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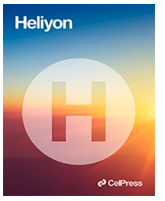

Research article

# Effects of microcredit programs on household financial portfolios: Evidence from rural Vietnam

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ABSTRACT

Although microcredit is generally regarded as an excellent instrument for assisting borrowers in improving their well-being, its contribution to improving family financial status is often overlooked. This study addresses this issue by examining the effects of microcredit programs in Vietnam on household financial portfolios. We utilize a balanced panel dataset of 1157 identical households from two Vietnamese provinces collected in 2016, 2017, and 2022. The estimated results are calculated using the multivariate Tobit method and the instrumental variable regression method. The findings prove that microcredit increases households' lending, savings, and investments. The results are consistent with the conceptual framework and robust to different econometric models and samples. The study suggests some policy implications based on its findings.

## 1. Introduction

Since its introduction in 1976 by Dr. Muhammad Yunus (a Bangladeshi economist), microcredit has been the subject of many different impact evaluation studies across the globe. Berger [1], Hashemi et al. [2], and Khandker [3] are among the earliest research efforts that have examined the effects of microcredit on households from its inception. Recently, numerous studies worldwide have sought to find evidence of microcredit effects on many different aspects of household welfare. Some studies focused on education and school enrollment [4–6]. Others shift the focus to the gender gap and women's empowerment [7–11]. Some turn their attention to the effects on agricultural technology adoption and productivity [12,13]. Some found a causal relationship between microcredit and poverty alleviation [14–17]. A number of studies examined the role of microcredit in household income and expenditures [5,7,13,18,19]. Some studies attempted to find the link between microcredit access and employment [20,21]. Aside from researchers investigating the beneficial impacts of microcredit, there are also others who examined the undesired consequences associated with microcredit [22–24]. In particular, there have been studies that focus on the effects of microcredit in the context of post-Covid-19 [25,26].

Although existing studies on the impact of microcredit on households have so far covered a wide range of areas, little attention has been given to financial portfolios. Among the few, Silva [27] proved that microcredit programs increased savings per capita for low-income households in Sri Lanka. Using data collected from 69 villages in Bangladesh during the period of 2006–2007,

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Aktaruzzaman and Farooq [28] discovered that microcredit had a positive influence on the savings of borrowers. However, a study conducted by Ara et al. [29] using more recent data from Bangladesh collected between 2013 and 2016 found mixed effects. Out of the households participating in microcredit programs, 21 percent increased their savings, 20.5 percent decreased their savings, and 58.5 percent remained unchanged. In China, Jiang et al. [7] found no impact of microcredit loans on investments in both long-term and short-term assets.

An important point that can be drawn from the existing literature on the impacts of microcredit on household financial portfolios is that all studies only examine a single household financial instrument (mostly savings). Tuan et al. [30] posited that families living in developing countries commonly use multiple financial instruments, which exhibit potential links among themselves. Microcredit is an instrument in household financial portfolios; as it expands, other instruments will be impacted to some extent. The possible impacts of the availability of microcredit on other financial instruments can be conceptualized as follows: upon receiving microcredit, households may allocate the money towards income-generating activities, leading to a rise in their income and subsequently enhancing their opportunities to increase other financial services. Hence, it is plausible to argue that microcredit might potentially influence household lending, saving, and investment activities. As such, it is essential to examine the effects on family financial instruments simultaneously so as to achieve a comprehensive understanding of the effects of microcredit and to account for their interrelationships.

Rural Vietnam provides an excellent case study for research into the effects of microcredit programs on household financial portfolios for several reasons. First, a significant proportion of the Vietnamese population lives in rural areas [14,31], but the living standards of rural people are lower than those of their urban counterparts. There are ongoing expenditure and income disparities between rural and urban families [32]. The Vietnamese government has identified reducing inequalities between rural and urban areas as its main policy priority [33]. Microcredit has proven a significant role in contributing to poverty reduction and fostering social development [34]; however, its effects in reducing rural-urban gaps in the Vietnamese context need to be investigated. Second, the effects of microcredit on rural development have been addressed in various studies. The main focus of existing studies within the Vietnamese context is on the effects of microcredit on poverty alleviation, household income, consumption, education, employment, and agricultural outputs [4,5,13,14,31,35,36]. However, no research focusing on household financial portfolios has been recorded. Tuan et al. [30] indicated that rural households generally use a basket of interrelated financial tools for their financial strategies. The availability of microcredit obviously influences other financial instruments as well as household financial strategies. Therefore, there exists an urgent need to study the effects of microcredit on household financial portfolios. Third, rural Vietnam is home to a multitude of microcredit programs administered by an array of lending institutions [36]. Although previous research has shown the effects of microcredit programs on a broad range of household aspects, additional aspects of the effects need exploration. This will guarantee that any decisions made by stakeholders regarding microcredit programs are more well-informed and take into account all possible outcomes.

The main aim of this paper is to study the effects of microcredit programs on household financial portfolios in rural Vietnam. A household's financial portfolios are made up of a wide variety of financial assets [37,38]. Due to data limitations, we only refer to some common financial assets of households in rural Vietnam, such as lending, savings, and investments [39]. The study is expected to make two novel contributions to the existing literature. First, by shifting the focus to family financial portfolios, this is the first research to look at the impacts of microcredit on household financial instruments in developing countries. Second, this research investigates the simultaneous impacts of microcredit on lending, savings, and investments using a multivariate Tobit model, therefore capturing possibly jointly determining processes within household financial instruments [30]. The Multivariate Tobit model is considered more efficient than separate Tobit equations when outcome variables are correlated [40]. Furthermore, a multivariate Tobit model generates correlation coefficients between the error terms of the equations in the system, which may provide insights into the relationships between different financial instruments.

The rest of this paper is organized as follows. Section 2 introduces the microcredit programs for rural households in Vietnam. Section 3 describes the conceptual framework and hypothesis derivation. Section 4 describes the data. Section 5 provides a description of the methodologies. Section 6 is the empirical results. The conclusion and policy implications are presented in Section 7. Section 8 presents some limitations of the study.

## 2. Microcredit programs for rural households in Vietnam

To date, microcredit programs in Vietnam have mainly been provided by a range of formal and semi-formal microfinance institutions. The two major formal lenders for rural households in Vietnam are the Viet Nam Bank for Agriculture and Rural Development (VBARD), established in 1988, and the Viet Nam Bank for Social Policies (VBSP), established in 1995. The VBARD, a state-owned bank, focuses mostly on rural regions, with individual customers making up about 90 % of its consumer base [41]. The VBARD has consistently contributed to more than 40 % of overall agricultural and rural loans in the banking industry and has supplied loans to 100 % of sub-districts (communes) nationwide [41]. The second major formal lending institution is the Viet Nam Bank for Social Policies (VBSP), which was established in 1995. The VBSP, as the name suggests, is a nonprofit organization whose primary goal is to contribute to social programs by providing credit [31]. The VBSP's 2021 annual report revealed that it has 22 credit programs, mainly serving the poor, near-poor, and other disadvantaged groups [42]. In addition to the VBARD and the VBSP, rural households can also find formal microcredit sources from some commercial banks, including Co-Op Bank and LienViet Bank.

Many socio-political mass organizations served as semi-formal microcredit providers. These include the Vietnam Youth Union, the Vietnam Women's Union, the Vietnam Farmers' Association, the Veterans Association of Vietnam, and the Vietnam Association of the Elderly [35]. According to the State Bank of Vietnam, there may exist up to 400 semi-formal microcredit programs that are operated as social funds or programs of the Viet Nam Women's Union or other socio-political mass organizations [43]. Aside from microcredit

programs offered by formal and semi-formal microfinance institutions, rural households may also access credit via informal channels. The lending providers include money lenders, pawnshops, credit groups (Ho/Hui or Phuong), relatives, and friends. Informal microcredit services typically have short maturities and meet unexpected and urgent needs [44]. The procedures are often relatively simple and collateral-free, and the amount of credit is dependent mostly on the trust between lender and borrower rather than collateral [45,46]. Informal microcredit is characterized by higher interest rates compared with formal microcredit [4].

In general, the microcredit market for rural households in Vietnam is quite diverse and abundant in alternatives. Along with the microcredit programs offered by formal and semi-formal lenders, a market for informal credit exists. Informal microcredit, which relies mostly on trust and lacks collateral, has potential risks for both creditors and debtors. Seriously, this microcredit channel includes so-called "black credit," wherein borrowers may be compelled to use their land or assets for repayment [47]. The expansion of coverage of formal and semi-formal channels will help reduce rural households' dependence on the informal financial sector and reduce the prevalence of "black credit" [36]. This research concentrates on examining the effects of microcredit programs provided via formal and semi-formal channels, with the intention of deriving policy implications for the development of these channels.

## 3. Conceptual framework and hypothesis formulation

This research is grounded in the intertemporal utility maximization theory, in which households maximize their intertemporal utility [48]. We follow the ways proposed by Ersado et al. [49] and Isoto & Kraybill [50]. We formulate the household intertemporal utility function as follows:

$$u_t = E\left(\sum_{t=0}^{\infty} U_t(C_t)\middle| I_t\right) \tag{1}$$

where, $U_t(C_t)$ is instantaneous utility function, $C_t$ is the consumption of goods and services at time t. And, $E(.|I_t)$ is the expectation conditional on information available at time t.

A households receives income ($Y_t$) from two sources each year: income from activities financed by microcredit ($Y_{mt}$) and income from all other sources ($Y_{ot}$). The value of $Y_{mt}$ depends not only on the amount of microcredit but also on households' characteristics (e.g., entrepreneurship). The household also receive an inheritance of wealth (W) from the previous year. Therefore, the household budget constraint between two years can be written as:

$$W_{t+1} = (1+r)[Y_{ot} + Y_{mt} + W_t - C_t] \tag{2}$$

where, r is the interest rate. The household maximizes its utility based on equation (1), subject to budget constraints from equation (2). The share of income (I) utilized to invest in financial services can be calculated as follows:

$$I = (W_{t+1} - W_t) = f(r, M, Y_{ot}, Z) \tag{3}$$

where M is the amount of credit, Z is a vector of household characteristics. Equation (3) implies that the portion of income used for financial services (savings, lending, and investment) depends on the interest rate, amount of credit, income from sources other than microcredit, and household characteristics.

Empirical evidence from studies carried out in various contexts supports the role of microcredit in equation (3). Dao [5] found that the Vietnam Bank for Social Policies' microcredit considerably increased agricultural income per capita of low- and middle-income rural Vietnamese households. Also, in Vietnam, the primary results from Duong and Nghiem [35] indicated that microcredit assists borrowers in augmenting their income and enhancing their expenditures. Elsafi et al. [51] showed evidence that a microfinance program in Sudan reduced monetary poverty among its members. Félix and Belo [15] discovered that microcredit helped alleviate poverty in 11 Southeast Asian developing nations. In agreement with equation (3) and based on empirical evidence from Dao [5], H. A. Duong and Nghiem [35], and Elsafi et al. [51], we propose the following hypotheses to explain the impacts of microcredit programs on household financial portfolios:

**H1**. Microcredit enhances household lending.

**H2**. Microcredit increases household savings.

**H3**. Microcredit raises household investments.

## 4. Data

The dataset employed in this research is sourced from the Thailand-Vietnam Socio-Economic Panel (TVSEP) project funded by the German Research Foundation (for further details, please visit: https://www.tvsep.de). The project's goal is to gather information on rural livelihoods and poverty dynamics in Thailand and Vietnam. The sampling method, which involves a three-stage stratified random procedure based on each country's administrative structure, follows the criteria of the United Nations Department of Economic and Social Affairs [52]. Since 2007, the TVSEP project has conducted direct interviews to collect social-economic data from 4400 representative rural households in six provinces: three in Thailand and three in Vietnam. In Vietnam, three central provinces were selected as study sites, including Ha Tinh, Thua Thien Hue, and Dak Lak (Fig. 1). The selection of these three provinces was based on

their significant dependence on agriculture, below-average per capita income, and inadequate infrastructure [53]. These three provinces are representative of the Vietnamese rural population [54].

Eight waves of surveys were conducted in Vietnam in 2007, 2008, 2010, 2011, 2013, 2016, 2017, and 2022. The data collection from the waves 2007–2017 took place in all three provinces. However, the 2022 wave was only done in Ha Tinh and Dak Lak, with Thua Thien Hue being excluded from the survey. TVSEP data was obtained using two questionnaires, one for households and one for villages. The household survey comprises nine sections containing information on household characteristics essential to this study, such as household head characteristics (age, gender, marital status, and ethnicity) as well as household features (credit status, lending status, saving status, numbers of children and elderly members, land use status, and income shocks). The sample for our research is a balanced panel of 1157 identical Vietnamese households in the years of 2016, 2017, and 2022, with a total of 3471 observations. This implies that our sample comprises only data from the provinces of Ha Tinh and Dak Lak but not from Thua Thien Hue. Compared to the sample size of wave 2022 (1227 households), the attrition rate of our sample is approximately 9.4 %. This is because we excluded households that were not present in all three years of surveys and households with missing information.

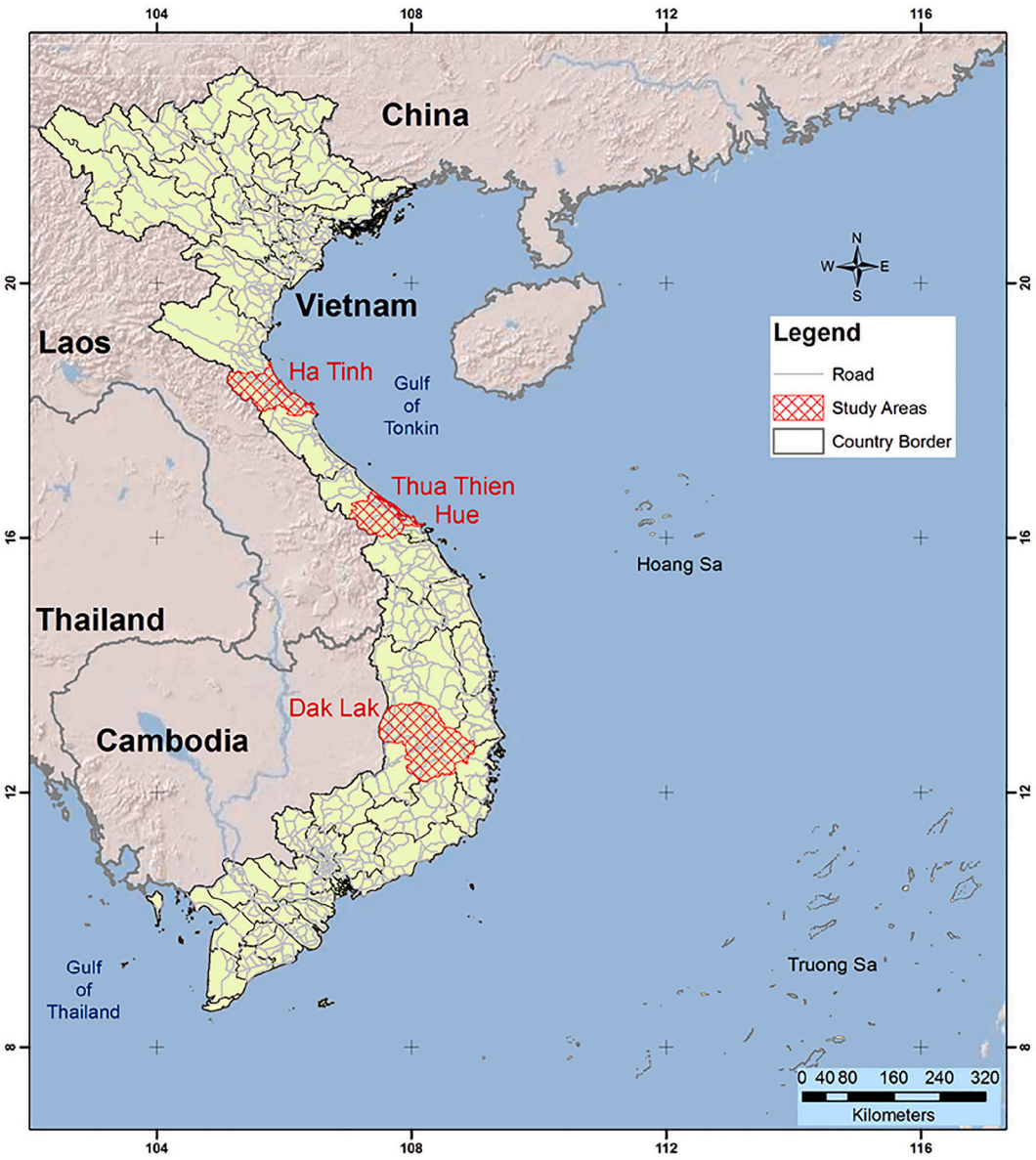


**Fig. 1.** Map of the surveyed provinces.

## 5. The methods

The primary focus of this research is to look into the impacts of microcredit value on household portfolios, including lending, savings, and investments. We face some methodological challenges due to lagged impacts, endogeneity issues, and the interrelationship between financial services. First, Based on our conceptual framework, we posit that the impacts of microcredit are not immediately noticeable but rather over a time lag [13,55]. For example, after receiving a loan, a household may engage in income-generating activities such as raising poultry or expanding the cultivated area of sugarcane. These activities need time to increase income, which then affects the household's portfolios. Second, in our regression model, there could possibly be unobserved factors that influence both the microcredit value and the outcome variables. When this occurs, the estimation results will be biased due to endogeneity [40]. Third, another concern is the possibility of correlations among dependent variables, including lending, savings, and investments; consequently, estimations derived from separate equations without accounting for these interdependencies may be biased and inefficient [56].

The regression model for this study is as follows:

$$Y_{it} = \gamma_0 + \gamma_1 credit\_value_{i,t-1} + \gamma_2 X'_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

In equation (1), $Y_{it}$ is the outcome variables, including lending value per capita, savings value per capita, and investment value per capita in year *t*. Our independent variable of interest is $credit\_value_{i,t-1}$, which represents the value of microcredit that household *i* had in the previous period. The purpose of using a lagged variable is to reflect the delayed impacts of microcredit. Because our data includes three waves (2016, 2017, and 2022), the inclusion of the lagged variable implies that the microcredit value of 2016 explains the outcome variables of 2017, and the microcredit value of 2017 explains the outcome variables of 2022. Because our sample lacks data prior to 2016, there are no explanations for 2016 outcomes, implying that observations in regression models will be 2.314 rather than 3471.

In addition to reflecting the late effects, lagging the independent variable of interest may help address the endogeneity issue caused by reverse causality [57]. Nevertheless, if there are unobserved confounders correlating with both the lagged microcredit amount and the dependent variable, the causal inferences drawn from equation (1) are still biased as a result of the issue of endogeneity. We adopted the instrument variable (IV) technique to address the possible endogeneity. An instrument variable must satisfy two conditions in order to be considered valid: (1) it must exhibit a correlation with the endogenous variable (relevance condition), and (2) it should only have an indirect effect on the dependent variable via its effect on the endogenous variable (exclusion restriction). In this study, we choose the house value as an instrument for the endogenous independent variable ($credit\_value_{i,t-1}$) in equation (1). There are two arguments supporting the justification for our choice. First, houses are largely utilized as collateral for credit borrowing in rural Vietnam [58]. A higher-value house helps increase the opportunity for a household to receive a large microcredit amount. A household also has a better chance of getting a high-value collateral-free loan if it owns a high-value house since the lender will have greater trust in the household's capacity to repay the loan. Therefore, house value reasonably satisfies the relevance condition. Second, houses are often seen as illiquid assets of a household [59], meaning they cannot be easily turned into cash and, therefore, do not have a direct impact on the family's lending, saving, and investment activities in a year. This proves that the instrument appropriately meets the exclusion restriction. In this study, we use a standard method to identify the weak instrument suggested by Stock and Yogo [60]. This involves comparing the Cragg-Donald Wald F statistic with the Stock-Yogo weak I.D. test critical values. If the value of the Cragg-Donald Wald F statistic exceeds Stock-Yogo weak I.D. test critical values, we may conclude that the null hypothesis of weak instrument identification is rejected [60].

In equation (1), $X'_{it}$ is a vector of control variables that encompasses a variety of household characteristics, such as the head's age, gender, marital status, and ethnicity; household size; the number of under-six children; the number of people over sixty; the number of members participating in sociopolitical organizations; the area of land the household manages; and income and asset losses as a result of shocks in the last year. We apply sub-district fixed effects ($\mu_i$) to control for unobserved heterogeneities across sub-districts. $\varepsilon_{it}$ is the independently distributed error term. The IV technique is carried out through two stages. In the first stage, we regress the lagged microcredit value ($credit\_value_{i,t-1}$) with the instrument (lagged house value). In the second stage, the outcome variables will be regressed on the predicted values of $credit\_value_{i,t-1}$, estimated in the first-stage regression, as well as other covariates. The *xtivreg2* STATA command is used to perform these two stages.

This research focuses on assessing the impact of microcredit value on three interrelated household financial services: lending, savings, and investments. Under such a situation, estimates derived from three separate equations ignoring the interrelationships of dependent variables may lead to bias. Therefore, in addition to using sub-district fixed-effects IV regressions, we pool the three waves of data and adopt a multivariate Tobit model to account for the correlation between pairs of dependent variables. The multivariate Tobit model has the advantage of simultaneously estimating the impacts of microcredit value on financial instruments while accounting for the correlation between error terms from equations [61]. One additional benefit of a multivariate Tobit model is that correlation coefficients between the error terms from equations may provide some insights into the relationships between each pair of household financial instruments [30]. Following Stanciole [62], Tuan et al. [30], and Haider et al. [63], we construct a recursive simultaneous multivariate Tobit model as follows:

$$Y^{c^*}_{i,t-1} = \beta_c X'_i + \gamma_c H_{i,t-1} + \varepsilon_{ci} \quad (2)$$

$$Y^{1^*}_i = \alpha_1 Y^c_{i,t-1} + \beta_1 X'_i + \varepsilon_{1i} \quad (3)$$

$$Y_i^{2^*} = \alpha_2 Y_{i,t-1}^{c} + \beta_2 X_i' + \varepsilon_{2i} \quad (4)$$

$$Y_i^{3^*} = \alpha_3 Y_{i,t-1}^{c} + \beta_3 X_i' + \varepsilon_{3i} \quad (5)$$

$$Y_{i,t-1}^{c} = \begin{cases} Y_{i,t-1}^{c^*}, \text{if } Y_{i,t-1}^{c^*} > 0 \\ 0, \text{if } Y_{i,t-1}^{c^*} \le 0 \end{cases}$$

$$Y_i^{1,2,3} = \begin{cases} Y_i^{1,2,3^*}, \text{if } Y_i^{1,2,3^*} > 0 \\ 0, \text{if } Y_i^{1,2,3^*} \le 0 \end{cases}$$

in the above equation system, $Y_{i,t-1}^{c^*}$ represents a latent variable for the observed microcredit value in year t-1 ($Y_{i,t-1}^{c}$). $Y_i^{1,2,3^*}$ is a set of latent outcome variables corresponding to observed outcome variables ($Y_i^{1,2,3}$), where $Y_i^1$ is lending value per capita, $Y_i^2$ stands for savings value per capita, and $Y_i^3$ represents investment value per capita). $X_i'$ is a vector of covariates, as already described in equation (1). $H_{i,t-1}$ denotes the house value of year t-1. The error terms $\varepsilon_{ci}, \varepsilon_{1i}$, $\varepsilon_{2i}$ and $\varepsilon_{3i}$ follow a multivariate normal distribution with a zero mean and variance-covariance matrix as defined below:

$$\begin{pmatrix} \varepsilon_{ci} \\ \varepsilon_{1i} \\ \varepsilon_{2i} \\ \varepsilon_{3i} \end{pmatrix} \sim N\left(0, \sum\right), \text{of which,} \sum = \begin{pmatrix} 1 & \rho_{c1} & \rho_{c2} & \rho_{c3} \\ \rho_{1c} & 1 & \rho_{12} & \rho_{13} \\ \rho_{2c} & \rho_{21} & 1 & \rho_{23} \\ \rho_{3c} & \rho_{31} & \rho_{32} & 1 \end{pmatrix}$$

where the off-diagonal element ($\rho_{jk} = \rho_{kj}$) represents the correlation between the error terms of any pair of financial tools. If the off-diagonal components in the covariance matrix do not equal zero, it supports the use of a multivariate Tobit model instead of using distinct Tobit models for each financial tool. A significant positive correlation coefficient ($\rho_{jk}$) between two financial instruments may suggest the existence of a complementary relationship between them. A significantly negative value of $\rho_{jk}$, on the other hand, could indicate the possibility of a substitution between two financial instruments. The multivariate Tobit model is estimated using a simulated maximum likelihood technique based on Halton sequence draws to compute the likelihood function [64]. This research uses a simulated maximum likelihood approach with 200 Halton draws to provide reliable estimates [65]. Estimates for the multivariate Tobit model are calculated using the *mvtobit* STATA command developed by Barslund [61]. In this study, the estimated results from both the IV regression model and the multivariate Tobit model are used to test the hypotheses in Section 3.

Because this research involved the analysis of pre-existing secondary data and no attempt was made to contact the participants, informed consent was not necessary.

**Table 1**
Descriptive statistics of variables.

| Variables | Description | 2016 | | 2017 | | 2022 | |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | Mean | SD |
| *Dependent variables* | | | | | | | |
| lendingP | Lending value per capita (PPP USD) | 194.83 | 2151.17 | 309.95 | 3695.59 | 257.46 | 2160.15 |
| savingP | Saving value per capita (PPP USD) | 442.93 | 2515.81 | 430.79 | 1534.47 | 1017.57 | 3458.29 |
| investP | Investment value per capita (PPP USD) on assets | 1443.76 | 3192.45 | 915.93 | 2685.00 | 959.00 | 3068.51 |
| *Independent variable of interest* | | | | | | | |
| credit_value | Microcredit value per capita (PPP USD) | 766.09 | 1953.58 | 1017.65 | 2263.56 | 733.06 | 2151.33 |
| *Household characteristics* | | | | | | | |
| head_age | Age of household head (years old) | 55.00 | 12.13 | 55.95 | 12.29 | 59.65 | 12.00 |
| head_gender | Gender of household head (male = 1, female = 0) | 0.80 | 0.40 | 0.78 | 0.41 | 0.76 | 0.43 |
| head_marital_status | Marital status of household head (married = 1, other = 0) | 0.81 | 0.39 | 0.80 | 0.40 | 0.78 | 0.42 |
| head_ethnicity | Ethnicity of household head (Kinh = 1, other = 0) | 0.81 | 0.39 | 0.81 | 0.39 | 0.80 | 0.40 |
| hhsize | Household size | 5.81 | 2.05 | 4.43 | 1.75 | 4.73 | 1.98 |
| no_children_under6 | Number of children younger than 6 | 0.22 | 0.47 | 0.26 | 0.53 | 0.21 | 0.50 |
| no_elderly | Number of older people (older than 60 years old) | 0.56 | 0.77 | 0.59 | 0.78 | 0.75 | 0.82 |
| no_social_member | Number of members participating in socio-political organizations | 2.11 | 1.38 | 2.01 | 1.51 | 1.29 | 1.06 |
| managed_land | Hectares of land under household management | 0.08 | 0.41 | 0.07 | 0.39 | 0.06 | 0.41 |
| loss_shockP | Income and asset losses from reported shocks in the last year (PPP USD) | 287.46 | 830.21 | 345.43 | 722.40 | 173.72 | 982.16 |
| *Instrumental variable* | | | | | | | |
| housevalue | The present market value of the house(s), land excluded, if sold (PPP USD) | 13836.24 | 16286.02 | 14077.49 | 18185.09 | 15924.73 | 19232.17 |
| | Obsevations | 1157 | | 1157 | | 1157 | |

## 6. The empirical results

### 6.1. Descriptive statistics

Table 1 displays the characteristics of the variables in the regression models. All monetary values were converted to the 2005 purchasing power parity US dollar (PPP USD). In terms of dependent variables, the average per capita amount of money a household lent out in 2016 was around 195 USD. The value saw a rise to nearly 410 USD in 2017, followed by a fall to around 257 USD in 2022. In 2016, the average saving value per capita stood at 443 USD. However, it slipped to 431 USD in 2017 before experiencing a significant increase to 1018 USD in 2022. The per capita investment value on assets was 1444 USD in 2016, decreased to 916 USD in 2017, and then rose to 959 USD in 2022. The average value of microcredit per capita was approximately 766 USD in 2016, which increased to nearly 1018 USD in 2017, and then decreased to 733 USD in 2022.

In regards to household characteristics, the average age of the household head across years has been 55 or slightly higher. Approximately 80 % of household heads were married, and a similar percentage were male. The Kinh majority comprised approximately 80 % of our sample, while the remaining 20 % were members of ethnic minorities. The average number of household members in 2016 was 5.8, which fell to 4.4 in 2017 and slightly increased to 4.7 in 2022. The mean number of children aged under 6 was 0.22, 0.26, and 0.21 for the years 2016, 2017, and 2022, respectively. The mean number of older people was 0.56, 0.59, and 0.75 for the years 2016, 2017, and 2022, respectively. The average number of household members over the age of 60 was 0.56 in 2016, 0.59 in 2017, and 0.75 in 2022. In 2016 and 2017, the average adult member of a household participated in social-political organizations such as the communist party, the Vietnam Women's Union, and the Veteran Union, but this figure dropped to 1,29 in 2022. In 2016, each household managed an average of 0.08 ha of land. This figure decreased to 0.07 ha in 2017 and further fell to 0.06 ha in 2022. The per capita value of income and asset losses due to shocks was 287.46 USD in 2016, rose to 345.43 USD in 2017, and then fell to 173.72 USD in 2022.

### 6.2. The results from IV regressions

The estimation results of IV regressions are presented in Table 2. The Cragg-Donald Wald F statistic of all three regressions is equal

**Table 2**
Impacts of microcredit on financial portfolios from IV regressions.

| Variables | lendingP | savingP | investP |
|---|---|---|---|
| | (1) | (2) | (3) |
| credit_value$_{t-1}$ | 0.981[c] | 1.056[c] | 1.494[c] |
| | (0.000) | (0.000) | (0.000) |
| head_age | 8.191 | 13.919[a] | 0.497 |
| | (0.345) | (0.083) | (0.960) |
| head_gender | −33.515 | −41.855 | −54.955 |
| | (0.899) | (0.864) | (0.856) |
| head_marital_status | −13.941 | 423.132[a] | 152.658 |
| | (0.960) | (0.099) | (0.630) |
| head_ethnicity | −686.745 | −735.393[a] | −1126.638[b] |
| | (0.147) | (0.094) | (0.037) |
| hhsize | −67.153 | −118.292[c] | −13.612 |
| | (0.172) | (0.009) | (0.809) |
| no_children_under6 | 149.978 | 125.026 | 326.782[a] |
| | (0.356) | (0.406) | (0.079) |
| no_elderly | 10.975 | 23.334 | 11.173 |
| | (0.929) | (0.837) | (0.936) |
| no_social_member | 120.991[b] | 41.093 | 74.329 |
| | (0.044) | (0.461) | (0.281) |
| managed_land | −235.028 | −244.455 | 536.520[b] |
| | (0.197) | (0.147) | (0.010) |
| loss_shockP | 0.233[c] | −0.103 | −0.073 |
| | (0.007) | (0.197) | (0.462) |
| Sub-district fixed effects | Yes | Yes | Yes |
| Instrumental variable | housevalue$_{t-1}$ | housevalue$_{t-1}$ | housevalue$_{t-1}$ |
| F (11, 2231) | 4.30 | 4.48 | 5.68 |
| Prob > F | 0.0000 | 0.0000 | 0.0000 |
| Cragg-Donald Wald F statistic | 48.10 | 48.10 | 48.10 |
| Stock–Yogo weak I.D. test critical values (10 % maximal IV size) | 16.38 | 16.38 | 16.38 |
| Obsevations | 2314 | 2314 | 2314 |

Note: Standard errors are in parentheses; significance levels.
[a] < 10 %.
[b] < 5 %, and.
[c] < 1 %.

to 48.10, which is greater than the Stock-Yogo weak I.D. test with a 10 % maximum IV size (16.38). Hence, the null hypothesis that the instrument is weak is rejected. The house value is highly correlated with microcredit value and fulfills the relevance condition. For all three regressions, the coefficients for lagged microcredit value are positive and statistically significant at the 99 % confidence level. This indicates that microcredit value has a positive impact on the size of household lending, savings, and investments. These results are consistent with our hypothesis and conceptual framework, which postulate that microcredit enhances household resources, which in turn increases the amount of money available for various uses, including lending, savings, and investments.

Regarding the remaining statistically significant coefficients of other variables, we observe that the covariates have heterogeneous impacts on financial instruments. Head age and head marital status have a positive impact on savings but not on lending or investments. The coefficients of head ethnicity in columns 2 and 3 exhibit a negative and statistically significant relationship, indicating surprising findings that the Kinh majority engages in less lending and investments compared to other minority ethnicities. The savings of a household are adversely affected by its size. The number of household members who participate in mass organizations and, unexpectedly, the losses caused by shocks have a favorable association with lending. Furthermore, the number of children under six and the area of land managed by households positively influence the investments.

### 6.3. The results from the multivariate Tobit model

Before examining the main estimated outcomes of the multivariate Tobit model, we direct our attention to the correlation between the error terms (ρ), which are demonstrated in Table 3. The results indicate that all pair-wise residual correlations between financial instrument equations are statistically significant and positive. These suggest the presence of unobserved factors that simultaneously enhance the amounts of the pair of financial instruments. Lending, savings, and investments are regarded to some degree by households as complementary services. Significantly, the Likelihood ratio test of $\rho_{1c} = \rho_{2c} = \rho_{3c} = \rho_{21} = \rho_{31} = \rho_{32} = 0$ rejects the null hypothesis that there is no correlation between error terms ($\chi^2(6) = 233.271$, Prob $> \chi^2 = 0.000$). This implies that the estimated outcomes derived from distinct equation regressions might be inefficient and biased. This offers justification for employing a multivariate model.

The main findings of the multivariate Tobit model are presented in Table 4. The Wald test for the four equations of the multivariate Tobit model yields a highly significant result (Wald $\chi^2$, (44) = 714.97; Prob $> \chi^2 = 0.000$), implying that the null hypothesis of all regression coefficients being equal to zero is rejected. Similar to the IV approach, the recursive simultaneous multivariate Tobit method shows that microcredit programs have a positive impact on lending, savings, and investments. We argue that microcredit is a form of external resource that households can utilize to enhance their resources for both agricultural and non-agricultural production activities. These production activities generate income, which subsequently enables households to augment their savings, investments, and lending. This study's results are consistent with findings from Silva [27], and Aktaruzzaman & Farooq [28] in terms of the positive effect of microcredit on household savings. According to Aktaruzzaman & Farooq [28] microcredit receivers save more than non-receivers because they have to make sure they have sufficient money to cover the payments. Concerning the impacts of independent variables, we observe some results that are similar to those of the IV regression method. To be specific, there is a statistically significant positive effect of head age on savings. This finding is consistent with that of Nwosu et al. [66]. We also find favorable effects of head marital status on savings, of the number of members participating in mass organizations on lending, and of the losses of shocks on lending. Nevertheless, we additionally observe significant effects, which are not present in IV regressions, of some independent variables. These include the positive impacts of household size and the number of members participating in mass organizations on investments. In addition, unlike in IV regressions, we find no effect of the number of children under six on investments. Finally, different from IV regressions, we discover that the Kinh majority engages in all three financial services to a greater extent compared to other minority ethnicities. The differences in the impacts of covariates may arise from the fact that the IV regression model fails to include the interdependencies among dependent variables, while the multivariate Tobit model takes these interactions into account.

### 6.4. The results from a sub-sample

Our sample consists of households that have access to microcredit programs as well as those that do not. In the above analyses, we treat households without access as those having a microcredit value of zero. In this section, as a robustness check, we restrict our focus to a sub-sample of only households with access to microcredit rather than the whole sample. The results obtained using IV regressions and the multivariate Tobit model are shown in Tables 5 and 6, respectively. The findings are in line with the results obtained from the

**Table 3**
Correlation (ρ) between error terms in multivariate Tobit regressions.

| | $credit\_value_{t-1}$ | lendingP | savingP |
|---|---|---|---|
| lendingP | −0.358[a] (0.065) | | |
| savingP | −0.449[a] (0.049) | 0.277[a] (0.036) | |
| investP | −0.288[a] (0.079) | 0.214[a] (0.038) | 0.262[a] (0.036) |

Note: Likelihood ratio test: χ2(6) = 233.271, Prob > χ2 = 0.000; standard errors are in parentheses; significance levels.
*< 10 %.
**< 5 %, and.
[a] < 1 %.

**Table 4**
Impacts of microcredit on financial portfolios from the multivariate Tobit model.

| Variables | credit_value$_{t-1}$ | lendingP | savingP | investP |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| credit_value$_{t-1}$ | | 2.19[c] | 0.99[c] | 0.62[c] |
| | | (0.41) | (0.12) | (0.14) |
| housevalue$_{t-1}$ | 0.35[c] | | | |
| | (0.04) | | | |
| head_age | −31.82[c] | −79.63 | 25.29[b] | −15.30 |
| | (8.71) | (58.97) | (11.83) | (9.96) |
| head_gender | −13.20 | 2037.86 | 41.69 | −55.34 |
| | (264.61) | (1969.57) | (365.14) | (309.07) |
| head_marital_status | 47.41 | −1420.67 | 872.46[b] | 365.34 |
| | (276.32) | (2012.83) | (383.18) | (323.46) |
| head_ethnicity | 423.04[b] | 4394.43[c] | 1000.90[c] | 1293.67[c] |
| | (203.54) | (1682.94) | (292.88) | (252.56) |
| hhsize | 165.34[c] | −1089.31[c] | −64.92 | 127.54[b] |
| | (48.74) | (357.68) | (65.48) | (55.81) |
| no_children_under6 | −257.53 | 1708.87 | −163.04 | 117.91 |
| | (159.18) | (1088.27) | (225.23) | (185.81) |
| no_elderly | −207.21[a] | −941.86 | 5.01 | −22.05 |
| | (122.95) | (818.76) | (166.16) | (139.82) |
| no_social_member | −203.58[c] | 1771.35[c] | −8.72 | 195.26[c] |
| | (56.09) | (373.74) | (80.80) | (67.59) |
| managed_land | 59.95 | −1447.85 | −155.46 | 729.52[c] |
| | (186.77) | (1600.67) | (240.40) | (190.24) |
| loss_shockP | 0.28[c] | 0.69[a] | −0.07 | 0.10 |
| | (0.08) | (0.41) | (0.11) | (0.10) |
| Constant | 353.58 | −17,050.56[c] | −4550.05[c] | −2017.11[c] |
| | (570.45) | (4141.18) | (807.77) | (672.50) |
| Wald $\chi2$ (44) = 621.78 | | | | |
| Prob > $\chi2$ = 0.000 | | | | |
| Number of Halton draws = 200 | | | | |
| Observations = 2314 | | | | |

Note: Standard errors are in parentheses; significance levels.
[a] < 10 %.
[b] < 5 %, and.
[c] < 1 %.

whole sample. That is, similar findings can be derived from both econometric specifications regarding the positive impacts of microcredit on lending, savings, and investments.

## 7. Conclusion and policy implications

While prior research on the impacts of microcredit mostly concentrated on topics such as family income, expenditures, employment, and child education, this study shows that microcredit also influences financial portfolios. Specifically, this study uses TVSEP data collected from 1157 identical Vietnamese families over the 2016, 2017, and 2022 waves to investigate the effects of microcredit programs on household financial portfolios, including lending, savings, and investments. We apply the multivariate technique as well as the IV regression approach for different sample types. The results indicate that the size of microcredit has a positive effect on the amounts of lending, savings, and investments by households. The results are consistent with the conceptual framework. The findings remain robust when using different econometric models and varied sample definitions. In addition, the correlation coefficients calculated by the multivariate model suggest that lending, savings, and investments exhibit a degree of complementarity. The findings of our study reveal some policy implications, not just for Vietnam but also for countries sharing comparable features.

First, the favorable effects of microcredit on household financial portfolios reflect the effectiveness of current microcredit programs for enhancing household financial status. On the supply side, it is thus important to keep encouraging these programs in the coming years. The widespread availability of formal and semi-formal microcredit schemes may help reduce the occurrence of “black credit” among rural communities. Second, on the demand side, the positive effects of microcredit also suggest that policies centered on boosting access to microcredit programs are important. In order to enhance household access, banks should seek methods to simplify procedures and credit assessment. Encouraging household members to join mass organizations is another way to increase their access to microcredit programs from semi-formal microfinance providers. Also, a mass campaign to increase public awareness of the significance of microcredit is an effective method for enhancing credit access. Moreover, upgrading infrastructure facilities and extending the network of bank branches are effective methods to augment the accessibility of microcredit for rural families. Third, our research suggests that the amount of microcredit has a significant impact on the levels of lending, savings, and investments. Consequently, in order to improve the financial status of households, policymakers not only attempt to improve microcredit access but also concentrate

**Table 5**
Impacts of microcredit of household financial portfolios from IV regressions (sub-sample).

| Variables | lendingP | savingP | investP |
|---|---|---|---|
| | (1) | (2) | (3) |
| credit_value$_{t-1}$ | 1.570[b] | 0.336[b] | 1.539[b] |
| | (0.000) | (0.000) | (0.000) |
| head_age | 9.990 | 1.473 | −0.260 |
| | (0.643) | (0.740) | (0.989) |
| head_gender | −799.377 | 5.054 | −404.481 |
| | (0.246) | (0.972) | (0.515) |
| head_marital_status | 13.146 | −107.841 | 45.263 |
| | (0.985) | (0.440) | (0.941) |
| head_ethnicity | −1217.760 | −278.387 | −1012.020 |
| | (0.204) | (0.158) | (0.241) |
| hhsize | 0.533 | 25.597 | 49.324 |
| | (0.997) | (0.333) | (0.670) |
| no_children_under6 | 361.706 | 15.843 | 96.093 |
| | (0.318) | (0.832) | (0.768) |
| no_elderly | −31.268 | −39.514 | −59.834 |
| | (0.915) | (0.515) | (0.822) |
| no_social_member | 172.607 | 33.341 | 100.730 |
| | (0.212) | (0.242) | (0.419) |
| managed_land | −436.667 | −111.678 | 781.545[a] |
| | (0.285) | (0.184) | (0.034) |
| loss_shockP | 1.124[b] | 0.009 | −0.313 |
| | (0.000) | (0.855) | (0.167) |
| Sub-district fixed effects | Yes | Yes | Yes |
| Instrumental variable | housevalue$_{t-1}$ | housevalue$_{t-1}$ | housevalue$_{t-1}$ |
| F (11, 857) | 4.65 | 2.21 | 3.03 |
| Prob > F | 0.0000 | 0.0125 | 0.0005 |
| Cragg-Donald Wald F statistic | 27.36 | 27.36 | 27.36 |
| Stock–Yogo weak I.D. test critical values (10 % maximal IV size) | 16.38 | 16.38 | 16.38 |
| Obsevations | 940 | 940 | 940 |

Note: Standard errors are in parentheses; significance levels.
*< 10 %.
[a] < 5 %, and.
[b] < 1 %.

on the size of the loans. Phan et al. [45] stated that the average microcredit loan size for Vietnamese families is quite small. Thus, the microcredit providers should expand the credit room to assist households in allocating more to income-generating activities. Last, the results derived from the multivariate Tobit model reveal that financial instruments show a certain degree of complementarity. The complementarity implies that any policies that influence one instrument will have an impact on the others as well. This fact should not be overlooked when designing policies for households.

## 8. Limitations of the study

Our work offers several significant empirical findings, but it also has certain limitations. First, our data contains information about only two rural provinces in Vietnam. Thus, the generalization of the results should be done with care. The second limitation is related to the selected IV. We are only able to test the IV's relevance requirement in this study; the restriction exclusion requirement cannot be tested. Berg et al. [67] stated that it is difficult to find instrumental variables for microcredit that satisfy the exclusion restriction. Thus, future studies should find more instrumental variables.

## CRediT authorship contribution statement

**Thi Hai Au Nguyen:** Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Quoc Trung Trinh:** Writing – review & editing, Visualization, Supervision, Methodology. **Thi Loan Nguyen:** Writing – review & editing, Visualization, Supervision.

## Data availability statement

This study relies on data from the long-term project No. 20220831434900116103, funded by the Deutsche Forschungsgemeinschaft (DFG). For more detailed information, see http://www.tvsep.de. The data that supports this research's findings is available from the corresponding author upon reasonable request.

**Table 6**
Impacts of microcredit on financial portfolios from the multivariate Tobit model (sub-sample).

| Variables | credit_value$_{t-1}$ | lendingP | savingP | investP |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| credit_value$_{t-1}$ | | 3.94[c] | 0.33[c] | 1.34[c] |
| | | (0.69) | (0.04) | (0.08) |
| housevalue$_{t-1}$ | 0.47[c] | | | |
| | (0.06) | | | |
| head_age | −10.14 | 31.00 | 5.73 | 9.88 |
| | (11.80) | (147.56) | (7.21) | (20.66) |
| head_gender | 451.40 | 3417.64 | 214.14 | −472.39 |
| | (353.94) | (4787.45) | (227.24) | (623.28) |
| head_marital_status | −75.43 | −3354.78 | −237.03 | 222.31 |
| | (367.97) | (4697.06) | (230.27) | (648.24) |
| head_ethnicity | 519.50[b] | 4267.53 | 307.16[a] | 171.53 |
| | (244.77) | (3667.25) | (156.85) | (431.58) |
| hhsize | −23.60 | −2248.49[b] | 103.40[b] | 100.46 |
| | (67.14) | (937.57) | (41.29) | (117.27) |
| no_children_under6 | −256.83 | 4465.13[a] | −176.26 | −80.84 |
| | (192.64) | (2404.79) | (122.76) | (342.04) |
| no_elderly | −34.74 | −3310.26 | −144.98 | −184.69 |
| | (161.33) | (2066.05) | (99.25) | (278.83) |
| no_social_member | −237.78[c] | 1796.76[b] | 21.95 | 322.53[c] |
| | (69.91) | (842.93) | (42.63) | (119.20) |
| managed_land | 64.53 | −5425.79 | −139.23 | 1027.19[c] |
| | (254.30) | (5281.75) | (151.26) | (388.97) |
| loss_shockP | 0.30[b] | 3.12[c] | 0.08 | −0.22 |
| | (0.12) | (1.10) | (0.11) | (0.21) |
| Constant | 753.00 | −29,152.17[c] | −1935.77[c] | −3129.82[b] |
| | (742.02) | (9831.43) | (466.19) | (1314.32) |
| Wald $\chi2$ (44) = 861.03 | | | | |
| Prob > $\chi2$ = 0.000 | | | | |
| $\rho_{1c} = -0.446^{***}$ (0.076), $\rho_{2c} = -0.507^{***}$ (0.056), $\rho_{3c} = -0.685^{***}$ (0.030), $\rho_{21} = 0.356^{***}$ (0.066), $\rho_{31} = 0.358^{***}$ (0.065), $\rho_{32} = 0.420^{***}$ (0.049) | | | | |
| Likelihood ratio test of $\rho_{1c} = \rho_{2c} = \rho_{3c} = \rho_{21} = \rho_{31} = \rho_{32} = 0$: *$\chi2(6) = 148.863$, Prob > $\chi2 = 0.000$* | | | | |
| Number of Halton draws = 200 | | | | |
| Observations = 940 | | | | |

Note: Standard errors are in parentheses; significance levels.
[a] < 10 %.
[b] < 5 %, and.
[c] < 1 %.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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