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The Impact of External and Internal Factors on the Dairy Farmer's Household Economics

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ABSTRACT

Domestic milk production is currently only able to meet 20% of the total domestic demand of milk, but this opportunity has not been responded well by dairy farmers. The objectives of this study were: (1) to analyze the performance of dairy farmers and (2) to analyze the impact of external factors (concentrate feed and milk prices) and internal factor (marginal productivity of concentrate feed) on production, income, and household welfare of dairy farmers. The number of sample households was 97 cooperative-member farmers and 46 cooperative-nonmember farmers in Lembang, West Java. The analytical method used included descriptive analysis and household economic models in the form of simultaneous equations. The results of the study showed that the scale of small-scale business with the percentage of lactating cattle and dairy farmers' productivity was still low. When the price of concentrate feed rises, the impact of the policy of increasing milk prices is greater than the increase in the marginal productivity of concentrate feed on increasing business income and household welfare of dairy farmers.

Keywords: production inputs; simultaneous equation models; well-being of the dairy farmers

INTRODUCTION

About 90% of dairy farmers in Indonesia are small farmers with around one to five cows (Quen *et al*., 2014; Kementan, 2016; Dalewikow *et al*., 2016). The scale of business is difficult to increase because the percentage of lactating cows achieved is below 60% (Asmara *et al*., 2017; Morey, 2011; Sirajuddin *et al*., 2012) so that milk productivity is below 10 L/cow/day, and consequently this condition is inefficient and not profitable (Morey, 2011; Sirajuddin *et al*., 2012). The ability of domestic production is only able to meet about 20% of domestic needs (Nugroho, 2012)

Farmer households act as producers with the aim of maximizing profits and as rational consumers maximizing satisfaction (Derosari *et al*., 2014). The decision on household consumption of farmers can affect the business of dairy cows so that the business productivity of dairy cows decreases. Farmers will sell cows without considering the contributions of cows to finance requirements of the household so that it affects the percentage of lactating cattle and milk productivity (Quen *et al*., 2014).

Most farmers sell milk production to the cooperatives and distributed to the Dairy Processing Industry/ IPS. Often farmers propose an increase in milk prices because the income of their businesses is insufficient to meet their daily needs, but their proposals are slowly responded by the cooperative managers because the price of milk is determined by the agreement between the cooperatives and IPS (Kumar *et al.,* 2015). Cooperatives as providers determine the price of concentrate feed so that if there is an increase in the price of concentrate feed the cost of feed will increase (Resty *et al*., 2017). Increasing the cost of livestock business has resulted in the decreased farmer income (Septiani *et al.,* 2017). Farmers reduce the use of concentrates when they are underfunded so that milk production decreases, resulting in the decreased income (Widiasti *et al.,* 2010). Farmers who are not members of cooperatives sell milk through milk companies, and they buy concentrate feed through feed traders and behave in the same way as the cooperative-member farmers to decide the business activities (Resty *et al*., 2017).

Based on the background and problems of dairy cattle business activities and farmer household behavior, it becomes important to be analyzed from the household-economic perspective. The scope and analysis tools use descriptive analysis, and the household economic model of dairy cattle farmers because the households of

dairy farmers have specificity in integrating production, consumption, and family labor allocation decisions. The objectives of this study are (1) to analyze the performance of dairy farmers, and (2) to analyze the impact of external factors (concentrate feed and milk prices) and internal factor (marginal productivity of concentrate feed) on production, income, and household well-being of dairy farmers.

METHODS

The study was conducted in May to August 2016 in Lembang District, West Bandung Regency, West Java Province. Purposive location selection was based on the consideration that Lembang is one of the main cow milk production centers in Indonesia. The sample farmer household was determined by a simple random technique of 97 cooperative-member farmers, and as many as 46 cooperative-nonmember farmers were determined by purposive sampling method. Primary data sources were cross section data for one year. The collected data were analyzed using descriptive analysis and household economic model of dairy farmers.

Descriptive analysis was used to describe the characteristics of dairy farmers, including the demographics of farmers and family members, as well as the business characteristics of dairy cows. The household economic model of dairy farmers built in the form of a simultaneous equation system consisting of 9 equations, namely 4 behavioral/structural equations, and 5 identity equations and estimated using the two stages least squares/2SLS method (Sitepu & Sinaga, 2018). Shock was done in 3 scenarios, namely the increasing in milk prices concentrate feed price, and the marginal productivity of feed concentrates (Sinaga, 2011).

The equations of household economic model of dairy farmers are as follows:

1. The block of dairy cow input

The amount of concentrate feed usage

$QPK = e_0 + e_1 HPKHSS + e_2 NLPK + e_3 PDRT + e_4 NK + U_1$ .....(1)

Hypothesis: $e_2, e_3 > 0$; $e_1, e_4 < 0$

2. **The block of dairy cow production**

The amount of milk production

$QSS = l_0 + l_1 QPK + U_2$ .....(2)

Hypothesis: $l_1 > 0$

Milk productivity

$YSS = QSS / QSL$ .....(3)

3. The block of household income of farmers

Revenue from milk

$PNSS = HSS*QSS$ .....(4)

Household income of farmer

$PDRT = PDSP + PDNSP$ .....(5)

4. The block of household expense of farmers

Food and non-food consumption expense

$NK = NKPNG + NKNPNG$ .....(6)

Dairy cow business investment expense

$NIVSP = r_0 + r_1 PDRT + r_2 NK + r_3 NIVSDM + r_4 DUAK + U_3$ .....(7)

Hypothesis: $r_1, r_4 > 0$; $r_2, r_3 < 0$

Education investment expense

$NIVPDD = s_0 + s_1 PDRT + s_2 NIVSP + s_3 DUAK + U_4$ .....(8)

Farmer household expense

$PGRT = NK + NIV$ .....(9)

Where: QPK is the amount of concentrates feed (Kg/year), HPKHSS is concentrate feed price/milk prices, QSS is the amount of milk production (L/year), QSL is the number of lactating cow (cow), YSS is milk productivity (L/cow), PNSS is milk revenue (000 IDR/year), PDNSP is business income other than dairy cows (IDR/year), PDRT is household income (000 IDR/year)), PDSP is income from dairy cow business (000 IDR/year), NKPNG is food consumption (000 IDR/year), NKNPNG is non food consumption (000 IDR/year), NK is food and non food consumption (000 IDR/year), NIVSP is dairy cow investment (000 IDR), NIVPDD is education investment (000 IDR), NIVSDM is human resource investment (000 IDR), NIV is total investment (000 IDR), PGRT is household expense (000 IDR/year), HPK is concentrate feed price (IDR/Kg), NLPK is loan value of concentrate feed (IDR/Year), HSS is milk prices (IDR/L), DUAK is business scale dummy (0= 3-5 cows, 1= 6-10 cows), and U is residues.

RESULTS

Characteristics of Dairy Farmers Household

The household characteristics of dairy farmers are used in analyzing the economic activities of household members. Table 1 present the household characteristics of cooperative-member and cooperative-nonmembers of dairy farmers. It can be seen that 95.5% of respondents stated that raising livestock was the main job. The average age of dairy farmers, both cooperative-members and cooperative-nonmembers were relatively the same (40.78 and 40.82 years). The formal education of cooperative-member and cooperative-nonmember farmers relatively low, i.e. 8.33 and 8.00 years schooling respectively, with experience in farming 13.39 and 11.72 years for cooperative-member farmers and cooperative-nonmembers farmers, respectively.

The number of family members of cooperative-member farmers and cooperative-nonmembers farmers was the same; that was 3 people, with 30% and 35% were students and 69% and 71% helping to work in livestock businesses. Farmers of cooperative-member were given counseling and training by extension workers from the Office of Cooperatives and Animal Husbandry Ser-vices, at least once a year. Farmers who were not the members of cooperative get information from the Milk Processing Industry and Animal Husbandry Service.

Characteristics of Dairy Farmers Household Business

Based on Table 2, the cooperative-nonmember farmer had more dairy cows than cooperative-member farmers (7.33 vs. 6.05 AU) with the same percentage of lactating cows, which was around 61%. Dairy production of cooperative-member farmer was higher than cooperative-nonmember farmers (18.40 vs. 16.19 L milk/day) and milk productivity were still low (10.55 vs 8.30 L milk/cow/day).

In dairy cows business, concentrate feed and forage were essential inputs. The cost of concentrate feed in cooperative-member and cooperative-nonmember dairy farmer were 91.70% and 90.66%, respectively, of the business costs of dairy cows (Table 3). Concentrate feed were purchased from cooperatives and animal feed traders. Forage feeds in the form of field grass, elephant grass, and king grass was obtained through flaking. Farmers also used agricultural waste as forage. The volume ratio (kg dry matter) for concentrates and forages was 36%:65% for cooperative-member farmers and 34%:66% for cooperative-non member farmers.

Table 4 showed that the contribution of male-family labor about 93.54% (cooperative member) and 93.59% (cooperative-nonmember) of labor force. This number indicates that male family labor plays an important role in running a dairy business while female-family labors are involved in helping to manage dairy cows with less time, which is 4.81% and 4.58% for cooperative-member and cooperative-nonmember farmers, respectively. Hired-male labor helped dairy cows business with a small portion of 1.65% and 1.82% in cooperative-members and cooperative-nonmembers farms.

Table 1. Household characteristics of dairy farmers in Lembang, West Java, 2016

Dairy farmers household characteristics	Average of dairy farmers household	
	Cooperative member (n= 97)	Cooperative nonmember (n= 46)
Farmer's age (year)	40.78	40.82
Formal education (year)	8.33	8.00
Dairy farming experience (year)	13.39	11.72
Main job as a farmer (%)	95.5	95.00
Side job as a farmer (%)	4.50	5.00
Numbers of family member (person)	3	3
Ratio of school children (%)	30.00	35.00
Ratio of family labor (%)	70.00	65.00

Table 2. The number of dairy cow ownership and productivity in Lembang, West Java, 2016

Components	Cooperative member (n= 97)	Cooperative nonmember (n= 46)
	Unit	Unit
Number of dairy cows (AU)	6.05	7.33
Number of lactating cow (%)	61.44	61.47
Number of non-lactating cow (%)	38.56	38.53
Productivity (L milk/farmer/day)	18.40	16.19
Productivity (L milk/cow/day)	10.55	8.30

Dairy Farmer Household Income and Expense

The household income of dairy farmers consists of income from dairy cow business and other businesses. The income of dairy cows derived from the sales of milk and rejected cows, subtracted by operation cost of the dairy business as shown in Table 5.

The most significant revenue of cooperative-member and cooperative-nonmember dairy farmers originated from milk sales, i.e. 93.02% and 95.35%, respectively, while the revenue from rejected cow sales was 6.98% and 4.65%, respectively. The largest household income of the farmers both cooperative-members and cooperative-nonmembers was from the dairy business (99%), while the rest was from trading and transportation services. The household income of cooperative-member and cooperative-nonmember dairy farmers was used for household expenditure and investment as could be seen in Table 6.

Food-consumption expenditures indicate the level of household food security or welfare. Food-consumption expenditure of cooperative-member farmers (48.48%) was smaller than nonfood-consumption expenditure (51.52%). On the other side, the food-consumption expenditure of cooperative-nonmember farmers (53.52%) was higher than nonfood-consumption expenditure (46.46%).

Table 3. The input value of dairy cow business in Lembang, West Java, 2016

Input	Cooperative member (n= 97)		Cooperative nonmember (n= 46)	
	IDR/year	%	IDR/year	%
Concentrate feed	19,717,809.80	91.70	22,716,124.08	90.66
Forage feed	1,685,325.41	7.84	2,226,873.57	8.89
Medicine and vitamin	49,721.21	0.23	45,184.45	0.18
Equipment	50,448.20	0.23	68,374.16	0.27
Total	21,503,304.62	100.00	25,056,556.25	100.00

Table 4. Labor allocation for dairy cow business in Lembang, West Java, 2016

Labor	Cooperative member (n= 97)		Cooperative nonmember (n= 46)	
	Man-days/ year	%	Man-days/ year	%
Male-family labor	196.14	93.54	202.22	93.59
Female-family labor	10.09	4.81	9.9	4.58
Male-hired labor	3.45	1.65	3.94	1.82
Labor for dairy cow business	209.68	100.00	216.06	100.00

Table 5. Dairy farmer household income in Lembang, West Java, 2016

Source of income	Cooperative member (n= 97)		Cooperative nonmember (n= 46)	
	IDR	%	IDR	%
Milk sales	98,421,943.07	93.02	100,439,279.03	95.35
Rejected cow sales	7,385,260.44	6.98	4,902,551.35	4.65
Dairy cow business revenue	105,807,203.51	100.00	105,341,830.37	100.00
Dairy cow business income	84,303,898.89	99.71	80,285,274.13	99.89
Farmer household income	84,551,321.57	100.00	80,372,230.65	100.00

Table 6. Dairy farmer household expense in Lembang, West Java, 2016

Source of expense	Cooperative member (n= 97)		Cooperative nonmember (n= 46)	
	IDR	%	IDR	%
Food consumption expense	13,526,528.88	48.48	9,479,992.49	53.54
Non-food consumption expense	14,373,784.73	51.52	8,227,763.41	46.46
Total consumption expense	27,900,313.61	100.00	17,707,755.90	100.00
Dairy cow investment expense	6,963,174.79	47.73	4,561,221.12	84.68
Education investment expense	7,399,234.08		711,439.14	
Health investment expense	22,204.65		113,581.63	
Human resource investment expense	7,624,438.73	52.27	825,020.77	15.32
Total investment expense	14,587,613.52	100.00	5,386,241.89	100.00
Total household expense	42,487,927.13		23,093,997.79	

The cooperative-member and cooperative-nonmember dairy farmers households allocate their income up to 34.33% and 23.32%, respectively, for investment. In cooperative-member farmers, investment in the dairy business (47.73%) was smaller than investment in human resources (52.27%), whereas in cooperative-nonmember farmers, investment in the dairy business (84.68%) was higher than investment in human resource. Expenditures for investment for household education in cooperative-member farmers were higher than in cooperative-nonmember farmers.

Impact of Changes in External and Internal Factors on the Farmer Households Well-being

Analysis of the impact of changes in external factors, i.e., increases in concentrate feed prices and milk prices. The simulation was done based on the tendency to the increased price of concentrate feed. Based on the experience of farmers, the simulation was done by increasing the price of concentrate feed by 20%. At each Annual Member Meeting (RAT) of the cooperative, the member farmers proposed an increase in the price of milk, but the cooperative management responds less. This low response was caused by the fact that the price of milk was determined by the agreement between Milk Processing Industry and cooperatives while the bargaining position of cooperatives was relatively lower. The farmer expectation of an increase in the price of milk by 1,000.00 IDR/L from the price currently received, which was 4,714.12 IDR/L for cooperative-member farmers and 4,703.13 IDR/L for cooperative-nonmember farmers.

The impact simulation of changes in internal factors was conducted by increasing the productivity of concentrate feed. The dairy cow production model (equation 2) stated that there is only one variable i.e. concentrate feed (QPK), which significantly affected milk production (QPK). The marginal productivity of concentrate feed was 0.74 L (parameter estimation). Cooperative recommended the use of concentrate feed ratio at 1.5 (one kg concentrate feed produced 1.5 L of milk), reconfirming the increase in the productivity of concentrate feed could be done. The farmer's internal effort by increasing the marginal productivity of concentrate feed by 40% (simulation 2), had increased the marginal productivity of milk by 1.04 L. There were other factors that influence milk productivity, namely breeding factors, environment, management, and others.

Table 7 shows the impact of the simulation combination on increasing the concentrate feed prices and milk prices (simulation 1) and the impact of a single simulation on increasing the marginal productivity of concentrate feed (simulation 2). It also shows the simulation effect of a combination on increasing concentrate feed price and marginal productivity of concentrate feed (simulation 3) on production, income, and the welfare of the dairy farmers.

Impact of Increase in Feed Prices and Milk Prices

As a result of an increase in concentrate feed (HPK) prices by 20% along with an increase in milk prices (HSS) of 20% (Table 7 simulation 1), cooperative-member farmers reduced the use of concentrate feed (QPK) by 0.23% while nonmember farmers were able to increase the use of concentrate feed (QPK) by 2.86%. The reduction of concentrate feeds caused milk production (QSS) to decrease by 0.06% for cooperative-member farmers, while for cooperative-nonmember farmers increased by 0.72% because it was still able to increase feeding.

Table 7. The impact of increasing concentrate feed prices (HKP), milk prices (HSS), and increasing marginal productivity of concentrates feed on production, income, and well-being of dairy farmers in Lembang, West Java in 2016

Block	Exogenous variable	Basic value		Changes (%)					
				Simulation 1		Simulation 2		Simulation 3	
		A	NA	A	NA	A	NA	A	NA
USE OF INPUT									
Amount of concentrates (Kg)	QPK	7,220.03	7,165.64	-0.23	2.86	1.90	1.85	-3.67	-0.64
PRODUCTION									
Amount of milk production (L)	QSS	20,878.13	20,838.09	-0.06	0.72	10.90	10.78	8.87	9.90
Milk productivity (L milk/cow)	YSS	6,166.34	6,523.20	-15.10	-15.40	7.17	7.08	-4.81	-5.05
INCOME									
Milk revenue (000 IDR)	PNSS	98,421.94	98,004.27	19.93	20.87	10.90	10.78	8.87	9.90
Household income (000 IDR)	PDRT	84,551.32	79,288.17	19.76	20.37	12.70	13.14	7.48	7.62
EXPENSE									
Food and non food consumption (000 IDR)	NK	27,900.31	17,609.36	5.47	8.37	3.51	5.40	2.07	3.13
Dairy cow investment (000 IDR)	NIVSP	6,963.17	4,468.97	19.77	29.76	12.70	19.20	7.48	11.13
Education investment (000 IDR)	NIVPDD	7,399.23	691.22	4.25	43.96	2.73	28.36	1.61	16.45
Household expense (000 IDR)	PGRT	42,487.93	22,903.38	7.58	13.60	4.86	8.77	2.87	5.09

Notes: Simulation 1= The combination of an increase in concentrate feed prices (HPK) by 20% and a rise in milk prices (HSS) by 20%*; Simulation 2= Concentrate feed marginal productivity increased milk production by 40%**; Simulation 3= The combination of an increase in concentrate feed prices (HPK) by 20% * and an increase in marginal productivity of concentrates feed on milk production by 40% **; A= Cooperative-member farmer; NA= Cooperative- nonmember farmers; (-)= Not available; * = External factor; ** = Internal factor; QPK is the amount of concentrates feed (Kg/year); QSS is the amount of milk production (L/year); YSS is milk productivity (L/cow); PNSS is milk revenue (000 IDR/year); PDRT is household income (000 IDR/year); NK is food and non food consumption (000 IDR/year); NIVSP is dairy cow investment (000 IDR); NIVPDD is education investment (000 IDR); PGRT is household expense (000 IDR/year).

Even though the price of concentrate feed and milk prices rose, the revenue from milk sales (PNSS) increased by 19.93% and 20.87%, so that farmers' household income (PDRT) increased by 19.76% and 20.37% for cooperative-member and cooperative non-member farmers, respectively. The farmer welfare increased with the increased household expenditure (PGRT) by 7.58% and 13.60%, respectively, for cooperative-member farmers and cooperative-nonmembers farmers. With the increased farmer welfare, it could increase food and non-food consumption by 5.47% and 8.37%, respectively, in cooperative-members and cooperative-non member farmers. There was an increase in investment in dairy cow business by 19.77% and 29.76% in cooperative-member and cooperative-nonmember farmers, respectively, while the investment in education for cooperative-nonmember farmers (43.96%) was higher than cooperative-member farmers (4.25%).

Impact of Increasing Marginal Concentrate Feed Productivity

Table 7 (simulation 2) shows that the use of concentrate feed (QPK) in cooperative-member and cooperative-nonmember farmers increased by 1.90% and 1.85%, respectively so that milk production (QSS) increased by 10.9% and 10.78% with milk productivity (YSS) increased by 7.17% and 7.08%. Further revenue from milk sales (PNSS) increased by 10.90% and 10.78% so that the farmer's household income (PDRT) increased by 12.70% and 13.14%, respectively, for cooperative-members and cooperative-nonmember farmers.

Household expenses (PGRT) increased by 4.86% and 8.77%, respectively, for cooperative-member farmers and cooperative-nonmember farmers so that farmers' household welfare increased. There was an increase of investment in the dairy cow business (NIVSP) of cooperative-nonmember farmers (19.20%) that was greater than in cooperative-member farmers (12.70%), as well as the increased investment in education in cooperative-nonmember farmers (28.36%) that was greater than in cooperative-member farmers (2.73%).

Impact of Feed Price Increase and Increased Marginal Concentrate Feed Productivity

At the time of increasing marginal productivity of concentrate feed to marginal productivity of milk production by 40% and an increase in concentrate feed (HPK) prices by 20% as in Table 7 (simulation 3) there was a decrease in concentrate feed use (QPK) in cooperative-member farmers (3.67%) that was greater than in cooperative-nonmembers farmers (0.64%). This condition led to a decrease in milk productivity (YSS) by 4.81% and 5.05%, but milk production (QSS) still increased by 8.87% and 9.90%, respectively, for cooperative-member and cooperative-nonmember farmers.

Milk income (PNSS) still increased by 8.87% and 9.90% and the impact on farmers' household income (PDRT) increased by 7.48% and 7.62% in cooperative-member farmers and cooperative-nonmember farmers, respectively. There was an increase in the farmers welfare with the increased farmers' household expenditure

(PGRT) which increased by 2.87% and 5.09%, used for increasing food and non-food consumption (NK) of 2.07% and 3.13%. Other expenditures for dairy business investment (NIVSP) in cooperative-member and cooperative-nonmember farmers were 7.48% and 11.13%, while for education investment (NIVPDD) was 16.45% and 1.61% in cooperative-member farmers increased more than in cooperative-nonmember farmers.

DISCUSSION

Characteristics of Dairy Farmers

The results of the study indicate that the ages of dairy farmers, both cooperative-members and cooperative-nonmembers farmers are relatively same, i.e. in the productive age group. The opportunity for farmers to carry out formal education between cooperative-member farmers and cooperative-nonmembers farmers is also low because they focus on working to maintain dairy cows. About 95% of cooperative-members and cooperative-nonmember farmers stated that the dairy cow business was the main job and was reflected in the experience of farming that had been carried out for quite a long time. In contrast to the research of Elizaphan *et al*. (2016) in East Africa, the average age of farmers was higher at 51 years. Likewise, formal education is almost the same, namely 7 years but has a longer experience of raising about 18 years.

The dairy cow business is a business that involves family members such as wive, children, or other family members so that it is known as animal husbandry. Family members who are still in school are involved according to their capacities so that almost all family members are the family workforce (Wantase & Paputungan, 2017; Ramadhan *et al.,* 2015).

Characteristics of Dairy Cow Business

The ownership compositions of dairy cows greatly influence the success of the business. The scale of dairy cattle ownership is 6.05 and 7.33 cows per cooperative-member farmer and cooperative-nonmember farmers. This condition is the same as folk farmers in Bangladesh with an ownership scale of 1.89 and 11.10 cows (Khan *et al.,* 2010). The composition of lactating cow for cooperative-nonmember farmers is greater (61.06%) than for cooperative-member farmers (60.32%). The results of this study were lower than the results of Quen *et al.* (2014) stated that composition lactating cow in Pangalengan was 77.19% and Ohla (2013) in India reaches 72%. However, Santoso *et al*. (2016) reported the lower condition with the percentage of lactating cow in KUD Getasan, KUD Sumber Karya, and KUD Mekar Kabupaten Semarang were to 42.8%, 55.9%, and 57.4%, respectively. With the percentage of lactating cow that is less than 60%, the dairy cow business was not efficient and profitable (Sirajuddin *et al.,* 2012). Also, Halolo *et al.* (2013) and Ekowati *et al.* (2011) informed the profitability of dairy cows through the percentage of lactating cow more than 60% with the efficiency level of 1.2-1.4.

About 80% of the dairy farming costs are feed costs (Quen *et al.,* 2014). In this study, the cost of concentrate feed reached 90% and forage feed costs around 7%. The results of this study are similar to those reported by Asmara *et al*. (2017) where forage costs reaching 4.89% to 7.47% in small and large-scale dairy farmers in West and East Java.

The largest allocation of male-family labor for dairy cow business is only 5% of farmers, because they have activities outside of dairy cow business. The allocation of female workers in the family of about 4% is used to work in the dairy business. Since early morning the farmers work for milking, cleaning the cow and the cage. Furthermore, doing routine work of raising cattle until the afternoon so there is not much time to do work other than dairy cattle business. The length of time devoted to raising dairy cows is 6.92 hours per day with long periods from early morning to night. This is in accordance to the household economic theory that raising dairy cows are managed by household farmers so that they cannot be separated between production decisions and household decisions. The dairy cattle business has problems with low productivity and genetic quality of livestock, low exploitation scale, availability of concentrate feed that do not fulfill nutrition, and maintenance management still needs to be improved (Anh *et al*., 2013; Srairi *et al.,* 2010).

The biggest dairy cow business income from milk sales reached 93.02% and 95.35% for cooperative-member farmers and cooperative-nonmember farmers. While the research of Santoso *et al*. (2016) in Semarang Regency farmers found household income of 99.71% and 99.89% in cooperative-members and cooperative-nonmember farmers originating from dairy cows.

The results of studies of food and non-food expenditure from cooperative-member and cooperative-nonmember farmers are the same as household/farm household expenditures in studies of Saefullah *et al.* (2012), Derosari *et al.* (2014), and Yuliandri (2015) namely food consumption expenditures of 43%-55% and non-food items at 45%-56%. Food consumption expenditures indicate the problem of food security or well-being. Based on the threshold, the level of food expenditure is 60% or with calorie adequacy of 80%. For this reason, cooperative-member and cooperative-nonmember farmers have shown food expenditure in the percentage below 60%. If referring to Engel's Curve that the tendency for cooperative-member farmers, the percentage of food expenditure is smaller than non-food expenditure.

Impact of Increase in Concentrate Feed Prices, Milk Prices, and Increase in Marginal Productivity Concentrate Feed on Household Well-being

The increasing of marginal productivity of concentrate feed by 40% (simulation 2) will increase the use of concentrate feed. Even though milk prices increase by 20% along with an increase in concentrate feed prices, cooperative-member farmers reduce their use. However, when the concentrate feed price increase and the increasing of the marginal productivity of concentrate

feed are done (simulation 3), there is a decrease in the use of concentrate feed.

When there is an increase in concentrate feed prices, the impact of an increase in milk prices (simulation 1) on the increase in milk production is lower than when increasing the marginal productivity of the concentrate together with an increase in feed prices (simulation 3). The impact of the increase in milk prices despite an increase in the price of concentrate feed can increase the highest investment in dairy cows. Also, the highest increase in household expenditure is that farmers are more prosperous than when increasing the marginal productivity of feed, there is an increase in the price of concentrate feed.

To improve the household welfare of dairy farmers when the price of concentrate feed increasing, the policy of increasing milk prices needs to be implemented. To increase the marginal productivity of concentrate feed, cooperatives as providers of concentrate feed can facilitate farmer's accessibility to get good quality of concentrate feed, such as increase protein content, and dairy cows.

CONCLUSION

Cooperative-member and cooperative-nonmember farmers are in the productive age with low education, but the experience is long enough so that the dairy cow business becomes its main job. The scale of cattle ownership is still low with the percentage of lactating cattle and milk productivity are still low. In conditions of increasing concentrate feed prices, the impact of increasing milk prices is greater than the increase in marginal productivity of concentrate feed on increasing business income and household well-being of dairy farmers.

CONFLICT OF INTEREST

We certify that there is no coflict of interest with any financial, personal, or other relationships with the other people or organization related to the material discussed in the manuscript.

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