rosenbluth Index (RI)
In order to measure the level of market concentration in a marketing agency, it is used the Rosenbluth Index (RI) analysis, which is formulated as follows:

\[ RI = \frac{1}{(2 \sum_{i=0}^{n} Si) - 1} \]  

(5)

Where:
RI= Rosenbluth Indeks
Si= Market Share company to \( i (i =1,2,3,...,n) \)

The RI value ranges between \( 1/n \leq RI \leq 1. \) If the value obtained is close to the minimum limit then the formed market structure tends to form a perfect competitive market, on the contrary if the value approaches the maximum limit then it tends to be an oligopoly competitive market [12].

2.5. Measurement of Entropy Index (EI)
The entropy index (IE) is an industry concentration measurement tool based on weighted sales of the market share of each company in the industry where the weight used is the natural logarithm and market share inverse. Mathematically formulated:

\[ EI = \sum_{i=1}^{n} Si \log e\left(\frac{1}{Si}\right) ; \quad 0 \leq EI \leq \log n \]  

(6)

Where:
Si = company market share in the industry.
n = the number of companies in the industry that are reviewed

The high interpretation of EI values indicates low industrial concentration, whereas a low EI value indicates high industrial concentration [17].
3. Results and Discussion
The results of the analysis of market concentration of beef cattle at the level of farmers (producers) and the traders are shown in Table 1.

Table 1. Market concentration of beef cattle between farmers and traders and criteria in ENT, Indonesia.

| Parameters | CR4 | Si (%) | HHI       | HKI       | RI      | EI      | Market Structure |
|------------|-----|--------|-----------|-----------|---------|---------|------------------|
| Farmers    | 0.125 | 12.50 | 134.127   | 365.793   | 0.785   | 1.951   | Perfect competition |
| Traders    | 0.614 | 62.40 | 1193.900  | 33.364    | 0.085   | 0.996   | Oligopsony        |

Notes: CR4 = concentration ratio for biggest four; HHI: Hirschman-Herfindahl Index (HHI); HKI: Hannan Kay Index; RI: Rosenbluth Index; EI: Entropy Index.

Data in Table 1 showed that the market concentration of cattle sales is low, as well as the criteria set in the CR4; HHI; HKI; RI and EI. Thus, there is no seller (rancher) that dominates market sales, meaning that, the market tends to lead to the criteria of a perfect competition market. Perfect competition market besides being characterized by concentration index values, farmers have the freedom to run a business, while cattle are traded uniformly, namely, “Bali Timor” cattle and there is no product differentiation. This is indicated by the enactment of the principle of the law of one price for all sellers so that there is no promotion/advertising because it is not effective. Access to market information is not perfect so it is easily manipulated by those who have the market power to take advantage. Therefore, it is necessary to develop access to price information, so that it can be used by traders and breeders in order to obtain a reasonable price. A study on dairy farmers in Western Kenya, found that only 16.9% of small farmers could access information in cattle production while 44.8% never and 38.3% sometimes because information is not available. In addition, the information obtained from the dairy brokers is often wrong and less accurate. This condition benefits traders who master information to take advantage of the asymmetric information [18]. The present results of the calculation of market concentration at the level of traders (buyers) based on the criteria that have been set are at a high concentration level and are classified in the oligopsonistic market structure as shown in Table 1. In the oligopsonistic market structure, there are few buyers/traders who have a high market share. Buyers in oligopsonies appear to have a big role in determining the price of cows. In this condition, the oligopsonists generally play as a distributor or as a liaison between producers and wholesalers outside ENT not as consumers. In this condition, traders generally control market information and have more power in bidding, so that traders are able to reduce the price of cattle in farmers. As a result, there is a tendency for prices at low farmer levels, especially if the sale of cattle is driven by the economic needs of farmers' households.

Other research results showed the same conditions. There is a strong market structure for beef which shows that the majority of traders at Regional State of Ethiopia are able to get more profit than producers. Conditions like this that occur in the research location where farmers with competitive market structures are perfect, but an asymmetric market information system with extreme weight must deal with buyers with an oligopsony buyer market structure. As a result, farmers are always offered low prices for cattle and are unable to maintain the price they want, which results in farmers' profits being low. Several research results showed the same conditions [19]. In Malaysia, for example, the meat market was quite concentrated because some large companies controlled a large market share so that each company could set its own price and quality without affecting the overall market [20]. The market concentration ratios in Regional State of Ethiopia showed a strong oligopoly beef market structure. This shows the majority of traders are able to get more profits than producers [19]. This a condition also occurs in the present study where farmers with perfect competition market structures, but asymmetric market information systems have to deal with buyers with an oligopsonistic market structure very heavily. As a result, farmers always get low prices for cattle and are unable to maintain the price they want which results in farmers' profits being low. Asymmetric market information becomes one of the main constraints in ENT reported by [8] that one of the main reasons for the beef
market in ENT is not integrated because of the asymmetric information on the market producers in Kupang Regency and Kupang City’s market and DKI Jakarta market. Judging from the business continuity even though the income derived from the sale of cattle is low, the beef cattle farmers still survive in their business because they do their business as a job carried out from generation to generation to support their household economy. Beef cattle farming as a way of life is kept fulfilling the social and cultural demands of society in ENT.

4. Conclusions
Market concentration for the sale of cattle in Indonesia that are perfectly competitive is dealing with traders who are in the oligopsonic traders market so that traders who have market power will have market power to take great advantage of the prices offered in the market compared to farmers. As a result, the income received by farmers is always low that is approaching or not even exceeding production costs. Therefore, an accurate and transparent market information system is needed in ENT so that farmers can have bargaining power so as to obtain fair profits. In addition to repairing and providing marketing infrastructure it is important to improve them in order to gain more income for beef cattle farmers in ENT.

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