The Determinants of Accessibility of Financial Services in Vietnam

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Abstract

The study aims to assess the impact of factors on the access to financial services by Vietnamese farmers. The number of respondents in this study is 402 household heads participating in six diverse agricultural value chains in Vietnam. The explanatory variables of the Multinomial Logit model estimates variables at the individual characteristics while the Mixed Logit model can combine the two types of variables together to estimate the effects simultaneously. On the other hand, the Ordinal Logit model is used to evaluate the determinants of the increase in the quantity of financial services used by individuals. The estimation results show that male-headed households have more access to financial services than females. Younger farmers are more likely to use formal financial services than the elderly. Financial literacy, land ownership, and shocks in agricultural production all have a positive impact on the probability of dealing with banks. In addition, the degree of linkage and credibility of the value chain have a significant positive impact on the accessibility of financial services to farmers. The findings of this study suggest that limiting gender inequality, focusing on youth marketing and developing agricultural value chains will have a positive impact on farmers' access to financial services.

Keywords: Accessibility, Agricultural Value Chain, Financial Services, Logit Models, Vietnam

JEL Classification Code: C35, G50, Q14

1. Introduction

Financial access captures the improvements in the access of the banking system and stock market. In other words, this shows how widely the banking system and stock market spread throughout the population (Bui, 2020). The access to financial services for agricultural production can be defined through the increased financial benefits for agricultural producers, the growth of production value in the agricultural sector, the increase in export competitiveness of the industry and the ability to meet food needs, reduce poverty, especially in rural areas (African Development Bank, 2013). According to the Delegated Monitoring theory, thanks to financial services, farmers have access to modern technologies to improve productivity and income. Dadson (2018) argues that farmers can borrow from formal financial institutions to buy inputs and cultivate on a larger area and thus, increase productivity. On the contrary, the increase in productivity and income can help farmers increase access to financial services related to payment and deposit accounts.

Agricultural finance has its own challenges that include inadequate physical and financial infrastructure, unsupportive policy environment, limited institutional capacity, inadequate investment in the rural areas, inadequate support in social capital development, microfinance misconceptions, and so on (Mago, 2014). Providing financial services to agriculture has always been a major challenge for formal financial institutions (Miller & Jones, 2010). However, developing financial services for the agricultural value chain helps to strengthen the linkage, improve the chain's performance and limit risks. Access to financial services in chains will help reduce transaction costs and procedures. The bank can save time searching for new customers so the yield of loan capital will be higher.

There have been a number of studies over the world on the role of the agricultural value chain in accessing financial services to develop and increase the value of agricultural production (Coon et al., 2010; Dadson et al., 2014; Swamy

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& Dharani, 2016, Dadson, 2018). In general, the studies have shown that access to financial products for the value chain has improved the productivity of actors in the chain as well as the profits of microfinance institutions. However, the majority of studies are primarily focused on analyzing credit products because of its extremely important role across different stages of production, processing, marketing and sales. Financing agricultural value chain provides an opportunity for most of the chain participants, especially smallholder farmers, to access capital (Miller & Jones, 2010). The lack of accompanying financial support services has led to financial intermediaries reducing the incentive to provide financial services to the agricultural sector. The agricultural value chain develops in an increasingly complex manner, besides the need for capital, other needs such as asset management, payment, agricultural insurance, etc. also need to be satisfied (Coon et al., 2010). Financial service providers also develop forms of deposits (idle capital management), which can be the basis for developing on-chain credit without requiring too much capital. In order to help members of the chain effectively manage idle capital, financial institutions can attract these funds to finance other members of the same agricultural value chain.

Since the economic reform, especially in the agriculture sector, Vietnam has become a middle-income country, but is facing a series of challenges in agricultural growth and sustainable development. In the near future, it will be difficult for the agriculture sector to maintain its current growth rate if its existing development model is still based on resource-based production growth, excessive use of inputs, and raw-material exports. According to 2019 statistics, about 66.4% of Vietnam's labor force is distributed mainly in rural areas, where most of the poor of the country are concentrated. It is time to restructure the agricultural sector toward improving quality, efficiency, value addition and sustainability (FAO, 2017). Accordingly, value chain development is one of the effective measures to increase the value of agricultural products, thereby increasing farmers' income. This is the driving force for finance inclusion to develop agriculture and rural areas in Vietnam. The goal of this financial inclusion movement is to reduce the number of people who do not have access to banking services, especially farmers, around the world (Ilahiyah et al., 2021). This study aims to discover the effects of the factors on the access to financial services – including credit, deposits and payments – by Vietnamese farmers. In addition to the characteristics of farmers, the capacity of financial institutions to provide services and the role of agricultural value chain are considered as factors affecting access to financial services. The study uses a variety of logit models to examine the effects of each group of determinants. The research results will be important policy implications for promoting the development of financial services through the agricultural value chain in developing agricultural countries such as Vietnam.

2. Literature Review

2.1. Determinants of Access to Agricultural Financial Services

2.1.1. Characteristics of Farmer Households

The literature review introduces various characteristics of farmer households that determine the accessibility of financial services such as gender, age, education, financial literacy of the head of household; size, income, land, and shocks of household. Women often cannot control their advantages of land, property and inheritance, so they are often more disadvantaged than men accessing formal financial services. Akpandjar et al. (2013) found that the demand for financial services tends to increase with age. However, when a turning point is reached there will be a decline due to the life cycle effects. The higher the education level, the more farmers understand the financial services providers (Dadson & Ramatu, 2014), so they will be more willing to use financial services. Akpandjar et al. (2013), Nguyen and Nguyen (2020) argued that people with low financial literacy often encounter many obstacles that prevent them from participating in the financial market. Akpandjar et al. (2013) suggest that, as the size of a household increases, the demand for financial services will increase. Dadson and Ramatu (2014) argue that high income from agriculture is an incentive for farmers to access financial services. Moreover, farmers with non-agricultural income are more likely to borrow because they have more resources to pay off their debt even when their agricultural productivity is low. Households with more land have an advantage over landless households when they enter into an agricultural credit relationship (Khoi et al., 2013). The shocks occurring in the past are also significant determinants of household financial service needs (Dadson & Ramatu, 2014).

2.1.2. Characteristics of Agricultural Value Chains

One of the key benefits to developing the value chain is the ability to effectively link production and distribution with regional and global markets. The increased level of links in the chain makes business relationships more conducive, thereby improving the reputation of agricultural producers (Sudha & Kruijssen, 2011). Lending capital is only effective when investing in closely linked chains (Miller & Jones, 2010). Linking finance to other activities in the value chain can contribute significantly to persuading formal financial institutions to reduce their reliance on land as collateral. This is an important condition for small-scale agricultural producers to borrow from formal financial institutions (FAO, 2012).

Table 1*:* The Variables Estimated in the Research Model

Variables	Definition	Measurements	Hypothesis*
Access to financial services			
Fin_Access	Access to financial services (used for OLM)	= 3 if using all three types of financial services; = 2 if using two of the three types; = 1 if using one of three types; = 0 if not using any financial services	
Credit	Access to financial services (used for MLM, CLM & MXL)	= 1 if borrowing at least 1 agricultural loan; = 0 otherwise	
Deposit		= 1 if owning at least deposit account; = 0 otherwise	
Payment		= 1 if three or more times transfer money related to agricultural production/business; = 0 otherwise	
Characteristics of farmer households			
Gender	Gender of household head	= 1 if the household head is female; = 0 otherwise	–
Age	Age of household head	= Natural logarithm of the actual age	+/–
Education	Educational attainment of respondents	= 5 if post-graduate level; = 4 if university level; = 3 if college level; = 2 if high school level; = 1 if lower secondary level; = 0 if elementary level	+
Fin_literacy	Financial literacy of household head	On a scale of 1 to 6, respondents will answer 6 questions about the basic financial knowledge, each correct answer corresponds to 1 score.	+
Size	Household size	The number of members who need nurturing care	+
Income	Household income	Natural logarithm of the total income of the last 12 months from agricultural production	+
Oth_income	Non-farm income	= 1 if earning extra non-farm income; = 0 otherwise	+
Land	Land ownership	The land area owned by households	+
Shocks	Shock on agricultural production	= 1 if having experienced at least one shock causing loss of USD 1,000 or more in the last 6 months; = 0 otherwise	+
Characteristics of agricultural value chains			
Linkage	The link of the chain	= 1 if respondents feel that the link of the value chain is tight; = 0 otherwise	+
Reputation	The reputation of the chain	= 1 if respondents feel that they are more trusted by the bank; = 0 otherwise	+
Support	The external support of the chain	= 2 if receiving more production and consumption support; = 1 if receiving more production or consumption support; = 0 otherwise	+
Characteristics of financial services			
Closeness	The proximity of financial service providers	= 4 if the distance to the nearest bank is less than 0.62 mile; = 3 if the distance to the nearest bank is less than 1.86 mile; = 2 if the distance to the nearest bank is less than 3.1 mile; = 1 if the distance to the nearest bank is less than 6.2 mile; = 0 otherwise	+
Cost	The price of financial services	= 1 if respondents feel the financial transaction costs are too expensive; = 0 otherwise	–
Requirement	Requirements of providing financial services	= 1 if respondents feel the process of providing financial services is too cumbersome and complicated; = 0 otherwise	–

*Expectations for positive effects (+), negative effects (–), non-specific effects (+/–)

On the other hand, members of the value chain are closely linked together on the basis of creating cash flows among members. Since then, the bank can focus on managing customer cash flows as well as cross-selling payment and deposits products for members of the value chain. Moreover, an important condition for forming a value chain is that the members of the chain must have close relationships and mutual trust, so information should be fully and transparently shared, limiting asymmetry. The bank can control the cash flow and product flow in the value chain as well as information of its members through cross-checking customers. Information transparency of actors is crucial to the success of the value chain service model (Konig et al., 2013). According to Sudha and Kruijssen (2011), value chain integration can improve the reputation of agricultural producers and ultimately reduce non-performing loans.

Agricultural producers can receive support in terms of technical expertise, inputs, and consumption markets when participating in the value chain (Oberholster et al., 2015). Such support may come from other members of the chain and from off-chain actors, including governmental or non-government entities (such as associations, universities, research institutes, etc.). Thanks to these support, chain members can easily improve technology, increase productivity and find consumer markets, thereby increasing income and becoming more attractive to banks. When agricultural producers have limited access to support services, especially for small producers, their access to bank loans decreases (Konig et al., 2013).

2.1.3. Characteristics of Financial Institutions

Some of the obstacles to access to financial services are identified in developing countries with regard to closeness, service cost and supply requirements. One of the advantages of informal financing for poor rural farming communities is proximity. Farmers often do not want to access formal financial services because of the inconvenience of traveling. On the other hand, according to the information asymmetric theory, farmers who are far away from financial service providers are less likely to have access to financial institutions due to lack of information (Dadson & Ramatu, 2014). Berger and Udell (2006) argue that high transaction costs not only increase financial costs, but can also limit access to external financial services. Farmers, even lacking capital, may also be reluctant to participate in the financial market due to risk aversion and transaction costs exceeding their expected profits (Dadson, 2018). The informal financial sector has advantages for poor rural farming communities because of its proximity, ease of implementation, low transaction costs, quick disbursement and comfort. Meanwhile, in order to have access to formal financial services, farmers need to follow the procedures prescribed by financial institutions. Depending on the requirements of supplier or level of knowledge, some customers find the processes too complicated, confusing and time-consuming.

2.2. Research Variables

For empirical analysis of the determinants of access to financial services for the agricultural value chain, the research model includes farmer-specific variables, value-chain specific variables and financial-services specific variables. Developing ideas from Oberholster et al. (2015), instead of using the Likert scale, the chain characteristic variables will be measured by farmer perceptions with responses defaulting to binary variables (Linkage and Reputation) or rank (Support). The dependent variable is the accessibility of formal financial services to farmers under three different product categories, including loans, savings and payments. These services are provided directly by commercial banks in Vietnam. The definition, measurement and expected effect of research variables are detailed in Table 1.

3. Methodology

3.1. Analytical Models

3.1.1. Multinomial Logit Model (MLM)

Logit models are commonly used in decision-making behavior. The mathematical framework of the models is based on the theory of utility maximization. The choice of farmers to use financial services depends on the utility of those services. The utility of an individual depends on deterministic components (V) and stochastic components (ε). The utility function of individual i when approaching financial service j (U_{ij}^{*}) is as follows:

$$U_{ij}^{*} = V_{ij} + \varepsilon_{ij} \tag{1}$$

Because U_{ij}^{*} cannot be observed, the probability of selection of individuals will be observed instead. Each alternative j will have a corresponding probability. When faced with a choice, individuals choose the alternative with the highest utility (U_{ij}). The probability for the individual i to choose the alternative j instead of any alternative $k \neq j$ is the probability for $U_{ij} > U_{ik}$. Specifically, the probability for the individual i to choose the alternative j (P_{ij}) will be:

$$
\begin{aligned}
P_{ij} &= P\left(U_{ij} > U_{ik}, \forall j \neq k\right) \\
&= P\left(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik}, \forall j \neq k\right) \\
&= P\left(\varepsilon_{ij} - \varepsilon_{ik} > V_{ik} - V_{ij}, \forall j \neq k\right)
\end{aligned} \tag{2}
$$

To solve Equation (2), it is necessary to assume a form of probability distribution applied to ε_{ij}. In the most basic case, the stochastic component is assumed to follow the "Identical and Independent Distribution" (IID) for all alternative j (Train, 2012). This assumption is that the stochastic components of the alternatives are not correlated with each other and have the same variance. That is, if there is an increase or decrease in the number of alternatives, the ratio of the probability of choosing between two alternatives (P_{ij}/P_{ik}) in the set of alternatives remains unchanged (Train, 2012). Then, the probability for the individual i to choose the alternative j can be expressed as follows:

$$P(Y_i = j) = P_{ij} = \frac{\exp(V_{ij})}{\sum_{k=0}^{J}\exp(V_{ij})}$$
$$= \frac{\exp(\beta X_i')}{\sum_{k=0}^{J}\exp(\beta_k X_i')}, \ j = 0,1,...J \quad (3)$$

In which, Y_i is a random variable representing the choice made by the individual i; X_i' is a vector of observable characteristics of individual i; β_j and β_k are vectors of coefficients specific to the alternatives j and k. MLM focuses on analyzing choice decisions based on individual characteristics because it identifies these factors having different effects on different alternatives. Therefore, MLM estimates $J – 1$ coefficients (β_j) for each explanatory variable. The estimated coefficients show the effect of the variables X on the probability of selection of each alternative compared to an alternative that serves as a common benchmark. For model identification, it is often assumed that $\beta_0 = 0$. The odds ratio of the alternatives j and l is:

$$\frac{P_{ij}}{P_{il}} = \frac{\exp(\beta_j X_i')/\sum_{k=0}^{j}\exp(\beta_k X_i')}{\exp(\beta_l X_i')/\sum_{k=0}^{j}\exp(\beta_k X_i')}$$
$$= \exp[(\beta_j - \beta_l)X_i'] \quad (4)$$

Note that Equation (4) imposes the "Independence from Irrelevant Alternatives" (IIA), that is, the odds ratio of the two alternatives j and l does not depend on any alternative other than j and l. This ratio should be the same regardless of the characteristics of other alternatives.

The log-likelihood function of MLM is:

$$LL = \sum_{i=1}^{N}\sum_{j=0}^{J}d_{ij}\ln P(y_i = j) \quad (5)$$

Where, d_{ij} equals to one if the individual i chooses the alternative j and zero otherwise. This article uses MLM to examine the impact of individual-specific variables and value-chains specific variables on the probability of choosing to use financial services for the agricultural value chain.

3.1.2. Conditional Logit Model (CLM)

The Conditional Logit model is defined similarly to MLM, but relies on the alternative characteristics instead of the individual characteristics. Using the properties of Type I extreme-value (Gumbel) distribution, the probability for the individual i chooses the alternative j from the set of alternatives C_i is:

$$P(Y_i = j) = P_{ij} = P\left[\alpha Z_{ij}' + \in_{ij} \geq max_{k \in C_i, k \neq j}\left(\alpha Z_{ik}' + \in_{ik}\right)\right]$$
$$= \frac{exp\left(\alpha Z_{ij}'\right)}{\sum_{k \in C_i}exp\left(\alpha Z_{ik}'\right)} \quad (6)$$

Where, Z_{ij}' is the vector of the characteristic of alternative j according to the perception of individual i. These characteristics have different values depending on the alternatives, but the effect of a characteristic Z is often assumed to be constant between alternatives. That is, only a single coefficient is estimated for each variable Z, so the effect of a variable on the probability of selection comes from the difference in its value between alternatives. It is assumed that there are n_i alternatives in the alternatives set C_i of each individual. With the assumption of IIA, the odds ratio of the alternatives j and l in CLM are:

$$\frac{P_{ij}}{P_{il}} = \frac{\exp(\alpha Z_{ij}')/\sum_{k \in C_i}\exp(\alpha Z_{ik}')}{\exp(\alpha Z_{il}')/\sum_{k \in C_i}\exp(\alpha Z_{ik}')}$$
$$= \exp[\alpha(Z_{ij} - Z_{il})'] \quad (7)$$

The log-likelihood function of CLM is:

$$LL = \sum_{i=1}^{N}\sum_{j \in C_i}d_{ij}\ln P(y_i = j) \quad (8)$$

This study uses CLM to analyze the probability for an individual can make a choice based on the characteristics of each alternative Z_{ij}'.

3.1.3. Mixed Logit Model (MXL)

The Mixed Logit model is a combination of MLM and CLM. In particular, the underlying utilities depend on not only the individual characteristics but also the alternative characteristics, even depending on the variables combined

between the two types of characteristics (such as the individual perception of the value of the alternatives). The probability for the individual i to choose the alternative j is as follows:

$$P_i(j) = \int Q_i(j|\xi_{ij}) f(\xi_{ij}|\gamma) d\xi_{ij} \qquad (9)$$

Where ξ_{ij} is an error component that can be correlated between alternatives and heteroscedastic for each individual. The random component in the utility function now includes the error ξ_{ij} following the general distribution and the random component ε_{ij} following the IID Gumbel distribution. $Q_i(j|\xi_{ij})$ is the density function of ξ_{ij}, where $f(\xi_{ij}|\gamma)$ is the distribution coefficient vector of ξ_{ij}. The probability of a conditional selection for a given value of ξ_{ij} is:

$$Q_i(j|\xi_{ij}) = \frac{\exp(\alpha Z'_{ij} + \xi_{ij})}{\sum_{k \in C_i} \exp(\alpha Z'_{ik} + \xi_{ik})} \qquad (10)$$

Since ξ_{ij} is not given, the unconditional selection probability, $P_i(j)$, is the integral of the conditional selection probability, $Q_i(j|\xi_{ij})$ on the distribution of ξ_{ij}. This model is called "Mixed Logit" because the probability of selection is a mixture of logits with mixed distribution $f(\xi_{ij}|\gamma)$. In general, MXL does not have an exact likelihood function, so the approximate probability is calculated based on a simulation method.

$$\tilde{P}_i(j) = 1/S \sum_{s=1}^{S} \tilde{Q}_i(j|\xi_{ij}^s) \qquad (11)$$

Where S is the simulation replications and $\tilde{P}_i(j)$ is the probability of being simulated. The simulated log-likelihood function is calculated as follows:

$$\tilde{L} = \sum_{i=1}^{N} \sum_{j=1}^{n_i} d_{ij} \ln(\tilde{P}_i(j)) \qquad (12)$$

3.1.4. Ordinal Logit Model (OLM)

OLM can be used to analyze individual decision-making probabilities for a set of prioritized alternatives. Theoretically, when individuals are asked to rank alternatives instead of choosing only the most preferred alternative, the coefficients of the choice model can be estimated more effectively.

The ranking given by the individual i is denoted by $Y_i = (Y_{i1}, Y_{i2}, ..., Y_{iJ})'$ where Y_{ij} is the preferred order of the individual i for the alternative j. For example, $Y_{ij} = 2$ means the alternative j is the second preferred choice by the individual i. Also, the rank of choice is also expressed in terms of the selected alternatives $r_i = (r_{i1}, r_{i2}, ..., r_{iJ})'$, where

r_{ij} is the alternative (encoded as a number) ranked j by the individual i. For example, $r_{ij} = 3$ means the third alternative is ranked j. The probability of ranking observations given by the individual i is as follows:

$$P(r_i|\beta) = P\left(U_{ir_{i1}} > U_{ir_{i2}} > \cdots > U_{ir_{iJ}}\right)$$
$$= \prod_{j=1}^{J-1} \frac{\exp(\beta_{r_{ij}} X'_i)}{\sum_{k=j}^{J} \exp(\beta_{r_{ik}} X'_i)} \qquad (13)$$

The log-likelihood function of OLM is:

$$LL = \sum_{i=1}^{N} \log \left\{ \sum_{k=0}^{J-1} \rho_k \exp \left[\begin{array}{l} -\log((J-k)!) + \\ \sum_{l=1}^{k} \left(\beta_{r_{il}} X'_i - \log \sum_{m=l}^{J} \exp(\beta_{r_{im}} X'_i) \right) \end{array} \right] \right\} \qquad (14)$$

Where, $U_{ir_{i1}} \ldots U_{ir_{iJ}}$ are the utilities for individual i in the preferred order of the alternatives.

3.2. Research Data

The study focused only on the possibility of developing formal financial services. According to Zander (2015), to reform the provision of financial services to the agricultural value chain, it is necessary to develop systematic and formal agricultural financial services. This will facilitate policy-makers to increase the effectiveness of the actors in the chain and the whole society. Research data is collected through direct survey of respondents with questionnaires. Respondents are farmers currently participating in one of seven different agricultural value chains distributed in the three regions of North, Central and South of Vietnam. The structure of the sample will be presented in the order of the respondents, the choice cases for the respondents, and the alternatives in each case. The choice cases for each respondent can be either one (not using financial services, using loans, deposits or payments) or two (using two of the three financial services) and three (using all three financial services). Each case will have four alternatives, of which one will have a value of one and the others have a value of zero (See Table 2).

4. Results and Discussion

This section presents estimates of logit models that analyze the role of the value chain and other factors that determine the accessibility of agricultural financial services to Vietnamese farmers. First of all, Table 3 presents the estimates of the three models using the characteristics of the value chain as the explanatory variables. In which, the standard MLM model adds individual characteristics to

Table 2: Sample Size According to Different Agricultural Value Chains

Value chain	Northern		Central			South		Total
	Orange	Cow	Vegetable	Pummelo	Grapes	Sticky rice	Catfish	
Persons	49	63	61	47	45	86	51	402
Persons-cases	71	117	86	83	86	154	89	686
Persons-case alternatives	284	468	344	332	344	616	356	2.744
• Credit	92	217	120	128	152	288	144	1.141
• Saving	64	88	68	80	80	104	80	564
• Payment	80	155	96	88	100	204	96	819
• None	48	8	60	36	12	20	36	220

Table 3: Results of Estimating Accessibility to Each Type of Financial Service

Estimates	Credit	Saving	Payment	Credit	Saving	Payment	Credit	Saving	Payment
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gender	−0.620	−1.103**	−0.421				−0.275	−0.721	−0.081
Age	−3.353***	−3.592***	−4.152***				−3.434***	−3.660***	−4.239***
Education	−0.145	−0.135	0.022				−0.121	−0.119	0.047
Fin_literacy	0.446**	0.438**	0.511**				0.303	0.290	0.368*
Size	0.369*	0.306	0.234				0.328	0.269	0.192
Land	1.407***	1.390***	1.421***				1.387***	1.367***	1.400***
Income	−0.440	1.523***	−0.674				−0.145	1.791***	−0.384
Oth_income	0.148	0.834*	0.480				0.221	0.910*	0.552***
Shocks	1.785***	1.277**	1.757***				1.699***	1.214**	1.671*
Linkage	1.216**	1.120*	1.163**	1.496***	1.531***	1.540***	1.073*	0.978	1.018
Reputation	0.857*	0.753	0.592	0.600	0.354	0.392	0.650	0.476	0.381**
Support	0.970***	0.853**	1.015***	1.336***	1.607***	1.503***	0.927**	0.820**	0.972
Closeness				0.368**	0.558***	0.431**	0.416**	0.498**	0.420**
Cost				−1.429***	−1.538***	−1.319***	−0.763	−0.962*	−0.811
Requirement				−0.234	0.045	−0.267	−0.231	−0.065	−0.206
Num. of cases	686			686			686		
Num. of obs	2.744			2.744			2.744		
Pseudo R^2	0.4498			0.3926			0.4579		
Wald chi^2(36)	144.01***								
Wald chi^2(18)				97.96***					
Wald chi^2(45)							141.46***		
Log-likelihood	−706.036			−767.166			−699.144		

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

explain the dependent variable; the MXL model further uses the characteristics of the alternatives (financial services) as explanatory variables; and the other MXL model includes both the individual characteristics and the characteristics of the alternatives. The pseudo R^2 values are in the range of 0.39 – 0.46 and the Wald tests according to the F distribution with the null hypothesis of there are unnecessary variables in the regression model all have p-value of 0, showing that the selected models are very suitable.

The estimates of MLM are presented in columns (1), (2) and (3) of Table 3. The coefficients express effects relative to the omitted category, not using any financial service (None). The results show that younger farmers with more financial knowledge and more land, will borrow, save or use payment services more (Mpuga, 2010; Akpandjar et al., 2013). The access to financial services of farmers who have experienced losses in agricultural production is also higher than those of peaceful ones (Dadson & Ramatu, 2014). In addition, single female-headed households are less likely to save than men-headed households. The demand for savings is also higher for families with higher incomes or extra non-agricultural incomes. The more dependents families have, the higher the borrowing demand will be (Dadson & Ramatu, 2014). For the characteristics of value chains, the greater the degree of integration and support in the value chain, the greater the accessibility of financial services to farmers. Closely linked chains will help farmers easily access inputs and expand markets for products, thus ensuring a more stable income. The support of production techniques, preservation, seed selection, technology application and market search have helped Vietnamese farmers change their perceptions of sustainable agricultural production. The green production orientation has received support from all stakeholders, including financial service providers. Moreover, the farmers who join the value chain, who are trusted by the bank, can easily get loans for agricultural production. The higher the reputation of the value chain, the higher the likelihood of unsecured loans or farmers will more easily access loans with less stringent requirements (FAO, 2012).

The MXL model is shown in columns (4) to (6). It can be seen that the proximity of financial institutions to farmers has a significant positive effect on the probability of borrowing, saving and using payment services by farmers (Dadson & Ramatu, 2014). In contrast, the costs, time, and effort that farmers spend will be inversely proportional to their need to access financial services. There is no evidence to suggest that cumbersome procedures and expensive service costs lead farmers to turn to informal financial institutions instead of formal institutions. The results on the effects of chain

characteristics on the accessibility of financial service are similar to the MLM model.

Finally, the estimates of the MXL model presented in columns (7) to (9) are slightly different from the previous models. The reputation of chains only has a positive effect on the ability to use payment services through banks while the degree of linkage in the value chain boosting demand for loans for agricultural production of farmers. The role of support reaffirms in accessibility of loans and savings to on-chain farmers. Furthermore, the coefficients of individual characteristics and characteristics of financial service providers show that the impacts of most of these characteristics are similar to that in the MLM model, except for non-farm income, farmer financial literacy, service costs and complexity of financial services.

On the other hand, the impact of characteristics on the accessibility of financial services with the increasing number of selected services is also evaluated and presented in Table 4. The Pseudo R^2 and Log-likelihood ratios both show the suitability of the selected variables. The result of LR test according to the Chi square distribution (χ^2) with p-value = 0 did not reject the null hypothesis of the independence of the dependent variable. As such, the use of the multinomial logistic specification and ordered logistic specification is appropriate to model access to financial services in an incremental manner. It should be noted in all cases that the estimated coefficients of the independent variables are compared with the base category (None). MLM and OLM only analyze the impact of individual characteristics on the trend of farmers' choice. The former assesses the decision to use one, two or three types of financial services versus not using any services, while the latter assesses the decision to use one additional type of financial service.

There is a significant negative relationship between age and access to formal financial services (Mpuga, 2010). In contrast, the coefficients of shocks in agricultural production are all positive, indicating that farmers who face difficulties will be motivated to access more financial services (Dadson & Ramatu, 2014). Male breadwinners are more likely to deal with banks than female. The households with more dependents and larger landholdings often deal with banks more often (Khoi et al., 2013; Dadson & Ramatu, 2014). A high level of education and agricultural income will motivate farmers to use all three financial services rather than not using any one. On the other hand, the linkage of the chain is tight and the prestige of the value chain is high, the majority of farmers participating in the chain will use two types of financial services at the same time. The impact of the on-chain support on farmers' access to financial services is not really clear. The reason may be that the support from the value chains to farmers in recent years has not really achieved the expected effect.

Table 4: Results of Estimating Accessibility to the Quantity of Financial Services

Estimates	MLM			OLM
	One	Two	Three	
	(1)	(2)	(3)	(4)
Gender	−0.827*	−1.941***	−0.121	−1.038***
Age	−4.261***	−5.678***	−7.096***	−1.143***
Education	−0.171	0.399	1.326***	−0.165
Fin_literacy	0.585***	0.588**	0.410	0.202**
Size	0.513**	0.281	−0.232	0.170*
Land	0.524	1.931***	1.966***	0.120**
Income	−0.620	−0.219	2.157***	−0.029
Oth_income	0.118	−0.033	0.774	−0.009
Shocks	1.207**	2.237***	2.074***	0.788***
Linkage	0.356	1.7578***	0.914	1.403***
Reputation	−0.732	1.822***	0.584	1.491***
Support	0.478	0.069	1.083**	−0.393**
/cut 1				−5.305
/cut 2				−2.643
/cut 3				−1.528
Num. of obs			402	402
Pseudo R^2			0.4838	0.2329
LR chi2 (12)				244.01***
LR chi2 (36)			506.95***	
Log-likelihood			−270.456	−401.927

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5. Conclusions

This paper has analyzed the roles of the agricultural value chain in the accessibility of financial services to Vietnamese farmers through the diverse use of logit models to estimate multiple-category discrete-choice problems. In general, the estimation specifications of the logit models are closely related, but they stem from different behavioral assumptions and are estimated in different forms. The explanatory variables of the MLM model are individual-level variables, such as individual characteristics or farmer perceptions of the value chain while the MXL model uses both individual-level variables and characteristics of financial services as explanatory variables. Interestingly, the estimates in the three models all gave fairly similar results on the determinants of farmers' access to financial services along the agricultural value chain. On the other hand, the study also uses the OLM method to evaluate the increase in the number of financial services used by farmers under the impact of characteristics.

The estimation results show that male-headed households are more likely than women to access financial services. Young, financially savvy farmers tend to use formal financial services more than others. Therefore, when developing financial services for the agricultural sector, policies should be encouraged to limit gender inequalities and encourage women to participate more in financial transactions with banks. At the same time, banks need to shift their marketing of services to young farmers, creating an incentive for them to get early access to financial services to escape poverty. On the other hand, the degree of linkage and support of the value chain have a positive impact on the probability of farmers dealing with banks. By participating in the value chain, farmers can release collateral constraints to make loans easier. On the contrary, in order to minimize the risk of unsecured lending, the bank may require farmers to participate in agricultural value chains to improve creditworthiness.

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