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Does microcredit increase household food consumption? A study of rural Vietnam

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ABSTRACT

Although microcredit is considered a crucial tool for economic development, its contribution to improving the welfare of poor households is not well established. This study investigates this issue. We start with a theoretical model in which microcredit is used to finance the family business of a representative household. The household maximises its lifetime utility, which yields a dynamic optimal consumption path as a function of microcredit borrowing. Guided by the theoretical model, we then empirically estimate the impact of microcredit using a panel dataset of rural Vietnamese households for the period 2008–2016. We find that microcredit programs in rural Vietnam were effective in raising household food consumption in both the short and long terms. Nevertheless, the burden of loan repayment may have diminished food consumption with a lag.

1. Introduction

Microcredit is considered a vital tool for economic development and poverty alleviation. The additional resources households gain from microcredit, combined with the new knowledge, skills, and experiences they glean from microfinance institutions and peer associations, can permanently transform livelihoods. More stable household food consumption paths can support better nutrition and human capital formation and thus lead to long term productivity benefits.

Much research has been done to test the impact of microcredit on household welfare, looking at food consumption expenditure in particular. However, the findings are mixed. For example, Pitt and Khandker (1998) found that microcredit significantly improves annual household consumption expenditure in Bangladesh, whilst Roodman and Morduch (2009), using the same dataset, found an insignificant effect. Similarly, Quach, Mullineux, and Murinde (2005) confirmed that microcredit in Vietnam benefits borrowers in terms of food and non-food expenditure, while Nghiem, Coelli, and Rao (2012), using a quasi-experimental approach, found no significant effect of microcredit on household food consumption. The mixed findings suggest that more research, with better quality data and more appropriate methodology, is needed, in order to provide solid evidence on the impact of microcredit. Contributing to this strand of research, this paper explores how microcredit affects rural household food consumption in Vietnam.

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In Vietnam poverty is widespread, and the government has made significant efforts to alleviate it. These efforts include implementation of a number of microcredit programs that function primarily through state-owned banks in coordination with non-governmental organisations. However, despite the fact that these microcredit programs date back more than two decades, it is unclear whether and to what extent the programs have been effective in improving the welfare of rural households.

This study sheds light on this issue. We posit a theoretical model in which microcredit supports a representative household by financing its family business. The household is assumed to maximise its lifetime utility, which yields an optimal consumption path as a function of the household's microcredit borrowing. With reference to this theoretical consumption path, we then estimate the impact of microcredit empirically. We make use of a household dataset for the period 2008–2016 from the Vietnam Access to Resources Household Survey (VARHS). We find that microcredit programs in rural Vietnam appear to have been effective in raising household food consumption in both the short and long terms.

Most previous studies of microcredit in Vietnam utilised cross-section data or panel data with only short time frames, such as Quach et al. (2005) involving data from 1992 to 1998. Accordingly, these studies did not account for the dynamic aspect of household food consumption. By contrast, we use a dataset that covers a longer period of time and allows for analysis of the dynamics of household food consumption. As such, we are able to more comprehensively assess the impact of microcredit on the food consumption of rural Vietnamese households. Further, some previous studies, such as Nghiem, Coelli, and Rao (2012) and Swain, Sanh, and Tuan (2008), focused on household income and assets in examining the impact of microcredit. However, food consumption is the more relevant indicator in the sense that it directly affects household welfare whereas the effects of income and assets are indirect.

The remainder of this paper is structured as follows: Section 2 briefly overviews microcredit in Vietnam. Section 3 contains a survey of the empirical literature on microcredit and household food consumption. Section 4 describes the data. Section 5 presents a dynamic consumption model, which guides the subsequent empirical estimation. Section 6 specifies the econometric models and discusses the estimation strategy. Section 7 discusses the results, and Section 8 concludes.

2. Microcredit in rural Vietnam

In rural Vietnam, both formal and informal microcredit providers co-exist and play important roles in poverty alleviation. In this section we provide a brief overview of these two channels of microcredit provision.

2.1. Formal channel

In the formal channel, two state-owned banks, the Vietnam Bank for Agriculture and Rural Development (VBARD, also known as Agribank) and the Vietnam Bank for Social Policy (VBSP) are the major microcredit providers. The VBARD was established in 1988 with an initial mission of financing public businesses. In 1996, the VBARD changed its target customers to rural households in the agricultural sector. Since then, the bank has rapidly increased the number of customers from rural families. By 1996, the VBARD had served 3.5 million households (Creusot & Thanh, 2003), and by 2002, that number rose to 7 million (Lelart, 2006). The success of these microcredit services is partly due to connections with such organisations as the Women's Association, the Farmer's Association, and the Veteran's Association. These social groups play a significant role in disseminating information, finding customers, performing transactions, and facilitating the loan procedure. A shortcoming, however, is that VBARD lending is targeted toward clients who can meet a collateral requirement even as most rural poor lack collateral and are thus unable to qualify.

To reach the poor, the Vietnamese government established antecedents for what would later become the VBSP. The Fund for the Poor, founded in 1995, was transformed into a lending facility as the Vietnam Bank for the Poor (VBP) operating under VBARD management. The VBP aimed at providing low-interest loans to the poor with minimal collateral required. To be eligible, clients must have been classified as poor by the People's Committee of the local commune and the Ministry of Labour, Invalids, and Social Affairs of Vietnam (MOLISA). Loans were distributed to poor households *via* the social groups to which they belonged. Under this program, the number of low-income families with access to credit increased rapidly. In 1998, the VBP provided microcredit to about 0.6 million poor people (Conroy & MacGuire, 2000). In 2003, the VBP was restructured to establish the VBSP as a separate entity from the VBARD. The VBSP has since become a major non-profit bank that implements microcredit projects, originating both with the government and with non-government organisations, to provide low-interest loans to high-risk groups.

The total number of borrowers reached by microcredit in Vietnam has grown from 7.81 million in 2005 to 10.42 million in 2014 (ADB, 2014). The VBSP in 2014 accounted for 66.2 percent of lending in value terms with the VBARD accounting for 14.3 percent and other formal and semi-formal microfinance institutions for 19.5 percent.

Despite these efforts, many rural households are still unable to access formal credit for three major reasons. First, many potential borrowers live in remote areas while bank offices are usually located in commune centres or more urban areas. Moreover, to qualify, poor households must meet criteria such as being certified as poor by local authorities, or must be nominated by their social groups, or must demonstrate that the borrowing is for agricultural projects. All this results in high transaction costs to the poor.

Second, collateral requirements create a major barrier to the poor in accessing microcredit. Banks usually ask for collateral to ensure that borrowers make repayments in agreed time. Common forms of collateral are the red-book, land title, or permanent residence certificate which many poor households do not necessarily have.

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Third, formal credit providers offer funding for only limited purposes. Banks generally lend for income-generating projects, not for spending on consumption, health, or education. In sum, the formal financial system does not serve the full needs of the rural population. This gap is filled by informal microcredit providers.

2.2. Informal channel

Coexisting with the formal microcredit institutions, informal microcredit providers, which include moneylenders, relatives, friends, and other entities, play an important role in providing credit to rural families. Indeed, the Vietnam Household Living Standards Survey (VHLSS) showed that informal lending accounted for more than 70 percent of rural credit in 1992. This proportion dropped to 30 percent in 1998 due to expansion of formal lending channels by the Vietnamese government. The informal share of lending remained at about one third in the 2000s (Barslund & Tarp, 2008).

The high demand for informal credit is mainly due to the simplicity of the procedures and the freedom to use funds for consumption purposes. The relationship between creditors and debtors is based on trust. Prospective borrowers provide information, and lenders make decisions on whether and how much to lend to them. Information provided by borrowers might pertain to their skills or properties, their use of previous loans, and the level of their indebtedness. The repayment arrangement is flexible, perhaps weekly or monthly, or may not be specified at all. Informal lenders may provide loans for consumption purposes. Consumption loans are much needed in rural areas where households are vulnerable to any shock. Poor households do not have durable assets that can be converted to cash when they are hit by natural disasters, illness, or harvest shortfalls. In such hardship situations, consumption loans can tide households over until they regain stability.

Overall, the performance of both formal and informal microcredit sectors in Vietnam appears remarkable. Microcredit has been a factor in the reduction of poverty incidence in rural areas from 27.0 percent in 2010 to 13.9 percent in 2016 (Pimhidzai, 2018). Nevertheless, this still leaves many households struggling. A better understanding of the role of microcredit in raising the consumption of rural Vietnamese households is thus important.

3. Literature review

In this section, we review previous studies of the impact of microcredit on household food consumption, with an eye to methods used to control for estimation problems such as selection bias. We classify these studies into two broad categories according to whether the findings are for a significantly positive effect of microcredit on consumption or for a negative or zero effect.

3.1. Findings of a positive effect

A number of previous studies have found that microcredit generates a significantly positive impact on household food consumption. Attanasio, Augsburg, De Haas, Fitzsimons, and Harmgart (2015) examined the impact of joint liability lending in rural Mongolia where group and individual lending programs were randomly implemented across rural areas. By utilizing a randomised control survey, the study found that group loans enhance entrepreneurship among borrowing households. Notably, the likelihood of owning a business was seen to grow by nearly 10 percent relative to comparable villages. The study also found a positive connection between borrowing and food consumption. In contrast, individual lending programs were not found to reduce the poverty rate.

In a well-known study, Pitt and Khandker (1998) utilised instrumental variables to estimate the impact on household consumption of lending by three major microcredit institutions in Bangladesh. Using extent of land ownership as an instrument, the estimations showed a significant impact of microcredit on per-capita consumption. In the same vein, Schroeder (2010) found that microcredit had a significantly positive impact on per-capita consumption in Bangladesh.

Khandker (2005) found that loans to women led to an expansion in household consumption in Bangladesh. Quach et al. (2005) employed the Heckman two-step method to analyse the impact of borrowing on food consumption in Vietnam using VHLSS data for 1993 and 1998, and found a modest impact. To address the self-selection problem in borrowing, Imai and Azam (2012) and Khandker and Samad (2014) applied fixed effects estimators to panel data for Bangladesh to capture unobserved characteristics at both village and household levels. They found microcredit was associated with a significant increase in both income and consumption. Similar findings were obtained for Vietnam by Duong and Nghiem (2014).

Islam (2015) used village fixed effects to address the non-random nature of program placement and instrumental variables to deal with self-selection and found that the effects of microcredit on food consumption in Bangladesh were heterogeneous among households. The author concluded that the poorest participants achieved the biggest increases in food consumption, and female borrowers received greater benefits than males. Islam and Maitra (2012) found that microcredit in Bangladesh played a role as insurance for rural households against health shocks. The authors pointed out that microcredit can help rural borrowers to maintain their consumption, and avoid selling their livestock, in response to health shocks.

Duong and Thanh (2014) evaluated the impacts of microcredit on the income and food consumption of rural household in Vietnam by using VHLSS data for 2006 and 2008. To deal with the selection bias, the authors applied propensity score matching (PSM) and difference in differences (DiD) methods. Their results showed a significant improvement in rural

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household food consumption and income due to microcredit. However, they found no evidence to support an increase in income among the rural poor. The authors suggested that local authorities should provide training in skills or business management to mitigate misuse of loans. Phan, Gan, Nartea, and Cohen (2014) also employed a PSM approach to analyse cross-section data for rural Vietnam in 2010. They found that VBSP loans affected food consumption and further that the effects were stronger among the "true poor" as certified by local authorities. Using a DiD approach, Li, Gan, and Hu (2011) analysed household data for rural China and found that microcredit to rural borrowers raised both consumption and income. However, they also found that the main beneficiaries were non-poor households.

3.2. Findings of a negative or no effect

Not all previous studies found that microcredit provided significant benefits to borrowers. Some found adverse effects or no connection between microcredit and household consumption.

Coleman (1999), using a quasi-experimental survey in Thailand, found no significant impact of microcredit on physical assets, labour time, or consumption expenditure. Lack of a discernible effect may be due to Thailand's relatively high income such that small loans do not matter as much. Crépon, Devoto, Duflo, and Parienté (2015) assessed the impact of microcredit on self-employment activities and consumption in Morocco using a quasi-experimental approach with instrumental variables to address the self-selection problem. They found a negative impact of microcredit on self-employment, although no effect on consumption.

Utilising a credit scoring technique to randomly select a treatment group, Karlan and Zinman (2010) found that microcredit did not affect food consumption in Manila. In an earlier study, Karlan and Zinman (2008) also find no significant benefit from microcredit borrowing by conducting a randomised trial in the Philippines, despite having found significant results in South Africa using the same method. The insignificant impact may be due to their focus on consumer credit rather than micro-entrepreneurial credit.

Banerjee, Duflo, Glennerster, and Kinnan (2015) used randomised trials to examine the effect of microcredit loans in Hyderabad, India. They randomly assigned groups of slums into control and treatment groups, where treatments groups benefited from access to new microfinance offices. They then analysed the impact of microcredit 15 to 18 months after opening the new offices and found no evidence of a change in average per capita food consumption. They did, however, find an increase in consumption of durable goods by those households who ran existing businesses. Augsburg, De Haas, Harmgart, and Meghir (2015) used a similar randomised controlled trial to analyse the impact of microcredit in Bosnia and Herzegovina. They found a negative effect of microcredit on food consumption and savings despite a positive impact on self-employment and labor supply.

Roodman and Morduch (2009) replicated the work of Pitt and Khandker (1998) for Bangladesh. They performed a regression discontinuity estimation and found that consumption was not driven by microcredit borrowing, in contradiction of the original findings of Pitt and Khandker. They argued that the eligibility criterion of owning land at some threshold level was not enforced and that therefore the use of this as an instrumental variable was not valid.

3.3. Assessment

Previous studies of the effect of microcredit on consumption have yielded inconclusive results. A complicating issue in the empirical estimation is that households self-select into microcredit borrowing, resulting in a bias that needs to be corrected. Researchers have generally relied on two approaches for this. One is to rely on quasi-experimental approaches or randomised control trials to determine access to microcredit and thus avoid household-based choice in borrowing. The other is to employ instrumental variables when observational data are used. Regardless of approach, however, the findings in the existing literature are conflicting as to the effect of microcredit on consumption.

Quasi-experimental and randomised control trial approaches are time-consuming and costly to implement. In contrast, with the availability of high-quality observational data involving long time series, it is feasible and less costly to adopt an instrumental variables approach, as we opt to do in this study. Specifically, we make use of nine years of time series data from 2008 to 2016 for rural households in Vietnam. We control for possible endogeneity and self-selection bias by employing system generalised method of moments (SGMM) and difference generalised method of moments (DGMM) estimation techniques with external instrumental variables.

4. Data

This study employs data from the Vietnam Access to Resources Household Survey (VARHS), which has been conducted every two years since 2002 for a select group of 12 provinces.[1] To obtain a representative sample of rural households, a three-

[1] The surveys are conducted under a collaboration involving the Central Institute for Economic Management of Vietnam, the Institute of Labour Science and Social Affairs of Vietnam, the Institute of Policy and Strategy for Agriculture and Rural Development of Vietnam, and the University of Copenhagen in Denmark. The 12 provinces covered are Ha Tay, Lao Cai, Phu Tho, Lai Chau, Dien Bien, Nghe An, Quang Nam, Khanh Hoa, Dak Lak, Dak Nong, Lam Dong, and Long An.

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Table 1
Sample size for the VARHS surveys, 2008–2016.

Year	2008	2010	2012	2014	2016
Households	3,269	3,208	3,704	3,648	3,582
Individuals	15,844	14,904	16,585	16,206	15,665
New households	1,184	106	598	136	77
Attrition households	239	45	103	191	143

Source: VARHS, 2008–2016.

level stratified sampling design is employed. First, the primary commune units were randomly chosen. Second, from each commune, three census enumeration locations were selected randomly. Third, from each census enumeration location, sample households were chosen randomly.

Sample sizes for the five survey rounds from 2008 to 2016 are shown in Table 1. Following expansion through earlier rounds, the number of households stabilised at around 3500 and the information collected was standardized. To compensate for attrition, new households are added with each round.

Table 2 shows, by year, the number and share of households that took out at least one microcredit loan and the sources of those loans. The number of households that accessed microcredit increased from 1,242 (43.8 percent) in 2008 to 1,457 (51.4 percent) in 2010, and then declined to 834 (29.4 percent) in 2016. This is because since 2010 the government has implemented policies to encourage more formal microcredit lenders to enter the market and to protect against risks of a "credit trap". However, the formal institutions usually require collateral such as land title or other valuable assets, which many rural borrowers do not have. As a result, it became more difficult for rural households to access both formal and informal microcredit.

Table 2 further shows the preponderance of credit originating from formal sources. The share of formal credit was fairly stable at around two-thirds through 2014, then showed a discernible increase in 2016 to 73.9 percent. The increase in 2016 occurred due to significant government efforts to reduce risks from informal credit sources.

In our econometric estimations, we employ a balanced panel dataset where households appeared in all years, 2008-2016. We then further restricted the sample by excluding those households that borrowed for consumption purposes, leaving only those that borrowed for income generating purposes, for example, to invest in family businesses.[2] These restrictions, together with data cleaning, reduce the sample size from 14,185 to 12,202. Moreover, to mitigate any potential bias related to commune characteristics, we exclude communes that contain only borrowing households or only non-borrowing households. This filter further decreases sample size to 11,647 households to be used in the estimations.

5. Theoretical framework

In order to examine the impact of microcredit borrowing on food consumption, we first derive an optimal consumption path as a function of microcredit borrowing based on dynamic utility maximisation. We then use the optimal consumption path to guide the empirical estimation.

5.1. Household optimizing framework

A representative household chooses a consumption path to maximise the present value of lifetime utility, U:

$$\max_{\{C_t\}} U = \sum_{t=0}^{\infty} \rho^t \frac{C_t^{1-\sigma} - 1}{1-\sigma} \tag{1}$$

where utility in year t is given by a constant elasticity of substitution (CES) utility function; C_t is consumption in year t ; ρ is a discount factor; and σ is the elasticity of substitution between consumption and saving.

In each year, the household receives income, inherits wealth from the previous year, consumes goods and services, and makes repayments on microcredit borrowing of previous years. Accordingly, the household faces the budget constraint:

$$W_{t+1} = (1+r)\left[\tilde{Y}_t + W_t - (1+r)M_{t-1} - C_t \right. \tag{2}$$

where W is household wealth; $\tilde{Y}$ is household income; r is the rate of interest; and M is the amount of microcredit debt.

[2] We exclude households that borrow for consumption purposes because the impact on consumption is straightforward. The survey data identify 14 loan purposes: (1) rice production; (2) other crop production; (3) animal husbandry; (4) forestry; (5) fishery; (6) non-farm activity; (7) build/buy house ; (8) buy land; (9) buy another asset; (10) pay for wedding/funeral; (11) education expenses; (12) health expenses; (13) general consumption; (14) other consumption. We exclude households who borrowed for items (10)-(14).

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Table 2
Frequency and source of credit for households with loans.2008–2016.

Year	2008	2010	2012	2014	2016
Total (number of households)	1,242	1,457	1,113	997	834
1 loan	953	972	830	755	692
2 loans	224	370	220	187	112
3 loans	65	115	63	55	30
% of households with loans	43.8	51.4	39.2	35.1	29.4
By source (%)					
Formal credit	67.4	69.0	67.9	64.4	73.9
VBSP	25.7	42.5	38.5	29.3	28.7
VBARD	24.8	16.4	20.4	24.1	31.4
Other formal banks	2.6	2.8	2.3	2.3	7.3
Group schemes	14.3	7.4	6.6	8.7	6.6
Informal credit	32.6	31.0	32.1	35.6	26.1
Money lenders	15.6	12.4	11.3	13.3	11.1
Friends and relatives	15.0	14.9	18.5	20.4	12.5
Other sources	2.1	3.7	2.4	1.9	2.6

Source: VARHS, 2008 – 2016.

The household receives income ($\tilde{Y}$) from two sources. One is earnings from small businesses the household owns (including farming) and finances with microcredit borrowing, Y_B, and the other is all else (*e.g.*, labour wage and remittances), Y:

$$\tilde{Y}_t = Y_{B_t} + Y_t \tag{3}$$

Running a small business requires households to have capability (*e.g.*, entrepreneurship), which is only partly observable. Let z denote household capability such that $z = \check{z}\tilde{z}$, where $\check{z}$ is the observed component, which depends on a set of factors to be specified shortly, and $\tilde{z}$ is the unobserved component, which is distributed over the range $\left[0, \bar{\tilde{z}}\right.$ with upper bound $\bar{\tilde{z}}$ and cumulative distribution function (CDF) $1 - G(\tilde{z})$. To achieve business success, a threshold level of capability is needed, which is denoted as $\underline{z}$. Given the CDF of $\tilde{z}$, we can write the probability of achieving success in business as follows:

$$p = Prob\left(z > \underline{z}\right) = Prob\left(\tilde{z} > \underline{z}\check{z}^{-1}\right) = G\left(\underline{z}\check{z}^{-1}\right) = G(C, E, S, H) \tag{4}$$

where the observed component of capability ($\check{z}$) is a function of household consumption, C; education, E; social networks, S; and other household characteristics, H; and with slight abuse of notation we still use $G(.)$ in the last equality.

5.2. Factors affecting household capability

Conceptually, food consumption, education, and social networks all affect household capability. For example, the more food one consumes, the better nutrition one receives (to a degree), and thus the higher is one's productivity and chance of achieving success in business. Education is a measure of human capital, which impacts the probability of success in business positively. One's social network also contributes to the probability of success in business by enhancing access to external resources and opportunities for exchange of knowledge and experiences.

The vector of other household characteristics (H) includes household experience (age of household head, whether the household is local), resources (household size, area of land owned, number of dependent members, involvement in non-farming business activities, income from sources other than the household business), and economic status (whether the household is classified as poor, whether it experiences any income shock), and finally a year indicator. These household characteristics are expected to signal the underlying household capability for business success. For example, an older household head with more experience is better able to deal with unforeseen situations. Moreover, local households have better understanding of the local business environment than households that migrated from other communes.

Labour (household size) and land are two important inputs for a household business, in particular a farming business. Accordingly, we expect these characteristics to enhance a household's probability of success in business. The number of dependent members of the household reflects a burden as it requires the allocation of limited resources toward looking after them with consequent negative effect on the probability of success in business.

A household's involvement in non-farming activities can affect its likelihood to succeed in business. However, the direction of such effect is not clear cut. On the one hand, the involvement is likely to equip the household with relevant experience, for example, to help perform better in risk management, which will increase the probability of success. On the other hand, as farming is the major livelihood strategy in rural areas, a household might pursue non-farming activities only because of lack of agricultural inputs, such as land and/or labour. For example, a household may be forced to engage in

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fertiliser trading or handicraft production because it does not have farm land. In such cases, resorting to non-farming activities suggests a lower probability of success in business.

Household status variables, such as whether a household is classified as poor[3] and whether it experiences an income shock, are also determinants of capability. If a household is classified as poor, it will be targeted in economic development programs and may receive public support, which can help it achieve success in business. On the other hand, being classified as poor might be due to low capacity which in the absence of outside support may doom it to a lower probability of business success.

Finally, we include a time dummy to control for unobserved year-specific factors that impact the probability of achieving business success.

5.3. Derivation of the estimating equation

Taking account of the array of factors that bear on the probability of achieving success in business, the expected income from the business can be written as:

$$Y_{B_t} = Prob\left(z_t > \underline{z}\right) \times AK_t^{\alpha} = G(C_t, E_t, S_t, H_t) \times AK_t^{\alpha} \tag{5}$$

where A denotes the productivity of business capital stock in year t, K_t ; and α is the elasticity of business income with respect to capital. K_t is derived as the depreciated capital stock of the previous year plus investment from microcredit borrowing in the current year, M_t, such that $K_t = (1-\delta)K_{t-1} + M_t$ where δ is the depreciation rate.

Utilizing the dynamic programming technique (Bellman & Dreyfus, 2015), the Bellman equation corresponding to Eq. (1) can be written as:

$$V(W_t) \equiv \max_{\{C_t\}} \{u(C_t) + \rho V(W_{t+1})\}. \tag{6}$$

The first-order condition yields the Euler equation given by:

$$C_t = \left(\frac{\rho \frac{\partial W_t}{\partial C_{t-1}} \frac{\partial W_{t+1}}{\partial W_t}}{\frac{\partial W_{t+1}}{\partial C_t}}\right)^{\frac{1}{\sigma}} C_{t-1}. \tag{7}$$

Taking the derivative of the budget constraint (2) with respect to C_t and C_{t-1}, Eq. (7) can be rewritten as:

$$C_t = \left(\frac{\rho\left(\frac{\partial G(C_{t-1}, E_{t-1}, S_{t-1}, H_{t-1})}{\partial C_{t-1}} AK_{t-1}^{\alpha} - 1\right)(1+r)}{\frac{\partial G(C_t, E_t, S_t, H_t)}{\partial C_t} AK_t^{\alpha} - 1}\right)^{\frac{1}{\sigma}} C_{t-1}. \tag{8}$$

Taking natural logarithms of both sides of Eq. (8), and linearizing $\frac{1}{\sigma} ln\left(\frac{\partial G}{\partial C_{t-1}} AK_{t-1}^{\alpha} - 1\right)$ and $\frac{1}{\sigma} ln\left(\frac{\partial G}{\partial C_t} AK_t^{\alpha} - 1\right)$, we obtain the following estimable equation:

$$lnC_t = \beta_1 + \beta_2 lnC_{t-1} + \beta_3 lnE_t + \beta_4 lnE_{t-1} + \beta_5 lnS_t + \beta_6 lnS_{t-1} + \beta_7 \ln K_t + \beta_8 \ln K_{t-1} + \beta_9 \ln H_{t-1} + \beta_{10} \ln H_t + \varepsilon_t \tag{9}$$

where the β coefficients are to be estimated from the data; and ε_t is an error term.

6. Estimation strategy

Eq. (9) links optimal household food consumption to microcredit borrowing (*via* the capital stock variable) and other explanatory variables. To evaluate the impact of microcredit on food consumption, we empirically estimate Eq. (9) using the survey data from Vietnam.

6.1. Technical challenges

Estimating Eq. (9) is faced with two challenges, namely, the presence of the lagged dependent variable and the non-random nature of the household borrowing decision. The lagged dependent variable (C_{t-1}) results in correlation between household characteristics and time-invariant unobserved household heterogeneity. In other words, the assumption that $E[X_t \varepsilon_t = 0$, where X is a vector of all explanatory variables in Eq. (9), does not hold. Therefore, using the ordinary least squares estimator or standard panel estimators, such as fixed effects or random effects estimators, will lead to inconsistent estimates of the coefficients (Hsiao, 2014). A widely-used approach to dealing with this problem is to adopt the Difference Generalised Method of Moments (DGMM) estimation (Arellano & Bond, 1991), which involves removing the fixed effects by first

[3] Local authorities classify a household as poor if its income is below the official poverty line (for example, $1.25/person/day for rural Vietnam in 2016). Once a household is classified as poor, the local authorities issue a certificate to confirm this status, which is reviewed every year.

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differencing, and then using lagged levels of the dependent variable as instruments for the endogenous and predetermined variables. However, this approach has been found to be weak in two situations: (1) when the dependent variable is close to a random walk, so that past levels are weak instruments as they convey little information about current changes, and (2) when the time series in the panel is short such that cross-sectional variation overwhelms the time variation (Bond, Hoeffler, & Temple, 2001).

To address these weaknesses, Blundell and Bond (1998) consider additional moment conditions to form a System GMM (SGMM) estimation technique. The SGMM estimator includes a simultaneous system of the level equations and the first-differenced transformed equations. In the first-differenced equations, the lagged levels of predetermined and endogenous variables are employed as instrumental variables (similar to those in the DGMM estimator), and in the level equations, the instruments used are differences of these variables to make them exogenous to the fixed effects. Given our short panel of only five time periods combined with a cross-section of 2,699 households, the SGMM estimation is more appropriate than DGMM (see Blundell & Bond, 1998). Nevertheless, we also report DGMM results, for comparison.

The second challenge is the selection bias in household borrowing, which also renders $E[X_t\varepsilon_t = 0$ invalid. The selection bias can occur from both demand and supply sides. On the demand side, households may be more likely to borrow when they possess superior knowledge or skills (entrepreneurship) that enable them to better exploit business opportunities. Similarly, on the supply side, microfinance lenders may regard knowledge and skills as indicators of likely success in business and loan repayment.

To address the problem of selection bias, we instrument the microcredit borrowing variable (K). Note that although the SGMM estimator employs lags and differences as internal instruments, this may not be sufficient to eliminate the selection-bias problem. Therefore, we employ the loan interest rate as an excluded instrument for microcredit. The interest rate is largely determined on the supply side in the micro-finance market with borrowers being in a very weak bargaining position. Therefore, the given interest rate directly affects a household's decision to borrow, but not its decision on food consumption (other than indirectly through the effect on borrowing). Education (E) and social network (S), too, may not be strictly exogenous but may rather reflect choices made in conjunction with food consumption and borrowing decisions. Accordingly, we also employ excluded instruments for these variables.

6.2. Variable definitions and summary statistics

Table 3 reports variable definitions and summary statistics. Household food consumption (C) is taken as expenditures on food, both inside and outside the household. As can be observed from Table 3, on average, a rural household in Vietnam spends over 10 million VND (478 USD) annually for food.

Accumulated microcredit borrowing (capital stock, K), the variable of interest, is measured as $K_t = (1-\delta)K_{t-1} + M_t$, where δ is the depreciation rate (5% per annum); and M_t is the microcredit borrowing in the current year. The capital stock, K, allows for the microcredit borrowing of previous years to play a role in the business in the current year, subject, however, to depreciation. The capital stock in the initial year, K_0, is set as microcredit borrowing in 2008, namely $K_0 = M_0$. The average accumulated capital for sample households is 25.3 million VND (1,150 USD). At the high end, some households accumulated capital of more than 3 billion VND (150,000 USD), while others had no accumulated capital.

The interest rate, used as an instrument for K, is calculated as the average interest rate on loans at prefecture level. The average interest rate for the sample is 3.82 percent, which is lower than interest rates normally observed in Vietnamese

Table 3
Variable definitions and summary statistics.

Variables	Description	Min	Max	Mean	Std. Dev.
C	Household food consumption (1000VND)	497	207,420	10,370	9,025
K	Accumulated microcredit borrowing (1000VND)	0	3,238,543	25,290	104,442
S	Social network size (index)	0	100	10.2	6.3
E	Education measured as the sum of schooling gaps relative to expected schooling for household children (years)	0	47	2.0	4.3
Y	Income from sources other than the household business (1000 VND)	0	1,576,355	30,726	47,804
EduH	Schooling of household head (years)	0	12	6.0	3.9
HSize	Household members (number)	1	17	4.6	2.0
AgeH	Age of household head (years)	18	100	51.5	13.7
Plot	Land holding (m^2)	0	844,910	10,612	17,510
Dep	Dependent members (number)	0	10	1.8	1.4
Nfarming	Whether a household is involved in non-farming business activities (1-yes; 0-otherwise)	0	1	0.25	0.43
Shock	Whether a household experienced an income shock (1-yes; 0-otherwise)	0	1	0.51	0.50
Poor	Whether a household is classified as poor by authorities (1-yes; 0-otherwise)	0	1	0.19	0.39
Local	Whether a household is local (1-yes; 0-otherwise)	0	1	0.78	0.42
Irate	Average interest rate of loans obtained within a prefecture (%)	0	76.41	3.82	36.3
HiE	Highest level of education of a member in the household (number of school years)	0	12	9.27	3.07
DiR	Distance to the nearest all-weather road (km)	0	80	3.5	7.66

N = 11,647, VARHS.2008–2016.

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credit markets of over 10 percent. This is a sign that the Vietnamese government has supported rural residents by lowering interest rates in rural areas.

The social network index (S) is calculated from four elements using principal components analysis. The four elements are: number of social events attended (weddings, festivals, or birthday parties); number of memberships in social associations; total duration of memberships in these social associations; and diversity of these social associations.[4] The index is subsequently transformed to a 0–100 scale to avoid difficulty in interpretation of negative values. The mean value of the social network index is 10.2.

To instrument the social network variable (S), we use distance to the nearest all-weather road since households who live closer to all-weather roads are likely to have better opportunities to make contacts and access information than those who live in more remote areas. Moreover, it is unlikely that this distance will affect household food consumption directly. The average distance from sample homes to an all-weather road is 3.5 km while the longest distance recorded is 80 km.

Education (E) is measured as the sum of school gaps of all children in a household. The school gap is the difference between actual years of schooling and expected years of schooling given a child's age (Islam & Choe, 2013). Children are expected to be in school from age six to age 18 such that 18-year-olds should have received 12 years of schooling. The average school gap per household is found to be two years, indicating that rural households in Vietnam face difficulties in sending their children to school. Many poor households find they must forego education for their children so that they can work to make a contribution to the household.

To instrument education, we make use of the highest level of education of a household member (number of school years). The most educated household member can serve as a role model to inspire others to pursue education. Conceptually, the highest level of education in the household should not directly affect the household's food consumption.

Income, Y, from sources other than the household business include (1) net income from wages/salaries; (2) net income from common property resources such as earnings from collecting forest products or hunting in forest areas not owned or rented by the household; (3) net income from private transfers, such as remittances from relatives; (4) net income from public transfers, such as remittances from government support programs; (5) income from other sources not related to the household business financed by microcredit. On average, a sample household earned almost 31 million VND (1,428 USD) from these five sources of income.

The average age of the household head is almost 52 years. Households own an average 1.06 ha of land. Around 19 percent of households are classified as poor. Local residents (non-migrants) comprise 78 percent of the population. More than half of households (51 percent) experienced at least one income shock in the past 2 years.

In the empirical estimation, we use logarithm transformations of some variables, which requires non-zero values. Therefore, we add one to variables that contain zero before the logarithm transformation. Such a strategy is also used by Mark and Shahidur (1998) and Roodman and Morduch (2014). All nominal monetary variables are converted to real terms using the producer price index with base year 2008 (General Statistics Office of Vietnam, 2017).

7. Results

We regress each endogenous variable, namely accumulated microcredit (K), school gap (E), and social network size (S), on all exogenous variables, and then test whether the three external instruments are jointly significant. The associated F statistics are 5.29, 49.91, and 41.72, respectively, all of which are all significant at the one percent level.

Table 4 reports SGMM estimation results.[5] Column 1 presents the results without external instruments, and Column 2 results with external instruments. While there exist variations in the magnitude of point estimates, the signs remain consistent. The parameter of focus is the coefficient of accumulated microcredit borrowing (K), which measures the elasticity of food consumption with respect to K. The results show that a one percent increase in the contemporaneous value of accumulated microcredit borrowing leads to a 0.177 percent increase in household food consumption with the external instruments, or a 0.461 percent increase without the external instruments, both statistically significant at the one percent level. This finding supports the hypothesis that microcredit borrowing helps rural households improve their living standards through financing business activities, and confirms the important role of microcredit in economic development in rural Vietnam. The finding is consistent with those of Islam (2015); Kaboski and Townsend (2012); Li, Gan, and Hu (2011b), and Li, Gan, and Hu (2011c) who report a positive impact of microcredit on food consumption in Bangladesh, Thailand, and China, respectively.

The coefficient of one-period[6] lagged accumulated microcredit borrowing is estimated at -0.150, which is significant at the one percent level (or −0.438 without the external instruments, also significant at the one percent level). Thus the

[4] Households were asked two questions regarding diversity of social associations: (1) Are members of this association mostly of the same extended family/family network/blood? (2) Do members of this group mostly have the same occupation? Answers are coded 2 for yes, 1 otherwise. The score is taken as the sum of these two values.

[5] One might wonder whether inclusion of the external instruments in the SGMM estimation improves efficiency since the number of internal instruments is already large. Table 4 thus reports SGMM results both with and without external instruments. In addition, Appendix Table A1 reports the results of DGMM estimations. We note differences between point estimates from SGMM and DGMM. As discussed in Section 6.1, the DGMM estimator is not well suited to our data given the short time series of five periods. Our discussion is therefore confined to the SGMM estimation results.

[6] Note that since the data are bi-annual, a one-period lag corresponds to two years.

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Table 4
Impact of microcredit on household food consumption, SGMM estimation.

	without external IVs		with external IVs	
	Coefficients	Robust SE	Coefficients	Robust SE
$log\ C_{t-1}$	−0.0365	0.110	0.119***	0.045
$log\ K_t$	0.461***	0.178	0.177***	0.056
$log\ K_{t-1}$	−0.438***	0.154	−0.150***	0.048
E_t	−0.0351	0.164	−0.116***	0.041
E_{t-1}	0.104	0.100	0.0893***	0.032
S_t	0.704***	0.134	0.190***	0.053
S_{t-1}	−0.401***	0.100	−0.0983**	0.039
$log\ Y_t$	−0.0532*	0.029	0.0108	0.010
$log\ Y_{t-1}$	0.0515**	0.026	0.0180**	0.009
$EduH_t$	−0.0875**	0.037	−0.000567	0.012
$EduH_{t-1}$	0.0108	0.032	0.00433	0.010
$HSize_t$	−0.302**	0.132	0.0383	0.048
$HSize_{t-1}$	0.154	0.096	−0.0240	0.034
$AgeH_t$	−0.0106	0.013	0.00655	0.005
$AgeH_{t-1}$	−0.00180	0.013	−0.00898**	0.005
$log\ Plot_t$	−0.171*	0.104	0.153***	0.051
$log\ Plot_{t-1}$	0.163*	0.087	−0.127***	0.042
Dep_t	0.152	0.111	0.0182	0.038
Dep_{t-1}	−0.108	0.169	0.0249	0.046
$Nfarming_t$	−0.796***	0.231	−0.152**	0.073
$Nfarming_{t-1}$	0.621***	0.155	0.238***	0.051
$Shock_t$	−0.367***	0.116	−0.154***	0.037
$Shock_{t-1}$	0.341**	0.133	0.0609	0.045
$Local_t$	0.120	0.168	0.0565	0.055
$Local_{t-1}$	0.0318	0.177	0.0197	0.057
$Poor_t$	0.0781	0.185	−0.104	0.065
$Poor_{t-1}$	−0.0688	0.144	−0.139***	0.048
Year	YES		YES	
AR(1)	−4.58***		−4.59***	
AR(2)	0.72		1.03	
Hansen test	20.61		18.70	
Instruments	42		45	
Observations	9,220		9,220	
Households	2699		2699	

Note: ***, **, and * indicate significance at 1, 5, and 10%, respectively.

previous period's accumulated microcredit borrowing negatively affects a household's current-period food consumption. An increase in the previous period's accumulated borrowing indicates an increase in the repayment burden, which may be the reason for a decrease in current period food consumption, *ceteris paribus*.

We can calculate the long-run elasticity of food consumption with respect to accumulated microcredit borrowing by imposing the steady-state conditions, namely $lnC_t = lnC_{t-1}$ and $lnK_t = lnK_{t-1}$. The result shows that a one percent increase in steady state accumulated borrowing leads to a 0.031 percent increase in steady state consumption (a 0.022 increase without the external instruments). Thus in either the short run or the long run, microcredit borrowing appears to promote household food consumption in rural Vietnam through the financing of business activities.

The findings of a positive impact of microcredit borrowing on rural household food consumption indicate that Vietnam's approach to microcredit programs has been effective. Two features of Vietnam's microcredit market are likely to contribute to the positive impact of microcredit. First, Vietnam's microcredit providers focus more on group lending, rather than individual lending, where group members are familiar with each other and the leader is a reputable person in the community and takes responsibility for the group. Borrowers in the same group can easily communicate with each other, and so when one member achieves success in utilizing microcredit, his/her experience can be quickly shared with other members of the group. There also exists peer pressure within the group, such that each member has an incentive to perform well in utilizing microcredit. Second, in addition to the loan, the microcredit providers frequently provide short training workshops to their customers, which helps to improve the use of microcredit and increase the probability of business success.

Despite the significant and positive impact of microcredit on food consumption in both the short and long run, the negative coefficient on one-period lagged accumulated microcredit borrowing (K_{t-1}) suggests that microcredit can be a burden to rural Vietnamese. The more a household has borrowed in the past, the bigger the repayment burden, which in turn negatively affects consumption, *ceteris paribus*. On average, a household has accumulated capital from microcredit borrowing of approximately 1,150 USD, which amounts to around 40 percent of household income. The repayment burden is thus substantial. Besides, the relatively small size of microcredit borrowing limits the scope of investment options for

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households. On this scale of borrowing, households can only afford to invest in small projects which may not be profitable enough to service their loans and support higher standards of living unless borrowing continues.

In considering the impact of other explanatory variables on household food consumption, we focus on the model with external IVs. The gap in children's educational attainment (E) shows a negative contemporaneous effect on food consumption. A gap of one year in children's education is associated with a 0.12 percent decrease in current food consumption with statistical significance at one percent. This may be due to a household with lower academic achievement being less likely to succeed in business and thus suffering a lower living standard. However, a one period lag in the education gap is positively associated with food consumption, which may be a reflection of the economic contribution made by children when not attending school.

A one unit increase in the contemporaneous social network index (S) is associated with a 0.19 percent increase in current food consumption. This suggests that an expansion in a household's social network can provide an immediate boost to its food consumption. However, the effect becomes negative after a one-period lag, perhaps due to the demands of maintaining an existing social network as households must allocate limited resources to social activities to the detriment of generating income for food consumption.

As expected, income from sources other than the family business (Y) positively affects household food consumption, although this effect registers as statistically significant only with a lag.

Household land holdings (*Plot*) affect consumption positively contemporaneously but negatively with a lag. Land is an essential input of household farming businesses. A household, with more land is thus more likely to achieve success in such business, and as a result increase its consumption. However, land requires capital investment to be productive. Faced with a credit constraint, household investment in the previous period may constrain consumption in the current period.

Non-farming activities have a negative effect on consumption contemporaneously but a positive effect with a lag. In theory the direction of the effect is ambiguous depending on whether non-farming activity is complementary to business success or whether it reflects a lack of farming resources. As expected, negative income shocks (*Shock*) and poverty (*Poor*) both show adverse effects on food consumption.

We conduct several tests to check the model specification. The Arellano and Bond (AB) test for autocorrelation obtains a significant test statistic for AR(1) and an insignificant test statistic for AR(2), suggesting that the estimation with one-period lag is appropriate. The Wald test rejects the null hypothesis that the coefficients are insignificant overall. Finally, the Hansen test of overidentifying restrictions fails to reject the null hypothesis that the instrumental variables are valid.

8. Concluding remarks

In this paper, we assess the impact of microcredit borrowing on the food consumption of rural Vietnamese households. We start with a theoretical model in which microcredit finances a family business. The household maximises its lifetime utility, which yields a dynamic optimal consumption path. We show that optimal consumption is a function of microcredit borrowing, and then use the optimal consumption function to guide the empirical estimation. To estimate the impact of microcredit on household food consumption, we implement the System Generalized Method of Moments estimation using a panel dataset from the Vietnam Access to Resources Household Survey for the period 2008–2016. In the estimation, we use excluded instrumental variables to address the endogeneity problem of explanatory variables and the sample selection bias due to households' non-random access to microcredit borrowing.

Our estimations indicate that the microcredit programs in rural Vietnam are effective in improving household food consumption in both the short and long terms. The study thus contributes to the debate over whether microcredit borrowing is a tool for poverty alleviation in Vietnam, and developing countries more generally, by confirming that it positively affects household welfare. However, it is worth noting that accumulated microcredit borrowing of the previous period can negatively affect a household's current-period food consumption, suggesting that repayment may be a burden to the household. Although rural Vietnamese households can benefit from microcredit borrowing, they are also facing the risk of falling into a "credit trap". Therefore, this finding also points to the need for careful management of microcredit loan policy.

Despite the positive impact found for food consumption, there exist a number of factors that limit the effectiveness of microcredit in Vietnam. First, the loan size is relatively small, which limits the scope of investment options for households. Second, despite the provision of training workshops by some microcredit providers, there is still a lack of business skills which could decrease the probability of achieving success in small business. Third, the survey data show a decrease in the number of households accessing microcredit in later years in both the formal and informal credit sectors. This decrease occurred because the government implemented policies to improve the formal microcredit sector and mitigate risk from informal microcredit. However, formal microcredit providers tend to require collateral which many rural households do not have. This constraint prevents microcredit lending from achieving its aim to the full extent.

To further promote the positive impacts of microcredit, microcredit lenders can increase their loan size to encourage borrowers to invest in larger and more profitable projects. They can also provide additional support services, such as business skill training and information on investment options that can help households to more effectively use their borrowings. For their part, regulators can revise loan requirements to allow not only physical collateral, but also social collateral, such as a household's social reputation, which will increase access to microcredit. Local authorities can encourage residents to participate in more social groups, such as the Women's Association, the Farmer's Association, and the Veteran's Association, which help them to access microcredit in the formal sector in rural Vietnam. Poor households can build their

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social networks and use these networks as collateral for their loan applications. These steps will facilitate greater use of microcredit to more fully achieve its aim of poverty alleviation in rural Vietnam.

Appendix A.

Table A1
Impact of microcredit on household food consumption, DGMM estimation.

	without external IVs		with external IVs	
	Coefficients	Robust SE	Coefficients	Robust SE
$log\ C_{t-1}$	0.619	1.106	−0.230	0.231
$log\ K_t$	−0.270	0.593	0.159	0.148
$log\ K_{t-1}$	0.683	0.496	0.859**	0.369
E_t	−0.832	0.608	−0.443	0.3
E_{t-1}	2.403	1.637	2.153	1.5
S_t	−1.679*	0.983	−1.568*	0.912
S_{t-1}	−0.0498	0.112	−0.0986	0.0873
$log\ Y_t$	0.0614	0.0864	0.0297	0.0666
$log\ Y_{t-1}$	−0.0216	0.127	−0.0938	0.0813
$EduH_t$	0.0491	0.0891	0.0349	0.0709
$EduH_{t-1}$	−0.481	0.36	−0.374	0.26
$HSize_t$	0.648	0.808	0.0246	0.237
$HSize_{t-1}$	0.0397	0.0373	0.0285	0.0341
$AgeH_t$	−0.00283	0.0343	−0.0153	0.0314
$AgeH_{t-1}$	−0.394	0.44	−0.474	0.402
$log\ Plot_t$	0.612*	0.335	0.416*	0.225
$log\ Plot_{t-1}$	−0.0637	0.296	0.111	0.192
Dep_t	−0.798	1.227	0.148	0.34
Dep_{t-1}	−1.514	1.204	−1.890*	0.999
$Nfarming_t$	0.931*	0.555	0.810*	0.477
$Nfarming_{t-1}$	−0.447	0.456	−0.434	0.403
$Shock_t$	0.956**	0.421	0.765**	0.326
$Shock_{t-1}$	0.978*	0.551	0.838	0.524
$Local_t$	0.833	0.774	1.029	0.712
$Local_{t-1}$	−0.627	0.762	−0.327	0.586
$Poor_t$	0.286	0.427	0.0850	0.306
$Poor_{t-1}$	0.253	0.319	0.118	0.25
Year	YES		YES	
AR(1)	−1.86**		−2.54**	
AR(2)	0.39		0.02	
Hansen test	4.24		4.85	
Instruments	33		36	
Observations	6,827		6,827	
Households	2,687		2,687	

Note: ***, **, and * indicate the statistical significance at the 1, 5, and 10% levels, respectively.

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