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Projection of shadow price of beef cattle in the Bali beef fattening industry

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Article Info

ABSTRACT

Any changes in supply and demand result in the imperfect development of a market mechanism, so a disequilibrium price occurs. Price changes, sometimes, do not reflect the prevailing price, issued by an agricultural business. Therefore, this research aims to project the shadow price of beef cattle (output) in the Bali beef fattening industry, utilizing cost production theory. Technically, the comparison of the total of the shadow prices of beef cattle employed two methods, such as a total of revenue and total cost. The research was conducted in the Regency of Lombok Tengah from July to September 2020. Then, the site and group of farmers were determined by purposive sampling. The criteria of samples were farmers performing the Bali beef fattening industry with an intensive raising system, utilizing cross-section data collected via interview and questionnaire. In conclusion, it is found that the shadow price of beef cattle was higher than the market price. It caused non-responsive market price changes unless a great change occurred. The shadow price was established by a greater marginal cost than marginal revenue.

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Introduction

Information on changes in the price of an item in the market is an important thing that encourages business owners to make decisions on the demand for goods that have a high chart or in the sense of high sales. Price information received by business owners is of a qualitative nature because the current goods marketing system still uses price estimation methods. A price reflects the average and marginal cost, which is expensed to produce a unit of goods or service. Costs are expensed to prepare production input, such as goods and services. The amount of expenses is determined by input price and a total of desired inputs. In addition, cost changes occur if there are any changes in input price or the total of desired inputs change.

The changes of input price and a total of inputs will be converted to output price, but the market price, sometimes, cannot well-respond to output price (production cost). The cost changing of production input against output changes is known as marginal cost. Also, a price is determined by revenue changes towards output changes, commonly known as marginal revenue. A maximal profit occurs as the margin of both marginal revenue and marginal cost is zero, stating that selling price is equal with output price (Pappas & Hirschey,1995; Nicholson, 2002; Herlambang et al., 2005).

A price received by a producer is based on the prevailing market price, and the market price is based on highly complex external factors from a total of the market's demand and supply. The occurring changing of supply and demand can cause an imperfect market mechanism, so price disequilibrium takes place. (Nicholson, 2002). Sometimes, the market price received by a producer is not based on the actual cost expensed in the production process. Then, the market price is higher or lower than total production costs. If a received price is below minimal cost, farmers will not receive normal profit. The agricultural commodities, typically, are non-sensitive to price, but, reversely, price is sensitive to demand due agricultural products are not ready-to-use products and require production time (Putong, 2018). Therefore, the price changes, usually, result in the prevailing market price does not reflect the actual cost, which is expensed by an agriculture business (Drèze & Stern, 1990; Bockel & Tallec, 2005). In the context of economics or social, to view revenue distribution, the utilization of the market price is incorrect due the market price does not reflect the actual economic value of manufactured goods and services. Further, a distortion of the market price and economic value is due to imperfect market information. Presumably, the external factors economy may affect the economy mechanism, so any information of the market price does not depict a revenue derived from a total of production costs. An assumption that the marginal productivity is similar to the market price is inappropriate if the value is higher than the market price (Bockel & Tallec, 2005). Thus, a price adjustment is required, also known as shadow price. A shadow price is an adjustment of market price towards production price and factors, or it can be said as social cost where a product's shadow price is determined by an opportunity cost.

Some methods can be used to project shadow prices. Specifically, Menon et al. (2005) regarding a shadow wage in children labor utilization, showed that a constructed model for estimating shadow price uses profit function and direct estimation of the production function. Li & Cheng (2005) employed shadow price to measure efficiency between the business group of farmers with an individual farmer using the function method of frontier production. Based on the analytical result, it showed that when production unit or optimal allocation of input, each unit of the production groups is inefficient, the causing factor is possibly individual inefficiency. The problem that is often encountered in the marketing of cattle in the market in Bali is the fluctuation in cattle prices. This is an unpredictable phenomenon when price changes occur. Price changes make it difficult for breeders to determine the shadow price of beef cattle in the fattening industry. So we need a strategy to deal with change.

Some production inputs for the cattle fattening industry are not paid in cash, such as labor. Part of the feed is obtained from the allocation of labor. Margin sales of beef cattle at feeder cattle prices and variable costs charged in cash constitute income. The price of cattle received by farmers is determined by various complex factors. However, farmers have slightly weak bargaining power in the beef marketing system, coupled with changes in non-production costs in marketing, such as transaction costs. To find out the actual price, a behavioral analysis is needed in the cattle fattening industry and the beef cattle market. In particular, an approach that can be used to analyze actual prices that reflect production costs and revenues is shadow prices.

Based on the background of the problems above, in providing solutions for fattening cattle related to changes in cattle prices, it is necessary to do research. Price changes become an emphasis for analyzing supply and demand. Information on price changes that are qualitative in nature is measured quantitatively in the value of the cattle price index. Therefore, this research aims to project the shadow price of beef cattle (output) in the Bali beef fattening industry, using production cost theory. It, then, compares the amount of cattle's shadow price by two methods, such as marginal revenue and cost.

Method

Research Site and Period
The research was performed on two groups of beef fattening in the Regency of Lombok Tengah from July to September 2020. The determination of site and group was by purposive sampling. The sample criteria were farmers conducting the Bali beef fattening under an intensive raising system. This sampling method was taken from the data population of farmers fattening cattle in Bali, then the narrower data collection that had to be found in the area resulted in the discovery of two livestock farmers as samples for researchers.

Data of The Research
The research used cross-section data with 113 cattle productions as the total of observation. It started with purchasing feeder beef and selling beef cattle. Data were collected via interview using a questionnaire by the following variables and measurement, as follows table 1.

As for the interview, it is necessary to prepare clear guidelines in asking questions. The first step, questions can be in the form of personal information related to the interviewees. The next step, the questions asked can

be in the form of discussions from general questions related to the focus of the discussion to specific questions that are more towards the research focus.

Table 1. Questionnaire by the following variables and measurement data collected

Variable		Measurement
Production input	:	1. The type and total of inputs used to produce beef cattle consisted of feed and labor.
		2. Green feeds were grasses and *Pennisetum purpureum* (elephant grass).
		3. Agricultural-waste feeds were straw, groundnut straw, and soybean straw.
		4. Husk feed was additional.
Production cost	:	Any cost expensed in cash for type and total of the used inputs.
Beef cattle (Output)	:	It was measured based on the weight of beef cattle.
Production	:	It was based on the margin of beef cattle's weight and feeder beef.
Cattle price	:	Cattle price received by farmers.

Projection Method of Beef Cattle's Shadow Price

The approach used to analyze the relationship between input and output was based on the target of the beef fattening industry, such as obtaining maximal profit. Further, one of the economic concepts used in analyzing cost was social cost (Pappas & Hirschey,1995; Nicholson, 2002; Herlambang et al., 2005).

Data Analysis

Two methods of analysis were projection/estimation was performed simultaneously by the Two-Stage Least Square (2SLS) method. Analysis used software of Statistic Analysis System (SAS version 9.0) (Sitepu & Sinaga, 2018). The shadow price was the parameter value showing the marginal value of the dependent variable towards the independent variable.

Table 2. Equation Notation, Average Values, and Deviation Standard

Variable of Notations			Average	Deviation Standard
Y	=	Cattle production (kg/cattle)	49,22	34,79
X_1	=	Total of green feeds (kg/cattle/day)	25,07	5,12
X_2	=	Total of agricultural-waste feeds (kg/cattle/day)	4,65	2,00
X_3	=	Total of husk (kg/cattle/day)	1,16	0,09
X_4	=	Labor (hour/labor/day)	2,02	0,91
Q	=	Beef cattle offering (kg)	257,99	40,91
P_{x5}	=	Price of feeder beef (Rp/kg)	32.459,65	5973,25
X_5	=	Feeder beef (kg)	257,99	40,91
P_q	=	Price of beef cattle (Rp/kg)	36.667,14	4625,21
TVC	=	Non-fixed cost (Rp/cattle/day)	22.214,68	6.193,04

Results and Discussions

Business Management of The Bali Cattle in The Province of West Nusa Tenggara

Mostly, the raising of the Bali beef cattle was performed under the collective-cage group, and a group of individual cages, which was established collectively. In detail. The collective cage consisted of 5 to 56 members. The limit of cage area and security factor was considered as an alternative in formatting groups of farmers in raising cattle collectively in a collective cage (Waldron et al., 2013). This collective cage, also, functioned to protect the environment from cattle-waste pollution in the surrounding. The collective cage system benefited farmers in the raising management and eased marketing of cattle due to buyers usually come directly to the collective cage to purchase beef cattle.

Geographically, in Lombok Islands, the area for cattle raising was relatively narrow, where the cattle ownership was between 2 up to 3 cattle per farmer, and the raising was intensively performed; while, in Sumbawa Island, the rangeland was widely available and could be publicly utilized based on local rules. The total of cattle ownerships in Sumbawa Island was larger, between 9 up to 10 cattle per farmer, and the raising was performed in both semi-intensive and extensive methods (Pemda, 2009).

According to the results of the research performed by Yuliana et al. (2014) on March up to July 2012, related to the beef fattening industry in three villages located in the Regency of Lombok Tengah, such as

Montong Oboq, Bun Prie, and Repok Nyerot, it was found that the varied initial weight of fattening, fattening duration, and addition of daily weight (PBBH) and weight of selling (weight of sold cattle) result in diverse profit, between 8 up to 11 percent. The different purchasing price of feeder beef and selling price of cattle derived from the fattening industry is around 3 up to 9 percent. Also, the different times of cattle purchasing and selling among farmers could result in different prices received by farmers. Thus, the different prices and other factors, such as fattening duration and PBBH can affect the different profits.

The beef fattening industry was mostly dominated by the Bali-typed cattle, being one of the germplasms in West Nusa Tenggara. The Bali cattle had a larger opportunity in both national and local markets. Its superiority was adaptability. Debertin (1986) in his study, concluded that the center of beef cattle, such as West Nusa Tenggara, is difficult to obtain cattle's weight above 300 kg per cattle. One of the issues is due to the shipping of qualified bulls from outside. Matondang & Rusdiana (2013) postulated that the uncontrolled cross-breeding of local cattle and superior foreign cattle (Limousine, Simmental, and Brahman) conducted by farmers causes the genetic degradation of local cattle, which was adaptability to the environment. The price of the Bali cattle was based on its meat value and total, the residual product (skin and innards), performance, and genetic characteristic. In addition, cattle price in the market was determined by factors determining supply and demand (Rutherford, 2004).

The pricing of the Bali cattle marketing was still based on estimation. Seller demanded this method to provide a higher margin. However, this traditional method largely caused loss for farmers. Farmers sold their cattle largely to collectors or butchers, where they directly came to cages to purchase cattle. Though farmers sold their cattle to market, there was no guarantee of obtaining a higher price. Thus, farmers preferred to sell their cattle on-site (cages) (Purba & Hadi, 2012).

Projection of Shadow Price of Beef Cattle in The Bali Beef Fattening Industry
A marginal value of revenue is a measured price based on revenue changes towards production changes. The revenue derived from beef cattle selling by farmers was varied and did not rely on the demand of output and market price. This became one of the issues for farmers in determining the selling price of beef cattle, so the received revenue relatively fluctuated. Then, farmers did not always respond to price changes. Shadow price being a marginal value from revenue towards production could easily adjust on production changes.

In addition, partial production factors in the model did not show a significant impact on production but provided a significant impact. The total of inputs used in the production process required costs, which amount was depended on the respective total and price of inputs. While production value was the total of costs expensed in the production process. Thus, the product price (output) was formulated from the total of costs expensed to produce a certain amount (Table 2).

Arslan (2011) demonstrated in his research on corn business by comparing shadow price and market price. The method used research adaptation Beatie & Taylor (1994), conducting prediction/estimation of marginal product of labor in the subsistent corn system in Mexico. The findings showed that shadow price is higher than the market price, received by farmers with asymmetric market obstacles. The shadow price, then, could be used to understand farmers' behavior due it could explain non-market price-based values. It proves that farmers were irresponsive towards the changes in the market price unless such changes were great enough.

In detail, the constructed model could display marginal value from the total revenue or costs. Such value could be said as the actual price of output, such as beef cattle produced from the beef fattening industry. The amount of shadow price was greater than the price received by farmers. Based on two methods used, such as marginal revenue and marginal cost, marginal revenue had a higher value than the market price of beef cattle. As seen in Table 2, the marginal value (revenue and cost) was depicted by the parameter value of Y and Q, which was the shadow price of beef cattle. The price of beef cattle received by farmers was shown in Table 1; on average, the price was within the range of Rp 36.667,14 ± 4.625,21 per kilogram. The projection of variables in this model is as follows (Table 3).

Production (Y) was determined by the utilization of inputs, though inputs did not show a positive relationship towards production. Then, the additional total of green inputs and agricultural waste was unequal with the production improvement. The amount of production affected total cost (TC), expensed for the production process. Also, production determined the weight of the sold beef cattle and the total revenue from the selling results (*TR*), and marginal revenue (MR) was shown by the projection of parameter value of $\partial TR/\partial Y = MR = 33.072,87$. Additionally, the amount of marginal cost (MC) was depicted by the parameter value of total cost against the demand of beef cattle. The projected shadow price was based on total cost toward demand, which was $\partial TC/\partial Q = MC = 43.716,28$.

Table 3. Results of Parameter Estimation

Variables	Estimation Parameter	t-hit	P > |t|
Cattle production (*Y*)			
Intercept	60,00163	1,27	0.2080
X_1	-2,26900	-3,80	0.0002
X_2	-3,76255	-2,07	0.0412
X_3	40,63953	1,01	0.3165
X_4	8,04613	2,41	0.0176
Beef cattle offering (*Q*)			
Intercept	10,39083	0,27	0,7913
P_q	0,00429	5,04	<,0001
X_5	0,63728	7,46	<,0001
P_{x5}	-0,00132	-2,16	0,0326
Price of beef cattle (*Pq*)			
Intercept	27.041,28	10,83	<,0001
P_{x1}	0,20017	2,69	0,0083
Y	63,55211	4,58	<,0001
Price of feeder beef (*Px1*)			
Intercept	12.329,24	2,23	0,0280
P_q	0,58093	3,57	0,0005
Y	-23,78700	-1,14	0,2556
Total revenue (*TR*)			
Intercept	7.845.335	26,18	<,0001
Y	33.072,87	6,44	<,0001
Total cost (*TC*)			
Intercept	-314272	-0,22	0,8254
Q	43.716,28	8,02	<,0001

Determination of shadow price was, then, based on marginal value from the total cost, which was the overall costs of production input used to produce output. The changes in beef cattle's market price did not directly affect the total cost, but had a direct impact on production input, such as feeder beef was affected by the market price. In the prediction method of this shadow price, the price of feeder beef assumedly similarly prevailed to the price of other production inputs. The shadow price measured over the marginal value of total cost was the actual price of output (beef cattle).

Moreover, the different value of marginal revenue and marginal cost (MR < MC) was due to the different determination methods of both values. It, theoretically, demonstrates that as maximal profit was achieved, marginal revenue was equal with output price. However, empirically, the results were different from the existing theory. This became one of the shortages from such theory in measuring an event or condition that happened in the empirical condition. Thus, employing the different measurement methods would provide the difference of measurement or analytical results. Typically, the shadow price was flexible, following any occurring changes in the beef fattening industry. The difference of type and total of production inputs would affect production cost and the total of beef cattle's production. Finally, shadow price was responsive towards changes of production input price and had not always higher value than the price received by farmers.

The price of cattle has a significant influence on the supply of beef cattle, which proves that the decision to sell cattle is based on price considerations. The supply of beef cattle is in line with the price, meaning that an increase in the price of cattle will increase the supply. It is known that changes in the price of slaughter cattle in the market do not have a significant effect on supply . The increase in the price of cattle reduces the ability of farmers to buy feeder cattle. In this case, the demand for feeder cattle will be measured based on the body weight of the cow in kilograms. The feeder weight at the start of fattening determines the fattening time period.

According to Mulyana (2009) states that the factors that affect the income of the cattle fattening business are the cost of feeder cattle, labor costs, the cost of the cage and the stable equipment. Cattle with low body weight require a longer fattening time (Yuliana et al., 2014; Panjaitan et al., 2019). Long fattening time absorbs greater costs thus affecting profits (Elfadl et al., 2015; Mlote et al., 2013; Mohammed et al 2013; Setiawan et al., 2013). The results of Rusdianto et al. (2016) research analysis show that fattening time has a significant effect on supply and shows a positive relationship. However, the price of fattening cattle received by breeders has a significant influence and has a positive relationship to supply. This condition was caused by delays in the sale of cattle when the price of slaughter cattle in the market decreased. Price changes faced by

farmers in the marketing of beef cattle affect the income of the beef cattle fattening business (Ayalew et al., 2013; Sarma et al., 2014).

Changes in the price of cattle affect the price of feeder cattle so that it also affects income. The biggest cost of the fattening business is for the purchase of feeder cattle Elfadl et al., (2015) stated that the price of feeder cattle has a very significant effect on income. (Mlote et al., 2013; Malole et al., 2014) states, to overcome price changes and keep the fattening business alive, a production and marketing strategy is needed so that it can provide profit (income). Changes in the price of slaughter cattle in the market determine the price of feeder cattle and fattening cattle. Therefore, price changes provide an opportunity for the cattle fattening business to make a profit. Production and marketing strategies to deal with price changes by adjusting the weight of feeder cattle purchased at the prevailing price and adjusting the selling price of beef cattle require consideration of production costs.

Conclusions

In sum, the results of the prediction demonstrate that the shadow price of beef cattle was based on a higher MC value than MR value, showing that farmers, being decision-makers to the received price, were irresponsive towards the changes of the market price. The fact was that the market price received by farmers was lower than the marginal cost expensed for the used production inputs, or farmers suffered from loss due to higher production costs than the received revenue.

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