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**THE IMPACT OF CREDIT AND PRODUCTIVITY IMPROVEMENT ON FARM HOUSEHOLD WELFARE  
BASED ON AGRO ECOSYSTEMS IN EAST NUSA TENGGARA PROVINCE, INDONESIA**

**\*Bernardus Bala deRosari, Helena daSilva and Yusuf**

Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Assessment Institute for Agricultural Technology East Nusa Tenggara, Jl. Timor Raya km 32 Naibonat, Kupang, East Nusa Tenggara, Indonesia

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**ABSTRACT**

This study about the impact of credit and productivity improvement was aimed to discover the changes in farm household production, income and expenditure in dryland and wetland agro ecosystem zones. The study was conducted in Kupang Regency and Timor Tengah Selatan (TTS) Regency, East Nusa Tenggara (NTT) Province, Indonesia. This province was chosen because it is one of the poorer provinces in Indonesia. Data were collected using the structured interview technique from 178 farm households; 128 households in the dryland zone and 50 households in the wetland zone. The data were analyzed using econometric analysis, the simultaneous equation system with the 2-SLS method (*two stage least squares*), validated, and simulation using the Newton method, and Simnlin procedure. The results of the analysis showed that if only given agricultural credit, the impact of increased production, income and welfare is only seen in farm households in the wetland zone. Agricultural credit policies followed by increased production input through improvements in technology would have a positive effect both on farm households in the dryland and in the wetland zone.

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**INTRODUCTION**

Empirical data show the positive impact agricultural credit has on agribusinesses, especially those in developing countries. Limited capital leads to low-quality and small-quantities of agribusiness input. The reason why the government extends credit to farm households is to increase their capital so that they may use adequate input both in quality and quantity which in turn would increase productivity, agribusiness production and welfare (Nuryartono *et al.*, 2005; Adebayo and Adeola 2008; Nwaru *et al.*, 2011; Saleem 2011; Yasmeeen *et al.*, 2011). The results of another study demonstrated that it is not enough to extend credit to increase agribusiness capital, but it is also necessary to encourage the farm households to use technology. Improvements in the technology they use would help increase productivity and agribusiness production (deRosari, 2014). In consequence, the farm household must be analyzed not only from the external side of view, but also from

the internal side of view, how it makes production and consumption decisions (Syukur *et al.*, 2002; Sihaloho *et al.*, 2004; Fatchudin *et al.*, 2006; Komicha 2007; Ashari, 2009; Muayila, 2012). The target of agricultural credit policies are poor household. The NTT Province is one of the provinces with the highest level of poverty in Indonesia, reaching 20 percent of the citizens of NTT Province (BPS NTT, 2014). Farm households in NTT Province are characterized by the numerous commodities they have and the main commodity being cattle. Facts show that quite a lot of agricultural credit is extended to farm households; however, the welfare level of farm households is relatively low. Therefore, an analysis of the impact of agricultural credit and technology change on farm households in making cattle agribusiness production and consumption decisions need to be conducted. This study was specifically aimed to measure changes in farm household production, consumption and welfare if there is an increase in agricultural credit and agribusiness productivity.

**Framework**

Production in this study is cattle production. Cattle production is a process which produces cattle through the use of a certain amount of input (feed, medicine, and vitamins), labor and

**\*Corresponding author: Bernardus Bala deRosari,**  
Indonesian Agency for Agricultural Research and Development,  
Ministry of Agriculture, Assessment Institute for Agricultural  
Technology East Nusa Tenggara, Jl. Timor Raya km 32 Naibonat,  
Kupang, East Nusa Tenggara, Indonesia

capital. The cattle produced by a farm household are measured by the number of livestock units valued at market price. Theoretically, cattle production is a function of the use of labor, feed, medicine and vitamins. The credit used in the cattle production process is for purchasing calves, paying labor, and purchasing medicine, vitamins, and other input. The function of cattle agribusiness production using a stochastic linear production function is:

$$Y = f(X_1, X_2, X_3, X_4, D_z, e_i) \dots\dots\dots 1$$

where:

- Y : cattle production in a year (heads)
- X<sub>1</sub> : number of calves in a year (heads)
- X<sub>2</sub> : amount of feed in a year (kg)
- X<sub>3</sub> : amount of medicine and vitamins administered to the cattle (dosages)
- X<sub>4</sub> : amount of family labor (male and female) and male external labor for the cattle agribusiness in a year (man days)
- D<sub>z</sub> : dummy for ecosystem zones, 1 for dryland ecosystem zone, 0 for others
- e<sub>i</sub> : disturbance

The theory of farm household economics was used to discover the farm household economic behavior as a result of agricultural credit and improved technology. Singh *et al.* (1986) stated that the basic model for farm household behavior in the agricultural production cycle in consuming a number of goods (commodities) with the assumption that the household maximizes utility, i.e.:

$$U = U(X_a, X_m, X_l) \dots\dots\dots 2$$

where X<sub>a</sub> is the consumption of commodities are an agricultural staple, X<sub>m</sub> is the consumption of market purchased good, and X<sub>l</sub> is the consumption of leisure time. In attaining utilitation in consuming the aforementioned goods, the household is faced with the constraints of income, time, and production technology.

Income constraint

$$p_m X_m = p_a(Y - X_a) - w(L - F) + E \dots\dots\dots 3$$

where p<sub>m</sub> is the price of the commodity in the market, P<sub>a</sub> is the price of the basic commodities consumed at market price, Y is the amount of production, (Y - X<sub>a</sub>) is marketed surplus, w is the wage level, L is the amount of labor needed for agribusiness, and F is the amount of available family labor. If (L - F) is positive, the household would hire external labor and if negative, the household would offer labor for labor market. Other sources of income that are not working (E) are for example credit.

Time constraint

$$X_1 + F = T \dots\dots\dots 4$$

The household would allocate time it has for on farm production, off farm and leisure activities, making all the time

possessed by the household (T) utilized for working (F) and leisure (X<sub>l</sub>).

Production technology constraint

$$Y = Y(L, A) \dots\dots\dots 5$$

The household faces a production technology constraint which is a function of fixed labor use (L) and fixed land use (fixed quantity, A). The household aims to obtain maximum utilitation through the consumption of the commodities are an agricultural staple, market purchased good and leisure time and is faced with income, time and production technology as constraints. The equations above are in effect, if (a) other input such as fertilizers and pesticides are not calculated, (b) the possibility of producing more than one commodity is ignored, (c) family labor and external labor are perfect substitutions and could be included directly, (d) production is riskless, and (e) the household acts as a price taker for prices (p<sub>m</sub>, p<sub>a</sub>, and w). The three constraint above could be substituted by a single constraint, by substituting the production and time constraint into the income constraint, resulting in:

$$p_m X_m + p_a X_a + w X_l = w T + \pi + E \dots\dots\dots 6$$

where π = p<sub>a</sub>Y(L,A) - wL is the profit from agribusiness, E represents the assets owed by the household, for example from credit. The left side represents total expenditure and the right represents full income. The household can choose the consumption level for the three goods (commodities), i.e. the main goods produced by on farm, goods purchased in the market, and time consumption which demonstrates the household's welfare level. Welfare level meant in this study is the household expenditure for consumption and investment. Time consumption for domestic and leisure activities is not calculated. As a consequence, a certain assumption needs to be included in the household welfare concept. The theory of household economics defines farm household welfare as the utilitation or the utility the farm household experiences when consuming goods purchased from the market, goods produced from its on farm, and when consuming leisure time. Leisure time is not included in the analysis; therefore, the assumption in this study is that the marginal utility of leisure is considered low. This assumption is based on empirical conditions: (1) the allocation of time for on farm activity is relatively large, causing latent unemployment, and (2) the opportunity for employment elsewhere is low, causing the opportunity cost of labor to be low. This is why the marginal utility is low. Because of the low marginal utility of leisure, the concept of welfare could be measured from the consumption of goods purchased from the market, goods produced by its on farm and other expenditures (investment).

## MATERIALS AND METHODS

The study was conducted in Kupang Regency and TTS regency, NTT Province, Indonesia. Data were collected between March and July 2013. The number of household samples was 178 households; 128 household within the dryland agro ecosystem zone and 50 household within the wetland agro ecosystem zone. Sample households were farm households which had received agricultural credit.

### **Data analysis**

The analysis was begun at the estimation of the simultaneous equation using the 2-SLS (*Two Stage Least Squares*) method then validated and simulated using the *Newton* method, and Simlin (*Simulation Non Linear*) procedure. The simulation had the following changes: (1) 25 percent increase in agricultural credit, (2) a simulation of the combination between 25 percent agricultural credit increase and 20 percent increase in the productivity of cattle agribusiness input (calf, feed, and medicine and vitamins).

## **RESULTS AND DISCUSSION**

### **The characteristics of the farm household**

The characteristics of the farm household explain the farm household's social and economic conditions, from the characteristics of the head of the family, the human resources and other assets available, to the household income and expenditure (Table 1). The mean age of the heads of the households was within the productive age and the mean education was junior high school dropouts. The number of family members was 5 and three were in the workforce, the numbers relatively balanced between male and female. The size of paddy fields and gardens owned was relatively small. The number of cattle owned was very low, only one to two heads per household. The agricultural credit received was also relatively little, only approximately IDR 4.4 million. The income contribution from the cattle agribusiness reached 19 percent of the total household income. Expenditure for food reached 30 percent of the total household expenditure.

### **The Impact of Credit Policy**

The agricultural credit policy was responded by farm households through their production and consumption decisions (Table 2). The decision to produce cattle as an important commodity in the household's economy was to decide on the number of cattle raised and the number of cattle sold to the market. The direction of the cattle production is different between household located in the dryland zone and households in the wetland zone. When there is an increase in agricultural credit, households in the dryland zone reduce their cattle production, whereas households in the wetlands increase cattle production. The dryland household's decision to reduce the number of cattle raised is because: (1) household in the dryland zone already have cattle; therefore, the capital from credit is utilized for other agribusinesses or other productive businesses or even for consumption, (2) the land's ability to provide feed is relatively low, especially during the dry season, and (3) the availability of family labor is limited because households in the dryland zone usually have many agricultural and non-agricultural businesses. On the other hand, households in the wetland zone usually do not have cattle yet, have a relatively abundant and varied supply of feed and are have better economic ability; therefore, credit is not used for consumption. Decisions for the utilization of the cattle agribusiness input also follow the direction of production decisions. Households in the dryland zone reduce the demand for cattle input (calf, feed, and medicine and vitamins), whereas households in the wetland zone increase

the demand for the cattle agribusiness. Households in the dryland zone reduce external labor (both male and female) for the cattle agribusiness because the number of cattle produced is reduced. On the other hand, households in the wetland zone increase family labor for the cattle agribusiness. As a consequence, the demand for external labor for the cattle agribusiness decreases in dryland households and increases in wetland households. Households in the dryland zone utilize credit for other agribusinesses, causing the allocation of family labor to other agribusiness to increase and even increase the demand for male external labor for other agribusiness. The phenomenon of focusing family and external labor for other agribusinesses in households in the wetland zone demonstrates that if there is an increase in agricultural credit for the cattle agribusiness, households in the wetland zone would reduce the number of male labor (both family and external labor) for other agribusinesses and increase use of female labor in other agribusiness. This explains that in certain stages of other agribusinesses, women are considered more skillful, for example in the paddyfield rice agribusiness in the wetland zone, they are more skillful in planting, weeding, and harvesting. The increase in credit that is not utilized to increase cattle production causes a decrease in income from the cattle agribusiness in households in the dryland zone and, in contrast, causes an increase in households in the wetland zone. The income is used for household expenditures, both for consumption and investments. Increased credit causes a decrease in the welfare of households in the dryland zone, indicated by a decrease in household expenditure. Increased credit improves the welfare of households in the wetland zone. This demonstrates that in order to improve welfare in farm households, especially those in the dryland zone, providing credit alone does not suffice, the productivity in the business input also needs to be improved. Input productivity could be increased by providing adequate technology.

### **The Impact of Credit Increase and Productivity Improvement**

The analysis of increased agricultural credit demonstrates that it alone cannot mobilize the farm household economy, necessitating improvements in technology to improve the productivity of the agribusinesses. The benefits of increased input productivity is that it would increase household production, income and welfare. As a consequence, there needs to be an effort to disseminate technology to user level (farm household level). The increased credit and productivity causes the number of cattle produced in both dryland and wetland households to rise (Table 3). Demand for cattle agribusiness input, which is calves, feed, and medicine and vitamins, increases. The increased credit and productivity causes an increase in income from the cattle agribusiness in a quite large percentage. The change in input productivity and increased credit also have an impact on other agribusinesses, increasing income from other agribusinesses. The total household income also increases. The income received from the household's various sources is allocated to consumptive expenditure and investment. Households in the dryland zone would increase expenditure for food purchased in the market and food produced by the household itself. Increased income means that there is an opportunity for households in the dryland zone to fulfill its needs for food that its agribusiness

**Table 1. The Characteristics of the Farm Household in The Wetland and Dryland Agro Ecosystem Zones in NTT Province, Indonesia**

Mean	Agro Ecosystem		NTT
	Wetland	Dryland	
Age of head of household (years)	46.00	47.58	47.13
Education of head of household (years)	7.60	8.31	8.11
Number of household members (people)	5.16	4.95	5.01
Number of male household members (people)	2.00	1.94	1.96
Number of female household members (people)	1.90	1.80	1.83
Number of workforce (people)	3.52	3.49	3.50
Paddy field (ha)	0.44	0.25	0.35
Gardens (ha)	0.30	0.75	0.51
Cattle (heads)	1.56	1.7	1.67
Agricultural credit (IDR)	3,763,600	4,713,840	4,459,860
Income from cattle (% of the total household income)	16.20	20.30	19
Expenditure for food (% of the total household expenditure)	27.55	30.59	29.68

Source: Analysis of primary data

**Table 2. The Impact of Increased Credit on Farm Households in Dryland and Wetland Agro Ecosystem Zones, NTT Province, Indonesia**

Endogenous Variables	Dryland		Wetland	
	Base Value	% Δ	Base Value	% Δ
Number of cattle produced (heads)	3.3644	-2.31	7.6311	4.13
Number of cattle sold (heads)	1.0569	-0.43	1.5609	1.56
Number of cattle still kept (heads)	2.3075	-3.17	6.0702	4.78
Number of calves (heads)	1.5966	-2.20	2.2108	6.83
Amount of feed (kg)	4.2142	-0.58	5.9072	1.73
Amount of medicine (dosages)	9.3316	-0.34	12.2475	1.18
Male family labor supply for cattle (man days)	407.9	-1.81	809	3.72
Female family labor supply for cattle (man days)	131.5	-2.59	305.4	4.65
Demand for male external labor for the cattle agribusiness (man days)	225.7	0.39	198.5	-1.96
Male family labor supply for non-cattle agribusinesses (man days)	307	0.09	445.3	-0.25
Female family labor supply for non-cattle agribusinesses (man days)	226.1	0.08	350.4	0.02
Demand for male external labor for non-cattle agribusinesses (man days)	39.4435	0.29	76.5212	-0.66
Demand for female external labor for non-cattle agribusinesses (man days)	99.7399	-0.08	137.8	0.07
Family labor supply for non-agricultural businesses (man days)	299.3	0.03	429.2	-0.04
Income from the cattle agribusiness (IDR)	6562568	-7.80	29881766	9.02
Income from non-cattle agribusinesses (IDR)	2962352	-0.15	934551	1.45
Non-agricultural income (IDR)	13973555	0.14	14248421	-0.62
Total family income (IDR)	23987578	-2.06	45648448	5.74
Expenditure for food that is purchased (IDR)	6211629	-0.09	3980069	0.73
Value of food consumed from the household's own farm (IDR)	3873557	-0.02	5160539	0.62
Expenditure for non-food consumption (IDR)	5201909	-0.42	7088805	1.63
Expenditure for investments in productive businesses (IDR)	1120848	1.57	-98200.6	94.96
Expenditure for social investments (IDR)	2067648	-1.37	3460000	4.33
Expenditure for educational and health investments (IDR)	1412755	-0.02	1528842	0.13
Savings (IDR)	18931049	0.14	17116917	-0.84
Total household expenditure (IDR)	18475591	-0.21	19591213	1.03

Source: Analysis of primary data

**Table 3. The Impact of Increased Credit and Productivity on Farm Households in Dryland and Wetland Agro Ecosystem Zones, NTT Province, Indonesia**

Endogenous Variables	Dryland		Wetland	
	Base Value	% Δ	Base Value	% Δ
Number of cattle produced (heads)	3.3644	40.71	7.6311	39.11
Number of cattle sold (heads)	1.0569	-3.25	1.5609	-3.18
Number of cattle still kept (heads)	2.3075	60.85	6.0702	49.99
Number of calves (heads)	1.5966	0.43	2.2108	8.14
Amount of feed (kg)	4.2142	0.90	5.9072	1.93
Amount of medicine (dosages)	9.3316	7.44	12.2475	9.78
Male family labor supply for cattle (man days)	407.9	-6.72	809	0.94
Female family labor supply for cattle (man days)	131.5	-5.25	305.4	3.67
Demand for male external labor for the cattle agribusiness (man days)	225.7	1.06	198.5	-0.96
Male family labor supply for non-cattle agribusinesses (man days)	307	0.85	445.3	1.98
Female family labor supply for non-cattle agribusinesses (man days)	226.1	1.19	350.4	3.57
Demand for male external labor for non-cattle agribusinesses (man days)	39.4435	-0.08	76.5212	-0.86
Demand for female external labor for non-cattle agribusinesses (man days)	99.7399	-0.76	137.8	-7.25
Family labor supply for non-agricultural businesses (man days)	299.3	-0.37	429.2	-3.31
Income from the cattle agribusiness (IDR)	6562568	133.43	29881766	64.16
Income from non-cattle agribusinesses (IDR)	2962352	0.30	934551	31.65
Non-agricultural income (IDR)	13973555	0.08	14248421	-1.43
Total family income (IDR)	23987578	36.59	45648448	42.19
Expenditure for food that is purchased (IDR)	6211629	0.64	3980069	-1.92
Value of food consumed from the household's own farm (IDR)	3873557	2.21	5160539	0.21
Expenditure for non-food consumption (IDR)	5201909	-25.03	7088805	-35.88
Expenditure for investments in productive businesses (IDR)	1120848	94.99	-98200.6	-22.19
Expenditure for social investments (IDR)	2067648	49.81	3460000	62.49
Expenditure for educational and health investments (IDR)	1412755	0.53	1528842	1.18
Savings (IDR)	18931049	-3.54	17116917	0.38
Total household expenditure (IDR)	18475591	4.97	19591213	8.84

Source: Analysis of Primary Data

does not produce. Increased credit and agribusiness input productivity increases the availability of food produced through the household's agribusiness. A positive percentage of change demonstrates the foodcrop agribusiness in dryland household's improved ability in providing food for itself and at the same time indicates improved food self-sufficiency. Households in the wetland zone have the ability to produce better foodstuff, reducing the demand for market-purchased food and increasing the ability to provide food from their own agribusinesses. Social and human recourse investments (education and health) increase, having a positive impact on the quality of human resources. Consumptive and investment expenditures in households in both the dryland and wetland households are indicated by the total household expenditure which describes welfare. A positive total household expenditure household indicates an increased household welfare. Increased credit and input productivity input increases household welfare. The highest rise in welfare is found in household in the wetland zone. This demonstrates that households in the wetland zone have better a economic response and condition than those of households in the dryland zone.

## CONCLUSION AND POLICY IMPLICATIONS

The policy to provide agricultural credit has resulted in an increased production and welfare, especially in farm households in the wetland zone. Providing agricultural credit alone for farm households in the dryland zone is not enough. Improvements in business input productivity input through the improvements of the quality and quantity of production input would increase both the production and welfare of farm households. The implications of the presence agricultural credit is the need for efforts to disseminate better agribusiness technology to improve the farm household's production and the income and welfare farm household.

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