

A FORMAL AND INFORMAL RURAL CREDIT OF ETHNIC MINORITY HOUSEHOLDS: EMPIRICAL STUDY IN VIETNAM

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Abstract

The rural credit market plays important role in poor alleviation in Vietnam, specially in rural and poor area. Yet, little if anything is known about the formal and informal credit market for ethnic minority households. This paper contributes to the microfinance literature by presenting an empirical analysis of the impact of formal and informal credit in Vietnam which emphasizes the gap of credit access between the Kinh and other ethnic minority groups. For this purpose, while most papers use logit model, we contribute a new methodology of random forest (RF) based classification and decision tree to analyse the formal and informal rural credit market and uncovered its relations, which will bring more accurate projections and measurements of the gap of credit accessibility. The data of the Vietnam Access Resource Household Survey (VARHS) 2014 is used in our paper. Our results show that the Kinh group has higher income and therefore its outreach is higher than any other ethnic minority group. Regarding formal credit, our results show that the Kinh group has a better chance to access credit from Vietnam Bank of Rural and Agriculture Development (VBRAD) while ethnic minority groups have better access from the Vietnam Bank of Social Policy (VBSP). Related to informal credit, the Kinh group has better access compared to ethnic minority groups. Kinh households having loans in the past tend to have a higher chance to access loans compared to those of ethnic minority families. Analysis confirms the difference between accessibility of two state owned banks mentioned above.

Ignoring this gap may lead to microcredit providers making loan decisions that are less than optimal. These results imply that an appropriate credit scheme needs to be considered by the Government to improve the credit access of ethnic minority groups.

Keywords: ethnic minority, rural credit; micro credit; household income; outreach; Vietnam
Jel codes: G21, O17, Q14

Highlight:

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1. Introduction

Since the “doi moi” reform process in 1986, Vietnam has come a long way to transform and achieve good performance in terms of economic growth. As a result, agricultural production and rural economic growth led to a large reduction in poverty. However, these improvements have not spread out throughout the country, especially in rural remote areas where ethnic minority groups tend to live. One of the most crucial tools for households to increase their income is credit access, which should be taken into account by researchers.

Credit is essential for households to develop their business and increase their income (Eswaran & Kotwal, 1989). Microcredit and other financial services would allow the poor to acquire assets, increase their income as well as decrease their vulnerability to economic shocks. However, commercial banks are generally not interested in poor rural clients because of insufficiencies in information and a shortage of collateral (Boucher, Stephen; Michael Carter; and Catherine Guirking, 2008). This led to the Vietnamese Government and its donor community building credit programs for the purpose of expanding rural households' access to credit with significant expansion foreseen in the near future.

Access to credit for rural households is an essential part in the promotion of agricultural production and transformation (Eswaran & Kotwal, 1989; Urdy 1990). As mentioned by Diagne, Zeller and Sharma (2000), access to credit impacts household welfare in at least two main ways. It increases households' risk bearing capacity and enables long term investments (Camille Saint-Macary and Manfred Zeller, 2012). In addition, Guirking and Boucher (2007) proves that 27% loss of agricultural output related to credit constraints in rural Peru. (Zeller, 2012)

In Vietnam, there are 54 ethnic groups, of whom the Kinh are the major group which accounts for nearly 86 percent of the total population (World Bank, 2017). In addition, the ethnic groups of Tay, Thai, Muong, Khmer and H'mong have populations of more than 1 million, and the other groups have populations between 500,000 and 1 million. Other ethnic minority groups tend to live in highland areas. There are large minority groups living in the North and the Central Highland area, while there are smaller concentrations of ethnic minority groups in the Central and Mekong regions (Bank, Country Partnership Framework for Vietnam, 2017).

A common type of rural credit markets in developing countries is the coexistence of formal and informal credit markets (Anderson & Malchow-Moller, 2006) (Boucher, Cater, & Guirknger, 2007) (Barslund & Tarp, 2008). In Vietnam, the formal credit sector accounted for 70% of the total credit (Bank, Vietnam delivering its promise, 2002). On the other side, the informal credit sector undoubtedly continue to play a role in rural credit markets.

While many papers focus on factors affecting the supply of rural credit, this paper will focus and compares the factors affecting credit demand of Vietnam market in general and ethnics minority group. The lack of attention to factors on the demand-side in the past analysis of credit rationing caused a number of researchers to argue that the magnitude of credit rationing in the formal credit market is likely to be overestimated. A number of factors have been identified by previous studies as the key factors determining rural households' overall demand for credit and demand for different credit sectors. Total savings or the total value of liquid assets relative to production was identified as an important factor determining household's overall need for credit. Covariate and/or idiosyncratic shocks would also affect the overall demand for credit. High interest rates and other transaction costs including tedious paper work, bureaucratic loan processes associated with formal loans, collateral risk (Boucher, Cater, & Guirknger, 2007), asymmetric information & political reasons, and the availability of formal credit institutions have been identified as the main obstacles to the demand for formal credit markets.

Arguably, the success of credit provision for poverty reduction by governmental banks depends on the possible access by poor households to these institutions. This level of access depends on the relationship of the demand and supply for rural credit. The former depends on households' decisions on whether they want to borrow and how large the loans are, while the latter is an outcome of the credit rationing policy of the financial institutions. Obviously, households need credit when they lack financial assets for consumption and production, and this lack will depend on the household's characteristics and the intended use of that credit.

Several studies have investigated the determinants of households' demand for credit from different institutions using multinomial discrete choice models ((Pham & Lensink, 2007); (Barslund & Tarp, 2008). In Pham and Lensink (2007), the model confirms that the supply of credit from formal, semi-formal and informal sources in Vietnam depends on the possible profits that can be made from the use of the loans. They add that credit supply may also increase if borrowers provide collateral, a guarantor and/or if credit is for business-related activities. In the case of Indonesia, Takahashi et al. (2010) found that access to credit is significantly affected by the relatively wealthier households but not by available collateral. The relation between gender and access to microcredit is discussed by Rahman et al. (2009). In this article we build on the analysis of Phan (2013) with a focus the gap of credit access on rural finance between Kinh group and ethnic minority. We analyse how household characteristics affect the uptake and amount of credit. Getting a better insight into the reasons for the gap between Kinh and ethnic minority at household level is important for

evaluating the current outreach of the microfinance institutions and for improving credit accessibility in Vietnamese rural areas. Reportedly, very few empirical studies have so far dealt with the determinants of a household access to credit in the ethnic minority region.

Our analysis focuses on the provision of microcredit by both formal and informal organisations. It is assumed that the availability of small loans without collateral requirement greatly increases the households' probability to borrow. It is important to note that our analysis is based on the borrower's characteristics. We acknowledge the importance of the lender and their need for credit rationing and careful client selection. Yet, arguably, it is the household that needs to file a request for credit to the lending institution, and the decision to do so determines the access to credit and ultimately also the amount borrowed.

In this study we provide a detailed review and an in-depth econometric analysis of how the rural credit market operates in twelve provinces of Vietnam, with a focus on basic characteristics and differences between the formal and informal credit markets with concentration on credit access of ethnic minority groups. A dataset of 3530 households from Vietnam Access Resource to Household Survey (VARHS) is used to provide a full picture of credit history of households in 2014. Compared with the previous studies, this study has two different features. Firstly, this paper contributes to the rural credit literature by presenting an empirical analysis of the impact of formal and informal credit in Vietnam which emphasizes the gap of credit access between the Kinh and other ethnic minority groups. Secondly, it uses the random forest and decision tree to forecast and evaluate the impacts to credit accessibility. Therefore, this study provides a different way of measuring the access of credit and thereby advances our projection capacity which is quite different with traditional method used by most recent papers such as logistics.

The paper is structured into five sections. Section two focuses on background information on rural finance and ethnic minorities in Vietnam. Section three presents the data and estimation methods used to analyse household characteristics, which potentially influence the probability of being credit rationed. Following is section four which provides the empirical results. Some key policy measures to further the allocation of rural credit in Vietnam and develop the credit market for ethnic minority group are discussed in the concluding section five.

2. Vietnam rural credit market

Vietnam has achieved good economic growth and poverty reduction over the past two decades. The poverty rate reduced significantly from 58 percent in 1993 to 20 percent in 2004 and 15 percent in 2010 (Nguyen, 2012). However, there is still a gap in living standards between the Kinh majority and ethnic minorities. The proportion of minorities among the poor increased from 29 percent in 1998 to 47 percent in 2010. There was still about 66 percent of ethnic minorities living below the poverty line and around 7 percent living below the extreme poverty line in 2010. By contrast, the figures for the Kinh majority

population were only about 13 percent and 3 percent, respectively (World Bank, 2017). In particular, there is a substantial proportion of ethnic minorities with a very low income and limited access to infrastructure, education, health services and non-farm employment (Nguyen, 2012). The majority of the poor - 9 out of 10 - live in rural areas, and also 82 percent of the near poor and 84 percent of those below the 40th income percentile. Poverty is concentrated among ethnic minorities, with the smaller ethnic minority groups and those living in the northern and central mountains particularly affected. Making up only 15 percent of the population, ethnic minorities account for 60 percent of the poor. Poverty reduction among these groups stalled from 2012 to 2014, and projections indicate that by 2020, around 84 percent of the poor will be from ethnic minority populations. (Bank, Country Partnership Framework for Vietnam, 2017).

In rural Vietnam, the supply of rural credit is currently served by two main sectors including the formal, semi formal and informal segments.

Formal credit markets in rural areas consists of banks and other financial institutions which include all formal institutions. Specifically, there are two main players in the market, the Vietnam Bank for Social Policy (VBSP) and the Vietnamese Bank for Agriculture and Rural Development (VBARD). VBARD is the biggest formal lender in Vietnam followed by much smaller Vietnam Bank for Social Policy (VBSP) which specialises in lending to poorer households. In addition, People Credit Funds and other organisations also take part in the rural credit market. In general, the formal credit sector accounts for around 70% of the rural credit market which almost for productions (Phan, 2013).

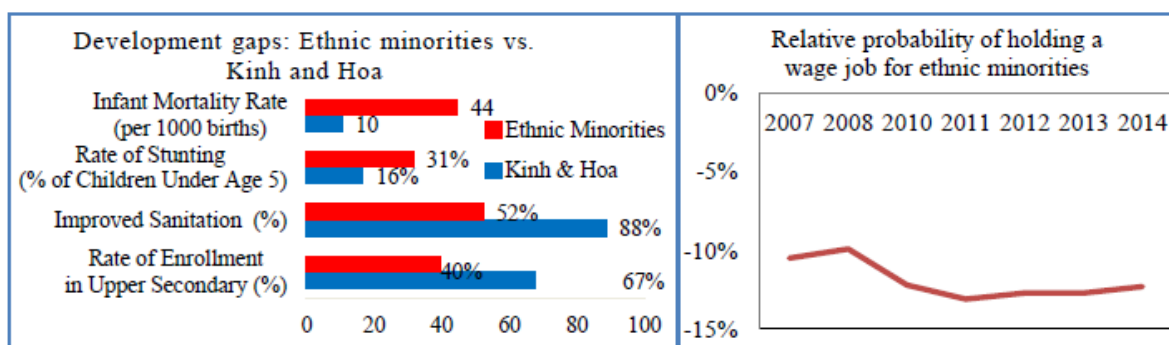
On the opposite view, the informal sector consists of (i) private organisation or unrelated individuals or friends who offer lending by charging interest, and (ii) lending from families, relatives and friends with zero interest. These two segments will be defined as 'private' and 'family'. Friends, who lend and charge interest, charge on average only slightly less than private money lenders (not characterised as friends). Information about the informal credit sector in Vietnam is primarily undisclosed, but it still plays an important role in the rural credit market, where more than 32% of credit is provided to farming households by informal sources (Dinh, 2015).

The semiformal credit sector has recently been established through microcredit schemes managed by international programs and non-government organizations (NGOs) in partnership with local provincial organizations. This sector offers microfinance services to the population excluded from the formal credit sector. However, the semiformal credit sector has a smaller role in the provision of microcredit in Vietnam because the legal framework for microfinance operations has not been well regulated. Most microfinance activities evolved under projects implemented at the local provincial level. Due to incomplete

information and the limited availability of data, the semiformal credit has been excluded from our study.

Ethnic minorities are 12 percent less likely than members of the Kinh and Hoa ethnic groups to hold wage jobs, and access to improved sanitation and rates of enrollment in upper secondary school are also lower among ethnic minorities

Table 1: Development gap and access level, ethnic minority vs Kinh and Hoa



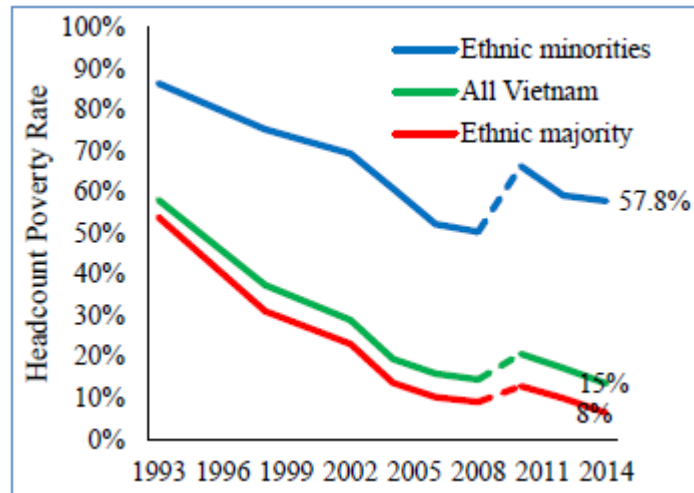
Source: World Bank staff analysis of VHLSS 2014 and MICS 2014 data.

Source: Demombynes and Testaverde (2016) based on analysis of Labor Force Survey data.

Source: Country Partnership Framework for Vietnam (World bank, 2017)

The proportion of the population living below the national poverty line (using the General Statistics Office of Vietnam and World Bank poverty line) up to 13.5 percent in 2014 which reduced from approximately 60 percent in 1993 (Figure 2). According to these figures, more than 40 million people escaped poverty over the last thirty years. A similarly strong trend is observed for people living on less than \$1.90/day (in 2011 purchasing power parity terms), where the rate fell from above 50 percent in 1993 to 2.8 percent in 2014. Poverty reduction has been done with significant improvements in shared welfare, with the average consumption level of Vietnamese in the bottom 40 percent increasing by 6.8 percent annually from 1993 to 2014. With an estimated 2014 Gini coefficient of 34.8 against 32.6 in 1993, Vietnam has not seen material increases in income inequality, compared to China and the Philippines, for instance, where the Gini exceeds 42 (Bank, Country Paternership Framwork for Vietnam, 2017)

Table 2: Poverty rate



Source: *Country Partnership Framework for Vietnam (World bank, 2017)*

3. Methodology

In low income countries, the economic choices of poor households are often constrained by the inefficient operation of local financial markets. A key issue is the extent to which households can access financial products, particularly in the formal sector. For example, providing access to borrowings that can be put to productive uses has the potential to lead to long term economic growth by helping farmers and investors build economies of scale in production and generate the profits necessary to lift themselves out of poverty. Throughout the developing world the typical response to this gap in the market has been the establishment of microfinance institutions. Morduch (1999) provides an insightful overview of the establishment of micro finance institutions and their role. These institutions, many of which operate on a not-for-profit basis, operate at the grassroots level providing small loans to people who otherwise would not be served by formal financial institutions. These institutions have been found to be effective in many settings but have been criticised on the grounds that they do not reach the very poor and also that they are not cost-effective (Cull et al., 2009).

An alternative approach to correcting for the failure of formal financial institutions to reach the poorest and most vulnerable is for the government to play a role in ensuring credit access.

In Vietnam, recognition of the importance of credit for rural households is clearly evident in government policy in relation to the provision of credit. Formal credit is provided to households in rural areas through two main state-owned banks, the Vietnamese Bank for Social Policy (VBSP) and the Vietnamese Bank for Agriculture and Rural Development (VBARD). While the VBARD operates on a commercial basis, the VBSP behaves very much like a microfinance institution and is considered a key social policy tool for reaching

the poor in rural areas. The bank provides a structured lending programme offering low (sometimes zero) interest credit for targeted categories of households including the poor, the disadvantaged and the disabled. Aubert et al. (2009) discuss the importance of creating the right incentives for credit agents in financial institutions to acquire information on potential borrowers so that they are selected in accordance with pro-poor policy objectives. Arguably direct government provision of credit could effectively perform this role.

Thus, to find impact factors on household's income and influence factors on credit assess of households. The regression of the model are used, as follows:

To access the impact on income, ordinary least squares (OLS) in the linear regression model was used. The regression equation is as follows:
$$Y = \alpha + \beta_1 X_1 + \varepsilon \quad (1)$$

Where Y_i is per capita income of household i , including Kinh household and ethnic minority household, Y represents the income of each family in 2014; X_i is vectors of impacting independent factors, variance of errors terms (ε).

After identifying influential factors of households' income, one-way analysis of variance (ANOVA) is employed to identify the critical difference between groups of independent variables as impacting factors of households' income (Lerd statistics). One-way ANOVA was used to analyse credit assess of household based on the difference impact factors between Kinh group and minority ethnic group, poor households and others, the head of household was educated and others, household was over natural disasters and others.

For testing results of influential factors of household's income, it is necessary to estimate the level of of impact of each factor and household access to credit.

Single classification, regression trees and random forests: Random forest method in decision tree model is used to identify the importance of each factor for household's access to credit, in order to build up a logistic model to evaluate the influences of each factor on access to credit. Random forests algorithm (Breiman, 2001) is a classification and regression tree. The Decision tree (DT) based on randomization of split in two at every node. At each node of the tree, sigle impact factor on credit assess of household. The value of each factor determines whether credit assess or not is considered later. The decision trees in the forest is suitable for the type of data. In the method, a forest of uncorrelated trees is built by using classification and regression tree analysis. Trees have some similarities, which used for regression and classification. However, trees also some diffirences to determine where to split. Steps of random forest procedure are as follows:

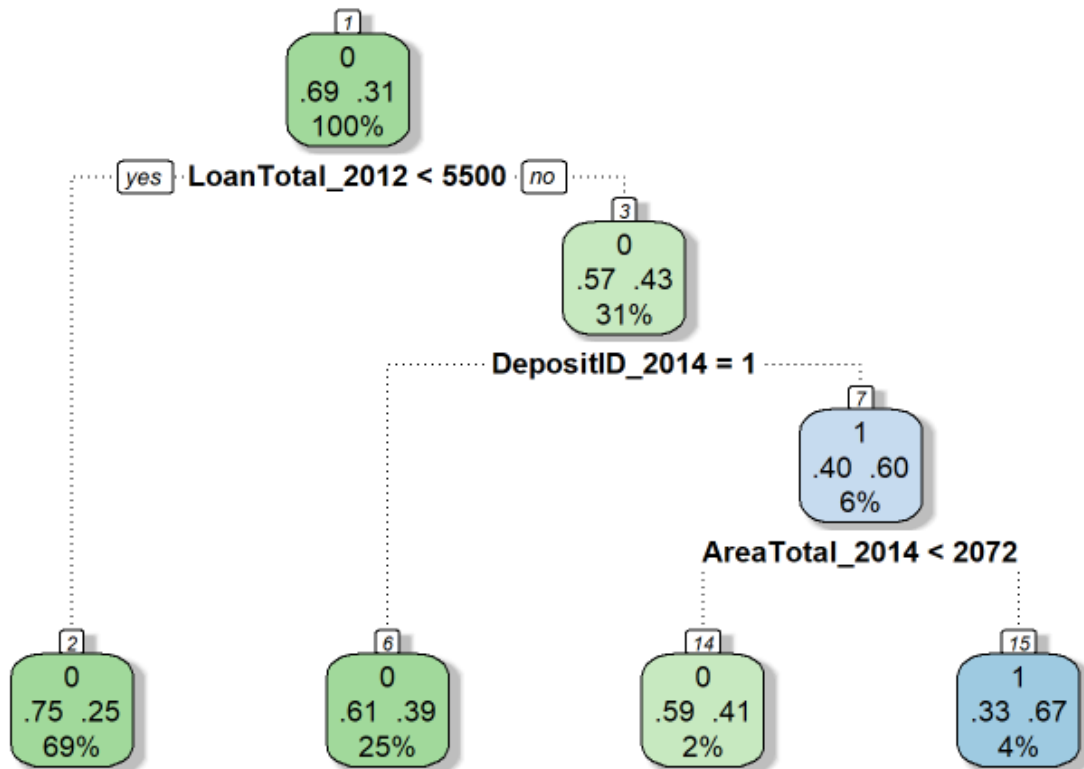


Figure 1. Demonstration of Random Forest methodology

Above is the decision tree for credit assess. The split variables are shown on the branches. The classification is shown in every node. The numbers under the prior nodes indicate classification rates and terminal nodes indicate misclassification rates on the test data. Random forest is better the prediction function. Random forest algorithm was used to make sure that all decision trees are not the same (Vu, 2006)). The prediction shown credit assess of household is higher (Trevor Hastie, 2008)). Figure 1 show that, at node 1, LoanTotal is the best variables to classify probability of credit assess. Therefore, if the household lent in 2012 and its loans were less than 5.500 million dong, its probability to borrow in 2014 was 0.31. DepositID is the second best to classify. The predicted results show that if the household had a deposit in the bank, its probability to assess credit was 0.43.

In the next step, the Gini coefficient will be used to measure the contribution of the homogeneity of the nodes and leaves in the resulting random forest.

Mean Decrease Gini (Mean Decrease Impurity importance (MDI)): To evaluate the importance of a variable X_m , by the weighted impurity decreases $p(t)\Delta i(s_t, t)$ for all nodes for predicting Y . The importance of a variable X_m is also estimated by measuring the Mean Decrease Accuracy (MDA) of the forest (Breiman, 2001). The values of X_m are randomly permuted all nodes of the forest tree. The averaged over all nodes N_t in the forest, as follows:

$$I_{mp}(X_m) = \frac{1}{N_T} \sum_T \sum_{t \in T: v(st) = X_m} p(t) \Delta i(s_t, t) \quad (2)$$

When one variable is removed, the regression model returns an accuracy factor. By applying for other variables, which a variable gives the greatest accuracy decrease, the variable is the most important. Therefore, the variable affects to access credit of the household.

Each time a particular variable is used to split a node, the Gini coefficient for the child nodes are calculated and compared to that of the original node. To measure inequality among value of levels of income, the Gini coefficient (Gini index) is used.

Use logistic model how do independent variables impact on credit assess (Trevor Hastie, 2008) For research which includes non-linear variables (0-1), the Logistic model is used to estimate probability. In the model, dependent variabe Y can be code 0 or 1, with 1 indicating credit assess of household, with 0 indicating no credit. The model $P[Y_i = 1|x_i]$ shows that the probablity of given valued of syndrom factors X_i ($i=1, \dots, n$). The purpose of the logit model is usually to understand of importance factors and to classify individuals. Binary variables are as follows:

$$Y_i = \begin{cases} 1: \text{Access to credit} \\ 0: \text{Not access to credit} \end{cases}$$

Logistic helps to describe the relationship between influential factors of access to credit.

$$P[Y_i = 1|x_i] = \frac{e^{\alpha + \beta X}}{1 + e^{\alpha + \beta X}} \quad (3)$$

Where Y is access to credit, X_i is vectors of impacting access to credit of households.

When estimating the parameters β_i , for each specific household we can estimate how credit assess is based on important factors. From there, it is possible to classify credit assess of household with each important factor with a cutoff point. In this case, cut off point is used 0.5.

The regression model (3) is the non linear logistic of X. Logistic model is used to estimate the coefficients as follows:

$$l(\alpha, \beta_i) = \prod_{i: y_i=1} P(x_i) \prod_{i: y_i=0} (1 - P(x_i)) \quad (4)$$

To estimate the parameters β_i , the maximum likelihood method is used. The coefficients α and β_i are decided. The model (4) is used to find out α and β_i via predicting probability of α and $\hat{\beta}(x_i)$ and thus $\hat{\alpha}$ and $\hat{\beta}_i$ are marginal effects to estimate model (3). Therefore, finding α and β_i to maximize the rational function.

An algorithm is used to classify the customers into two groups, which are those able to get loans and those unable to do so. Better algorithms should have better classification regarding credit granting decision of banks and minority groups' access to credit. Credit rationing of the Kinh group and minority groups was compared. The logit model is used to get rid of endogenous variables and to test whether minority groups' access to credit is affected by various factors. The marginal effect was estimated from the logistic regression model. In this case, variables can only take on two values, 0 or 1. The marginal effect model for variables shows how $P(Y=1)$ changes variable value from 0 to 1. For each variable, X_i Marginal Effect is: $X_i = P(Y = 1|X, X_i = 1) - P(Y=1|X, X_i = 0)$ (Williams, 2017). The results of regression show that based on factors such as the age of the head of household, the member of the household the ethnic household or kinh group, the gender of the head of household, the household lived in rural area or urban area, the household has a deposit or not, the household has own land or not, the household has a member of social organization or not?

Access to credit has an important role for economic development of countryside, especially for minority groups. In Vietnam, access to credit focuses on 2 credit markets. There are formal and informal credit market.

Formal credit markets are understood as credit market constructed by formal institutions. In Vietnam, formal credit is granted mainly by Vietnam's bank of social policy (VBSP) and Vietnam's bank of agriculture and rural development (VBARD), which makes up for 2/3 of farmers' credit (HỒ, 2015)

Credit informal market consists of (i) private lending by unrelated individuals and friends charging interest, and (ii) lending from families, relatives and friends carrying zero interest. These two segments will be referred to as 'private' and 'family' (Development Economics Research Group (DERG) University of Copenhagen (UoC))

4. Data

This paper relies on two data sets from the VARHS, which were conducted by the ILSSA in 2012 and 2014 covering 3530 households for which data was available for both years, including 2869 of Kinh and 661 ethnic minority families. The 12 provinces (Ha Tay, Nghe An, Khanh Hoa, and Lam Dong, Dak Lak, Dak Nong, Lao Cai, Dien Bien, Lai Chau, Phu Tho, Quang Nam, and Long An) which were all initially surveyed include the 466 communes that make up the VARHS panel. The ILSSA survey is not nationally representative, but it is representative for rural households in the 12 provinces under study. They cover a lot of the variation in geographical and socio-economic conditions present in Vietnam, including regional differences between the north, centre and south of the country.

The sample design of 2012 and 2014 VARHS follows a method of classified random group sampling in all rural provinces of Vietnam. Among each stratum, communes were selected randomly as a primary sampling unit. The number of communes per stratum is proportionate to the population. The number of selected communes in each VARHS is 466. In each commune, about seven households were selected randomly.

Data on credit rationing were collected using very detailed questionnaires. Information on household and commune categories was collected and then aggregated into panel per household.

The samples of 2014 VARHS are presented in table below:

Table 3 Number of provinces

No	Province	District	Communes	Households
1	Ha Tay (Ha Noi 2)	14	71	589
2	Lao Cai	9	28	295
3	Phu Tho	13	49	385
4	Lai Chau	6	34	320
5	Dien Bien	9	33	317
6	Nghe An	20	69	228
7	Quang Nam	13	44	338
8	Khanh Hoa	8	29	108
9	Dak lak	14	41	350
10	Dak Nong	8	35	307
11	Lam Dong	10	24	78
12	Long An	14	43	333
	Total	138	500	3648

(Source: VARHS 2014)

The ILSSA survey covered a large variety of topics related to land, labour and credit of households. In this research, we rely on the credit component, including a number of instructive questions on household resources in order to obtain the loan and full credit history of households during the recent past. The purpose of this part of the survey was to clarify the functioning of rural credit markets in Vietnam and to assess the extent to which credit rationing constrains rural area and ethnic minority groups. Questions covered issues such as (i) number of loans actually received, including information on amounts involved, loan terms and sources of credit, (ii) various other relevant background such as the criteria of the households, use of loans, collateral requirements etc.

Description of variables

Dependent variable: Income of household.

The relationship between independent and dependent variables are estimated by logistic model with the following independent variables:

Independent variables: The independent variables represent impacting factors of minority groups' income. Variables representing social factors are typically non-continuous, thus they are encoded as 0-1 while many papers applied linear function to assess factors impact to credit rationing (Nguyen, 2012), Phan (2013).

Table 4: Independent variables

Variables	Interpretation
Age	Age of household head
hh_size	Size of household
EthnicMinority	1 = Kinh ethnicity
EthnicMinority	0 = other ethnic groups
NaturalDisasters	1 = Affected by disaster
NaturalDisasters	0 = Unaffected by disaster
GenderID	1 = Household head is male
GenderID	0 = Household head is female
AreaTotal	Land size
MarriedID	1 = Household with married couple (alive)
MarriedID	0 = Household without married couple
SectorID	1 = Household in urban areas
SectorID	0 = Household in countryside
PoorID	1 = Poor households
PoorID	0 = Not a poor household
DepositID	1 = Household with saving account
DepositID	0 = Household without saving account
OwnLandID	1 = Household with Registration book
OwnLandID	0 = Household without Registration book
LoanTotal	Total value of the loan
LoanTotalID	1 = Household with loans
LoanTotalID	0 = Household with no loans
LoanVBSP	Total value of the loan at VBSP
LoanVBSPID	1 = Household with loans by VBSP
LoanVBSPID	0 = Household with no loans by VBSP

LoanVBARD	U\$ Total value of the loan at VBARD
LoanVBARDID	1 = Household with loans by VBARD
LoanVBARDID	0 = Household with no loans by VBARD
LoanFormal	1 = Household with formal loans
LoanFormal	0 = Household with no formal loans
LoanInformal	1 = Household with informal loans
LoanInformal	0 = Household with no informal loans
EducationID	0 = Household with no education diploma
EducationID	1 = Household with short-term education certificate
EducationID	2 = Household with bachelor or higher diploma
NumberGroup	The number groups that the household takes part in

(Source: Prepared by the authors)

5. Results

Over period from 2010 to 2014, the percentage of Kinh households borrowing money increased from 45% to 48% and then reduced sharply to 32% in 2014 while ethnic minority borrowing only fell to 38% in the same year. The number of ethnic minority households being rejected was almost 6 time higher than for the Kinh group. Moreover, the amount of loans per household of the Kinh group was about double that of ethnic minorities.

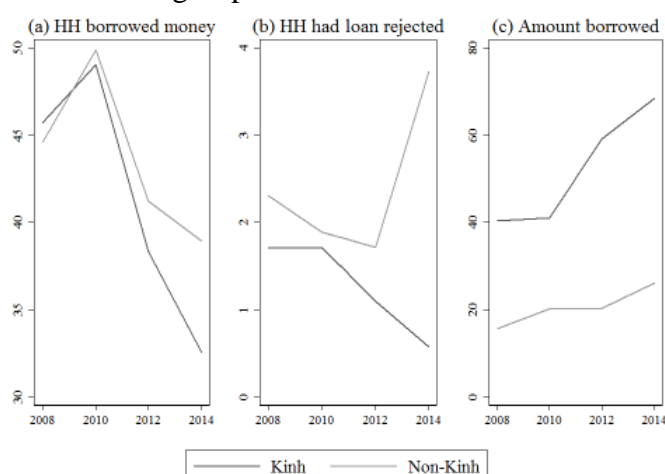


Figure 2. The amount of loan per household Kinh group

Source: VARHS (2014)

In this section we look in more detail at the gap between average income of Kinh group and ethnic minority group, VND 2,637,000 and VND 1,161,000, respectively. There are also gaps among the 53 ethnic minorities. The charts show us that Mang, Kho Mu, Lo Lo, Chut, La Hu, O Du, Mong, La Chi, Bru Van Kieu, Co Lao and Xinh Mun groups have the lowest

income with less than VND 632,000. On the other hands, the highest income group have VND 1,200,000 per month, almost double compared to the lowest group (Irish Aid, 2015).

Almost 23% of ethnic minority households is poor while the national poverty rate is 7%. Specifically, La Hu, Mang and Chut have a poverty rate over 70%. Ethnic groups with poverty rates over 60% include the O Du, Co, Kho Mu and Xinh Mun followed by La Ha, Khang, Mong and Xo Dang with 43% rate of poor.

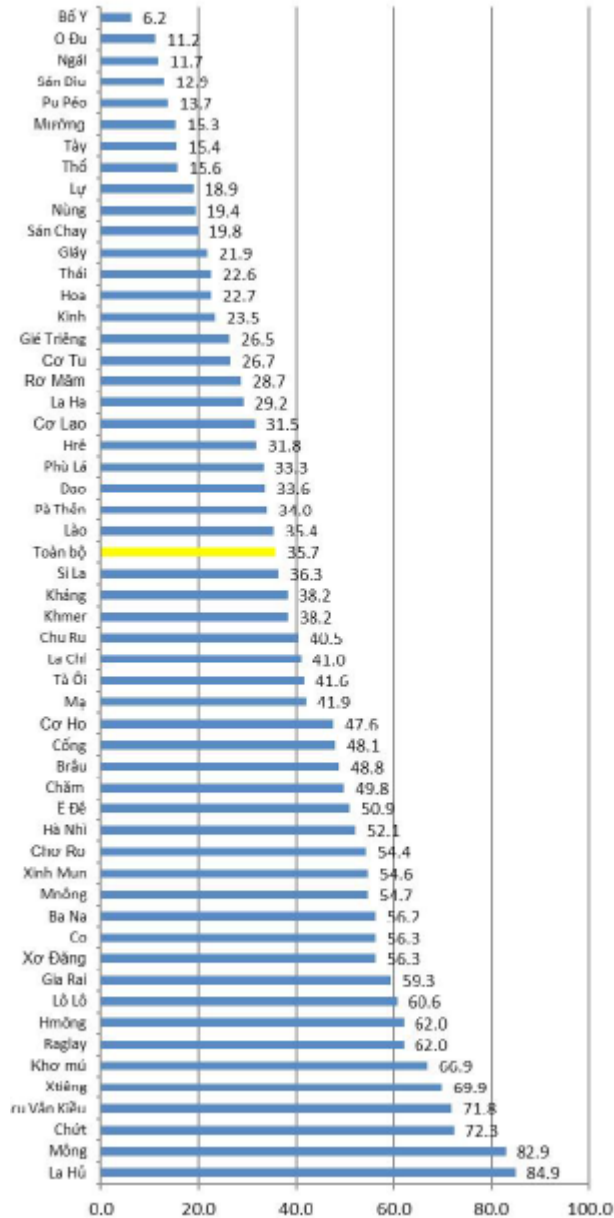


Chart 1. Rate of multi-poors

Source: Overview socio economy of 53 ethnic minorities (2017)

Gini index

Random forests offers a very natural way to rate the importance of variables, since different variables being left out of the trees fitted in our forests are permuted (Aslett, 2013).

The cut off point is 0.5. **The figure 3** shown that owned land area is the most important factor influencing loan accessibility, followed by age, distance to the central area, loans in the past and household size. Other factor such as member of social associations, education, deposit, natural disaster, ethnic minority, poor certificate, gender or marital status do not play important role compared to the mentioned above.

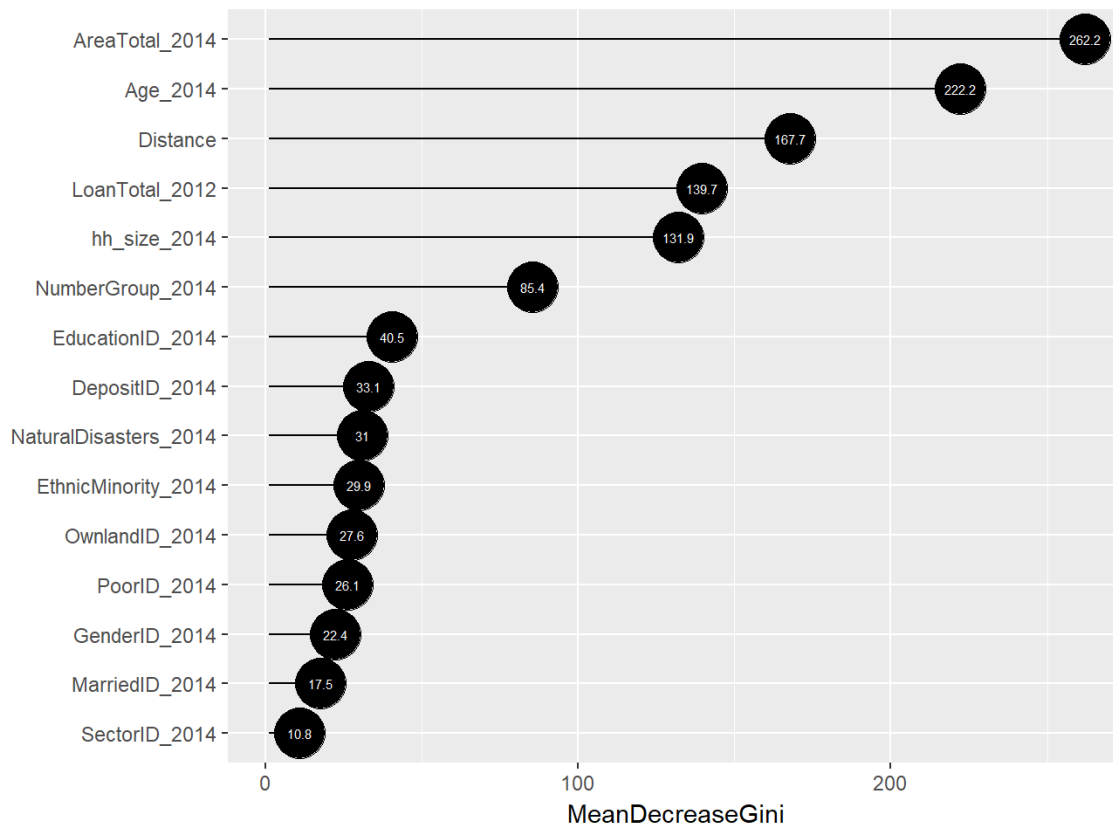


Figure 3. Gini index
Source: VARHS (2014)

Table 6 confirmed that Ha Tay is ranked first among provinces in the survey for loans offered to households, followed by Phu Tho, Daklak and Dak Nong. Those four leading province accounted for 69% of the loan segment while only 8.6% ethnic minority households can access credit in these areas.

Table 6. Households by value of loan obtained (2014)

No	Province	No of households	Weighted No of loan (%)	Value of loans (bn VND)	Kinh group	Ethnic minority
1	Ha Tay	188	23%	12,606	99%	1%
2	Lao Cai	39	1%	780	14%	86%
3	Phu Tho	104	19%	10,390	90%	10%
4	Lai Chau	60	3%	1,570	14%	86%
5	Dien Bien	114	5%	3,014	30%	70%
6	Nghe An	69	5%	2,891	98%	2%
7	Quang Nam	57	3%	1,893	99%	1%
8	Khanh Hoa	27	1%	799	90%	10%
9	Dak Lak	184	16%	9,045	68%	32%
10	Dak Nong	121	11%	6,196	89%	11%
11	Lam Dong	37	3%	1,852	75%	25%
12	Long An	84	8%	4,347	100%	0%
	Total	1,084	100%	55,382		

Source: VARHS (2014)

Table 7 (Formal loans) shows the formal loan structure in 12 provinces in Vietnam. In northern mountain areas such as Lao Cai, Lai Chau and Dien Bien, the loan amount of ethnic minority accounts for 86%, 88% and 70% total loan respectively, mostly funded by VBSP as the ethnic population in these provinces are widely targeted segments. For the Central Highland areas (Khanh Hoa, Daklak, Dak Nong, Lam Dong) the loan amount of ethnic minority households is from 11% to 32% while the VBSP still dominates the market. The remaining Ha Tay and Long An which are located very close to economic centers has almost no loans to ethnic minority groups.

In this section we look in more detail at loans obtained in 2014. It is the most recent year from which data are available, and they provide the best up-to-date picture of the rural credit market in Vietnam. Table x (Formal loans) illustrates some subtle differences between loans obtained from different formal sources in the loan market such as VBARD and VBSP.

Table 7. Formal loan

Province	Kinh		Ethnic minority		VBARD		VBSP	
	% households	% value of loan	% households	% value of loan	% households	% value of loan	% households	% value of loan
Ha Tay	98%	99%	2%	1%	51%	73%	49%	27%
Lao Cai	8%	14%	92%	86%	14%	18%	86%	82%
Phu Tho	72%	90%	28%	10%	59%	81%	41%	19%
Lai Chau	10%	12%	90%	88%	7%	8%	93%	92%
Dien Bien	13%	30%	87%	70%	6%	28%	94%	72%
Nghe An	93%	98%	7%	2%	43%	74%	57%	26%
Quang Nam	98%	99%	2%	1%	34%	59%	66%	41%
Khanh Hoa	78%	90%	22%	10%	26%	34%	74%	66%
Dak Lak	51%	68%	49%	32%	33%	44%	67%	56%
Dak Nong	78%	89%	22%	11%	21%	36%	79%	64%
Lam Dong	65%	75%	35%	25%	9%	9%	91%	91%
Long An	100%	100%	0%	0%	91%	97%	9%	3%

Source: VARHS 2014

Table 8. Formal and informal loan of Kinh group and Ethnic minority

Type of loan	Kinh group		Ethnic minority	
	2012	2014	2012	2014
Formal loans	57.08%	71.01%	73.21%	66.97%
Informal loans	23.21%	17.07%	17.23%	17.07%
Semi - formal	20%	11.92%	9.56%	15.96%
Total	100%	100%	100%	100%

Source: VARHS (2014)

Credit is obtained for many purposes, such as consumption and investment. Non farm activities such as investing in land used right or real estate made up of 73% of volume and is critically important for the development of a market based economy and for the efficiency of the economy in general. As land is widely used as collateral in Vietnam, it is therefore of interest to explore any interactions between the credit and land markets.

Table 9. Characteristics of household

Use of loan	No of household	Loan amount
Education	107	3,294
Farm activity	153	5,060
Food	164	5,580
Health expense	57	1,270
Non farm activity	603	40,178
Total	1,084	55,383

Source: VARHS (2014)

Due to unfavorable living conditions in their regions, such as more frequent natural disasters, underdeveloped transportation infrastructure, limited access to education, incomplete credit environment, many minority households have to take loans from informal credit sources instead of formal ones (VBSP, VBARD in their provinces). The informal credit is loans which borrowed from friends, relatives, commercial credit, state-related debt (for example, tax and insurance). Therefore, to assess the influential factors of minority households' income and their access to credit, it is necessary to include the impact of formal and informal credit, with VBSP and VBARD as two main organizations following government-supported credit program. The result is as follows:

Table 11: Households' access to formal credit and informal credit

Variables	Formal credit			Informal credit		
	Coefficient	dF/dx	P value	Coefficient	dF/dx	P value
Age_2014	-0.021200	-0.003605	0.000000 ***	-0.026040	-0.003024	0.000000 ***
hh_size_2014	0.108900	0.018512	0.000010 ***	0.069790	0.008105	0.018028 *
EthnicMinority_20141	0.146600	0.024596	0.162934	0.264400	0.029811	0.030876 *
GenderID_20141	0.057100	0.009615	0.715566	0.066110	0.007567	0.714539
AreaTotal_2014	0.000011	0.000002	0.000104 ***	0.000010	0.000001	0.000925 ***
SectorID_20141	0.697200	0.097395	0.001441 *	0.800100	0.070655	0.001190 *
PoorID_20141	0.268900	0.047873	0.024454 *	-0.194700	-0.021620	0.151485
NaturalDisasters_20141	-0.100000	-0.016791	0.291594	-0.173200	-0.019562	0.122419
DepositID_20141	-0.533400	-0.099337	0.000002 ***	-0.595300	-0.079483	0.000006 ***
OwnlandID_20141	0.540300	0.083658	0.000000 ***	-0.062080	-0.007307	0.637089
EducationID_20141	-0.002248	-0.000382	0.984595	0.077150	0.009135	0.566868
EducationID_20142	-0.109500	-0.018129	0.500999	-0.505400	-0.050116	0.006423 *
MarriedID_20141	-0.024840	-0.004243	0.886426	-0.411100	-0.052577	0.056624 *
NumberGroup_2014	0.203400	0.034583	0.000001 ***	0.157000	0.018231	0.001360 **
Loantotal_2012	0.000001	0.000000	0.004492 **	-0.000001	0.000000	0.326515
Distance	-0.026360	-0.004482	0.089707 .	-0.059280	-0.006886	0.003642 **

*significant at 10%, ** significant at 5%, *** significant at 1%

Notes: The regressions include lag variable (loan 2012 and 2014)

The logistic regression model and marginal effect was used.

Source: Estimation from VARHS 2012 and 2014

Table 11 shows that for PoorID and EducationID formal credit is different from informal credit. The coefficients of PoorID and Education in the formal credit regression are positive and significant. These results include marginal effects. But the coefficients of PoorID and Education ID in the formal credit regression are negative and significant. Therefore, non-poor households do not access to informal credit. The same results apply to EducationID. The findings supported by Pham et al (2013) results.

Based on the results above, the coefficient of Age is negative and significant at the 1% level. Indicating that the Age of the household head has a negative effect to access both formal credit and informal credit. The results suggest that an increase in age improves access to credit, but when the household head is over 55 years old, their access to credit becomes more and more limited. Regarding access to informal credit, the household head's age is not an influential factor.

In terms of informal credit sources, Kinh households have better access than minority ones, but this ethnicity difference does not have any influence when it comes to formal credit sources. Additionally, although poor households have better access to formal credit, it is harder for them to approach informal sources (the coefficient is not statistically significant). Households with registration books for their land can borrow from banks easier than those without. This factor, however, does not affect their abilities to take loans from informal credit sources. It is also more difficult for households who have saving accounts to take loans from both formal and informal credit sources than those who do not. These results are consistent with (Tuyen, 2015) and Khoi (2013).

The amount of land owned also enhances a household's ability to access credit, both formally and informally (the coefficients are positive in both testing models). In addition, living areas only affect access to formal credit, as households in urban regions have better access than those in the countryside. This factor does not affect their abilities to access informal credit.

In the model, loan in 2012 is used as lag variable to ensure that the results of logistic regression model are efficient and reliable. If the household loan was an informal one in 2012, it would affect borrowing in 2014. An opposite result is found in the case of formal credit.

Beside the regression results above, accessing VBSP's and VBARD's credit is difference. The results show that ethnic minority groups can access VPSB easier than VBARD and

informal sources. Since VBSP has preferential policies for ethnic minority households, the results are consistent with their missions in providing credit to this group. This is also supported by Nguyen (2015).

Table 12 presents the determinants of accessibility to VBSP and VBARD in Vietnam, including marginal effects. The coefficients of EthnicMinority, OwnlandID, EducationID are negative and significant. They show that households who are ethnic minority, owning less land and having lower education will assess VBSP's credit. Otherwise households are not ethnic minority and more land owned will tend to VBARD's credit. The findings are totally consistent with the Vietnamese credit policies in reducing poverty and improving mountainous and rural areas in recent years. It is also consistent with (Nguyen, 2012)'s results.

The EducationID coefficient is negative and significant, suggesting that microcredit programs for education loans are applied in two banks. This implies that poor households and ethnic minority groups tend to receive more formal credit from VBSP and VBARD than from other institutions and from informal credit.

In terms of household characteristics, the Age, hh_size, AreaTotal, MarriedID, LoanID coefficients are all significant and consistent between VBSP and VBARD. The results reflect the characteristics of the formal credit market in the country.

Table 12. Households' access to VPSB's and VBARD's credit

Variables	dF/dx	P value		dF/dx	P value	
Age_2014	0.002048	0.171060		0.000016	0.990335	
hh_size_2014	0.001205	0.904640		0.017204	0.045008	*
EthnicMinority_20141	-0.256960	0.000000	***	0.096737	0.003344	**
GenderID_20141	0.014855	0.819610		-0.073813	0.223717	
AreaTotal_2014	-0.000004	0.003040	**	0.000001	0.190875	
SectorID_20141	0.058732	0.633080		-0.012422	0.891127	
PoorID_20141	0.289910	0.000000	***	-0.142550	0.000603	***
NaturalDisasters_20141	0.123710	0.001010	**	0.055651	0.088935	.
DepositID_20141	0.028278	0.452150		-0.005724	0.863798	
OwnlandID_20141	-0.079535	0.071790	.	0.196490	0.000004	***
EducationID_20141	-0.006559	0.883650		-0.009913	0.789191	
EducationID_20142	0.046999	0.499660		-0.007911	0.888749	
MarriedID_20141	0.029596	0.675780		0.130350	0.019782	*
NumberGroup_2014	0.016207	0.313210		-0.003667	0.787728	
LoanVBSP_2012	0.000009	0.000012	***	0.000005	0.000000	***
Distance	0.012238	0.113500		-0.000721	0.920338	

5. Conclusion

This paper examines different factors which impact the effectiveness of credit outreach initiatives on ethnic minority group households ability to access the informal and formal credit sectors in rural Vietnam. Our results show that the income gap between ethnic minority and Kinh households is VND 44 million per annum leading to lower access to rural credit (Cuong, Ethnic Minorities in Northern Mountains of Vietnam: Poverty, income and assets, 2012). This supports the conclusions of (Rweyemamu, 2003). On the contrary, other studies shows that the chance of getting a loan reduces with household income ((Swain, 2007). In addition, our result confirms total land owned, household size and being a member of an association significantly affect accessibility to both formal and informal credit markets. Other factors such as education, amount of deposits held in banks, natural disasters, gender and poor certificates do not materially impact loan accessibility. Education factor, however, is proved by Miller and Ladman (1983) and contrary with Phan (2013) in the list of credit outreach. It is therefore necessary to improve economic and social conditions of agricultural areas in order to lower the gap of living standards and income between households of different ethnicities.

Factors with similar effects on access to both formal and informal credit include age, total land owned, membership of an association and distances to the local administrative center. The area of land owned is supported by Phan (2013), Zeller (2012) and Pham and Izumida (2002). Lending through a group or association is mentioned as an appropriate improvement for accessibility to a formal loan as it is cost saving tool to solve the problem of asymmetric information which individual lending faces. Rural households residing in areas with direct road access to a town center are likely to have better chance to access to a loan. In addition, agricultural land ownership positively increases credit demand; therefore, it is appropriate to offer loan to household having larger land. In some extents, formal loan can be replaced by informal loan with more flexibility. With 36% of market segment, ignoring informal credit market may result in a biased assessment of demand of formal credit market.

On the oposit view, our results confirm that the outreach for formal credit is also affected by the following factors: poor certificates, land with a registration book and being a household with historical credit. This can be considered a bias in the selection process, though improving accessibility to microcredit using a poor certificate is arguably a good social policy intervention. In addition, microcredit providers can effectively ration credit to borrowers based on the borrowers' income level. Moreover, households which are ethnic minority, possess poor certificates, are facing natural disaster and have an historical VBSP loan will have better access

to credit from VBSP. On the other hand, ethnic minority groups will face more difficulty in access credit from VBARD.

In addition, the demand for informal credit is also influenced by education, marital status and ethnic minority status. It is proved that the Kinh group has better access to informal loans compared to ethnic minorities. Rural households residing in urban areas have a better chance to obtain informal credit from private lenders, friends and relatives. A flexible informal loan duration can compensate for a high interest rate. Thus, informal credit is more popular for Kinh households which seek funding for trade and consumption.

The above findings highlight two important points in the microcredit literature. First, the ethnic minority groups that have lower income compared to Kinh group will face more credit rationing than Kinh groups in the VBARD. This, however, supports (Amin, 2003) who concluded that microcredit successfully reached the poor, but was less successful at reaching the vulnerable in Bangladesh. Their findings show the issue in microfinance researched by (Armendariz de Aghion, 2005) about capital does not appropriate fund to the poor. This also addresses the issue of government needs policy to intervene in their rural credit markets in order to better serve lower income households, which including ethnic minorities. Secondly, our research shows a strong connection between the informal and formal credit sectors and emphasises that both credit sectors play important roles in rural credit market.

Our results propose policy implications with regard to banking practice which will help to improve households' accessibility to credit (Phan, 2013) particularly for the ethnic minority groups. First, as ethnic minorities have lower income due to insufficient land and capital, banks and credit institutions should not only provide finance for farming activities but also for non farm purposes such as job training programs, so borrowers can generate more income from non-farm activities or participate in other labor markets. Secondly, it is suggested that households should actively participate in social associations and improve their education and work skills. This is critical as education and membership of an association add up to creditworthiness for borrowers and work skills improve repayment ability. Therefore, the government should also consider providing incentive programs to attract more investment in ethnic minority area. However, the coexistence of formal and informal credit appears foreseeable. This suggests that any one credit sector can be replaced by the other in the rural credit market. Hence, combination of these two credit sectors into a well-functioning rural credit market can effectively improve credit access for rural ethnic minority households.

Due to the limited size of survey, some policy implications are particularly relevant to the survey province, but may not be relevant nationwide. This reflects the presumption that informal credit is popular in other regions of Vietnam as well, while formal credit is monitored and restricted by formal lending procedures.

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APPENDIX

Table A1. Number of provinces

No	Province	District	Communes	Households
1	Ha Tay (Ha Noi 2)	14	71	589
2	Lao Cai	9	28	295
3	Phu Tho	13	49	385
4	Lai Chau	6	34	320
5	Dien Bien	9	33	317
6	Nghe An	20	69	228
7	Quang Nam	13	44	338
8	Khanh Hoa	8	29	108
9	Dak lak	14	41	350
10	Dak Nong	8	35	307
11	Lam Dong	10	24	78
12	Long An	14	43	333
	Total	138	500	3648

(Source: VARHS 2014)

Table A2: Regression model to estimate the influential factors of household income

	Estimate	Std. Error	z_stat	Pr(> t)	
(Intercept)	8.873000	0.168500	52.660000	< 2e-16	***
Age_2014	0.044250	0.005503	8.041000	1.20E-15	***
Age2_2014	-0.000408	0.000047	-8.763000	< 2e-16	***
hh_size_2014	0.113300	0.006983	16.223000	< 2e-16	***
EthnicMinority_20141	0.437800	0.030360	14.422000	< 2e-16	***
NaturalDisasters_20141	-0.037260	0.026650	-1.398000	0.162061	
GenderID_20141	-0.078530	0.041710	-1.883000	0.059833	
AreaTotal_2014	0.000008	0.000001	9.106000	< 2e-16	***
SectorID_20141	-0.159400	0.062220	-2.562000	0.010448	*
PoorID_20141	-0.458200	0.032050	-14.296000	< 2e-16	***
DepositID_20141	0.261900	0.030290	8.645000	< 2e-16	***
OwnlandID_20141	-0.053160	0.030910	-1.720000	0.085535	
LoanTotal_2014	0.000001	0.000000	5.139000	2.92E-07	***
LoanTotal_2012	0.000000	0.000000	3.635000	0.000282	***
NetIncomeTotal_2012	0.000001	0.000000	13.954000	< 2e-16	***
MarriedID_20141	0.124000	0.045340	2.735000	0.006269	**
EducationID_20141	0.187500	0.032860	5.707000	1.24E-08	***
EducationID_20142	0.469100	0.044930	10.441000	< 2e-16	***
NumberGroup_2014	0.046480	0.011590	4.009000	6.24E-05	***
Distance	-0.003563	0.003826	-0.931000	0.35179	

*significant at 10%, ** significant at 5%, *** significant at 1%

Notes: The regressions include lag variable (loan 2012 and 2014)

The OLS regression model and oneway ANOVA was used.

Source: Estimation from VARHS 2012 and 2014

Table A3. Households' ability to get credit

	dF/dx	Std. Err.	z	P> z
Age_2014	(0.006059)	0.000661	-9.1615	< 2.2e-16
hh_size_2014	0.023244	0.004785	4.8572	1.19E-06
EthnicMinority_20141	0.041156	0.019801	2.0785	0.03766
GenderID_20141	0.004149	0.029247	0.1419	0.8871799
AreaTotal_2014	0.000003	0.000001	4.6439	3.42E-06
SectorID_20141	0.130150	0.033826	3.8475	0.0001193
PoorID_20141	0.018996	0.022641	0.839	0.4014594
NaturalDisasters_20141	(0.042340)	0.017705	-2.3914	0.0167831
DepositID_20141	(0.164250)	0.022672	-7.2444	4.34E-13
OwnlandID_20141	0.060588	0.019856	3.0514	0.002278
EducationID_20141	0.010540	0.022332	0.4719	0.6369677
EducationID_20142	(0.057205)	0.028814	-1.9853	0.0471106
MarriedID_20141	(0.053261)	0.034019	-1.5656	0.1174405
NumberGroup_2014	0.039433	0.007935	4.9693	6.72E-07
LoanTotal_2012	0.000000	0.000000	1.6177	0.1057257
Distance	(0.012508)	0.003137	-3.9868	6.70E-05

Notes: The regressions include lag variable (loan 2012 and 2014)

The OLS regression model and oneway ANOVA was used.

Source: Estimation from VARHS 2012 and 2014

Table A4. VPSB credit

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-1.174000	0.719900	-1.630000	0.103040	
Age_2014	0.009008	0.006581	1.369000	0.171060	
hh_size_2014	0.005302	0.044260	0.120000	0.904640	
EthnicMinority_20141	-1.102000	0.161900	-6.805000	0.000000	***
GenderID_20141	0.065770	0.288400	0.228000	0.819610	
AreaTotal_2014	-0.000017	0.000006	-2.963000	0.003040	**
SectorID_20141	0.269800	0.565100	0.477000	0.633080	
PoorID_20141	1.211000	0.188400	6.428000	0.000000	***
NaturalDisasters_20141	0.527900	0.160500	3.289000	0.001010	**
DepositID_20141	0.125700	0.167100	0.752000	0.452150	
OwnlandID_20141	-0.340100	0.188900	-1.800000	0.071790	.
EducationID_20141	-0.028930	0.197700	-0.146000	0.883650	

EducationID_20142	0.201800	0.298900	0.675000	0.499660	
MarriedID_20141	0.132100	0.315800	0.418000	0.675780	
NumberGroup_2014	0.071280	0.070680	1.009000	0.313210	
LoanVBSP_2012	0.000038	0.000009	4.379000	0.000012	***
Distance	0.053830	0.034010	1.583000	0.113500	

Table A5. VPSB credit (marginal effects)

	dF/dx	Std. Err.	z	P> z 	
Age_2014	0.002048	0.001496	1.369000	0.171008	
hh_size_2014	0.001205	0.010062	0.119800	0.904643	
EthnicMinority_20141	-0.256960	0.037357	-6.878500	0.000000	***
GenderID_20141	0.014855	0.064704	0.229600	0.818420	
AreaTotal_2014	-0.000004	0.000001	-2.976900	0.002912	**
SectorID_20141	0.058732	0.117090	0.501600	0.615940	
PoorID_20141	0.289910	0.044497	6.515200	0.000000	***
NaturalDisasters_20141	0.123710	0.038402	3.221300	0.001276	**
DepositID_20141	0.028278	0.037218	0.759800	0.447383	
OwnlandID_20141	-0.079535	0.045219	-1.758900	0.078600	.
EducationID_20141	-0.006559	0.044691	-0.146800	0.883311	
EducationID_20142	0.046999	0.071136	0.660700	0.508810	
MarriedID_20141	0.029596	0.069687	0.424700	0.671055	
NumberGroup_2014	0.016207	0.016060	1.009100	0.312908	
LoanVBSP_2012	0.000009	0.000002	4.380000	0.000012	***
Distance	0.012238	0.007742	1.580700	0.113946	

Table A6. VBARD credit

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-3.247000	0.717000	-4.528000	0.000006	***
Age_2014	0.000085	0.006995	0.012000	0.990335	
hh_size_2014	0.092080	0.045930	2.005000	0.045008	*
EthnicMinority_20141	0.542700	0.185000	2.934000	0.003344	**
GenderID_20141	-0.373100	0.306700	-1.217000	0.223717	
AreaTotal_2014	0.000006	0.000004	1.308000	0.190875	
SectorID_20141	-0.065460	0.478200	-0.137000	0.891127	
PoorID_20141	-0.888700	0.259100	-3.430000	0.000603	***
NaturalDisasters_20141	-0.309800	0.182100	-1.701000	0.088935	.

DepositID_20141	-0.030520	0.177900	-0.172000	0.863798	
OwnlandID_20141	1.337000	0.290600	4.600000	0.000004	***
EducationID_20141	-0.053520	0.200200	-0.267000	0.789191	
EducationID_20142	-0.042740	0.305500	-0.140000	0.888749	
MarriedID_20141	0.814300	0.349400	2.330000	0.019782	*
NumberGroup_2014	-0.019630	0.072890	-0.269000	0.787728	
LoanVBARD_2012	0.000029	0.000005	5.350000	0.000000	***
Distance	-0.003858	0.038580	-0.100000	0.920338	

Table A7. VBARD credit (marginal effects)

	dF/dx	Std. Err.	z	P> z 	
Age_2014	0.000016	0.001307	0.012100	0.990335	
hh_size_2014	0.017204	0.008583	2.004500	0.045015	*
EthnicMinority_20141	0.096737	0.031183	3.102300	0.001920	**
GenderID_20141	-0.073813	0.063802	-1.156900	0.247315	
AreaTotal_2014	0.000001	0.000001	1.307300	0.191102	
SectorID_20141	-0.012422	0.092143	-0.134800	0.892761	
PoorID_20141	-0.142550	0.034078	-4.183100	0.000029	***
NaturalDisasters_20141	0.055651	0.031318	-1.777000	0.075570	.
DepositID_20141	-0.005724	0.033497	-0.170900	0.864316	
OwnlandID_20141	0.196490	0.030343	6.475500	0.000000	***
EducationID_20141	-0.009913	0.036744	-0.269800	0.787319	
EducationID_20142	-0.007911	0.056003	-0.141300	0.887670	
MarriedID_20141	0.130350	0.046679	2.792600	0.005229	**
NumberGroup_2014	-0.003667	0.013621	-0.269200	0.787746	
LoanVBARD_2012	0.000005	0.000001	5.063600	0.000000	***
Distance	-0.000721	0.007208	-0.100000	0.920333	

Table A8. Formal Credit Assess

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-1.798000	0.390200	-4.608000	0.000004	***
Age_2014	-0.021200	0.003487	-6.081000	0.000000	***
hh_size_2014	0.108900	0.024830	4.384000	0.000012	***
EthnicMinority_20141	0.146600	0.106500	1.376000	0.168820	

GenderID_20141	0.057100	0.158300	0.361000	0.718262	
AreaTotal_2014	0.000011	0.000003	3.879000	0.000105	***
SectorID_20141	0.697200	0.276400	2.523000	0.011637	*
PoorID_20141	0.268900	0.114500	2.347000	0.018918	*
NaturalDisasters_20141	-0.100000	0.096060	-1.041000	0.297846	
DepositID_20141	-0.533400	0.103500	-5.152000	0.000000	***
OwnlandID_20141	0.540300	0.118200	4.572000	0.000005	***
EducationID_20141	-0.002248	0.116500	-0.019000	0.984602	
EducationID_20142	-0.109500	0.167300	-0.655000	0.512706	
MarriedID_20141	-0.024840	0.173100	-0.143000	0.885918	
NumberGroup_2014	0.203400	0.041500	4.901000	0.000001	***
Loantotal_2012	0.000001	0.000000	0.004428	0.004428	**
Distance	-0.026360	0.015550	-1.695000	0.090074	

Table A9. Formal Credit Assess (Marginal effects)

	dF/dx	Std. Err.	z	P> z 	
Age_2014	-0.003605	0.000586	-6.155100	0.000000	***
hh_size_2014	0.018512	0.004201	4.407000	0.000010	***
EthnicMinority_20141	0.024596	0.017628	1.395300	0.162934	
GenderID_20141	0.009615	0.026386	0.364400	0.715566	
AreaTotal_2014	0.000002	0.000000	3.881200	0.000104	***
SectorID_20141	0.097395	0.030566	3.186400	0.001441	**
PoorID_20141	0.047873	0.021278	2.249900	0.024454	*
NaturalDisasters_20141	-0.016791	0.015922	-1.054600	0.291594	
DepositID_20141	-0.099337	0.020778	-4.781000	0.000002	***
OwnlandID_20141	0.083658	0.016443	5.087900	0.000000	***
EducationID_20141	-0.000382	0.019789	-0.019300	0.984595	
EducationID_20142	-0.018129	0.026941	-0.672900	0.500999	
MarriedID_20141	-0.004243	0.029706	-0.142800	0.886426	
NumberGroup_2014	0.034583	0.007016	4.929100	0.000001	***
Loantotal_2012	0.000000	0.000000	2.841400	0.004492	**
Distance	-0.004482	0.002641	-1.696900	0.089707	

Table A10. Informal Credit Assess

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-0.955700	0.462200	-2.067000	0.038688	*

Age_2014	-0.026040	0.004201	-6.198000	0.000000	***
hh_size_2014	0.069790	0.029610	2.357000	0.018445	*
EthnicMinority_20141	0.264400	0.126400	2.092000	0.036449	*
GenderID_20141	0.066110	0.183400	0.360000	0.718551	
AreaTotal_2014	0.000010	0.000003	3.303000	0.000957	***
SectorID_20141	0.800100	0.340400	2.350000	0.018763	*
PoorID_20141	-0.194700	0.142200	-1.369000	0.171005	
NaturalDisasters_20141	-0.173200	0.115400	-1.500000	0.133530	
DepositID_20141	-0.595300	0.117100	-5.082000	0.000000	***
OwnlandID_20141	-0.062080	0.129800	-0.478000	0.632586	
EducationID_20141	0.077150	0.132200	0.584000	0.559442	
EducationID_20142	-0.505400	0.221000	-2.286000	0.022236	*
MarriedID_20141	-0.411100	0.197500	-2.082000	0.037363	*
NumberGroup_2014	0.157000	0.049290	3.185000	0.001449	**
Loantotal_2012	-0.000001	0.000001	-0.980000	0.327013	
Distance	-0.059280	0.020570	-2.882000	0.003951	**

Table A11. Informal Credit Assess (Marginal effects)

	dF/dx	Std. Err.	z	P> z 	
Age_2014	-0.003024	0.000475	-6.371700	0.000000	***
hh_size_2014	0.008105	0.003427	2.365100	0.018028	*
EthnicMinority_20141	0.029811	0.013810	2.158700	0.030876	*
GenderID_20141	0.007567	0.020687	0.365800	0.714539	
AreaTotal_2014	0.000001	0.000000	3.312500	0.000925	***
SectorID_20141	0.070655	0.021798	3.241300	0.001190	**
PoorID_20141	-0.021620	0.015078	-1.434300	0.151485	
NaturalDisasters_20141	-0.019562	0.012664	-1.544700	0.122419	
DepositID_20141	-0.079483	0.017579	-4.521500	0.000006	***
OwnlandID_20141	-0.007307	0.015489	-0.471800	0.637089	
EducationID_20141	0.009135	0.015951	0.572700	0.566868	
EducationID_20142	-0.050116	0.018388	-2.725400	0.006423	**
MarriedID_20141	-0.052577	0.027582	-1.906200	0.056624	
NumberGroup_2014	0.018231	0.005692	3.202900	0.001360	**
Loantotal_2012	0.000000	0.000000	-0.981200	0.326515	
Distance	-0.006886	0.002368	-2.907600	0.003642	**