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Borrowed capital and factors affecting its utilization among rice farmers in the Province of Albay, Philippines

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ABSTRACT. Agricultural credit programs provide opportunities for farmers to acquire the necessary farm inputs and apply appropriate technologies. However, it remains a challenge for farmers to use the credit for what it was intended for. This study aimed to measure the factors affecting the utilization of borrowed capital of 233 randomly selected rice farmers from the province of Albay using binary logit as its analytical procedure. The factors influencing the utilization of borrowed capital are the type of the optimization behavior of the farmers, sex, family size, and farm size. The output maximizers and the male farmers have a higher probability to use the borrowed capital for rice production. Farmers with a bigger family size and with larger farm size, however, are more inclined to use part of the borrowed capital for non-rice farming activities. Given the results, agricultural financial institutions may consider the production optimization behavior of farmers, and their socio-demographic and farm characteristics in crafting policies and intervention strategies to target and select appropriate farmer-borrowers for a specific credit product or service.

Keywords: *Credit utilization, optimization behavior, rice farmers*

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INTRODUCTION

Agricultural credit plays an important role in increasing agricultural production and income of farmers (Moahid et al., 2021). Improvement of agricultural production can be attributed to the increase and appropriate use of agricultural inputs, technological change, and technical efficiency. Agricultural production can be improved through an appropriate and better mix of farm inputs, while financial capital must be accessible and readily available for farmers. Agricultural credits are a common source of financial capital for farmers.

Cooperatives and banks are common sources of credit amongst rice farmers in the Philippines. Farmers access credit from the Land Bank of the Philippines (LBP) and the Development Bank of the Philippines (DBP) through their program on Expanded Rice Credit Assistance (ERCA). This loan program aims to increase the productivity of rice farmers, and assist them in establishing agricultural production, processing facilities, and farm improvement (Development Bank of the Philippines, n.d.; Land Bank of the Philippines, 2019). Likewise, the Department of Agriculture (DA) has facilitated loans for the rice farmers through the Land Bank of the Philippines through its programs on Expanded Survival and Recovery Assistance Program for Rice Farmers (SURE Aid Program) and Rice Farmer Financial Assistance (RFFA) (Bejarin, 2019).

Loans are used by farmers to purchase the necessary inputs and pay their farm workers (Nilo & Catelo, 2017). Rice farmers have difficulty in managing and utilizing their loan proceeds (Geron et al., 2016). They tend to use a portion of the loan intended for rice for non-rice activities. However, farmers who have used their loan for rice production have higher net income than those who utilize part of it for other activities (Quiring, 2016).

On the other hand, according to managers of cooperatives, the problem pertaining to using rice loans for non-rice purposes has persisted for several years. Lenders lack the capacity or mechanism to determine and select the farmers that will fully utilize their loan proceeds for rice production and to monitor the loan utilization. This indicates that there seems a problem of information asymmetry between the farmer-borrowers and lenders on adverse selection and moral hazard.

Credit utilization is among the major factors for credit default and poor repayment rate of farmers (Ibrahim et al., 2015). It is associated with socio-demographic characteristics of the farmer-borrowers (Aladejebi et al., 2018) and other relevant variables such as farm size and farm experiences (Ameh & Lee, 2022). Credit is commonly used to purchase

farm inputs to maximize their output (Pearce, 2003). Theoretically, farmers can be classified into two when it comes to their optimization behavior: output maximizers and cost minimizers. The former usually use credit more to finance production-related expenses than the latter (Quilloy, 2015).

According to Hoff and Stiglitz (1990), contracts between the lenders and borrowers and factors affecting the borrower's behavior are mechanisms to address the problem of information asymmetry. The farmers' cooperatives have mechanisms such as character and background investigation and cash flow analysis to evaluate the borrowers' risk levels as they know their member-borrowers better and their proximity of operation is within the areas where the members reside (Ahmed & Mesfin, 2017; Linh et al., 2020).

Managers of agricultural cooperatives in Albay province note repayment and loan utilization are the major concerns in the operation of the credit services to rice farmers. Based on their initial evaluation, the farmers with credit default tend to use their loan for household expenses. This is similar to the results of the evaluation of Rural Assistance Support and Credit Program channeled to agrarian reform cooperatives, which found that more than 10% of loans were past due (University of the Philippines Los Baños Foundation, Inc., 2005). Hence, poor repayment rate and poor credit evaluation are the factors that contribute to the failures of credit cooperatives (DA - Agricultural Credit Policy Council, 2015). Demographic and institutional factors such as road distance and contact with development agents influence poor repayment rate of farmers (Kassegn & Endris, 2022). Also, the delinquency of the members of the cooperatives, mismanagement of financial resources, and institutional problems are among the reasons for the cooperative business failure (Dimas, 2021; Torres et al., 2015).

Given the context above, this study aimed to analyze the factors that affect the credit utilization of rice farmers in the Province of Albay. Rice is among the major agricultural industries in the province. The production output of paddy registered 224,533 metric tons (Calipay, 2022). Albay is the second largest producer of paddy in the Bicol region. It registered a 14% increase from 2019 to 2020 despite the 3.6% decline in paddy harvest area (Guarin, 2020). In relation to the importance of rice in Albay, this paper specifically intended to describe the specific characteristics of rice farmers in the province in terms of their socio-demographic profile, farm characteristics, concerns, production optimization behavior; determine the farmer's sources and use of their financial capital; and measure the factors affecting the credit utilization of rice farmers.

Likewise, this study serves as an input in strengthening the agricultural credit policy on rice production, specifically on expanding the screening of loan applicants' criteria and improvement of the credit packages to tailor-fit their production behavior to reduce or avoid credit default. It supports one of the objectives of the Philippine Development Plan on expanding economic opportunities in agriculture, specifically on increasing farmers' access to innovative financing. As mentioned, this study may serve as a basis to develop innovative financing schemes suited for the farmers' production behavior.

This study is limited to determining the factors that influence the credit utilization of rice farmers. It does not measure the relationship between loan repayment and credit utilization. Many studies have found that loan repayment is affected by the decision of the borrowers to use the loan for what it is intended for or for other purposes (Endris, 2022; Ibrahim et al., 2015; Kassegn & Endris, 2022). This study intends to provide information that would help agricultural credit institutions develop specific credit policies based on the factors affecting the loan utilization of farmers.

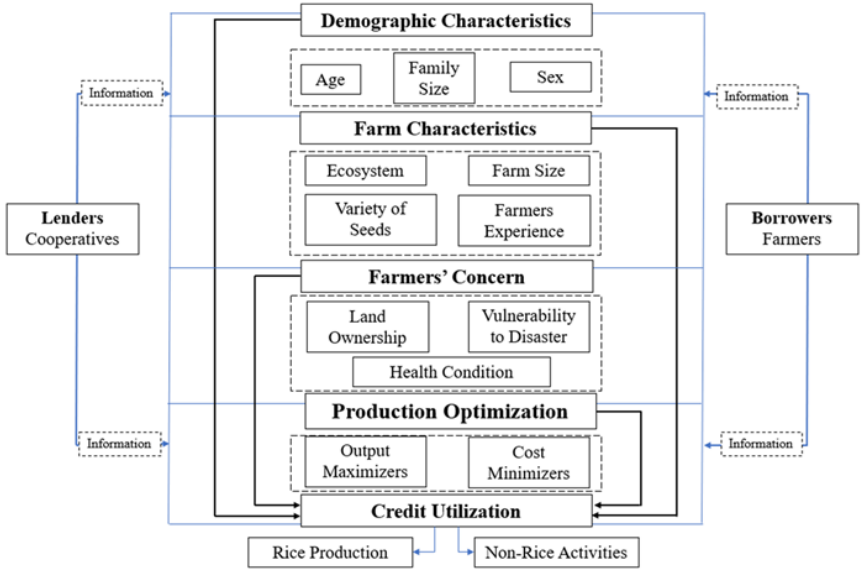
Conceptual Framework

This study is guided by the Theory of Asymmetric Information (Akerlof, 1970). This theory argues that the incomplete borrower information makes it difficult for the lender to distinguish between the low and high risk borrowers (Stiglitz & Weiss, 1987). In this study the farmer-borrowers have better information about their level of credit risk to cooperative-lenders. The lenders need to access and fully utilize complete information about the characteristics of the borrowers and its effects on credit utilization (Sandhu, 2020).

Following this theory, Figure 1 shows the interaction between the lenders and borrowers where information flows completely and is accessible between the farmers and cooperatives. This information includes the demographic profile, farm characteristics, and production optimization behavior of the rice farmers. These are the factors to be measured to determine the probability of the farmers to use the loan for rice production or for non-rice activities.

The demographic characteristics, farmers' concern, and farm characteristics of the borrowers may influence credit utilization (Gunawardhana & Silva, 2021; Howley & Dillon, 2012). The demographic characteristics of the farmer-borrowers include sex, family size, and educational attainment; and farmers' concern comprises land ownership, vulnerability to natural disasters, and their health condition; and the farm

Figure 1
Conceptual framework



characteristics refer to type of ecosystem, variety of seeds, farm experience, and farm size. These farmer characteristics are factors to be measured relating to their intent to utilize the credit to production or otherwise (Javed et al., 2022).

Studies have shown that women have a higher probability to repay their loans than men (D'Espallier et al., 2011; Shahriar et al., 2020), but men have more control than women in credit utilization (Shohel et al., 2022). Additionally, male-borrowers tend to divert loans to non-agricultural activities. Farmers who head large households tend to use their loan for agricultural activities (Kolade et al., 2020). Educational attainment, family size, property rights, and farming experience are positively related to farmers' intent to use loans for farm-related expenses (Ameh & Lee, 2022; Javed et al., 2022). Use of agricultural credit improves rice productivity (Nonvide, 2017) and is significant to farmers by using modern hybrid rice varieties (Jimi et al., 2019).

Likewise, the constraint production optimization behavior of the farmers can be an indicator to determine the probability of using the loan for production-related expenses. Theoretically, the output maximizers are constrained with the production cost while the cost minimizers are

constrained with the technology (Quilloy, 2015). Output maximizers aim to maximize their output and profit, but they are restricted by the production cost (Varian, 2014). Thus, rice farmers that are output or profit maximizers use their loans to acquire quality inputs to achieve a higher level of technical efficiency in their production (Sossou et al., 2014).

METHODOLOGY

The study was conducted amongst rice farmer-clients of two cooperatives in Albay identified by the Land Bank of the Philippines as their conduit partners for loans intended for rice production. These cooperatives provide rice loan products in the municipalities of Manito, Daraga, Sto. Domingo, Bacacay, Malilipot, Malinao, and the cities of Legazpi and Tabaco.

A cross-sectional field survey of the rice farmers in the province of Albay was used as the research design. The respondents were rice farmers in Albay province who availed financial capital through credit from formal institutions.

The population size of the study is 590 rice farmers from the two major agricultural credit cooperatives. Using Cochran's formula with 95% confidence level, and 5% margin of error, the sample size or respondents of the study is 233 rice farmers and were selected through random sampling. The random selection of the respondents was based on the proportional size of the population from the two districts in Albay where the cooperatives operate. Below is the formula for the computation of sample size:

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

The farmers were individually interviewed using a structured survey questionnaire. The results were tabulated and interpreted using binary regression analysis based on the definition of the variables of the study shown in Appendix A.

This study utilized binary logit models to estimate the probability of the farmers' utilization of borrowed capital with either the famers utilizing the borrowed capital solely for rice production, or a portion of the borrowed capital was utilized for non-rice livelihood activities or for family expenses. The binary logit model is a discrete choice model that follows a

cumulative logistic distribution. Meanwhile, the binary logit regression analysis as an approach to analyze credit utilization was based on several studies on credit agricultural analysis (Isitor et al., 2014; Javed et al., 2022) and credit access decision (Ambong & Pasco, 2022).

The utilization of borrowed capital of the farmers is expressed in the discrete category from taking a value of 1 when used purely for rice production and 0 when borrowed capital is partly used for non-rice activities. The probability of the optimization behavior of the farmers in a binary logit model (Greene, 2012) can be expressed as follows:

$$P_i\ (Farmer_i = 1) = \frac{e^{zi}}{1 + e^{zi}} = \frac{1}{1 + e^{-zi}}$$

$$Z_i = \ln\frac{\mathrm{P_i}}{1 - \mathrm{P_i}} = \beta_0 + \beta_m \mathrm{X_i} + \varepsilon_i$$

Where:

$\ln P_i/1- P_i$	: Log of odds ratio
β_m	: parameters estimate
X_i	: vector of explanatory variables
ε	: error term

The marginal effects of each explanatory variable can be computed as:

$$\frac{\partial \mathrm{P_i}}{\partial \mathrm{X_{ij}}} = \beta_j\ \mathrm{P_i}\ (1 - \mathrm{P_i})$$

The dependent variable represents a binary behavior of the farmers either they solely utilize the loan proceeds for rice production or a portion of it was utilized for non-rice activities. The explanatory variables or independent variables includes socio-demographic profile and farm characteristics. The binary logit regression of the probability of the farmers' utilization of borrowed capital is shown below:

$$Farmer_i = \beta_0 + \sum_{k=1}^{1} \beta_k \mathrm{O_{ki}} + \sum_{l=1}^{4} \beta_l \mathrm{W_{li}} + \sum_{m=1}^{4} \beta_m \mathrm{T_{mi}} + \sum_{n=1}^{4} \beta_n \mathrm{Z_{ni}} + \varepsilon_i$$

Where:

Farmer	: Utilization of borrowed capital
β_0	: Intercept
$\beta_o\beta_k\beta_l\beta_m\beta_n$	: Coefficient of the j_{th} k_{th} v_{th} of the explanatory variables
O	: Optimization behavior O : Optimization behavior
W	: Vector of socio-demographic profile W_1: Age W_2: Education W_3: Sex W_4: Family size
T	: Vector of farm characteristics T_1: Ecosystem T_2: Seed T_3: Farm experience T_4: Farm size
Z	: Vector of farmers' concern Z_1: Property rights Z_2: Natural disaster Z_3: Health condition
ε	: Error term

This study also conducted a series of diagnostic tests using Breusch-Pagan/Cook-Weisberg to determine if there is a violation of heteroscedasticity and test using variance inflation factor and correlation of the independent variables to determine if there is a problem on multicollinearity. Heteroscedasticity refers to a violation of the assumption of constant variance of errors in a regression model. Huber-White's Robust standard errors or the robust standard errors approach was used to obtain results of robust variance estimators.

RESULTS AND DISCUSSION

Characteristics of Rice Farmers

Socio-demographic characteristics. The mean age of the rice-farmer respondents is 48. Their age range is 28-80 years old. The largest household size is 11 while the smallest household size is 2. The mean years of schooling of the rice farmers is 11, which corresponds to first year level in college. The highest educational attainment of the respondents is college degree, which is 14 years of schooling while the lowest educational attainment of the respondents is Grade 4 in elementary education (Table 1).

Table 1
Age, family size, and years of schooling of rice farmers in Albay, Philippines, 2021

Variable	Obs	Mean	Std dev.	Min	Max
Age	233	48.42	10.60	28	80
Family size	233	5.12	1.51	2	11
Years of schooling	233	11.27	2.09	4	14

The average age of the rice farmers in this study, i.e., 48, is lower than the estimated average age of Filipino farmers which is 54. It also appears that rice farmers in Albay achieved a slightly higher educational attainment compared to the estimated average of Filipino years of schooling as indicated in the results, showing a mean of 11 years of schooling, corresponding to college undergraduate or have taken vocational courses while the estimated average of Filipino years of schooling is 9 equivalent to high school undergraduate (Palis, 2020).

However, the rice farmers in Albay have a slightly bigger family size which is 5.17 compared to the estimated average family size of Filipino farmers which is 4.61 (Palis, 2020). The average family size of the farmers in this current study is also a bit higher than the estimated family size in the province of Albay which is 4.7 by the Philippine Statistical Authority (PSA, 2016).

Table 2 shows that 63% of the respondents are female while 37% are male. This is indicative of clientele borrowers of the cooperatives being female. The predominant number of women borrowers in the cooperatives in Albay province is like the composition of female membership in the Philippines. According to the Cooperative Development Authority (CDA), women constitute 58% of total membership in the cooperative (CDA, 2021).

Table 2
Frequency distribution of the biological sex of the rice farmers in Albay, Philippines, 2021

Sex	Frequency	Percentage (%)
Male	233	48.42
Female	233	5.12
Total	233	11.27

Farm characteristics. The farm characteristics include type of ecosystem, years of farming, and types of seeds. Table 3 describes the types of ecosystems of the rice farms, its farm size, and years of farming of the respondents. Almost 82% of the farmers have irrigated rice fields with a mean average of 0.56-ha farm size. The largest irrigated farm size is at 2.2 ha while the smallest farm size is 0.13 ha. Some 18% of the rice farmers have non-irrigated rice fields with a mean average of 0.38 ha. Non-irrigated type of rice farm ecosystem has the largest farm size of 1 ha and the smallest farm size is 0.06 ha.

Table 3
Age, family size, and years of schooling of rice farmers in Albay, Philippines, 2021

Type of Ecosystem	Frequency	Percentage	Mean FS/YF*	Min	Max
Irrigated (ha)	191				
Non-irrigated (ha)	42				
Total	233	100	-	-	-
Years of farming	-	-	16.20	1	45

Note. *FS – farm size; YF – years of farming

According to PSA (2020), the irrigated rice fields produce higher yield of paddy compared to non-irrigated rice fields. This can be attributed to the 83% of the 2020 total volume of rice production coming from the irrigated rice fields. The non- irrigated rice fields only contribute 14%. However, the farm size of the rice farmers in the province of Albay is smaller than the average size of farm holdings in Bicol Region ranging from 1 to 3 ha (PSA, 2004).

The mean average of years in farming of the rice-farmer respondents is 16.20. The longest number of years of farming is 45 years while the shortest is 1 year. This implies that the rice farmers in the province of Albay have less experience in farming compared to the average farming experience of Filipino farmers at the national level at 25.12 (Palis, 2020).

Table 4 shows that 89% of farmer-respondents use the combination of traditional and high yielding variety (HYV) of seeds. Only 7% of the farmers solely use a traditional variety of seeds and 5% of the farmers merely utilize HYV of seeds. Based on the study by Digal and Placencia (2020), the factors that influenced the rice farmers in the Philippines to use HYV are irrigation, farm size, and training.

Table 4
Frequency distribution of seed varieties of rice farmers in Albay Philippines, 2021

Types of Seeds	Frequency	Percentage
Traditional	16	6.87
High yielding variety (HYV)	12	5.15
Combination of HYV and traditional	205	87.98
Total	233	100

According to Cañete & Temanel (2017), the cost of farming services, seeds used, and application of fertilization are factors that influence the rice yield in irrigated farms. For non-irrigated farms, the cost of farm services, quantity of seeds, land area, quantity of fertilizer applied, and cost of pesticides and farms are factors affecting the rice yield. Non-irrigated farms have greater technical inefficiency and lower return to scale compared to irrigated farms. The concerns of the rice farmers include lack of financial capital, calamities, and soil and irrigation/water management.

Majority of the rice fields in Albay are irrigated. Farmers use HYV of seeds, and previous studies show that irrigated farms with HYV report higher yields compared with non-irrigated farms planted with traditional variety of seeds. Hence, it could be said that there is a good production of rice in Albay. The rice farmers in the province can be considered as small landholders (area is <1 ha), rely on family labor, and spend low capital input. They may be using much of the production of rice for home consumption.

Farmers' concerns. The farmers' concerns noted were on land ownership, level of vulnerability to natural disaster, and their health condition. Table 5 shows that 84% of the farmers own their rice field; the rest are tenants.

Table 5
Frequency distribution of land ownership of rice farmers in Albay, Philippines, 2021

Types of Ownership	Frequency	Percentage (%)
Privately owned	195	83.69
Tenant	38	16.31
Total	233	100

Historically, Bicol Region has significantly increased the number of landholdings but has decreasing land areas of landholding; specifically, in Albay, from 66,000 landholdings in 1980 to 107,000 in 2012, and from an average 2.4 ha of land holdings of the farmers in 1980 to an average 1 ha landholdings in 2012. The reasons behind this were the land being divided among family members from one generation to another and the government's implementation of the Comprehensive Agrarian Reform Program (PSA, 2012).

Table 6 describes the level of the disaster risk vulnerability of the rice farmers. Some 57% of the farmers are moderately vulnerable to disasters. *Moderately vulnerable* means that less than 70% or partial/ minimal destruction of property or disruption of operation, and inaccessibility to product and input market during and after disasters.

Table 6
Frequency distribution of the level of disaster risk vulnerability of the rice farmers in Albay, Philippines, 2021

Level of Vulnerability	Frequency	Percentage
Moderately vulnerable	133	57.08
Highly vulnerable	100	42.92
Total	233	100

Table 7 shows the frequency distribution of the level of vulnerability of rice farmers to disaster. The farmers report the following risks: moderately vulnerable to flood and typhoon (Rank 1), inaccessibility to farm input market (Rank 2) and product market (Rank 3). The risks are generally attributable to the location of the respondents, specifically those in the upland areas of Legazpi City and Daraga, Albay. While upland areas may be less vulnerable to flooding and have existing local traders of inputs and buyers of Palay, 42% are highly vulnerable to disaster. Results indicate that disasters result in 70% to 100% destruction of property and disruption of operation. Several respondents live at the foot of Mayon Volcano, which is indicative of the results of the study that shows that volcanic eruption led to the highest degree of vulnerability to disaster (Rank 1), followed by storage facilities made up of light materials (Rank 2), and lack of accessibility to product market (Rank 3).

The degree of vulnerability of the rice farmers in the province of Albay to various natural calamities is evident. The damages brought by volcanic eruption and typhoons from 2018 to 2020 can still be traced in their farmlands. In the 2018 eruption of Mt. Mayon Volcano, an estimated

Table 7
Frequency distribution of the level of vulnerability of the rice farmers to disaster in Albay, Philippines, 2021

Type of Disaster	Level of Vulnerability			
	Highly Vulnerable		Moderately Vulnerable	
	Frequency	Rank	Frequency	Rank
Floor and typhoon	90	4	144	1
Volcanic eruption	127	1	104	5
Storage facility of rice	112	2	121	4
Accessibility to product market	107	3	125	3
Accessibility to input market	88	5	142	2

PhP 100 million (USD 1.7 million) worth of damages were made in the crops including the rice, and a total of around 3,775 ha of farmlands were heavily affected. It lost more than 12,000 metric tons of rice due to the continuous volcanic activity (Calipay, 2018). Likewise, Albay is frequently visited by typhoons due to its location on the eastern side of the Pacific. The recent strongest typhoon that hit the province of Albay was super typhoon Goni, which severely damaged the rice and other high-value crops particularly the areas in the third district of Albay (Food and Agriculture Organization, 2020). Table 8 shows that 85% of the farmers are in good health. The other 15% may have difficulty working in the farm due to illness such as but not limited to respiratory problems and hypertension. If the weather condition is cold, they cannot work well leading them to hire farm workers and ask their relatives or any of the family members to work in the farm.

Table 8
Frequency distribution of the health condition of rice farmers in Albay, Philippines, 2021

Health Condition	Frequency	Percentage (%)
Poor health condition	35	15.02
Good health condition	198	84.98
Total	233	100

Based on a study Kedia and Palis (2008), the common health problems of Filipino rice farmers were fatigue, dizziness, and body pain. They reported various types of chronic health-related symptoms, which were categorized as neurological, dermal, respiratory, ophthalmic, and cardiovascular. The COVID-19 pandemic had significantly affected the entire population, especially the small-scale rice farmers, and the government has provided subsidies to reduce its economic impacts (DA, 2020).

Production optimization behavior. Table 9 shows the constrained production optimization behavior of the rice farmers. Majority of the rice farmers are cost minimizers. This shows that their objective is mainly to minimize the cost and their constraint is the target yield. However, almost 50% of the farmers are output maximizers indicating that the objective of the farmers is to increase the output, but their constraint is the production cost.

Table 9
Frequency of the distribution of the production optimization behavior of rice farmers in Albay, Philippines, 2021

Production Optimization Behavior	Frequency	Percentage
Output maximizer	111	48.00
Cost minimizer	122	52.00
Total	233	100

Sources and Utilization of the Financial Capital

Sources of financial capital. Farmer-respondents reported two sources of financial capital: own equity and borrowed capital (Table 10). Owned equity is the savings of the farmers or any cash that the farmers use for their rice production. Borrowed capital is loan from the cooperatives. The mean amount of equity as the financial capital of rice farmers is PhP 3,678.97 (USD 74.65). The highest equity of the farmers amounts to PhP 23,000.00 (USD 466.72) and the lowest amount of equity is PhP 500.00 (USD 10.15). It shows that the amount of equity of the farmers is spread out to the mean amount of equity as shown in standard deviation 3080.81.

Table 10
Sources and amount of financial capital of rice farmers in Albay, Philippines, 2021

Variable	Obs	Mean	Std Dev.	Min	Max
Equity (in PhP)	233	3,678.97	3080.81	500.00	23,000.00
Borrowed capital (in PhP)	233	16,724.03	7862.87	1,700.00	50,000.00

Note. 2021 average exchange rate: 1 US Dollar = 49.28 Philippine Peso

Moreover, the mean amount of borrowed capital to cooperatives is PhP 16,724.03 (USD 339.37). The highest amount of capital borrowed is PhP 50,000 (USD 1,014.61) and the lowest amount of borrowed capital is PhP 1,700.00 (USD 34.50). This indicates that the amount of borrowed capital of the farmers is spread out to the mean of borrowed capital as shown in standard deviation PhP 7,862.87 (USD 159.55).

The amount of borrowed capital for many of the rice farmers is higher than their own equity that they can use for rice production. Generally, loans offered by cooperatives to rice farmers have an interest rate ranging from 1.5 to 4% per month. However, in the case of the cooperatives in this study the credit package offered to the farmers have an interest of 2% to 2.5% per month. These cooperatives source the available credit for rice farmers from Land Bank of the Philippines.

According to cooperative managers, many of the farmers amortized the principal amount of their loan and monthly interest for 5 to 6 months. Other farmers agree to pay the principal amount of their loan and interest in lump sum after the harvest. This, however, is very risky for the cooperatives leading them to charge a slightly higher interest rate than to the farmers who prefer to pay the loan monthly. The loanable amount is computed based on the farmer-borrowers' capacity to pay. Cooperatives provide them with the amount of loans from 60% to 90% of their computed production cost. Remaining percentage of the production cost is the counterpart or the equity of the borrowers.

According to the farmers, the own equity used to finance the operation of the farm is generated through various sources such as through remittance of their children who are employed in the province, in Manila, and overseas, as well as earnings from farm and non-farm activities. Majority of the equity comes from their savings in their off-farm employment and remittances from their children who are also employed. Some of them source their equity through other livelihood activities that they are engaged in such as poultry, livestock, and crop production.

However, very few of the rice farmers generated their equity through their earnings in rice production. This can be attributed to farmers using a big portion of their produce for home consumption. They sell only a small portion of their harvest to pay for some of their expenses such as the rental fee of the farm equipment and the salary of the labor force. This practice is notable among farmers with less than 0.25 ha of land. However, for those with more than 0.5 ha of land, majority of their produce are sold to the major rice traders. Most of them, however, mill their produce and sell to local rice wholesalers and retailers. Hence, most of these farmers have higher equity on their financial capital.

From the interviews, it was found that majority of the farmers admitted that they have limited financial capital and cited this as the reason for joining the cooperative. Members of cooperatives can avail of lower interest rates for credit, which are far lower than the rates offered by other entities such as the local traders. They emphasized that a significant portion of their financial capital comes from the proceeds of their loans from cooperatives. This finding is true mostly among farmers with less than 1 ha landholding.

Farmers disclosed during the interview that there are various informal lending credit services in the local areas that could be their possible sources of credit. Some of them have availed themselves of such services during emergency situations. But comparing their experiences with the local traders and cooperatives, they prefer the cooperatives to local traders because of their lower interest rate and patronage refund. They highlighted the various training programs they attended in the cooperatives that helped them in managing their limited sources. This is also among the reasons they prefer cooperatives to informal lenders.

Majority of rice farmer-borrowers have been members of cooperatives for more than 5 years. They value their membership in these cooperatives because of the dividends they receive during the annual general assembly, plus, they also receive awards as good borrowers. Additionally, cooperatives offer various credit packages that are not limited to rice production. The operation of the cooperatives has adjusted their collection conveniently for them because the loan officers directly collect the loans in their areas of coverage. These are the reasons most of them are loyal to cooperatives as their sources of financial capital for their farm operation.

Utilization of credit. The utilization of loan proceeds shown (Table 11) is comprised of purchase of farm inputs for rice production, acquisition of fixed assets such as farm tools, and renting of land, and for non-rice

Table 11
Utilization of loan proceeds of rice farmers in Albay, Philippines, 2021

Variable	Number of Farmers	Rank	Amount in PhP*		
			Mean	Min	Max
Rice Production					
Seeds	155	4	1,912	320	3,600
Fertilizers	219	1.5	5,197	1,100	19,200
Pesticides	153	5	724	110	1,900
Labor	213	3	4,128	1,000	15,000
Farm equip / Carabao-soil preparation	219	1.5	5,787	1,200	20,600
Fixed Assets					
Farm tools	13	9	3,055	1,050	6,000
Land (renting)	17	8	5,915	1,000	27,720
Non-Rice					
Farm inputs (livestock, crop production)	48	7	3,140	1,100	13,600
Family expenditure	94	6	3,865	1,080	11,000

Note. *2021 average exchange rate: 1 US Dollar = 49.28 Philippine Peso

activities such as purchasing of farm inputs for livestock and crop production, and for family expenditure which includes food, education, and payment for utility bills.

Purchase of fertilizers and payment for hand tractor service or renting a carabao for soil preparation have the highest number of responses. The mean amount of loan proceeds used for the purchase of fertilizers is PhP 5,197.00 (USD 105.46) and the mean of loan proceeds used for the payment of farm equipment service like tractor and thresher is PhP 5,787.00 (USD 117.43). The highest amount of loan utilization for the purchase of fertilizer is PhP 19,200.00 (USD 389.61) and its lowest amount of utilization is PhP 1,100.00 (USD 22.32).

Payment of salary or wages of the labor force is Rank 3 in terms of the number of farmers utilizing the loan. This labor force includes land preparation, farm maintenance, and harvest of paddy. It has a mean

amount of loan utilization of PhP 4,128.12 (USD 83.77). The highest amount utilized for payment of labor services is PhP 15,000.00 (USD 304.38) and its lowest amount of payment is PhP 1,000.00 (USD 20.29).

Purchase of seeds is Rank 4 and buying of pesticides is Rank 5. The mean amount of utilization of loan for the purchase of seeds is PhP 1,911.61 (USD 38.79). The highest amount of loan utilized for the purchase of seeds is PhP 3,600.00 (USD 73.05) while the lowest amount is PhP 320.00 (USD 6.49). The mean amount of utilization of loan for the procurement of pesticides is PhP 724.44 (USD 14.70). The range of expenditure on purchasing pesticide varies from a minimum of PhP 110.00 (USD 2.23) to a maximum of PhP 1,900 (USD 38.55).

There were 94 farmers who reported that they utilized the loan to cover family expenses (Rank 6). They used a portion of it to buy food, pay school fees and utility bills. The mean amount utilized for family expenditure is PhP 3,865.00 (USD 78.43). The highest amount of loan spent for family expenditure is PhP 11,000.00 (USD 223.21), and the lowest amount used for family expenditure is PhP 1,080.00 (USD 21.92).

Purchase of farm inputs on livestock and crops is Rank 7. This is considered as non-rice utilization of loan. The mean amount of loan used for acquisition of farm inputs on non-rice farm production is PhP 3,140.31 (USD 63.72). The highest amount of loan used for purchasing farm inputs on livestock and crops is PhP 13,600 (USD 275.97) and the lowest amount is PhP 1,100.00 (USD 22.32).

There were some rice farmers who used the loan to rent additional land area to intensify their rice cultivation efforts (Rank 8) and acquire farm tools. The mean amount of loan used for renting additional land is PhP 5,915.59 (USD 120.04) and the mean amount of loan utilized for purchasing farm tools is PhP 3,055.00 (USD 61.99).

The result of the study implies that almost all farmers use their borrowed capital to finance the required fertilizers and needed service of farm equipment or water buffalo for soil preparation. This is due to their perception that use of appropriate fertilizer ensures higher paddy output. This finding supports the research conducted by Das and Hossain (2019), which concluded that agricultural credit has a positive and statistically significant impact on total rice production, while chemical fertilizer also positively influences total rice production. Fertilizer intensification and access to credit mutually influence each other. An increase in the amount of credit could increase the quantity of fertilizer used in rice production (Ouattara et al., 2020).

However, utilization of loan proceeds to purchase seeds and pesticides ranked lower. This is because some of them already have seeds, particularly those who use traditional varieties. Likewise, the government distributes to farmers high-yielding varieties. The quantity of pesticides used by the farmers is also small as many of them own small parcels of land.

There were a number of farmers who used their borrowed capital to acquire fixed assets such as tools and equipment as well as renting of land to expand the production as they prefer labor-intensive farming practices. Purchasing farm equipment may not be suited to them because they have small land areas, and this equipment is available for rent at the local rice traders and other farmers. According to some farmers, renting of land to increase their production is not their current because of the lower price of rice in the market.

Less than half of the rice farmer-respondents used a portion of the loan for non-rice livelihood activities and family expenditure. This implies that farmers are juggling the available financial capital for their various agricultural livelihood activities such as rice cultivation, poultry and pig farming, and growing other crops. Financial difficulties pushed them to use borrowed capital for household expenses.

Factors Affecting the Credit Utilization of Rice Farmers

The factors affecting the decision of the farmers to use the borrowed capital either solely for rice production or for other non-rice expenses was measured through binary logit estimates. The optimization behavior, socio-demographic characteristics, farm characteristics, and farmers' concerns were considered as factors that may influence the likelihood of the farmers to be categorized as farmers using the borrowed capital purely for rice production or otherwise. The binary logit estimates explain whether the output maximizer has the probability to exclusively utilize the loan proceeds to rice production.

Specification test. The result of chi-square statistics of Breusch-Pagan/Cook-Weisberg test is 0.1797, which means there is a constant variance, an indication that there is no violation for heteroscedasticity. The independent variables are not highly correlated with one or more of the other independent variables using correlation and variance inflation factor tests. Although there are significant correlated variables at 1%, the absolute correlation coefficient is less than 0.7 or 70% among two or more predictors indicating that there is no presence of multicollinearity. This is supported by the Variance Inflation Factor that the result is not greater than 10.

Logistic Regression Sensitivity and Specificity Test. Table 12 shows the estimates of the probability of rice farmers' utilization of financial capital to rice production. To ensure the accuracy of the logistic regression results, sensitivity and specificity tests were conducted. These tests are indices used to evaluate the accuracy of tests that predict a dichotomous outcome. The results of the test of accuracy reveal that the sensitivity is 61.61% which is the percentage of true positives, specificity is 62.81% which is the percentage of true negatives, and 62.23% are correctly classified. It means that 61.61% of the samples in predicting the probability of the farmers' utilization of the borrowed capital are true positives. Hence, these samples are correctly classified as farmers exclusively utilizing their borrowed capital to rice production. It also shows that 62.81% of the samples in estimating the probability of the farmers' utilization of the borrowed capital are true negatives; thus, these samples belong to the farmers that are not solely utilizing the borrowed capital for rice production; they belong to the category of cost minimizers. It also revealed that 62.23% of the samples are correctly classified as farmers either solely utilizing borrowed capital for rice production or otherwise.

Table 12
Estimates of probability of 233 rice farmers' utilization of borrowed capital[2] to rice production and non-rice activities in Albay, Philippines, 2021

Variable	Log Odds Ratio Coefficient	Marginal Effects Coefficient
Optimization Behavior (1 - Output maximizers, 0 - Otherwise)	0.51*	0.13*
	(0.29)	(0.070)
Socio-Demographic Characteristics		
Age (number of years)	0.02	0.006
	(0.02)	(0.005)
Sex (1 - male, 0 - female)	0.95***	0.23***
	(0.33)	(0.08)
Family size (number of family members)	-0.20**	-0.05**
	(0.10)	(0.03)
Educational attainment (years of schooling)	0.07	0.02
	(0.08)	(0.02)
Farm Characteristics		
Ecosystem (1 - irrigated / combination, 0 - non-irrigated)	0.19	0.05
	(0.46)	(0.11)

Table 12 (continued)
Estimates of probability of 233 rice farmers' utilization of borrowed capital[2] to rice production and non-rice activities in Albay, Philippines, 2021

Variable	Log Odds Ratio Coefficient	Marginal Effects Coefficient
Variety of seeds (1 - combination of HYV & traditional, 0 - otherwise)	0.70 (0.73)	0.17 (0.16)
Farm experience (years of farming)	-0.01 (0.02)	-0.003 (0.005)
Farm size (in hectares)	-0.91** (0.37)	-0.23** (0.09)
Farmers' Concern		
Land ownership (1 - owned, 0 - tenant)	0.73 (0.49)	0.18 (0.11)
Disaster (1 - moderately vulnerable, 0 - highly vulnerable)	0.05 (0.32)	0.01 (0.08)
Health (1 - good health, 0 - poor health)	0.05 (0.31)	0.01 (0.08)
Constant	-2.46 (1.50)	
P-chi[2]	0.0007	
Pseudo R^2	0.11	
Sensitivity	61.61%	
Specificity	62.81%	
Correctly classified	62.23%	

Note. ( ) Standard deviation
*** Significant at 1%
** Significant at 5%
* Significant at 10%

The goodness of fit model is shown in pseudo R^2 with value of 0.11. It indicates the model has weak "likelihood" given the regressors. This is based on the indicators close to 1.0 that shows that the model has high likelihood and close to zero has low likelihood. However, pseudo R^2 only has meaning if it is compared to another pseudo-R-squared of the same type, on similar data, predicting similar outcome. Hence, the higher pseudo-R-squared indicates which model better predicts the outcome (Long & Freese, 2014).

[2] Loan utilization 1- solely to rice, 0 - a portion of it to non-rice activities

Factors affecting farmers' utilization of borrowed capital. The statistically significant coefficients for the probability of the farmers' optimization behaviors are optimization behavior at 10%, sex at 1%, and household size & farm size at 5%. If the farmers are output maximizers, the change in log odds ratio of utilization of borrowed capital purely to rice production will increase by 0.51. If the farmers are male, the change in log odds ratio of utilization of borrowed capital solely to production increases by 0.95 given the same characteristics of the female. Per unit increase in family size, the change in log odds ratio of famers to merely utilize the loan to rice production decreases by 0.20. Farmers with bigger farm size, the change in log odds ratio of farmers to purely use the borrowed capital to rice production decreases by 0.91.

Based on the result of the logistic regression analysis, the farmers' probability to utilize the credit utilization for the 233 randomly selected farmers is stated below. The independent variables or the factors that can affect the credit utilization were production optimization behavior (PROD), age, sex, family size (HSIZE), educational attainment (EDUC), ecosystem (ECOS), variety of seeds (SEED), farm experience (EXP), farm size (FSIZE), land ownership (LAND), vulnerability to disaster, and health.

$$\text{Farmer}_i = -2.46 + 0.51\text{PROD}_i \text{ *+ } 0.02\text{AGE}_i + 0.95\text{SEX}_i \text{ *** } -0.20\text{HSIZE}_i \text{ **} \\ +0.07\text{EDUC}_i + 0.19\text{ECOS}_i + 0.70\text{SEED}_i - 0.01\text{EXP}_i -0.91\text{FSIZE}_i \text{ **} \\ +0.73\text{LAND}_i + 0.05\text{DISASTER}_i + 0.05\text{HEALTH}_i + \varepsilon_i$$

Marginal effects of the probability of famers' utilization of borrowed capital. The marginal effects describe the average effect of changes in the optimization behavior, socio-demographic profile, farm characteristics, and farmers' concerns to the probability of the farmers' utilization of borrowed capital either solely to rice production or a percentage of it was utilized to non-rice expenses. It is a measure of the immediate effect that a change in a certain explanatory variable has on the predicted probability when the other covariates are constant. Table 12 shows the estimates of the marginal effects of the probability of rice farmers' borrowed capital to rice production.

Demographic profile. Sex and family size were the two variables significant at 10% and 5%, respectively, among the socio-demographic characteristics of the rice farmers. If the farmer is male, the probability of solely utilizing the borrowed capital for rice production increases by 0.23 or 23%, given the same characteristics of the female. An increase in family size, decreases by 0.05 or 5% the probability of exclusively using the borrowed capital to rice production.

This implies that the women farmers or the wife of the farmer has the probability to use the borrowed capital for non-rice production, particularly for household expenses. Rice farmers with small-scale production, have limited resources. The management of the limited resources of the household is commonly assigned to women farmers. In times of financial difficulty of the family, women farmers may allocate the borrowed capital toward expenses related to food, electricity, and educational expenses. This financial difficulty intensified for any additional family members which resulted in an increase in household expenses. This is reflected in the result of the study noting that farmers are inclined to use the borrowed capital for non-rice production.

However, membership of women in microcredits like cooperatives is considered as an effective empowerment strategy. This allows women borrowers to make household decisions such as on mobility, daily expenditure, children school, health expenditure, and loan order decision making. They are empowered to make household decisions pertaining to mobility, daily expenditure, children school, health expenditure and loan order decision (Al-shami et al., 2017). This is among the reasons that the women borrowers utilize a portion of their loan proceeds not for livelihood activities but for household expenses. This recommendation on encouraging women borrowers to enlist themselves in microcredit organizations aligns with other studies (e.g., Mukamana et al., 2017). Additionally, the findings show that overall, there was gender equality in participating in livelihood income generating activities and power over economic decision-making. A potential indicator of inequality between men and women noted in this study was about the level of freedom from domination.

A cursory review on the problems and challenges of women entrepreneurs from 1982 to 2018 found that women are overburdened with family responsibilities that adversely affect their performance relating to livelihood activities (Goswami, 2019). This could be the reason women sometimes used their borrowed capital to respond to their family responsibilities.

Moreover, family size is among the significant determinant of microfinance loan utilization by smallholder farmers (Amanuel & Degye, 2018). A study on the influence of socio-economic characteristics showed that male farmers have greater likelihood to divert agricultural loans to non-agricultural purposes (Kolade et al., 2020). Most families of rice farmers are of extended family type, which means higher family expenses. Farmer-borrowers in this context are inclined to use a portion of their borrowed capital for family expenses.

Farm characteristics. Farm size is statistically significant at 5%, and it is the only variable significant among the farm characteristics of rice farmers. For farmers with bigger farm size, the probability of solely using the borrowed capital for rice production decreases by 0.23 or 23%. This implies that the farmers with bigger farms have the tendency to use the borrowed capital for non-rice production, as they usually have various livelihood activities such as animal and crop production.

Optimization behavior. Farmers' optimization behavior is statistically significant at 10%. If the farmers are output maximizers, the probability that they will use the borrowed capital solely for rice production increases by 0.13 or 13%. The result conforms with the theoretical explanation that the farmers manifested an output maximizer behavior constrained with their farm budget. Hence, farmers exclusively use their borrowed capital to address the limitation of their farm budget on the rice production.

CONCLUSION AND RECOMMENDATIONS

The effective utilization of agricultural credit in rice production aims to enhance farms' technical efficiency and productivity, ultimately leading to a higher repayment rate by the farmers to cooperatives. Based on the results of the study, output maximizers and male borrowers are highly likely to use the credit for rice production. However, farmers with bigger farms and from relatively large households are highly likely to use part of their rice credit for non-rice activities. Rice farmers use their credit to purchase fertilizers and pay rental fees for the farm equipment and the salary of the farm workers for soil preparation.

Given the results above, it can be concluded that the production optimization behavior of the farmer-borrowers can be a good source of information for the agricultural credit cooperatives to determine the credit worthiness of the farmer-borrowers. The output maximizers are more likely to solely utilize the credit for rice production. Ideally, the farmers with a bigger farm size are expected to be output maximizers and use credit solely for rice production. The results of the study, however, revealed otherwise. This may be due to the many other agricultural livelihood activities they may be engaged in aside from rice farming. While they do not use the loan entirely for rice production, they may not necessarily be delinquent borrowers as they have many other sources of income.

Furthermore, it can also be concluded that the increasing household expenses for food and other essential needs can be a reason for some borrowers not to use their credit to rice production. This is anchored on the result of the study that for female-borrowers in bigger households, there is a probability that a portion of the credit is not utilized for rice production. This may be due to the women being burdened with the role of managing the household expenditure which may lead them to use their rice credits to buy food and pay household bills instead of utilizing it fully for rice production.

With these factors influencing the credit utilization, agricultural financial institutions would do well to develop policies and mechanisms pertaining to targeting and selecting appropriate farmer-borrowers for a specific credit product or service. Policies and mechanisms anchored on the results of the study may contribute to addressing the problem of information asymmetry between agricultural credit cooperatives and their clientele. Specifically, the observation that women have a higher tendency to utilize the borrowed capital for unintended purpose suggests that designing financial literacy programs specifically for them is in the right direction.

The determination of the production optimization behavior of the farmers can be included in policies for screening and evaluating the farmer -borrowers for rice production. It can be a guide for loan managers on what loan package they are suited for and the required regularity for monitoring the loan utilization. To implement this, there is a need to develop a loan package that is customized for farmers based on their classification of the production optimization behavior. Additionally, strategies must be crafted to expand credit services based on the said factors that influenced credit utilization.

Moreover, cooperatives and other financial institutions may consider the feasibility of releasing the credit in kind and not in cash in the form of farm inputs. This is based on the results of the study that credit is utilized to purchase fertilizers and to pay farm workers. However, this is applicable to the farmers that are cost minimizers and can be part of the terms and conditions of a particular loan package.

Further studies can be conducted to determine the relationship of loan repayment and credit utilization for the rice farmers. These studies will provide in-depth analysis of the loan repayment problem of the farmers.

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APPENDIX A
Definition of the Variables for Binary Regression of the Probability of the Farmers Utilization of Borrowed Capital

Dependent Variable	Definition
Farmers	Dummy variable representing the optimization behavior of the farmers: 1 - Solely to rice production 0 - A portion of it utilize to non-rice activities

	Independent Variable	Definition
O	Optimization behavior	1 - Output Maximizer 0 - Cost Minimizer
W_1	Age	Age of farmers
W_2	Education	Years of schooling of farmers
W_3	Sex	Sex of the farmers dummy variable (1 - Male, 0 - Female)
W_4	Family size	Household size of the farmers
T_1	Ecosystem	1 - irrigated 0 - rainfed
T_2	Seed	1 - modern variety 0 - traditional variety
T_3	Farm experience	Number of years in rice farming
T_4	Farm size	Farm size of the farmers used for rice
Z_1	Property rights	1 - Owned land 0 - Otherwise
Z_2	Natural disaster	1 - Perceived highly vulnerable to natural disaster 0 - Perceived moderately vulnerable to natural disaster
Z_3	Health condition	1 - Poor health condition of the farmers 0 - Healthy condition of the farmers