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Impact of microcredit on rural households: An evaluation using panel data

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Abstract

This paper investigates the impact of microcredit on rural households. The impact of a microcredit program on target households is subject to two main sources of bias, observed and unobserved bias. To evaluate the microcredit program's impact, we used the 2006 and 2008 Vietnam Household Living Standard Surveys and applied the Propensity Score Matching approach and Fixed Effects models. The results show a greater consumption and income impact for the 'true poor' when only the poor group is included in the comparison. This implies that the 'true poor' benefit more from involvement with a microcredit program than do low-income households. In addition, greater impacts were identified in the Mekong River Delta, assuming that endogeneity is significantly controlled for in the models.

Keywords: microcredit, rural households, Mekong River Delta, Vietnam

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1 Introduction

Rural finance plays an important role in the Vietnamese economy. However, providing loans to the rural poor remains a difficult task because of the nature of the rural credit market and the lending procedures that prevent rural households, particularly the poor, to access credit. The poor and low income households face two main problems in borrowing from commercial banks. First, most poor households have no collateral and are not able to borrow against their future income. Second, banks find it costly to deal with small credit transactions, such as individual lending and lending through microcredit program. Without any external support the rural poor find it difficult to access formal credit hence they seek alternative sources of credit. Therefore, improving formal credit access through subsidized microcredit programs is considered as a strategic tool to support the rural poor. Although government intervention in rural credit markets is controversial, this intervention is widely accepted because it can overcome loan failures in these markets.

In Vietnam, formal credit is available through individual lending and group lending schemes. Group lending schemes notably improve repayment incentives and monitoring through peer pressure based on the joint-liability principle. Grouping and sharing information among credit group members also helps to build support networks and educate borrowers (Ghatak & Guinnane, 1999; Karlan & Goldberg, 2007). However, individual lending is quite a popular practice in Vietnam. Another form of lending where microcredit is distributed to individuals is also widely practiced in the rural credit market. This lending practice relies on the joint-liability principle in a credit group but the loans are subject to individual liability. Specifically, the borrowers are required to form a group, including a number of certified poor members and a group leader without joint liability specification. Quach (2005) shows that lending through a group in microcredit program in Vietnam helps to reduce transaction costs as it deals with asymmetric information more effectively than lending to individuals.

The Vietnamese rural credit market is characterized as being fragmented, heavily subsidized, with a high degree of government intervention, and with many credit providers coexisting to serve the clients (McCarty, 2001). The credit market is dominated by state-owned bank providers; the Vietnam Bank for Agriculture and Rural Development (VBRAD), the Vietnam Bank for the Poor (VBP) and the People's Credit Funds (PCFs). Together, these control as much as 70% of the total credit (World Bank, 2002). VBRAD has branches at the district level and only to a limited extent at the commune level; therefore, outreach to the poorer households in remote and rural communes is limited. In addition, biasedness in risk assessment and complicated administrative procedures contribute to the underdevelopment of VBRAD's operation (Putzey, 2002). To overcome the VBRAD's operational weaknesses, the VBP and the PCFs were established to address the credit needs of the rural poor. The PCFs, whose objectives are to restore public confidence in the formal rural finance system, aim at mobilizing savings from its members. Since the PCFs' networks have been predominantly established in areas that are economically better off and have better developed infrastructure, the PCFs plays a limited role in microcredit provision.

The Vietnam Bank for the Poor began operation in 1996, providing credit at low interest rates through formal microcredit programs to the rural poor who did not qualify for individual loans because of limited collateral. In 2003, it was renamed the Vietnam Bank for Social Policies (VBSP). Its operations have been modified to focus on the poor and it closely cooperates with local organizations in lending procedures. For example, the Commune People's Committees help the VBSP to verify poor and socially disadvantaged groups. Other social mass organizations in villages such as the Women's Union and the

Farmers' Associations help the VBSP to monitor the loans. Collateral is not required for loans, but the social mass organizations provide a Guarantee Fund. If the borrowers default, the VBSP will take a portion of the guaranteed fund. To ensure repayment, the social mass organizations organize the borrowers into credit groups. Joint-liability groups were also formed in the initial stage of the microcredit lending, a practice later replaced by flexible group lending strategy in which the individual is liable only for her or his loan, but not for those of other group members (Bhole & Ogden, 2010).

Despite the establishment of numerous microcredit policies targeting the rural credit market over the past two decades, Vietnam is still home to over 12 million people (14.2% of the population) living in poverty (World Bank, 2008). The majority of households in rural areas suffer a variety of poor living conditions such as temporary housing, lack of fixed assets, and unstable incomes. In addition, accessibility to credit has remained one of the main difficulties that hinder agricultural productivity and improvement the country's poverty and rural development strategy programs. Pham and Izumida (2002) show that as much as 30% of farm households were unable to borrow from formal lenders. Improving access to microcredit is therefore one of the main objectives of many microcredit programs targeting rural households and the poor. This is because credit is believed to improve rural households' livelihood by improving productivity, and smoothing consumption and income irregularities. However, improving microcredit access for the poor incurs costs that raise the cost-benefit question of how much these microcredit programs impact the target group.

Most microcredit programs in Vietnam are managed by the Vietnam Bank for Social Policies (VBSP). Since its official establishment in 2003, studies evaluating the impact of the VBSP microcredit program on target households have been sporadically done at national, regional and local levels. Few studies have focussed on the evaluating the impact of the program on the Mekong River Delta (MRD). This study examines the impact of the microcredit program impact on the MRD and to enrich the field of microcredit program impact evaluation.

Accessibility to microcredit programs undeniably has desired impacts on the poor. However, interpretations of the impact of these programs have proven to be controversial. Impact evaluation inferences are sensitive to their evaluation methods and assumptions; different impact evaluation methods depend on their specific assumptions to resolve the missing data problem. This implies that different methods of data collection will encounter different missing data problems, such that a chosen econometric evaluation method may thereby perform better than others for program impact assessment. Moreover, evaluation of the impact of a microcredit program should address informal credit as an alternative source of credit relative to the formal microcredit program. This is because informal credit is prevalent in the rural markets in developing countries. In Vietnam, the formal and informal credit sectors coexist to serve clients. Failure to control for complementarity and substitutability between the formal and informal credit sectors when evaluating the impact of formal microcredit programs likely overestimate the positive impact of these programs.

To the best of our knowledge, no study has investigated the long-term impact of credit on household welfare in rural Vietnam. The purpose of this study is to provide empirical evidence on the long-term impact of credit on household welfare, using panel data based analysis. If we can observe a household who borrows in two periods, we can see the difference (or change) in the amount borrowed and household welfare. If the change in household welfare is correlated with a change in household borrowing, it reveals the long-term relationship. However, long-term impact of microcredit program remains questionable due to limited data. Khandker (2003) shows the main difference between cross-sectional data based analysis and panel data based analysis is that the former shows the comparison

across households while the latter shows the movement within households. Hence, long-term impact is likely to be subjected to changes in the environment that the program is being implemented.

This study examines the impact of microcredit programs on the incomes and consumption patterns of rural households in the Mekong River Delta, Vietnam. In order to do so, we present an overview of the rural credit programs that target the rural credit market. We then evaluate these programs using estimation techniques that control for the exogenous contribution of informal credit to income and consumption patterns of this group in rural Vietnam. The remainder of the paper is organized as follows: Section 2 describes the data and research method for impact evaluation. Section 3 discusses the empirical results and Section 4 concludes the paper.

2 Data and research method

The data used for impact evaluation of the VBSP microcredit program were drawn from the 2006 and 2008 VHLSS surveys. The VHLSS surveys contain information both at household and commune levels. At the household level, each survey contains a sample of 9,189 households and the two datasets form a panel dataset of 4,127 Vietnamese households. The panel data contain information about the households for two separate years, including the urban and rural population. Only the rural sample is used in this study. At commune level, information on commune characteristics was collected from 2,880 and 2,219 communes in the 2006 and 2008 surveys, respectively. These data consist of demographic and general information regarding communes, general economic conditions and aid programs, non-farm employment, agricultural production, local infrastructure and transportation, education, health, and social affairs. The commune data were then merged with the household data to form a combined panel dataset that includes household, village and commune characteristics. Another panel dataset of 866 households was also drawn from the VHLSS surveys for the MRD.

The VHLSS data contain information on demography, income, expenditure, education, health care, employment, fixed assets and durable goods and particularly, access to finance through formal or informal credit. The information on household members' characteristics such as age, gender, place of residence, educational qualifications, as well as information on expenditure and income is used for the analysis. Information about participation in microcredit programs such as loans, values of loans, the interest rate from different banks and social funds, loan purposes are also used. A description of the variables is provided in Table 1.

The panel data can be used to estimate the unbiased program impact if the two years' data are collected before and after the program implementation, respectively. In other words, we need to have a baseline dataset before the VBSP microcredit program was officially established and implemented in 2003 and one post period. Since our first dataset was collected in 2006 when the VBSP microcredit program was already in operation, Nguyen (2008) raises concerns of bias in program impact using only the post-program data because there may be significant differences between the control and treated groups in the first period. Therefore, adjustments are required before the panel data can be used in the fixed effects model.

To deal with the data issue, we estimate the propensity score matching (PSM) in the first period to match the borrowers with the non-borrowers using a set of observed characteristics. The PSM creates a new panel dataset that consists of the borrower and non-borrower groups that are more comparable in terms of the observed characteristics than the original panel data. The comparison between the borrowers and non-borrowers is performed over a common support region with similar characteristics.

The purpose of this step is to remove the observed heterogeneity in the initial period before using the fixed effects (FE) model (see Heckman, Ichimura, & Todd, 1998).The observed characteristics including individual, household, village and commune factors in the covariates are documented in Table 1.

Given the matched pre-program attributes from the PSM and program participation is exogenously defined, the program impact estimator can be obtained using equation (1):

$$Y_{it} = \alpha_0 + \delta_0 D_t + \boldsymbol{X}'_{it}\mu_i + \phi I_{it} + \nu_i + u_{it} \quad (1)$$

where the program participation variable, I_{it}, takes the value of 1 if the i^{th} household borrows microcredit in the post-program period and 0 otherwise. The parameter of interest, ϕ, is the impact estimator measuring the effect of the microcredit program on the outcome variables. Y represents the outcomes of interest, which are household consumption or income in natural logarithm. D_i is the program participation dummy variable which takes the value of 1 if the i^{th} household belongs to the borrower group and 0 otherwise. D_t is a time dummy variable which equals 1 for t=1 (post-program period) and 0 for t=0 (pre-program period). The coefficient δ_0 captures the aggregate time influences on both groups. $\mathbf{X}_{it}$ is a vector of households characteristics (e.g., age, gender, household size, etc.); μ captures the effects of the observed covariates on the outcome for each time period, ν_{it}, is a time-invariant unobserved error and u_{it} is the idiosyncratic error.

To account for the impact of microloan size on the outcomes, Nguyen (2008) shows that when the amount of a microloan (ML) replaces I_{it}, the impact estimator ϕ is interpreted as the impact of an additional amount of credit on the participant. In addition, the specification allows ML to enter the FE model as an exogenous variable that indicates a possible correlation between the microloan and time-invariant individual unobserved factors. The estimated model for a *ML* in the outcome equation is rewritten as follows:

$$Y_{it} = \alpha_0 + \delta_0 D_t + \boldsymbol{X}'_{it}\mu_i + \phi ML_{it} + \nu_i + u_{it} \quad (2)$$

Unbiased estimators in equations (1) and (2) can be obtained using a FE model that is able to deal with the individual unobserved time invariant errors (Wooldridge, 2005). However, microcredit participation and microloan size are possibly endogenous in equations (1) and (2). Endogeneity is likely to occur if the assumption of unobserved factors at the household, village and commune levels does not remain fixed. For example, time varying unobserved factors of different microcredit schemes such as expanding lending coverage or a change in lending regulations that might jointly influence credit participation and microloan size at the borrowing period but also influence households' consumption or income over a longer period of time. Households adjust credit demand and consumption according to such changes. If I and ML are not exogenously defined the households' outcomes, e.g., households within the program villages self-select into the microcredit program which depends on differential unobserved trends, biased estimators are likely obtained from the standard FE models (1 and 2), respectively. Khandker (2005) suggests testing for endogeneity to detect whether the FE method is sufficient for the exogenous program impact or if instrumental variables (IV) are needed for identification of endogenous program impact.

Table 1: Description of variables using VHLSS 2008

		Borrowers		Non-borrowers	
Variables	Description	Mean	S.D.	Mean	S. D.
1. Individual characteristics					
AGE	Age of household head (years)	46.90	10.86	50.89	13.44
GENDER	Gender of household head	0.78	0.41	0.74	0.44
ETHNIC	Ethnic group (1= ethnic group, 0=Kinh)	3.31	5.49	1.88	3.52
MARRIED	Marital status (1=married, 0=otherwise)	0.86	0.35	0.81	0.39
PRI_SCHO	Head with primary school	0.01	0.07	0.01	0.08
SEC_SCHO	Head with secondary school	0.26	0.44	0.27	0.44
HIG_SCHO	Head with high school	0.33	0.47	0.29	0.45
TEC_DEGRE	Head with technical degree	0.10	0.30	0.14	0.35
UNI_DEGRE	Head with university degree	0.01	0.07	0.01	0.10
POST_GRAD	Head with post-grad degree	0.01	0.09	0.04	0.19
2. Household characteristics					
HH_SIZE	Household size	4.54	1.63	4.12	1.67
R_FEMALE	Ratio of female members	0.51	0.18	0.52	0.20
R_BELOW16	Ratio of member below 16	0.26	0.21	0.22	0.21
R_ABOVE60	Ratio of member above 60	0.06	0.14	0.14	0.27
R_WAGRI	Ratio of members working in agriculture	0.47	0.29	0.39	0.33
R_WINDUS	Ratio of members working in industry	0.28	0.25	0.25	0.26
R_WSERV	Ratio of members working in services	0.12	0.21	0.15	0.23
R_PRI_SCHO	Ratio of members with primary school	0.26	0.25	0.25	0.26
R_SEC_SCHO	Ratio of members with secondary school	0.26	0.26	0.24	0.26
R_HIG_SCHO	Ratio of members with high school	0.14	0.22	0.15	0.23
R_UNI_DEGRE	Ratio of members with tertiary education	0.01	0.05	0.03	0.12
NUM_SDAYS	No. of days off due to illness per member	7.15	6.48	6.67	6.19
LAND_ACROP	Area of annual crop land (m^2)	4309.05	8685.75	3459.07	9890.42
LAND_PCROP	Area of perennial crop land (m^2)	1538.86	11269.48	1270.29	6203.83
LAND_WSURF	Area of aquaculture water surface (m^2)	195.25	1341.47	406.68	4598.76
RE_OVERSEAS	Overseas remittance (1,000 VND)	504.70	4533.89	1218.28	8815.66
RE_DOMESTIC	Domestic remittance (1,000 VND)	1605.16	3391.04	2460.80	7597.42

PENSION	Pension (1,000 VND)	608.56	2861.87	1496.57	5655.33
SAVINGS	Savings (1,000VND)	37.75	426.46	656.57	9199.07
POOR_CER	Poor certified households	0.34	0.47	0.11	0.32
3. Village and commune characteristics					
GEO_CSTAL	Coastal area	0.07	0.26	0.07	0.25
GEO_DELTA	Delta	0.36	0.48	0.55	0.50
GEO_MIDLAND	Midland/hilly land	0.05	0.22	0.07	0.25
GEO_LMOUNT	Low mountainous areas	0.23	0.42	0.18	0.38
GEO_HMOUNT	High mountainous areas	0.29	0.45	0.13	0.34
CR_COM	Having car road commune	0.81	0.39	0.69	0.46
DE_CENTER	Distance to the nearest extension centre (km)	12.96	10.86	10.96	8.83
NF_ENTER	Having nonfarm enterprise commune	0.49	0.50	0.53	0.50
TR_VILLA	Having traditional-village commune	0.08	0.27	0.10	0.30
CR_VILLA	Having car road village	0.75	0.43	0.63	0.48
4. Instrumental variables					
R_POVERY	Poverty ratio by commune authority	0.24	0.17	0.16	0.14
D_BANK	Distance to the nearest bank (km)	9.19	3.24	7.80	2.67
	Number of observations		556		3,571

Source: The Vietnam Household Living Standard Survey in 2008, GSO.

To overcome the potential endogeneity, this study used two IVs, the commune poverty rate and the distance from village to the nearest bank, to test the endogeneity of ML in the program impact in equation (2). The commune poverty rate provides a correlation between microloans and the households' criteria of program selection. The poverty rate of the commune is suggested to control for time invariant unobserved factors because it is one criterion that makes a microcredit program available to poor households. However, a commune that has a large number of poor households will have a large number of potential participants in the program. Nguyen (2008) argues that when there are many applicants applying for credit, credit groups and commune heads tend to screen the applicant list more carefully because they have the responsibility of ensuring the repayment rate of the borrowers. More applicants are likely to be excluded from the borrowing list. As a result, an eligible household that is in a commune with a large number of poor households is likely to face higher competition when borrowing from the program.

The second IV is distance from a village where the households are located to the nearest bank. The nearest bank can be any commercial bank, including VBSP. However, the coverage of VBSP has been expanded to reach rural areas and many bank branches are often located close to each other in the commune centre. Households in a village that are closer to a VBSP branch are more likely to obtain microcredit more than distant households.

Equations (1) and (2) were estimated using fixed effects models with the specified instruments. The estimated results are presented in Table 2 and 3. To obtain unbiased estimators, tests for under identification, endogeneity, weak identification and instrument-robust inference were conducted. The test results reported in Table 4 and 5 indicate that the models are not under identified.

However, given the potential endogeneity problem in program participation and microloan size in equations (1) and (2), the test for endogeneity confirms that program participation and microloan were endogenously defined with consumption and income in the fixed effects model. Therefore, the instrumental variable fixed effects models (IV-FE) were used to obtain the unbiased estimators for the program and microloan impacts. The results of the first stage of the FE models show that only the "commune poverty rate" is negative and significantly correlated with credit participation at the 1% level, i.e., higher poverty ratio in the commune corresponds to lower participation in a microcredit program. High poverty rate implies that there are many eligible households residing in the area that has a microcredit program implemented. Thus, high poverty rate increases competition of being selected and reduces the chance of participation in the microcredit program. Controlling for the program endogeneity in our model, the IV-FE estimation can resolve the biased impact estimators (see Table 2).

Although the IV can be significant on the endogenous variables, i.e., program participation and microloan size, they can be weakly correlated with the endogenous variables. The problem of weak identification causes the traditional two stage least square (2SLS) estimator to be inefficient and the inference from the estimates will not be reliable. Therefore, a test for weak identification of instruments is suggested using the Cragg-Donald statistic (Cragg & Donald, 1993; Stock & Yogo, 2002). The test results for weak identification of instruments indicate that the instruments are not weak for the Vietnam sample but rather weak for the MRD sample (see Tables 4 and 5). In addition, tests for instrument-robust inference are performed to assure the coefficients are able to be inferred under the presence of heteroskedasticity. The estimated results are obtained using the Generalised Method of Moment (GMM) with IV because the IV-GMM class allows for arbitrary heteroskedasticity with smaller standard errors hence its estimation gains are more efficient than the 2SLS (Baum, 2009; Wooldridge, 2002).

Table 2: Results for IV fixed effects models for VBSP microcredit impact on household per capita expenditure

Variable	First-Stage Regression				Second-Stage Regression ln per capita Expenditure			
	Programme		Amount of Formal Microcredit		Programme		Amount of Formal Microcredit	
	The MRD	Vietnam	The MRD	Vietnam	The MRD	Vietnam	The MRD	Vietnam
Participation in VBSP					2.1150***	1.4140***		
					[0.6160]	[0.1630]		
ln Formal Microcredit							0.3530**	0.3120***
							[0.1470]	[0.0728]
1. **Individual factors**								
AGE	0.0010	0.0029***	0.0051	0.0124	-0.0015	0.0010	-0.0013	0.0013
	[0.0014]	[0.0010]	[0.0119]	[0.0111]	[0.0041]	[0.0024]	[0.0049]	[0.0042]
GENDER	0.1190	0.0112	0.8210	0.0535	-0.1070	-0.0528	-0.1450	-0.0532
	[0.0830]	[0.0519]	[0.7540]	[0.4650]	[0.2180]	[0.0941]	[0.2980]	[0.148]
ETHNIC	-0.0066	0.0056	-0.2560*	0.0364	0.0210	-0.0199***	0.0963	-0.0246*
	[0.0237]	[0.0056]	[0.1440]	[0.0573]	[0.0515]	[0.0068]	[0.0660]	[0.0137]
MARRIED	-0.0355	0.0099	-0.3050	0.2540	0.0110	0.0848	0.0441	0.0148
	[0.0444]	[0.0350]	[0.4490]	[0.3670]	[0.1520]	[0.0805]	[0.2050]	[0.1260]
PRI_SCHO	0.0291	0.0209	0.3420	0.1430	-0.0787	0.0906	-0.1480	0.0849
	[0.0517]	[0.0639]	[0.3700]	[0.6450]	[0.2180]	[0.1380]	[0.2370]	[0.2330]
SEC_SCHO	-0.0223	-0.0037	0.2250	-0.2990	0.0522	0.0768	-0.0758	0.1620*
	[0.0429]	[0.0257]	[0.3550]	[0.2610]	[0.1090]	[0.0513]	[0.1310]	[0.0970]
HIG_SCHO	-0.1180	-0.0198	-0.7340	-0.2750	0.2420	0.0733	0.2480	0.1300
	[0.0778]	[0.0369]	[0.7310]	[0.3390]	[0.1960]	[0.0666]	[0.3050]	[0.1150]
TEC_DEGRE	-0.1000	-0.1090**	-0.1400	-0.5920	0.1330	0.1410	-0.0337	0.1700
	[0.0686]	[0.0475]	[0.6520]	[0.4330]	[0.2010]	[0.0915]	[0.2600]	[0.1500]
UNI_DEGRE	-0.0381	0.0260	0.3030	-1.2650	0.4710***	0.1450	0.2950	0.5990**
	[0.0691]	[0.0789]	[0.5860]	[1.0220]	[0.1590]	[0.1670]	[0.2190]	[0.2790]
POST_GRAD	-0.0440	-0.2450**	0.7000	-1.4180	0.5470**	0.2730	0.2250	0.3810
	[0.1000]	[0.0953]	[0.8540]	[0.9370]	[0.2580]	[0.1990]	[0.3400]	[0.3250]
2. **Household factors**								
HHSIZE	-0.0138	-0.0132*	0.0077	-0.0064	-0.0704**	-0.0917***	-0.1040**	-0.1100***
	[0.0131]	[0.0069]	[0.1270]	[0.0789]	[0.0341]	[0.0136]	[0.0461]	[0.0271]
R_FEMALE	0.0076	0.0131	0.6160	0.2750	-0.4380*	-0.0121	-0.6410*	-0.0765
	[0.1170]	[0.0590]	[0.9310]	[0.6030]	[0.2580]	[0.1170]	[0.3610]	[0.2050]

R_BELOW 16	0.0857	0.0037	0.8430	0.5850	-0.4330	-0.3780***	-0.5570	-0.5590***
	[0.1330]	[0.0645]	[1.1980]	[0.570]	[0.2940]	[0.1150]	[0.4370]	[0.1920]
R_ABOVE 60	-0.0352	-0.0805	-0.9620	-0.7550	0.1280	0.1720	0.3990	0.2990
	[0.0917]	[0.0498]	[0.9430]	[0.4910]	[0.2390]	[0.1200]	[0.3540]	[0.1920]
R_WAGRI	-0.0632	0.0012	-0.4620	-0.1160	0.0961	-0.0867	0.1220	-0.0486
	[0.0651]	[0.0310]	[0.5670]	[0.3040]	[0.1510]	[0.0591]	[0.2220]	[0.1020]
R_WINDUS	0.0756	0.0771**	0.0778	0.3850	-0.1860	0.0200	-0.0522	0.0082
	[0.0597]	[0.0376]	[0.5510]	[0.3600]	[0.1480]	[0.0685]	[0.1990]	[0.1190]
R_WSERV	0.0430	-0.0147	0.0516	0.0882	-0.1380	0.1280	-0.0688	0.08110
	[0.0797]	[0.0465]	[0.6530]	[0.4230]	[0.2060]	[0.0898]	[0.2520]	[0.1470]
R_PRI_SCHO	0.0345	-0.0127	0.7360	0.0735	0.00562	0.1460*	-0.1800	0.1140
	[0.0882]	[0.0443]	[0.7920]	[0.4520]	[0.1860]	[0.0843]	[0.3080]	[0.1540]
R_SEC_SCHO	0.2280*	0.0585	1.8140	0.4480	-0.0628	0.1970*	-0.2150	0.1560
	[0.1250]	[0.0568]	[1.1230]	[0.5630]	[0.3030]	[0.1100]	[0.5000]	[0.1950]
R_HIG_SCHO	0.1380	0.2690***	0.0382	1.9520**	0.5030	0.2070	0.8060*	-0.0080
	[0.1220]	[0.0704]	[1.264]	[0.731]	[0.3190]	[0.1410]	[0.4730]	[0.2880]
R_UNI_DEGRE	0.0818	0.3570*	0.4330	2.1180	-0.6230	0.2140	-0.5930	0.0849
	[0.1390]	[0.2080]	[1.0130]	[1.8920]	[0.4770]	[0.3500]	[0.5190]	[0.6000]
NUM_SDAYS	-0.0037*	-0.0010	-0.0101	-0.0062	0.0081*	0.0028	0.0036	0.0031
	[0.0019]	[0.0010]	[0.0159]	[0.0086]	[0.0047]	[0.0017]	[0.0057]	[0.0028]
LAND_ACROP	8.80e-08	8.63e-07	7.62e-08	7.18e-06	3.32e-06*	3.08e-06**	3.53e-06**	2.15e-06
	[2.63e-07]	[8.94e-07]	[2.28e-06]	[7.92e-06]	[1.76e-06]	[1.57e-06]	[1.79e-06]	[2.43e-06]
LAND_PCROP	-1.63e-06	1.68e-06*	7.20e-06	9.77e-06	2.52e-05*	2.32e-07	1.95e-05	-7.73e-08
	[7.55e-07]	[9.73e-07]	[3.36e-05]	[9.41e-06]	[1.45e-05]	[2.41e-06]	[1.50e-05]	[3.23e-06]
LAND_WSURF	-8.65e-07	4.43e-07	-1.22e-05*	6.51e-06	1.02e-05**	1.01e-05***	1.25e-05***	8.73e-06***
	[1.12e-07]	[1.04e-06]	[6.97e-06]	[6.84e-06]	[3.99e-06]	[2.97e-06]	[3.54e-06]	[3.26e-06]
RE_OVERSEAS	-1.19e-07	-8.04e-07	-1.64e-05	-8.02e-06	7.25e-06	2.97e-06**	1.06e-05	4.41e-06**
	[1.80e-07]	[7.03e-07]	[1.49e-05]	[6.49e-06]	[5.49e-06]	[1.23e-06]	[7.25e-06]	[2.20e-06]
RE_DOMESTIC	9.23e-07	-6.23e-07	-1.51e-05	-4.63e-06	2.32e-05***	1.31e-05***	3.03e-05***	1.37e-05***
	[2.08e-06]	[5.81e-07]	[2.17e-05]	[4.47e-06]	[4.86e-06]	[3.36e-06]	[8.20e-06]	[3.71e-06]
PENSSION	-9.26e-06	-6.56e-06**	-8.97e-05	-5.56e-05	4.12e-05**	1.56e-05**	5.40e-05**	2.40e-05*
	[8.09e-06]	[2.76e-06]	[6.66e-05]	[3.46e-05]	[1.61e-06]	[6.15e-06]	[2.40e-05]	[1.27e-05]
SAVINGS	-2.40e-06	-1.14e-06	-7.90e-06	-3.81e-06	2.56e-05**	1.64e-05***	2.38e-05	1.65e-05***
	[3.76e-06]	[9.29e-07]	[3.78e-05]	[8.35e-06]	[1.24e-05]	[4.56e-06]	[1.69e-05]	[5.62e-06]
POOR_CER	-0.0365	0.0502	0.2960	0.6150**	-0.0311	-0.1410**	-0.2160	-0.2620**
	[0.0746]	[0.0325]	[0.7270]	[0.3130]	[0.1630]	[0.0533]	[0.2440]	[0.1090]

3. **Village and commune**								
CR_COMMUNE	0.0038	0.0345	-0.3820	-0.2300	0.0662	0.1170	0.2150	0.2530
	[0.0617]	[0.0681]	[0.5510]	[0.4980]	[0.1410]	[0.0998]	[0.1980]	[0.1460]
DE_CENTER	-0.0075**	-0.00361**	-0.0693**	-0.0265*	0.0102	0.0009	0.0189*	0.0034*
	[0.0032]	[0.0017]	[0.0268]	[0.0151]	[0.0074]	[0.0027]	[0.0113]	[0.0052]
NF_ENTER	0.0297	-0.0022	0.0187	-0.2850*	-0.0591	0.0904***	-0.0054	0.1740***
	[0.0395]	[0.0177]	[0.3610]	[0.1680]	[0.0990]	[0.0320]	[0.1300]	[0.0590]
TR_VILLA	-0.0110	0.0229	0.5010*	0.2840	0.0410	-0.0342	-0.1520	-0.0929
	[0.0378]	[0.0265]	[0.2720]	[0.2450]	[0.1010]	[0.0485]	[0.1360]	[0.0818]
CR_VILLA	0.0367	0.0242	0.8480**	0.3320	0.0335	-0.0596	-0.1800	-0.1190
	[0.0473]	[0.0258]	[0.4120]	[0.2600]	[0.1120]	[0.0507]	[0.2080]	[0.0931]
Regional dummy								
GEO_CSTAL		-0.2220**		-0.3910		0.1920		0.3330
		[0.1100]		[1.0750]		[0.1570]		[0.3010]
GEO_DELTA		-0.2420**		0.5450		0.1270		0.1070
		[0.1160]		[1.1040]		[0.1170]		[0.2240]
GEO_MIDLAND		-0.1780*		0.4910		-0.0594		-0.0240
		[0.0998]		[0.9550]		[0.0977]		[0.1920]
GEO_LMOUNT		-0.1580*		0.2340		0.1290		0.1930
		[0.0844]		[0.7960]		[0.0807]		[0.1570]
4. **Instrumental variables**								
D_NBANK	0.0307	-0.0239**	0.2260	0.0683				
	[0.0272]	[0.0105]	[0.2120]	[0.0972]				
R_POVERTY	-0.8520***	-0.8000***	-4.5710**	-3.2730***				
	[0.2360]	[0.0886]	[2.1290]	[0.7500]				
Number of observations	1,052	5,096	1,052	5,096	1,052	5,096	1,052	5,096

Note: 1. Robust Standard Errors are in the brackets

2. *, **, and *** indicate significant level at 10%, 5%, and 1%, respectively.

Table 3: Results of IV fixed effects models for VBSP microcredit impact on household per capita income

Variable	First-Stage Regression				Second-Stage Regression			
					ln per capita income			
	Programme		Amount of Formal Microcredit		Programme		Amount of Formal Microcredit	
	The MRD	Vietnam	The MRD	Vietnam	The MRD	Vietnam	The MRD	Vietnam
Participation in VBSP					1.6660**	0.8370***		
					[0.5830]	[0.1350]		
ln Formal Microcredit							0.2540**	0.1620***
							[0.1290]	[0.0459]
1. **Individual factors**								
AGE	0.0007	0.0028***	0.0035	0.0120	0.0010	0.0006	0.0013	0.0012
	[0.0013]	[0.0010]	[0.0118]	[0.0111]	[0.0040]	[0.0026]	[0.0044]	[0.0033]
GENDER	0.1090	0.0117	0.7350	0.0580	0.0397	0.0604	0.0309	0.0592
	[0.0814]	[0.0518]	[0.7410]	[0.4650]	[0.2320]	[0.0850]	[0.2740]	[0.1040]
ETHNIC	-0.0057	0.0057	-0.2480*	0.0369	0.0843	-0.0116	0.1370*	-0.0137
	[0.0241]	[0.0056]	[0.1470]	[0.0574]	[0.0700]	[0.0088]	[0.0805]	[0.0115]
MARRIED	-0.0299	0.0096	-0.2580	0.2510	-0.0845	0.0210	-0.0645	-0.0129
	[0.0437]	[0.0349]	[0.4400]	[0.3660]	[0.1730]	[0.0772]	[0.2000]	[0.0944]
PRI_SCHO	0.0287	0.0208	0.3390	0.1420	0.0102	-0.0372	-0.0403	-0.0371
	[0.0506]	[0.0639]	[0.3640]	[0.6460]	[0.1920]	[0.1100]	[0.1870]	[0.1490]
SEC_SCHO	-0.0260	-0.0047	0.1940	-0.3080	0.1510	0.0386	0.0562	0.0838
	[0.0427]	[0.0256]	[0.3530]	[0.2610]	[0.1060]	[0.0458]	[0.1150]	[0.0664]
HIG_SCHO	-0.1180	-0.0202	-0.7350	-0.2780	0.3340*	0.0600	0.3200	0.0880
	[0.0773]	[0.0368]	[0.7280]	[0.3390]	[0.1770]	[0.0587]	[0.2440]	[0.0771]
TEC_DEGRE	-0.0949	-0.1080**	-0.0965	-0.5850	0.2460	0.1230	0.1060	0.1260
	[0.0684]	[0.0475]	[0.6500]	[0.4330]	[0.2080]	[0.0877]	[0.2330]	[0.1060]
UNI_DEGRE	-0.0331	0.0265	0.3450	-1.2600	0.1720	0.1630	0.0420	0.4050
	[0.0685]	[0.0789]	[0.5810]	[1.0190]	[0.2790]	[0.1840]	[0.2970]	[0.2560]
POST_GRAD	-0.0466	-0.2450**	0.6790	-1.4160	1.3010***	0.1860	1.0690***	0.2200
	[0.0998]	[0.0954]	[0.8490]	[0.9370]	[0.3360]	[0.1820]	[0.3530]	[0.2340]
2. **Household factors**								
HHSIZE	-0.0146	-0.0133*	0.00123	-0.0071	-0.0552*	-0.0889***	-0.0819**	-0.1000***
	[0.0130]	[0.0069]	[0.1260]	[0.0788]	[0.0303]	[0.0124]	[0.0372]	[0.0179]
R_FEMALE	0.0273	0.0180	0.7810	0.3150	-0.6120**	-0.1200	-0.7690**	-0.1550
	[0.1160]	[0.0589]	[0.9150]	[0.6010]	[0.2420]	[0.1060]	[0.3040]	[0.1390]

R_BELOW 16	0.0365	-0.0063	0.4320	0.5030	-0.5230*	-0.3650***	-0.5820	-0.4560***
	[0.1250]	[0.0639]	[1.1400]	[0.5660]	[0.2720]	[0.1020]	[0.3430]	[0.1290]
R_ABOVE 60	-0.0455	-0.0822*	-1.0480	-0.7700	0.0333	0.0101	0.2340	0.0700
	[0.0909]	[0.0498]	[0.9370]	[0.4910]	[0.240]	[0.1130]	[0.2990]	[0.1420]
R_WAGRI	-0.0888	-0.00436	-0.6750	-0.1620	0.1890	-0.0217	0.2100	0.0002
	[0.0616]	[0.0306]	[0.5450]	[0.3020]	[0.1460]	[0.0533]	[0.1950]	[0.0677]
R_WINDUS	0.0723	0.0756**	0.0504	0.3720	0.1040	0.3200***	0.2140	0.3230***
	[0.0593]	[0.0376]	[0.5490]	[0.3590]	[0.1500]	[0.0587]	[0.1730]	[0.0781]
R_WSERV	0.1030*	-0.0021	0.5500	0.1930	0.0909	0.3770***	0.1200	0.3440***
	[0.0580]	[0.0454]	[0.4750]	[0.4160]	[0.1880]	[0.0805]	[0.2020]	[0.1000]
R_PRI_SCHO	0.0439	-0.0101	0.8150	0.0958	0.0207	0.1850**	-0.1120	0.1650
	[0.0878]	[0.0442]	[0.7850]	[0.4520]	[0.1830]	[0.0786]	[0.2680]	[0.1060]
R_SEC_SCHO	0.2380*	0.0591	1.8990*	0.4530	0.1110	0.2110**	0.03210	0.1980
	[0.1230]	[0.0568]	[1.1130]	[0.5630]	[0.2950]	[0.1040]	[0.4290]	[0.1320]
R_HIG_SCHO	0.1440	0.2680***	0.0938	1.9470***	0.3220	0.1580	0.5680	0.0770
	[0.1200]	[0.0704]	[1.2490]	[0.7310]	[0.3290]	[0.1320]	[0.4050]	[0.1940]
R_UNI_DEGRE	0.1280	0.3590*	0.8180	2.1380	-1.5380**	0.3360	-1.5200**	0.3110
	[0.1370]	[0.2080]	[0.9770]	[1.8920]	[0.7280]	[0.3480]	[0.7420]	[0.4150]
NUM_SDAYS	-0.0030	-0.0009	-0.0043	-0.00508	0.0014	0.0006	-0.0027	0.0005
	[0.0018]	[0.0010]	[0.0151]	[0.00857]	[0.0042]	[0.0015]	[0.0045]	[0.0019]
LAND_ACROP	8.43e-08	8.57e-07	4.49e-08	7.13e-06	1.28e-05***	1.16e-05***	1.30e-05***	1.12e-05***
	[2.61e-07]	[8.91e-07]	[2.38e-06]	[7.89e-06]	[2.36e-06]	[1.89e-06]	[2.43e-06]	[2.18e-06]
LAND_PCROP	-1.49e-06	1.68e-06*	8.36e-06	9.79e-06	2.77e-05*	2.44e-06	2.33e-05*	2.54e-06
	[7.53e-06]	[9.74e-07]	[3.38e-05]	[9.43e-06]	[1.67e-05]	[2.67e-06]	[1.21e-05]	[2.06e-06]
LAND_WSURF	-1.07e-06	2.40e-07	-1.39e-05**	4.82e-06	5.26e-06	5.64e-06	6.99e-06*	5.11e-06
	[1.19e-06]	[1.07e-06]	[6.84e-06]	[6.83e-06]	[4.07e-06]	[3.68e-06]	[4.03e-06]	[3.73e-06]
RE_OVERSEAS	-1.28e-06	-7.95e-07	-1.71e-05	-7.94e-06	1.47e-05***	1.43e-05***	1.69e-05**	1.49e-05***
	[1.80e-06]	[7.01e-07]	[1.50e-05]	[6.47e-06]	[5.47e-06]	[1.44e-06]	[6.94e-06]	[1.58e-06]
RE_DOMESTIC	6.35e-07	-6.31e-07	-1.75e-05	-4.69e-06	2.21e-05***	1.73e-05***	2.74e-05***	1.76e-05***
	[2.05e-06]	[5.82e-07]	[2.14e-05]	[4.50e-06]	[5.69e-06]	[2.54e-06]	[7.26e-06]	[2.70e-06]
PENSSION	-8.84e-06*	-6.61e-07**	-8.62e-05	-5.60e-05	6.66e-05***	2.41e-05***	7.47e-05***	2.79e-05***
	[8.05e-06]	[2.76e-06]	[6.64e-05]	[3.45e-05]	[1.38e-05]	[5.40e-06]	[1.90e-05]	[7.86e-06]
SAVINGS	-2.36e-06	-1.14e-07	-7.52e-06	-3.82e-06	1.34e-05	1.64e-05***	1.21e-05	1.65e-05***
	[3.72e-06]	[9.32e-07]	[3.75e-05]	[8.34e-06]	[9.32e-06]	[4.53e-06]	[1.22e-05]	[5.00e-06]
POOR_CER	-0.0396	0.0504	0.2700	0.6170**	0.0199	-0.1540***	-0.1190	-0.2120***
	[0.0743]	[0.0325]	[0.7280]	[0.3120]	[0.1470]	[0.0475]	[0.1980]	[0.0722]

3. **Village and commune**								
CR_COMMUNE	0.0052	0.0345	-0.3710	-0.2310	0.1160	0.1150	0.2300	0.1940*
	[0.0607]	[0.0679]	[0.5450]	[0.4960]	[0.1460]	[0.1020]	[0.1780]	[0.1140]
DE_CENTER	-0.0075**	-0.0036*	-0.0693***	-0.0265*	-0.0075	-0.0030	-0.0020	-0.0020
	[0.0032]	[0.0017]	[0.0267]	[0.0151]	[0.0069]	[0.0026]	[0.0100]	[0.00345]
NF_ENTER	0.0292	-0.0021	0.0147	-0.2850*	0.0374	0.0831***	0.0817	0.1270***
	[0.0395]	[0.0177]	[0.3600]	[0.1680]	[0.0950]	[0.0265]	[0.1100]	[0.0374]
TR_VILLA	-0.0123	0.0233	0.4900*	0.2870	0.0566	-1.11e-05	-0.0807	-0.0286
	[0.0375]	[0.0265]	[0.2660]	[0.2450]	[0.1030]	[0.0406]	[0.1240]	[0.0521]
CR_VILLA	0.0364	0.0242	0.8460**	0.3320	-0.0128	-0.0367	-0.1600	-0.0627
	[0.0475]	[0.0258]	[0.4120]	[0.2600]	[0.1130]	[0.0435]	[0.1830]	[0.0616]
Regional dummy								
GEO_CSTAL		-0.2210**		-0.3800		-0.0633		0.0040
		[0.1110]		[1.0760]		[0.1340]		[0.1800]
GEO_DELTA		-0.2390**		0.5690		-0.0785		-0.0896
		[0.1160]		[1.1050]		[0.0914]		[0.1330]
GEO_MIDLAND		-0.1760*		0.5120		-0.1840**		-0.1620
		[0.0997]		[0.9550]		[0.0781]		[0.1170]
GEO_LMOUNT		-0.1570*		0.2500		0.0274		0.0619
		[0.0843]		[0.7960]		[0.0607]		[0.0937]
4. **Instrumental variables**								
D_NBANK	0.0323	-0.0236**	0.2390	0.0702				
	[0.0272]	[0.0105]	[0.2110]	[0.0972]				
R_POVERTY	-0.8200***	-0.7980***	-4.2970**	-3.2530***				
	[0.2320]	[0.0885]	[2.1060]	[0.7500]				
Number of observations	1,050	5,094	1,050	5,094	1,050	5,094	1,050	5,094

Note: 1. Robust Standard Errors are in the brackets
2. *, **, and *** indicate significant level at 10%, 5%, and 1%, respectively.

Table 4: Tests for underindentification, endogeneity, weak Instruments, and weak instrument-robust inference for IV fixed effects models using the Vietnam sample

	IV Equation	Consumption Equation	Income Equation
1. Underidentification test	Programme	$Chi2_{(2)} = 88.09^{***}$	$Chi2_{(3)} = 87.69^{***}$
Kleibergen-Paap LM statistic		*p*-value = 0.000	*p*-value = 0.000
	Microcredit	$Chi2_{(2)} = 19.25^{***}$	$Chi2_{(2)} = 19.09^{***}$
Kleibergen-Paap LM statistic		*p*-value = 0.000	*p*-value = 0.000
2. Test of endogeneity	Programme	$Chi2_{(1)} = 111.81^{***}$	$Chi2_{(1)} = 42.08^{***}$
Durbin-Wu-Hausman statistic		*p*-value = 0.000	*p*-value = 0.000
	Microcredit	$Chi2_{(1)} = 116.63^{***}$	$Chi2_{(1)} = 39.49^{***}$
Durbin-Wu-Hausman statistic		*p*-value = 0.000	*p*-value = 0.000
3. Weak IV identification test:	Programme		
Cragg-Donald F statistic		43.27	43.08
	Microcredit		
Cragg-Donald F statistic		9.76	9.68
4. Weak instrument-robust inference	Programme	$Chi2(_2) = 139.53^{***}$	$Chi2(_2) = 64.47^{***}$
Anderson-Rubin Wald test	Microcredit	*p*-value = 0.000	*p*-value = 0.000

Note: 1. *, **, and *** indicate significance level at 10%, 5%, and 1% that Ho is not true, respectively.

2. Critical values for the Weak IV identification tests are based on Stock and Yogo (2005) tables.

- Given the desired maximal bias of IV estimator relative to OLS estimator (5%), Cragg-Donald F statistics reject Ho of Weak IV identification at the 5% level for IV fixed effect models of programme impact on the consumption and income equations.
- Given the desired maximal bias of IV estimator relative to OLS estimator (20%), Cragg-Donald F statistics reject Ho of Weak IV identification at the 5% level for IV fixed effect models of microcredit impact on the consumption and income equations.

Table 5: Tests for underidentification, endogeneity, weak Instruments and weak instrument-robust inference for IV fixed effects models using the MRD sample

	IV Equation	Consumption Equation	Income Equation
1. Underidentification test	Programme	$Chi2_{(2)} = 15.53^{***}$	$Chi2_{(3)} = 14.86^{***}$
Kleibergen-Paap LM statistic		*p*-value = 0.000	*p*-value = 0.000
	Microcredit	$Chi2_{(2)} = 6.40^{**}$	$Chi2_{(2)} = 5.85^{*}$
Kleibergen-Paap LM statistic		*p*-value = 0.041	*p*-value = 0.054
2. Test of endogeneity	Programme	$Chi2_{(1)} = 33.85^{***}$	$Chi2_{(1)} = 19.87^{***}$
Durbin-Wu-Hausman statistic		*p*-value = 0.000	*p*-value = 0.000
	Microcredit	$Chi2_{(1)} = 35.95^{***}$	$Chi2_{(1)} = 19.31^{***}$
Durbin-Wu-Hausman statistic		*p*-value = 0.000	*p*-value = 0.000
3. Weak IV identification test:	Programme		
Cragg-Donald F statistic		7.27	6.80
	Microcredit		
Cragg-Donald F statistic		2.97	2.80
4. Weak instrument-robust inference	Programme	$Chi2(_2) = 51.78^{***}$	$Chi2(_2) = 35.16^{***}$
Anderson-Rubin Wald test	Microcredit	*p*-value = 0.000	*p*-value = 0.000

Note: 1. *, **, and *** indicate significance level at 10%, 5%, and 1% that Ho is not true, respectively.

2. Critical values for the Weak IV identification tests are based on Stock and Yogo (2005) tables.
Given the desired maximal bias of IV estimator relative to OLS estimator (5%), Cragg-Donald F statistics do not reject Ho of Weak IV identification at the5% level for IV fixed effect models of programme and microcredit impact on the consumption and income equations.

3 Results and discussion

Tables 6 and 7 summarize the estimated results of the four IV-FE models for microcredit impact on household consumption and income (only the significant variables in each model were reported). Each table has two sets of results, one for the MRD and another for Vietnam. The first set includes the results of the microcredit program impact on household consumption (model E_1) and microloan size impact on household consumption (model E_2) using the MRD sample and likewise for household income (models I_1 and I_2). The last two columns are the results of the microcredit program impact (model E_3) and microloan size impact (model E_4) using the Vietnam sample and similarly for household income (models I_3 and I_4). The per capita expenditure and income in real terms are used to measure household consumption and income in the models, respectively[1]. The IV coefficients were estimated in the first stage regression but for the purpose of identifying the impact coefficients, the IV will also be discussed. Since the estimated results (models E_1, E_2, and I_1, I_2) for the MRD are subject to weak instrument identification, the estimated results (models E_3, E_4 and I_3, I_4) for Vietnam are mainly discussed. Unless otherwise stated, all explanatory variables are discussed using the results of the IV fixed effects models (E_3 and I_3) for the program impact. Given that the determinants of consumption and income are identified, the treatment variables - microcredit program and microloan size are discussed for the average treatment on the treated (ATT) and the average treatment of additional microloan amount on the treated (ATTM), respectively.

3.1 Impact of VBSP microcredit on household per capita consumption

Table 6 summarizes the factors in estimating the impact of VPSB microcredit on the household per capita consumption in the MRD and Vietnam. For individual factors, ETHNICITY is not significant in the MRD but significant at the 1% level in Vietnam. This implies that household heads belonging to an ethnic group have a lower per capita consumption than the main ethnic group. Different ethnicities contribute a 2% difference in household expenditure across the country but not for the MRD.

Among the household factors in four models, HHSIZE, R_BELOW16, R_PRI_SCHO, R_SEC_SCHO, LAND_ACROP, LAND_WSURF, RE_OVERSEAS, RE_DOMESTIC, PENSSION, SAVINGS, and POOR_CER significantly explain household expenditure. The negative coefficients of HHSIZE and R_BELOW16 are significant at the 1% level. Household size and number of household members below 16 years old are negatively correlated with the per capita expenditure. An increase in family members in a household significantly reduces 10% of per capita expenditure whereas an increase of 10 percentage points of the ratio of members below 16 years old decreases per capita expenditure by 5%. The coefficient POOR_CER is negatively significant at the 5% level, which indicates that poor certified households have less per capita consumption than non-poor households. Given a large family size with a high ratio of household members below 16 years old, poor certified household per capita expenditure is 24.6% less than the non-poor households (see Table 6).

The coefficients R_PRI_SCHO and R_SEC_SCHO are both positive and significant at the 10% and 5% level, respectively. The results show that the expenses related to primary and secondary schooling are important expenditures. Households with children in primary and secondary school require 14.5% and 19.7% more spending, respectively. The results reflect the common spending pattern in the Vietnamese households where spending on education takes an important share of the household budget because most Vietnamese families expects a high return from their children's education (Doan, 2011).

[1] To obtain the real term, first nominal data were adjusted for monthly price changes over the survey periods and then regional price differences over each survey. Next, the annual CPI was used to align the survey data to the base line year. Hence, all results in this section were reported in the real term.

Table 6: Summary of fixed effects estimations for household per capita expenditure

	The MRD		Vietnam	
	ln per capita Expenditure (E_1)	ln per capita Expenditure (E_2)	ln per capita Expenditure (E_3)	ln per capita Expenditure (E_4)
Impact estimators				
Participation in VBSP	2.1150***		1.4140***	
ln Microloan		0.3530**		0.3120***
Individual factors				
ETHNICITY	0.0210	0.0963	-0.0199***	-0.0246*
SEC_SCHO	0.0522	-0.0758	0.0768	0.1620*
UNI_DEGRE	0.4710***	0.2950	0.1450	0.5990**
POST_GRAD	0.5470**	0.2250	0.2730	0.3810
Household factors				
HHSIZE	-0.0704**	-0.1040**	-0.0917***	-0.1100***
R_FEMALE	-0.4380*	-0.6410*	-0.0121	-0.0765
R_BELOW 16	-0.4330	-0.5570	-0.3780***	-0.5590***
R_PRI_SCHO	0.00562	-0.1800	0.1460*	0.1140
R_SEC_SCHO	-0.0628	-0.2150	0.1970*	0.1560
R_HIG_SCHO	0.5030	0.8060*	0.2070	-0.0080
NUM_SDAYS	0.0081*	0.0036	0.0028	0.0031
LAND_ACROP	3.32e-06*	3.53e-06**	3.08e-06**	2.15e-06
LAND_PCROP	2.52e-05*	1.95e-05	2.32e-07	-7.73e-08
LAND_WSURF	1.02e-05**	1.25e-05***	1.01e-05***	8.73e-06***
RE_OVERSEAS	7.25e-06	1.06e-05	2.97e-06**	4.41e-06**
RE_DOMESTIC	2.32e-05***	3.03e-05***	1.31e-05***	1.37e-05***
PENSSION	4.12e-05**	5.40e-05**	1.56e-05**	2.40e-05*
SAVINGS	2.56e-05**	2.38e-05	1.64e-05***	1.65e-05***
POOR_CER	-0.0311	-0.2160	-0.1410**	-0.2620**
Village and commune				
DE_CENTER	0.0102	0.0189*	0.0009	0.0034*
NF_ENTER	-0.0591	-0.0054	0.0904***	0.1740***
Instrumental variables				
D_NBANK	0.0307	0.2260	-0.0239**	0.0683
R_POVERTY	-0.8520***	-4.5710**	-0.8000***	-3.2730***
Number of observations	1,052	1,052	5,096	5,096

Notes: 1. *, **, and *** indicate significance level at 10%, 5%, and 1%, respectively.
2. The coefficients of instrumental variables are estimated in the first stage.

The coefficients LAND_ACROP and LAND_WSURF are positive and significant at the 5% and 1% levels (in models I_2 and I_3), respectively. This suggests that annual crop land and areas of water surface for aquaculture positively increases the household per capita expenditure. Similarly, RE_OVERSEAS, PENSSION, RE_DOMESTIC, and SAVINGS are positive and significant at 5% and 1% levels, respectively. This indicates that household per capita expenditure is supported by overseas remittances, domestic remittances, pensions, and savings. The remittances (money and goods) sent back home by overseas migrant workers have a profound impact on the living standards of people in developing countries (Adams &Page, 2005). The overseas and domestic remittance coefficients are positive and significant at the 5% level. Overseas remittances suggest an external source of money sent from family members working or living overseas to support household consumption in Vietnam.

On the other hand, RE_DOMESTIC is positive and significant at the 1% level, which indicates that domestic remittances from family members working away from home largely support household spending, particularly rural households. International remittances reflect the economic relationship between high income and low income countries and the internal remittances suggest a wage discrepancy and job opportunities between the rural and urban areas in a country. Our results reveal a greater weight in domestic remittances over overseas sources in the determinants of household consumption in rural Vietnam. In addition, pensions and savings coefficients are positive and significant at the 5% and 1% level, respectively (see Table 6).

The coefficient of the variable related to the commune having non-farm enterprises (NF_ENTER) is positive and significant at the 1% level. This means having non-farm enterprises located in the commune significantly contributes to the household consumption. This finding is consistent with Lanjouw and Lanjouw's study (2001) which emphasises that the non-farm sector potentially absorbs a growing rural labor force in slowing down rural-urban migration and improves equitable income distribution. Similarly, Oostendorp, Trung, and Tung (2009) show non-farm enterprises play an important role in increasing income and reducing income inequality in Vietnam (see Table 6).

The two IVs, D_BANK and R_POVERTY are negative and significant at the 5% and 1% level, respectively (see Table 1). The results indicate that the ratio of poverty rate at the commune and distance to the nearest bank are negatively correlated with credit accessibility. The result confirms that a higher poverty ratio reduces the possibility of being selected in a microcredit program. The findings are consistent with Nguyen's (2008) finding in Vietnam that shows a negative relationship of the two IVs. Thus, they are significantly valid IVs for microcredit impact in our study.

The impact estimator for household per capita expenditure is positive and significant at the 1% level. This indicates that the VBSP microcredit program significantly helps increase the participants' consumption in Vietnam. The result reconfirms the positive impact of a microcredit program on the consumption indicator of welfare. Our finding is consistent with a number studies on microcredit such as Pitt and Khandker (1998), Mosley (2001), Setboonsarng and Parpiev (2008), and Islam (2011), among others. Particularly, the result is consistent with Nguyen's (2008) study in Vietnam and it also supports the empirical findings of microcredit impact in Bangladesh (Khandker, 2005).

3.2 Impact of VBSP microcredit on household per capita income

Table 7 summarizes the significant factors in the income models (I_1, I_2, I_3, and I_4). The result shows that only the UNI_DEGRE coefficient is positive and significant at the 10% level. This indicates that the household head with a university degree significantly increases the household income level by as much as 50%. The result is consistent with Doan and John's (2010) finding that the trend of returns on education increased sharply after Vietnam's economic transition and the returns to education reached a peak that significantly contributes to income growth.

In terms of the household factors, HH_SIZE, R_BELOW16, and POOR_CER are negative and significant at the 1% level in model I_3 and I_4. In addition, R_WINDUS, R_WSERV, LAND_ACROP, RE_OVERSEAS, RE_DOMESTIC, PENSION, and SAVINGS are significant at the 1% level. The result shows the number of household members working in the industry and services are positive and significant at the 1% level in the income model but insignificant in the consumption model. The results indicate that households with members working in the industry or service sectors significantly increase their per capita income. This result strongly supports the trend of the shifting of labor supply in agriculture to the other sectors since the mid-1990s. The main reasons are documented in Haughton, Haughton, and Phong (2001) where the share of hired farm workers without annual cropland was only 55% of the agriculture work and that landless households were

forced to work outside the agriculture sector. The share of workers in the agriculture sector has been declining. As a result, non-agricultural income significantly contributes to total rural household income while the bulk of poor and low income households are self-employed farmers.

Table 7: Summary of IV fixed effects estimations for household per capita income

	The MRD		Vietnam	
	ln per capita Income (I_1)	ln per capita Income (I_2)	ln per capita Income (I_3)	ln per capita Income (I_4)
Impact estimators				
Participation in VBSP	1.6660**		0.8370***	
ln Microloan		0.2540**		0.1620***
Individual factors				
ETHNICITY	0.0843	0.1370*	-0.0116	-0.0137
HIG_SCHO	0.3340*	0.3200	0.0600	0.0880
POST_GRAD	1.3010***	1.0690***	0.1860	0.2200
Household factors				
HHSIZE	-0.0552*	-0.0819**	-0.0889***	-0.1000***
R_FEMALE	-0.6120**	-0.7690**	-0.1200	-0.1550
R_BELOW 16	-0.5230*	-0.5820	-0.3650***	-0.4560***
R_WINDUS	0.1040	0.2140	0.3200***	0.3230***
R_WSERV	0.0909	0.1200	0.3770***	0.3440***
R_PRI_SCHO	0.0207	-0.1120	0.1850**	0.1650
R_SEC_SCHO	0.1110	0.03210	0.2110**	0.1980
R_UNI_DEGRE	-1.5380**	-1.5200**	0.3360	0.3110
LAND_ACROP	1.28e-05***	1.30e-05***	1.16e-05***	1.12e-05***
LAND_PCROP	2.77e-05*	2.33e-05*	2.44e-06	2.54e-06
LAND_WSURF	5.26e-06	6.99e-06*	5.64e-06	5.11e-06
RE_OVERSEAS	1.47e-05***	1.69e-05**	1.43e-05***	1.49e-05***
RE_DOMESTIC	2.21e-05***	2.74e-05***	1.73e-05***	1.76e-05***
PENSSION	6.66e-05***	7.47e-05***	2.41e-05***	2.79e-05***
SAVINGS	1.34e-05	1.21e-05	1.64e-05***	1.65e-05***
POOR_CER	0.0199	-0.1190	-0.1540***	-0.2120***
Village and commune				
CR_COMMUNE	0.1160	0.2300	0.1150	0.1940*
NF_ENTER	0.0374	0.0817	0.0831***	0.1270***
GEO_MIDLAND			-0.1840**	-0.1620
Instrumental variables				
D_NBANK	0.0323	0.2390	-0.0236**	0.0702
R_POVERTY	-0.8200***	-4.2970**	-0.7980***	-3.2530***
Number of observations	1,050	1,050	5,094	5,094

Notes: 1. *, **, and *** indicate significance level at 10%, 5%, and 1%, respectively.
2. The coefficients of instrumental variables are estimated in the first stage.

There are some notable differences between the results from the MRD and Vietnam as a whole (see Table 7). First, the ETHNIC coefficients have mixed signs, which show an inconsistent relationship between ethnicity and income. Ethnicity is positively significant at the 10% level in model I_2 and positive but insignificant in model I_1, and it is negative and insignificant in the other models (I_3 and I_4). The results imply that ethnicity is not significantly correlated with household income in the MRD where there are few numbers of ethnic minorities such as Khmer, Chinese and Cham whose income

levels are not significantly different. However, when ethnicity is investigated at the national level with a wider range of ethnic minorities with different geographic and economic conditions from mountainous and remote areas, the impact exhibits an inverse relationship. The finding is consistent with Nguyen, Albrecht, Vroman, and Westbrook's (2007) findings that show ethnicity is one of the determinants of income gaps. In addition, the coefficient of geographic factors is negative and significant at the 1% level for mid land and hilly land areas. If we consider the MRD only, geographic factors do not vary but geographic effects become significant at the national level. The result indicates that lower income is closely related to mid land or hilly land areas across the country.

The R_PRI_SCHO and R_SEC_SCHOO coefficients are positive and significant at the 5% level. The result indicates that the households tend to spend 18.5% for children to attend primary school and 21.1% to attend secondary school in Vietnam (see Table 7). The number of household members in school can have an inverse effect if more household resources have been used for their children to obtain higher education. For example, the negative and significant coefficients of R_UNI_DEGRE are reported in models I_1 and I_2. This is expected because more household members engaging in higher education level uses more household resources but contributes less to per capita income.

The two IVs variables, D_NBANK and R-POVERTY are negative and significant at the 5% and 1% level, respectively. However, D_NBANK is negative and significant in both E_3 and I_3 (see Table 6 and 7) but is positive and insignificant in the rest of the models. The inconsistency may arise from missing data at the commune level because of mismatched communes from merging the commune and household datasets. Some communes in the VHLSS survey data for commune were not interviewed in the same VHLSS surveys for households. As a result, D_NBANK is a valid instrument for the credit participation at the national level but may be invalid for the microloan and the MRD models. In addition, as pointed out by Nguyen (2008), the distance from a village where the households are located to the nearest bank does not guarantee that the branch bank is a VBSP branch; the nearest bank can be any commercial bank, including VBSP. The distance is probably an inaccurate proxy for many observations. Moreover, the coverage of the VBSP microcredit program has been expanded over time. Increased lending to groups has been organised in villages where microcredit groups can be formed by credit group members with the presence of village heads or local authorities rather than lending to individuals at the VBSP branch. Therefore, the time varying effects could possibly make this variable an inappropriate proxy for VBSP credit availability in the current context.

The impact estimator for household per capita income is positive and significant at the 1% level. The result confirms the positive impact of microcredit programs on household income. This result is consistent with the findings of Zaman (1999), Sarangi (2007) and Nguyen (2008), but contradicts Coleman's study (2006) which shows an ambiguous impact of a microcredit program on income indicators in Thailand.

Table 8 compares the impacts of microcredit program participation and microloan size between the MRD and Vietnam as a whole. Both impact estimators are positive and significant. This finding suggests two important points: 1) participation in a microcredit program has benefited the target households and 2) the marginal effect of microloan size significantly contributed to either household consumption or income. There appears to be a large difference in the magnitude of the impacts between MRD and Vietnam as a whole, provided that endogeneity has been significantly controlled for in the models. Microcredit has a greater impact in the MRD in terms of both income and consumption compared with the country as a whole.

Table 8: Summary of impact estimators of VBSP microcredit program using IV-FE models

Impact variable	The MRD		Vietnam	
	ln per capita Expenditure	ln per capita Income	ln per capita Expenditure	ln per capita Income
Program participation	2.1146*** [0.6159]	1.6659*** [0.5835]	1.4140*** [0.1629]	0.8369*** [0.1351]
Microloan (1,000 dong)	0.3531** [0.1473]	0.2543** [0.1294]	0.3116*** [0.0738]	0.1629*** [0.0488]
Number of observations	1,052	1,050	5,096	5,094

Notes: 1. *, **, and *** indicate significance level at 10%, 5%, and 1%, respectively.
2. Robust S.E. (with sampling weight error corrected) are in brackets.

The impact estimators are significant at the 1% level, while the MRD impact estimators of microloan on consumption and income are significant at the 5% and 10% level, respectively. The significantly high magnitude of the MRD impact estimators at lower significance levels is largely due to two possibilities. First is the smaller sample size of MRD that produces larger variances of the impact estimators in the model. Another possibility can be explained based on Morduch's (1998) claim about the weak instrument identification problem. The instruments are supposed to pick up any systematic heterogeneity such as land ownership, entrepreneurial skills, etc., that may correlate with program participation. However, weak instrument identification in models E_2 and I_2 indicates that the instruments fail to account for such systematic heterogeneity. As a result, the unobserved heterogeneity, for example, 'better borrowers' get bigger loans, yield what appears to be positive insignificant marginal impacts in the models.

4 Conclusion and implications

This paper examines the impact of participation in a microcredit program on rural households in the MRD and Vietnam. Controlling for program heterogeneity at individual, household, village, commune, and regional levels, the results of IV-FE models document a positive and significant impact of microcredit program participation and microloan size in the household per capita consumption at the national level. Greater impacts were identified for the microcredit programme in the MRD compared to the country average, assuming that the endogeneity was significantly controlled for in the models. This greater impact is largely attributed to the observed factors at the regional level; however, unobserved factors such as, individual heterogeneity, are also believed to contribute to the differences. This is because the people in the MRD region are more business-oriented than other regions, access to microcredit helps reduce the capital constraint, which likely improves marginal productivity of capital hence increases income and consumption. This occurs even in micro and small-scale business at the rural household level.

One unexpected finding arising from this study is that the instrumental variable's validity is subject to a time varying effect. The instrumental variables used to account for unobserved endogeneity in impact evaluation likely change with changes in economic conditions where the microcredit programmes are implemented. This is particularly so when the poverty rate of the commune remains valid but the distance to the nearest bank is inconsistent and insignificant. The inconsistency of IV may cause inconsistent impact estimators from the IV-FE models because instruments encountering endogeneity likely face weak instrument identification. This time varying effect requires extra caution when IV-FE models are used to evaluate programme impact.

This study produces evidence of a long-term impact of the formal microcredit programme in rural areas. Future research can explore the dynamic impact of microcredit programmes. As past credit

and the length of microcredit participation is believed to contribute to a wider concept of impact evaluation, i.e., dynamic impact, a confirmation of the dynamic impact of microcredit programmes provides further evidence whether the programme impacts accrue beyond the participation period.

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