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Full Length Research Paper

Loan Utilization and Household Food Security in Rural Vietnam

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This study examined the utilization and amount of preferential loan contributed to the improvement in household food-insecurity in Vietnam. We collected primary data by the field survey that was conducted in July 2013 at three communes in Son Dong district, Vietnam. Among 1,136 households below the poverty line, we randomly selected 103 households. To measure household food security status, we used the method provided by USDA. The result showed that 56.31% of households in the district were food insecure. Logistic regression model was employed to determine factors influencing household food security levels. The results of the model found that, the positive impacts of share of the loans used for agricultural production on the food security status, but no significant impact in amount of the loan on it. This study also tried to explain the factors affecting loan utilization. We employed the generalized linear model to estimate the coefficients. We found that when amount of borrowed loan increases, households tend to use less loan for investing in production activities. Therefore, Vietnamese government can reduce its expenses on preferential credit programs without affecting the household food security status by carefully monitoring the use of the loans.

Key words: household food security, discount rate, preferential credit

INTRODUCTION

Security is closely linked to the welfare of human society and has been the core agricultural and economic policies in developing countries. The prevalence of undernourishment in those countries declined from 23.6% to 14.3% between 1990 and 2013 (FAO & IFAD, 2013; FAO *et al.*, 2012). Vietnam showed a more rapid decline from 48.3% to 8.3% in the same period. However, there were still 166.6 thousand households suffering from malnutrition in early 2014 while the prevalence of low weight, stunting, and wasting of children under five years old was 16.8, 27.5 and 6.6%, respectively, in 2011, which is higher than the world average of 16, 26, and 5% (General Statistics Office of Vietnam (GSO, 2014) and Vietnam National Institution of Nutrition (VNIN, 2014).

To improve the food security status and economic (Pham *et al.*, 2010) conditions in rural areas, the Vietnamese government has implemented poverty reduction policies including supporting programs such as agricultural production, education, services access, housing, infrastructure, healthcare support, training and competence creating, subsidies, and ethnic minorities support. Agricultural production support programs have played a very important role in improving household food security. These programs consist of agricultural extension training, input materials subsidies, agricultural land,

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Table 1: Number of Households belowthe Poverty Line in Surveyed Area

Commune	Households below the Poverty Line in 2013	Sample Size	Percentage	Poverty rate in 2013*	Poverty rate in 2016*
Cam Dan	408	37	9.06	47.4	53.4
An Chau	360	34	9.44	33.0	29.3
Long Son	368	32	8.70	34.4	48.0
Total	1,136	103	9.07		

Source. Statistical Office of Son Dong District 2013 and 2016, and author's survey in 2013.
*The poverty line in rural areas in the period 2011-2015 and 2016-2020 were set at VND 400,000 and VND 700,000 per capita per month (Legal Normative Document, 2011 and 2015).

fishery, forest protection, forest management and exploitation, and preferential credit (Do *et al.*, 2010; Pham et al., 2010).

Preferential credit programs, mainly conducted by the Vietnam Bank for Social Policy (VBSP), have provided non-collateral credits with low interest rates (6.5% per year) to more than 21.4 million households and other beneficiaries living below the poverty level (VND 400,000 per capita per month). Approximately three million households are estimated to have exceeded the poverty threshold so far through these programs (VBSP, 2012). Total outstanding loans as of December 31, 2012 were VND 113,921 billion (VBSP, 2012). The banking portfolio of VBSP includes programs for poor households, less privileged students, business and production households living in extremely remote areas and communes, safe water and rural sanitation, job creation, housing for the poor, and others. Outstanding loans of the poor household program was VND 41,560 billion, accounting for the biggest proportion at 36.48% of total outstanding loans (VBSP, 2012). Hence, this study focused on the preferential credit programs for poor households. The purpose of the poor household program was to lend to poor and near-poor households for production development such as buying seeds, fertilizers, and breeding animals. Poor households could borrow up to VND 30 million with an interest rate of 6.5% per year in the first 3 years (VBSP, 2014). If borrowers could not pay back the loan by the due date, the VBSP would consider the difficulties of the households for extending the payment deadline. Cuong (2008) confirmed positive impacts of the programs on household consumption and income per capita.

By contrast, Do et al. (2010) concluded that many poor households might use the loans for purposes other than investment in agricultural production because they do not have an appropriate plan for their production. However, previous studies do not examine the effects of the inappropriate use of the loans on household food security. If the inappropriate use of the loans worsens the food security status of households, more careful monitoring of loan usage is needed.

In this study, we first examine if the preferential credit program for poor households contribute to a reduction in the number of food-insecure households. Contrary to previous studies, which consider only the total amount of the loans as an explanatory factor, we asked each household in the survey how the loans were used to see if the usage of loans for non-production purposes worsens the food security status.

Then, we identify factors affecting loan-utilization behaviors of surveyed households. Understanding why households use the loans for non-production purposes is necessary to find cost-effective policies to improve the food security status of rural households. The Vietnamese government spent VND 734,000 billion on poverty reduction from 2005 to 2012, in other words, VND 90,000 billion annually, accounting for more than 12% of annual government spending. Of the VND 90,000 billion, preferential credit programs and their interest rates subsidies accounted for VND 20,000 billion and VND 8,000 billion, respectively (Timberg *et al.*, 2011). Thus, an improvement in the efficiency of the programs has a non-negligible impact on public finances.

The remainder of the paper is organized as follows. We discuss the estimation model in the next section. In Section 3, we explain the data obtained from the field survey. Estimation results are presented in Section 4. Section 5 concludes with a summary of results and policy implications.

METHODOLOGY

Data and Variables

Primary data were collected through a field survey conducted in July 2013 in three communes − Cam Dan, An Chau, and Long Son − in Son Dong district, one of the 62 poorest districts in Vietnam. Among 1,136 households below the poverty line in these three communes, 103 households were selected randomly (Table 1). Because our interest lies in the effects of the inappropriate use of loans on the food security status of households, we visited 103 farmers receiving loans from the VBSP's preferential credit programs for poor households.

By scrutiny in the secondary data on socioeconomic features in 2013 and 2016 of Son Dong district, we can affirm that data from our survey in 2013 can fully reflect

Table 2: Household Distribution by Socioeconomic Characteristics

Variable	Freq.	%
Commune		
Cam Dan	37	35.9
An Chau	34	33.0
Long Son	32	31.1
Gender		
Female	12	11.7
Male	91	88.3
Education		
Primary school and lower	72	69.9
Secondary school	24	23.3
High school and higher	7	6.8
Ethnicity		
Kinh	43	41.8
Tay	17	16.5
Nung	17	16.5
Cao Lan	26	25.2

Source. Author's calculation based on household survey, 2013

the current situation of household food security in the district. According to Statistical Office of Son Dong District (2013, 2016), the poverty rates that mainly influence on household food security at 3 sampled communes Cam Dan, An Chau and Long Son change slightly from 47.4%, 33.0% and 34.4% in 2012 to 53.4%, 29.3% and 48.0% in 2016, respectively (Table 1). Additionally, poverty reduction policies implemented in Vietnam do not change much through the years. As for preferential credit programs, since May 2014 VBSP has lent poor households up to VND 50 million instead of VND 30 million. However, total loan of poor-household-program decreases from VND 41,650 billion to VND 36,384 billion in 2013 and 2015 (VBSP, 2013 and 2015), while poverty rates of Vietnam in the years just decrease from 9.8% to 7% (GSO, 2015). This means raising the credit line at VND 50 million does not encourage poor households to borrow more money. Hence, preferential loan utilization of poor households does not change a lot through the time.

Households' socioeconomic characteristics are showed in Tables 2 and 3. Household heads who make production decisions are mainly male (88.35%). Education levels of household heads are not high (about 70% of them stopped at primary school or lower). In term of ethnicity, four groups are living together in the study site including Kinh, Tay, Nung and Cao Lan, in which Kinh is the main ethnicity and the others are ethnic minorities.

The age of households was between 25 and 71 years, with an average of 43.12 years, indicating the advantage of age for economic development. The high average age also implies that the household heads have much knowledge in farming practices. Yet, together with low education and risk aversion (the older, the more risk-averse), it prevents the households from obtaining new technology and market approaches. Household size was defined based on the number of household members usually eating together in a salver and living in the same house. The result implies that each household has an average of nearly 5 persons. Moreover, the dependency ratio is calculated to evaluate the ratio of dependent people younger than 15 or older than 64 to the working age population from ages 15-64. The high dependent ratio in the sampled households accounts for the burden on household laborers and directly influences food security. Each family there has only one dependent, usually a child. This means the number of household laborers will increase in the future. Paddy size also plays a very important role in ensuring household food security. However, paddy fields in Son Dong district are not fully irrigated. Rice can only be grown once per year, which partly prevents those families from obtaining enough rice for daily meals. Terraces and forests also contribute to generating extra income for households, but very few households possess them. The average annual household income is VND 17.5 million. Households are reported as poor, so they are qualified to borrow preferential credits from the VBSP. The loan amount ranges from VND 1 to 60 million.

Analytical methods

The U.S. Household Food Security Survey Module (US HFSSM) provides a measure of the food security status of households. This module is used in a variety of studies from developed to developing countries (Bickel *et al.*, 2000; Derrickson *et al.*, 2001; Frongillo & Nanama, 2006; Gulliford *et al.*, 2006; Usfar *et al.*, 2007). Food security can beclassifiedat4 levels, defined as follows (Bickel et al., 2000):

Food secure — Households show no or minimal evidence of food insecurity.

Food insecure without hunger — Food insecurity is evident in household members' concerns about adequacy of the household food supply and in adjustments to household food management, including reduced quality of food and increased unusual coping patterns. Little or no reduction in members' food intake is reported.

Food insecure with hunger (moderate) — Food intake for adults in the household has been reduced to an extent that implies that adults have repeatedly experienced the physical sensation of hunger. In most (but not all) food-insecure households with children, such reductions are not observed at this stage for children.

Food insecure with hunger (severe) — At this level, all households with children have reduced the children's

Table 3. Descriptive Statistics of Socioeconomic Characteristics

Indicator	Unit	Mean	Std. Dev.	Min	Max
Age of household head	Year	46.15	9.86	25	71
Household size	Person	4.46	1.23	2	9
Number of laborers in family	Person	3.23	1.36	1	6
Number of children in family	Person	0.97	1.02	0	3
Paddy area	ha	0.16	0.08	0.04	0.43
Irrigated paddy area	ha	0.10	0.05	0	0.36
Terrace area	ha	0.03	0.06	0	0.36
Forest area	ha	1.91	2.18	0	15.80
Residence area	ha	0.03	0.08	0	0.50
Borrowed loan amount	Mil. VND	18.49	13.92	1	60
Annual income of family	Mil. VND	17.50	15.53	0	80.22

Source. Author's calculation based on household survey, 2013

Table 4: Household Food Security Scale

Number of Affirmative Responses		Food Security Status Level
(Out of 18) Households with Children	(Out of 10) Households without Children	Category
0-2	0-2	Food secure
3-7	3-5	Food insecure without hunger
8-12	6-8	Food insecure with hunger, moderate
13-18	9-10	Food insecure with hunger, severe

Source. Guide to Measuring Household Food Security (Bickel et al., 2000)

food intake to an extent indicating that the children have experienced hunger. For some other households with children, this already has occurred at an earlier stage of severity. Adults in households with and without children have repeatedly experienced more extensive reductions in food intake.

Households without children and those with children would be asked 10 and 18 questions, respectively, about conditions and behaviors that characterize their household when they are having difficulty meeting basic food needs. Dieting to lose weight is not considered in the measure (Coleman-Jensen *et al.*, 2012). Households go through different experiential and behavioral stages as food insecurity becomes more severe. In the first stage, households suffer from shortage in food supplies and food budgets, feel anxiety about whether their quantity of food meets basic needs, and control their food budgets and food types. In the second stage, whenfood insecurity turns more severe, adults reduce their food intake and experience hunger, but they spare the children this experience. In the third stage, children's food intake is also reduced and they feel hunger and even they do not eat anything for whole days (Bickel et al., 2000). Households would be asked those questions one by one. Based on the number of affirmative responses in each stage, the interviewer would decide whether to continue asking questions in the next stages. Affirmative responses include "often true for the last 12 months" or "sometimes true for the last 12 months" to questions 1–6; "almost every month" or "some months but not every month" to questions 8, 13, and 16; and "yes" to the other questions (see Table 5) (Bickel et al., 2000). In stage one, households give their replies for questions 1–3 and answer additional questions 4 and 5 if they have any children. If responses to any one of questions 1–5 are affirmative, we proceed to stage 2; otherwise, we skip to the end. For stage 2, if households have children, we ask question 6; if not, we skip to questions 7-11. If responses to any one of questions 6 to 11 are affirmative, we proceed to stage 3; otherwise, we skip to the end. In stage 3, the interviewer asks questions 12 and 13, as well as questions 14–18 if households have children; otherwise, they skip to the end.

The number of affirmative answers of an interviewed household indicates that household's level of food security, displayed in Table 4. Each range of affirmative responses expresses 4 levels of food security by the above definitions. For food-secure households without children, they stopped at stage 1 if they reported 0 to 2 evidences of food insecure. Food insecurity brings pressure on adults first and on children last, so if a household with children reported any affirmative responses to questions 4 and 5 (meaning food insecurity also affects children), food security has become severe to the whole family. Therefore, when households with and

Table 5. Summary of Affirmative Responses to Items of US HFSSM

No.	Question/Statement	Frequency of Affirmative Responses	Percentage
Stage 1	1. "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?	53	51.5
	2. "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?	50	48.5
	3. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?	71	68.9
	4. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?	49	47.6
	5. "We couldn't feed our children a balanced meal because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?	43	41.8
Stage 2	6. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?	28	27.2
	7. In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)	6	5.8
	8. (If yes to question 7) How often did this happen? — almost every month, some months but not every month, or in only one or two months?	0	0.0
	9. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)	9	8.7
	10. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)	2	1.9
	11. In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)	5	4.9
Stage 3	12. In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)	1	1.0
	13. (If yes to question 12) How often did this happen? – almost every month, some months but not every month, or in only one or two months?	2	1.9
	14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)	0	0.0
	15. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)	0	0.0
	16. (If yes to question 15) How often did this happen? – almost every month, some months but not every month, or in only one or two months?	0	0.0
	17. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)	0	0.0
	18. In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)	0	0.0

Source. Author's calculation based on household survey, 2013

without children give 0–2 affirmative responses, they are classified as food secure.

At first, an ordered probit regression was employed for the dependent variable of food security with 4 levels (1: food secure; 2: food insecure without hunger; 3: food insecure with hunger, moderate; and 4: food insecure with hunger, severe). However, the result of the ordered probit regression was not good because group 3 had only three observations and group 4 had no observations. In addition, there was not much difference between the characteristics of these groups and those of group 2. Hence, the three observations were put into group 2 to improve results of the logistic regression.

Therefore, the food security status of a household is a dichotomous variable (secure and insecure), and the following food security status modelis estimated by logit:

$$ln\frac{p_i}{1-p_i} = \beta_0 + \beta_1 TL_i + \beta_2 SL_i + \beta_3 Z_i, \quad (1)$$

where p_i is the probability that *i*-th household is food secure; TL_i represents the total amount of the loans *i*-th household receives; SL_i is the share of the loans used for agricultural production (for example, a household borrows VND 20 million from the VBSP, then uses VND 15 million to invest in agricultural activities and VND 5 million for

Table 6. Household Food Security Level by Child Presence

Indicator	Food Insecurity		Food Security	
	Freq.	Percent	Freq.	Percent
Without children	21	20.4	26	25.2
With children	37	35.9	19	18.5

Source. Author's calculation based on household survey, 2013

buying a TV, so *SL* is the share of the VND 15 million out of the total loan of VND 20 million, which is 75%); and Z_i includes demographic variables such as gender, education, ethnicity and age of household heads, household size, proportion of adults in the family, and share of irrigated paddy out of the total paddy area (Babatunde *et al.*, 2007; Haile *et al.*, 2005; Hofferth, 2004; Thapa, 2008; WFP, 2001). Positive β_1 indicates that the total amount of preferential loans contributes to improving the food security status of rural households. By contrast, positive β_2 suggests that the share of the loans used for agricultural production is a key for food security at the household level, implying that the loans used for non-production purposes can be reduced to improve the efficiency of the programs.

The food security status was asked for the last 12 months (from July 2012 to July 2013) while the information on loan borrowing was asked before 2012, which ensures that the loan amount was not independent from the food security level. The demographic variables were collected at the time of the survey in July 2013.

Finally, to identify factors affecting loan-utilization behaviors, the following loan utilization model is estimated by a generalized linear model (GLM) because SL is proportion-variable (Papke & Wooldridge, 1993).

$$SL_i = \alpha_0 + \alpha_1 DR_i + \alpha_2 TL_i + \alpha_3 Z_i + \varepsilon_i, \quad (2)$$

Where, DR_i is the time discount rate of *i*-th household. The time discount rate measures the rate at which individuals are willing to trade off currentincome against future income (Anderson & Gugerty, 2009) and is estimated based on Tanaka *et al.* (2010). In our experiments, the interviewee makes 45 choices between smaller rewards delivered today and larger rewards delivered at specified times in the future as follows: Option A: receive *x* dong today; or Option B: receive *y* dong in *t* days. The reward *x* varies between 40,000 to 400,000 and the time delay *t* varies between 1 week and 2 months.

We denote the probability of choosing the immediate reward of *x* over the delayed reward of *y* in t days by P(*x*> (*y, t*)), and use a logistic function to describe this relation as follows (Tanaka *et al.*, 2010):

$$P\big(x > (y,t)\big) = \frac{1}{1 + exp(-\mu(x - y \times \beta exp(-rt)))}$$

We assume that there is no present bias (β=1). Then we estimate the noise parameters μ and discount rate *r* in the logistic equation above. Households with a high discount rate consider the money they consume today as more valuable than that earned in the future and hence, they prefer using the loans for non-production purposes to invest in low-return projects in agricultural production. Therefore, we expect parameter α_1 to have a negative sign.

RESULTS AND DISCUSSION

Measurement of Household Food Security Status

We adapt the US HFSSM to surveyed households to identify their food security status as of July 2013. Questions 1 to 10 were asked to households without children, while questions 11 to 18 were asked only if the household had children ages 0-14. The summary of affirmative responses to 18 items is displayed in Table 5. Based on the percentage of affirmative responses to each item, we can conclude that households there did not experience hunger, but they usually do not eat balanced meals (68.93%) or use low-cost food to feed children (47.57%).

Based on the number of affirmative answers reported by households and the household food security scale displayed in Table 1, we quantify the food security status as follows (Table 6). Households with children are more food-insecure than those without children. Households with children have fewer laborers, but high demand for nutritious food to feed children. Adults in the family must give up food to their children. Results in Table 7 show that 56.3% of surveyed households are classified as food-insecure, indicating that food insecurity still is a serious problem in this area. This figure is lower than that of the studies carried out in Tanzania (Knueppel *et al.*, 2009), Bangladesh (Benson, 2007), Iran(Salarkia *et al.*, 2014) Burkina Faso and Bolivia(Melgar-Quinonez *et al.*, 2006) but higher than food-insecurity rate in Vietnam in 2013 (Ali *et al.*, 2013). Located in the most distant area from the urban center of Bac Giang province, Long Son commune has the highest food insecurity rate (65.6%) among the three surveyed regions. Female-headed households tend to be more food-insecure than male-headed counterparts (91.7% against 51.7%). Undernourishment is more likely if the household head completes only primary school or lower (62.5%). Finally,

Table 7. Household Food Security by Household Characteristics

Variable	Food-insecure household		Food-secure household	
	Freq.	Percent	Freq.	Percent
Commune				
Cam Dan	20	54.1	17	45.9
An Chau	17	50.0	17	50.0
Long Son	21	65.6	11	34.4
Gender				
Female	11	91.7	1	8.3
Male	47	51.7	44	48.3
Education				
Primary school and lower	45	62.5	27	37.5
Secondary school	10	41.7	14	58.3
High school and higher	3	42.9	4	57.1
Ethnicity				
Kinh	23	53.5	20	46.5
Tay	10	58.8	7	41.2
Nung	10	58.8	7	41.2
Cao Lan	15	57.7	11	42.3
Total	58	56.3	45	43.7

Source. Author's calculation based on household survey, 2013

Table 8. Summary Statistics by Food Security Status

Variables	Unit	Food-insecure household		Food-secure household	
		Mean	Std. dev.	Mean	Std. dev.
Age of household head	Year	45.40	10.06	47.11	9.62
Household size	Person	4.45	1.16	4.47	1.32
Number of adult members in household	Person	3.02	1.34	3.51	1.34
Irrigated paddy area	ha	0.09	0.05	0.12	0.05
Annual income of household	Mil. VND	12.56	10.51	23.85	18.55
Total amount of the loans (*TL*)	Mil. VND	16.78	(13.14)	20.69	(13.91)
Share of the loans used for agriculture (*SL*)	Percent	60.31	(46.18)	74.60	(40.74)

Source. Author's calculation based on household survey, 2013

there is no significant difference in rates among ethnicities.

Table 8 shows summary statistics by food security status. Annual income of household consists of earnings in 2012 from crop cultivation, livestock breeding, timber production, and off-farm jobs. The average annual income of food-secure households is almost twice that of food-insecure counterparts (VND 23.9 million versus VND 12.6 million).

Preferential credit programs have been implemented by the Agricultural Bank and Vietnam Bank for Social Policy. Households below the poverty line can borrow a maximum of VND 30 million for one to five years at a preferential interest rate of 0.65% per month from women's unions, farmer's unions, and saving-credit groups. The application for the loans is assessed by these groups based on the needs, production plan, and payable capacity of the household. After the application is approved, the groups monitor how the loans are used by the applicants.

Most of the loans are used to buy inputs for agricultural production. However, some households use the loans for non-production purposes not listed on the plan submitted to banks, such as building or fixing houses (27 of the surveyed households), buying food or assets (8 households), medical treatment (6 households), and lending to other non-poor households (4 households). Therefore, in addition to the total amount of the loans borrowed before 2012 (*TL*), we include the share of the loans used for agricultural production (*SL*) in Table 8. On average, food-secure households borrow VND 20.7 million, using 74.6% of the loans for agricultural production. By contrast, food-insecure households borrow VND 16.8 million, using 60.3% for agriculture.

Table 9: Summary of Loan Utilization by Food Security Status

Loan utilization	Food-insecure household		Food-secure household	
	Freq.	Percent	Freq.	Percent
Invest entire loan in production	32	50.8	31	49.2
Invest partial loan in production	16	66.7	8	33.3
Consume loan for non-production	10	62.5	6	37.5

Source. Author's calculation based on household survey in 2013

Loan Utilization and Household Food Security

Food security can be driven by appropriate loan utilization, but it is not necessary. Statistics of loan utilization sorted by food security status in Table 9 reveal the reality. Food insecurity still existed even when households used their loan entirely on production. Approximately 50% of households were reported as food insecure despite using their loan in proper ways, while for other households the figure is over 60%. Together with appropriate loan utilization, investment effectiveness is a crucial element that contributes to household food security.

Table 10 shows estimation results for the food security status model (equation 1). At the beginning, many variables were introduced in the logit model. However, some analyses gave the best-fitted model including 12 variables, of which 5 variables were found to have significance for food security. To ease the interpretation of the results, the marginal effects averaged across observations are presented in the table. They represent a change in the probability of being food secure in response to a one-unit change in the independent variable. The coefficient of the total amount of the loans is not statistically significant. This finding is different from the one of Bidisha *et al.* (2017) that concluded that access to credit tends to improve food security in Bangladesh. The coefficient of the share of the loans used for agriculture is positive and significant. A one percent increase in the proportion of the loans used for agricultural production increases the probability of being food secure by 0.002. Thus, how much households use the loans for agricultural production is more important for food security than how many loans they receive, supporting the concern of Do et al. (2010) about the inappropriate use of the loans.

For demographic variables, the probabilities of being food secure increases by 0.51 for male-headed households. This result is consistent with previous studies (Abdullah *et al., 2017*; Baidhya, 2004; Kassie *et al.*, 2014; Maharjan & Joshi, 2011; Thapa, 2008; Tibesigwa & Visser, 2016), but it is surprising to find this large gap even after controlling the educational attainment of the household head, the share of adults in the household, and the annual income of the household. By contrast, and unexpectedly, the educational attainment of the household head does not affect the probability. If the head of household is Cao Lan, the probability of food security declines by 0.21. Cao Lan people do not share the same language with other ethnic groups, making it difficult to diffuse agricultural technology to them. This finding is in agreement with that of Do *et al*. (2010) and (Pham *et al.*, 2010). Finally, both the share of adults in the household and the household income have positive impacts on the food security status, which is consistent with the result of Hofferth (2004) and Babatunde *et al.* (2007). A one percentage point increase in the share of adults in the household and one million VND increase in the household income correspond to a rise in the probability by 0.004 and 0.013, respectively.

Estimation results for the loan utilization model (equation 2) are presented in Table 11. The parameter on the time discount rate is negative but not significant. This may be partly because some respondents did not seriously answer survey questions. In the survey, following Tanaka et al. (2010), respondents are asked to choose between "Receive VND x today" and "Receive VND y ($>x$) t days later". In the survey, Tanaka et al. (2016) actually paid the amount respondents chose so that they seriously answer the questions, but we could not do the same because of the budget constraint. The parameter on the log of total amount of the loans is negative and significant. As the total amount of loans increases by 1%, households tend to use the loans for non-agricultural purposes. In fact, some households borrowed a large loan for building or fixing houses or buying household assets rather than investing in production. In fact, many poor households in Vietnam do not want to escape from poverty because they want to continue receiving long-term government support. This fact is in agreement with the results of Do *et al.* (2010) and Pham *et al.* (2010). Therefore, the Vietnamese government can reduce its expenses for preferential credit programs without affecting the household food security status by carefully monitoring the use of the loans. Household size is also statistically significant to the portion of loans used in agricultural production.

CONCLUSION AND RECOMMENDATIONS

The results of quantifying household food security in Son Dong district indicate that the food insecurity rate is very high (56.3%) compared to the national rate (8.3%). Hence, the Vietnamese government should reinforce the implementation of policies on poverty reduction and food security at the household level in poor districts like Son

Table10: Estimation Results for Food Security Status Model

Variables	Coefficients	Marginal effects
Log of total amount of the loans (log(*TL*))	−0.0098	−0.0016
Share of the loans used for agriculture (*SL*)	0.0117*	0.0020*
Gender		
Male	3.0456***	0.5102***
Education		
Secondary school	0.1667	0.0282
High school and higher	0.5464	0.0933
Ethnicity		
Tay	0.4984	0.0813
Nung	−0.2367	−0.0383
Cao Lan	−1.395*	−0.2098**
Age of household head	0.01217	j 0.0020
Household size	−0.2708	−0.0454
Share of adults in household	0.0248**	0.0042**
Share of irrigated paddy in the total paddy area	0.0050	0.0008
Annual income of household	0.0785***	0.0132***
Constant	−6.296***	
Log-likelihood	−51.8026	
Observations	103	
LR Chi2 (13)	37.54	
Prob> Chi2	0.0003	
Pseudo R2	0.2660	

Source. Author's calculation based on household survey, 2013
Note: Dependent variable is a dummy variable taking value one if food secure household and zero otherwise. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 11. Estimation Results for Loan Utilization Model

Variables	Coefficients	Marginal Effects
Time discount rate (*DR*)	-0.8394	-0.1546
Log of total amount of the loans (Log(*TL*))	-0.7210**	-0.1328**
Gender		
Male	0.8230	0.1516
Education		
Secondary school	0.0625	0.0113
High school and higher	-0.8577	-0.1691
Ethnicity		
Tay	-0.7497	-0.1497
Nung	-0.4471	-0.0867
Cao Lan	0.2293	0.0402
Age of household head	0.0230	0.0042
Household size	0.3611**	0.0665**
Share of adults in household	0.0124	0.0023
Share of irrigated paddy in the total paddy area	-0.0111	-0.0020
Annual income of household	-0.0034	-0.0006
Constant	-1.0740	
Log Pseudo Likelihood	−53.4534	
(1/df) Deviance	1.0690	
(1/df) Pearson	0.9454	
Observations	103	

Source. Author's calculation based on household survey, 2013
Note: Dependent variable is the share of the loans used for agriculture. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Dong. This research finds that households headed by females are more vulnerable to food insecurity. To improve food security of those households, the government should mitigate the gender disparity and facilitate female access to social services and support programs.

The biggest challenge to food security of ethnic minority households is the lack of knowledge and skills for agricultural production. To help those households ensure food security by themselves, many agricultural extension services should be carried out to disseminate the agricultural technique to farmers. The number of household laborers plays a very important role in maintaining the household food security status since laborers are responsible for generating income.

An increase in household income has a direct impact on food security. Income sources include crops, livestock, forestry, and off-farm jobs. Rice is the main crop that helps to ensure food availability in Son Dong district. However, because of water deficiency, rice output there is much lower than the national average, causing low income and food shortage. Thus, the government should invest in constructing irrigation systems and adopting high-yield varieties of rice to increase rice productivity. Although livestock provide another important income source for households, they also come with serious risks of diseases and market price fluctuation. Furthermore, inappropriate animal varieties and low breeding techniques cause failures in livestock production. Therefore, it is very necessary to diffuse livestock-breeding knowledge and skills to households. In addition, the Vietnamese government should subsidize for inoculation against livestock disease epidemics. Despite forests accounting for large areas of Son Dong, income from forestry is still low, especially from protected forests. Presently, the government supports households with only VND 70,000 per ha per year; thus, households either earn a small income or do not participate in forest protection activities. To increase income of households and ensure the sustainability of forests, the government should consider raising support for households in forest areas. Off-farm jobs offer higher income but are not stable. Migration for off-farm income brings about many social problems. Hence, the government should create jobs for residents in their localities to deal with unemployment in rural areas without migration.

This research shows that how much households borrow is not important to food security, while the higher the percentage of a loan is used in production, the more the household's food security is ensured. Hence, it is not necessary for the Vietnamese government to increase the credit line for the poor, which helps to save the national budget for other poverty reduction programs. Besides, the VPSB should carefully consider different credit lines corresponding to households' production demands. The bank should tighten the current lending mechanism by controlling and monitoring households' loan utilization.

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