The Effect of Microfinance and its Impact on Economic Growth

- A Case Study of Rural Vietnam -

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Abstract

Since its birth in 1970s, microfinance has been growing rapidly with the aim to reduce poverty and to promote economic growth. In this paper, we focus on the effect of microfinance in rural Viet Nam using the panel data of the Vietnam Access to Resources Household Surveys (VARHS). We have two objectives: the first is to examine the effect of microfinance at the micro level, and the second is to evaluate the impact on economic growth. For the first objective, we employ the method for project evaluation and identify the effect of microfinance on production activity and net income of rural households who use microfinance. After examining the impact of microfinance on poverty reduction, we aggregate the effect of production increase and income growth among rural households and evaluate the macro impact with applying input-output analysis. The results at micro level find that microcredit benefits self-employment rather than other activities. The result from the macroeconomic viewpoints is that effect of output increase is not so large.

Keywords: microfinance, poverty reduction, economic growth, input-output analysis, VARHS

1. INTRODUCTION

Poverty reduction, access to education, clean water, sanitary, health care, etc. are the top concerned among 17 Sustainable Development Goals - SDGs) which formerly was Millennium Development Goals (MGDs). They are the important issues and attract the attention of every country, especially the developing countries like Vietnam. During the past decades, Vietnam has had remarkable achievements in the socio-economic development. Vietnam is considered one of the few countries that have obtained the remarkable achievement in poverty reduction. Statistics by World Bank Indicators showed that the poverty rate (using GSO-WB Poverty Line) has declined from 37.4 percent in 1998 to 17.2 percent in 2012 (Demombynes and Vu, 2015). The report also shows that the poverty rate in 2012 in rural areas (22.1 percent) is four times higher than that in urban areas (5.4 percent). The statistics indicate that a large number of rural households in Vietnam, especially the rural poor, still live in poverty with under poor living standards and suffer from the lack of socio-economic opportunities.

Poverty reduction, education, gender equality, good health and clean water and sanitation, especially in the rural area, are the most concerned issues among the 17 Sustainable Development Goals. In the world and in Vietnam, many programs have been implemented to achieve these goals.

Morduch and Haley (2002) state that credits can help the poor to improve their living standards or at least cover their living expenses. However, a research by Brau and Woller (2004) find that the poor have difficulties in accessing to formal credit sources; particularly, the poor in the developing countries have more difficulties in accessing than those in the developed countries. In Vietnam, many rural households have difficulties in accessing to credit, especially poor households, households in remote areas, the minority ethnic groups, or households operating in such fields with high risk as aquaculture, etc., These households always have high demand for credit (Duong and Izumida, 2002) but they have some difficulties in borrowing from semi-formal and formal credit sources such as banks or financial institutions due to lack of collateral assets. Thenceforth, many households have to borrow from informal credit sources such as friends, relatives, money-lender, etc. The Government has taken a lot

of effort to support the rural households with accessing to semi-formal and formal credit but the result is still rather limited. Microcredit is designed as a collateral-free credit services and established to serve the poor, and thereby it can increase the poor households' accessibility to formal credit. Microcredit is defined as a small loan granted to the poor so that they can run production or do business to generate income and improve their well-being **(**Microcredit Summit, 1997).

Microcredit programs have applied in many countries as a tool of poverty reduction and hunger eradication. Microcredit is considered as a tool for the goal of fighting poverty and improving welfare via increasing their income or consumption (Khandker, 1998; Yunus, 2003; Li et al., 2011; Khandker and Koolwal., 2016). Some researchers argue that microcredit has no significant affect on households' living standards or only benefit the less poor households (Hulme and Mosley, 1996; Coleman, 1999; Dupas and Robinson, 2008; Coleman, 2006). Takahashi et al. (2010) conclude that microcredit has no significant impact on various outcomes, except for sales from self-employment for the non-poor and schooling expense for the poor, thereby indicating that microcredit has no immediate impact on poverty reduction.

In Vietnam, microcredit is found to improve households income, consumption or self-employment profits, thereby reducing poverty-gap and contributing to the poverty alleviation (Nguyen, 2008; Lensink and Pham, 2011; Phan et al., 2014). Reis and Mollinga (2012) also conclude that microcredit program was founded to improve the quality of water supply and the sanity system of the rural households in Vietnam. However, neither of these studies investigates the role of microcredit in improving different income sources.

Households are always rational when making decisions. Moreover, due to the constraint in intra-household resources, the farmers may choose the appropriate income-generating activities to optimize their benefit. Credit is fungible and thereby credit borrowed for nonfarm activities can be diverted to other income-generating activities such as agriculture (Khandker and Koolwal, 2016). Therefore, it is interested and necessary to investigate the effect of microcredit on various income sources. Literature document that few studies in Vietnam investigate the role of microcredit on different types of income sources. Therefore, this research is conducted to examine the

role of microcredit in improving income from such activities as agriculture, self-employment, common property resources, etc. To capture to better results, this research applies match difference in difference (Match DID or PSM-DID) to investigate the micro-impact of microcredit.

Though there are many studies which evaluate the impact of microfinance on poverty and welfare at household level as explained above, surprisingly little is known about macro impact. Within these studies, there are two types of studies, econometric study and quantitative study such as computable general equilibrium analysis. For example, Maksudova (2010) shows the Granger causality from microfinance to economic growth with Microfinance Information Exchange (MIX) data. In contrast to econometric study, Buera et al. (2012), Mahjabeen (2008) and Raihan et al. (2017) employ computable general equilibrium model for evaluating aggregate and distributional impact of microfinance targeted to small business, impact on household consumption and welfare, and show the existence of macro impact. Essentially these studies are counterfactual analysis, and are not based on the econometric study. Thus we use the econometric results on the effect of microfinance at the household level, and evaluate the macroeconomic effect, especially the increase in outputs, by using input-output framework. To our best knowledge, there is no study for using input output model for evaluating macroeconomic effect.

2. METHODOLOGY

2.1. Model for Analyzing Micro-Impact of Microcredit

2.1.1. Estimation Strategy

The objective of Impact evaluation of a program is to investigate the difference in outcome between participation and non-participation in the programs. However, in reality, we cannot observe one household at two stages at the same time. That is, there is no household that can both participate and non-participate in a program. Impact evaluation methods will construct a counterfactual to make comparison between participating group (Treatment) and non-participating group (Control) with the most similar characteristics. Thenceforth, it is possible to evaluate the impact of the

programs on the outcome (welfare). This research employs PSM-DID for estimating the impact of microcredit on various welfare indicators.

Propensity Score Matching (PSM)

PSM method was initiated by Rosenbaum and Rubin (1983), and then it is developed in many studies by Becker and Ichino (2002), Dehejia and Wahba (2002), Khandker et al., (2010). On the basis of impact evaluation using PSM, the following steps should be conducted:

Firstly, a probit model is conducted to estimate determinants of accessibility to microcredit. The estimated probability of participation (or propensity score) of each household in the research data is calculated from this model. The equation is written as follows:

$$Pr(Cr_i=1) = \beta_0 + \beta_1 Z_i$$

Where, Cr_i denote the participation in microcredit program (1=Borrow; 0=Non-borrow). Z_i represents determinants of the accessibility to microcredit.

In the next step**,** the common support region is specified. In this step, some observations of control group may be dropped out because they have too high or two low estimated probability. Also in this step is the balancing test conducted to testify whether, in each block, the average Propensity score and mean of X are not different between treated units and control units. Dehejia and Wahba (2002) state that this test is conducted via distributing the observations into blocks based on the estimated propensity scores.

At the matching step, each treated unit is matched with one or some control units based on the most similar propensity score. Then the outcomes between each treated unit and control units are compared. The difference from this comparison reflects the impact of microcredit programs with respect to each treated unit, or individual gain. In order to match these two groups, various techniques of matching may be applied such as Nearest-neighbor, Caliper (or radius), Stratification (or interval), and Kernel matching.

Average outcome of all individual differences is then calculated to capture overall mean value that is considered as impact of microcredit program.

PSM has been a common method for policy researches including impact evaluation of credit programs. PSM may to reduce the selection biases when estimating the results. However, this method results in some limitations such as: (1) PSM does not measure the difference in an outcome pre–post attendance in the program overtime. (2) Hidden bias may still exist because PSM do not include unobservable characteristics.

Difference in Difference (DID)

Followed Lester (1946) and Khandker et al. (2010), the model using DID is as follows:

$$Y_{it} = \beta_0 + \beta_1 T + \beta_2 CR + \beta_3 T * CR + \varepsilon_{it}$$

Where, $\boldsymbol{Y_{it}}$ denotes outcomes of households *i* at time *t*. C***r*** is treatment status (1=Treatment; 0=Control) or Participation in microcredit programs (1=Borrow; 0=Non-borrow). ***T*** denotes time Variable (0=Before Treatment; 1=After Treatment). $\boldsymbol{\varepsilon_{it}}$ is error term.

($\hat{\beta}_0$) and ($\hat{\beta}_0 + \hat{\beta}_1$) are the mean outcomes of control group before and after program, respectively. Meanwhile, ($\hat{\beta}_0 + \hat{\beta}_2$) and ($\hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2 + \hat{\beta}_3$) are the mean outcome of treatment group before and after program, respectively. Accordingly, ($\hat{\beta}_2$) and ($\hat{\beta}_2 + \hat{\beta}_3$) are the single differences between two comparison groups before and after program, respectively. The DID estimate is the variation in outcome between two comparison groups before and after program. Therefore, ($\hat{\beta}_3$) is estimated coefficients using DID.

PSM-DID

PSM-DID is a combination of PSM and DID using panel data. Khandker et al. (2010) state that PSM-DID can capture better results due to its reduction in estimation bias. Based on PSM and DID methods, the PSM-DID include some main stages including (1) calculation of propensity score; (2) balancing test and common support ; (3) DID combined with matching to match treatment with control group and estimate the impact of program. In this research, the PSM-DID is estimated using command *diff* developed by Villa (2016). Command *diff* combines DID estimation with kernel

matching (Heckman et al., 1997, 1998; Blundell and Dias, 2009; cited in Villa, 2016). The kernel weights are also incorporated to capture a kernel matching DID treatment effect.

2.1.2. Selection of variables

Microcredit, in this research, is defined the small loan loans from formal and semi-formal sources that are used for income-generating activities such as production or self-employment. As prescribed in the Decision No. 306/QD-TTg of the Prime Minister, the maximum amount that Vietnam Bank for Social Policy can grant the poor is 100 million dong. Moreover, Khoi et al.'s (2013) research in Vietnam specifies the amount of microcredit no larger than 100 million dong. On these basis, this research also limits the loan amount under 100 million dong to be considered as microcredit.

The independent variable used for calculating Propensity Score are presented at **Table 2**. There is no firm theory on the selection of variables to be incorporated into the model of determinants of accessibility to credit sources, including formal or informal. The empirical evidences document that factors affecting households' probability of accessing microcredit may includes characteristics at household head level, household level, region level and institutional level (Duong and Izumida, 2002; Li et al, 2011; Phan et al., 2013; Li et al., 2013). On the basis of literature review and data availability, this research selects the independent variables (*see* **Table 2**) to include in the research model. Based on the research by Khandker et al. (2016), Takahashi et al. (2010), Lensink and Pham (2012), the outcome variables (dependent variables) used for estimation the micro-impact of microcredit are presented in **Table 3**.

2.2. Model for Analyzing Macro-Impact of Microcredit

The fundamental system of equations are written as follows:

$$
\begin{aligned}
X_1 &= A_{11}X_1 + A_{12}X_2 + F_1 + E_1 - M_1 \\
X_2 &= A_{21}X_1 + A_{22}X_2 + F_2 + E_2 - M_2 \\
M_1 &= \hat{M}_1(A_{11}X_1 + A_{12}X_2 + F_1) \\
M_2 &= \hat{M}_2(A_{21}X_1 + A_{22}X_2 + F_2)
\end{aligned}
$$

where X_i are sub vector of output column vector, A_{ij} are sub matrix of input-output coefficient matrix, F_i are sub-vector of final demand, E_i are sub vector of export, M_i are sub vector of import and $\hat{M}_i$ are diagonal matrix of import to domestic demand ratios. First two equations are demand and supply equilibrium conditions, while third and fourth equations show that the import is determined as a portion of domestic demand.

In the standard input-output model, final demand vectors are assumed to be exogenous, and we obtain output by the following system of equations:

$$\begin{pmatrix} X_1 \\ X_2 \end{pmatrix} = \begin{pmatrix} I_1 - (I_1 - \hat{M}_1)A_{11} & -(I_1 - \hat{M}_1)A_{12} \\ -(I_2 - \hat{M}_2)A_{21} & I_2 - (I - \hat{M}_2)A_{22} \end{pmatrix}^{-1} \begin{pmatrix} (I - \hat{M}_1)F_1 + E_1 \\ (I - \hat{M}_2)F_2 + E_2 \end{pmatrix}$$

The associated comparative static version of the above model is

$$\begin{pmatrix} dX_1 \\ dX_2 \end{pmatrix} = \begin{pmatrix} I_1 - (I_1 - \hat{M}_1)A_{11} & -(I_1 - \hat{M}_1)A_{12} \\ -(I_2 - \hat{M}_2)A_{21} & I_2 - (I - \hat{M}_2)A_{22} \end{pmatrix}^{-1} \begin{pmatrix} (I - \hat{M}_1)dF_1 + dE_1 \\ (I - \hat{M}_2)dF_2 + dE_2 \end{pmatrix}.$$

When we evaluate the macroeconomic effect of micro finance, we treat the output of some industries as exogenous. Suppose X_2 as exogenous. First and third fundamental equations are used for obtaining the following:

$$X_1 = \left(I - (I - \hat{M}_1)A_{11}\right)^{-1}\left((I - \hat{M}_1)A_{12}\overline{X}_2 + (I - \hat{M}_1)F_1 + (I - \hat{M}_1)E_1\right)$$

This is one of the modifications in this paper. We can evaluate the endogenous output change due to the change in exogenous output by

$$dX_1 = \left(I - (I - \hat{M}_1)A_{11}\right)^{-1}\left((I - \hat{M}_1)A_{12}d\overline{X}_2\right).$$

From the second fundamental equation, M_2 is determined as well. This formula examines only *interindustrial linkage* due to the intermediate transaction among industries. Another modification is treating final demand as endogenous. Since when output of some industries change, value added is changed as well. This induces the change in income of laborers for example, and as a consequence final demand will be changed. The final demand function is modified as follows:

$$F_1 = F_{10} + F_{11} = F_{10} + c_1 f_1(V_1 X_1 + V_2 X_2)$$
$$F_2 = F_{20} + F_{21} = F_{20} + c_1 f_2(V_1 X_1 + V_2 X_2)$$

where V_i are row vector of value added coefficients, c_1 is marginal propensity to consume, and f_i is share vector of final demand. In this formulation, we obtain

$$X_1 = \left(I - ((I - \hat{M}_1)A_{11} + c_1(I - \hat{M}_1)f_1V_1)\right)^{-1}\left((I - \hat{M}_1)A_{12} + c_1(I - \hat{M}_1)f_1V_2)X_2 + E_1\right).$$

Comparative static version is

$$dX_1 = \left(I - ((I - \hat{M}_1)A_{11} + c_1(I - \hat{M}_1)f_1V_1)\right)^{-1}((I - \hat{M}_1)A_{12} + c_1(I - \hat{M}_1)f_1V_2) \cdot dX_2.$$

Using this formula, we can evaluate the *income linkage* as well as *interindustrial linkage*. That is, the effect of final demand change on industrial output due to income change is captured.

3. RESEARCH DATA

3.1. Data Source

VARHS are conducted under the cooperation of the Central Institute for Economic Management (CIEM), Ministry of Planning and Investment (MPI), the Center for Agricultural Policy (CAP), Institute of Labor Science and Social Affairs (ILSSA), Ministry of labor - Invalids and social affairs (MOLISA); the Development Economics Research Group (DERG), the University of Copenhagen; and the Ministry of Foreign Affairs (DANIDA), Denmark. Vietnam Access to Resource Household Survey (VARHS) is a large-scale survey. This survey collects data from 3703 rural households in 47 communes located in 12 provinces in Vietnam, including 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. These 12 provinces represents 7 socio-economic regions in Vietnam, including Red River Delta, North East, North West, North Central, South Central Coast, Central Highlands and Mekong River Delta.

VARHS survey provides detailed information about a wide range of important demographic, economic and social characteristics of the farm households, such as on farm- and farmer-specific attributes, resources endowment, agricultural inputs and outputs, economic activities and welfare, savings and borrowings etc., From 3703 households survey in 2012, 3644 households are re-interviewed in 2014. In order to create a balance panel data, some observations with missing data are dropped out of

the research sample. The final sample used for estimation are 7088 observations, including households each survey.

For estimating the macro impact of microcredit, we also employ Vietnamese Input-Output (IO) table of 2007 published by the General Statistics Office of Vietnam (GSO). This IO table provides a useful framework that accounts for interrelationships among 138 sectors in Vietnam's economy. Input-Output (IO) is considered as a useful tool for analyzing the relationship between microcredit and economic activities, thereby capturing the impact of microcredit on economic growth.

3.2. Descriptive Statistics

Table 1 reports the loans obtained by households in this research. **Table 1** show that for the case of pooled sample, the number of households granted with loans is 2654, accounting for 37.44%. The number of borrowers tend to reduce over time while the average amount increases from 2012 to 2014, which indicates that credit provider seem to give priority to the amount of each loan rather than the number of loan. This trend is similar for the case of microcredit and loan form production (formal or informal). However, for the case of microcredit and informal loan for consumption, there is an inverse trend; that is, the number of borrowers tend to increase but the loan amount reduces over time. For the case of formal and semi-formal loan for consumption, both number of borrowers and loan amount tend to increase over time. **Table 1** also report that among 2654 borrowers, there are 1908 borrowers from formal and semi-formal sources and 967 from informal sources, which indicates that some households borrow from both sources. The total amount of informal loan imply that informal credit sector still plays a significant role in rural financial market in Vietnam. This information is similar to Barslund and Tarp's (2008) research in Vietnam, in which find that credit informal sector co-exist with formal sector and accounting for about one-third of all loans. The explanation is that the rural poor households still rely on informal networks and relatives.

Table 1 – Loans Obtained

	Number of Borrowers			Average Amount		
	2012	**2014**	**Pooled**	**2012**	**2014**	**Pooled**
ANY LOAN	1408	1246	2654	40.474	57.248	48.349
Microcredit	572	313	885	27.845	35.856	30.678
Non-Microcredit	922	974	1,896	63.558	50.013	56.971
BOTH	86	41	127			
Formal & Semi-formal	1,017	891	1,908	42.578	67.138	54.047
Production	637	362	999	50.055	77.133	59.867
Consumption	449	583	1,032	30.540	61.467	48.011
Informal	512	455	967	37.798	34.523	36.257
Production	350	192	542	36.192	38.671	37.070
Consumption	217	308	525	37.961	31.971	34.447
BOTH	121	100	221			

Note: Average amount in Million VND

885 households are found to borrow from microcredit sources and of those, there are 572 borrowers in 2012 and 313 borrowers in 2014. Meanwhile, there are 1896 borrowers from other non-microcredit sources, and of those 922 borrowers in 2012 and 974 borrowers in 2014. The results on number of borrowers from any source, microcredit and non-microcredit sources indicate that some households borrow from both sources. Similarly, the results on number of households borrowing from any source, formal and semi-formal source and informal sources show that some households have access to both sources.

The objective of this research is to evaluate the impact of microcredit program using PSM-DID. Therefore, the households who borrow from microcredit at T=1 are considered as treatment; the remaining households are control. Therefore, in this research, there are 313 microcredit borrowers at T=1, which indicates that the number of treatments are 313 households (616 observations in both surveys). The descriptive statistics present the characteristics of treatment and control groups over times.

Table 2 shows some statistical summary on the characteristics of treatment and control group in the first wave (baseline or year 2012 or T=0) and second wave (follow-up or year 2014 or T=1). There is significant difference between treatment and control groups in terms of some characteristics.

Table 3 shows the mean of outcomes of both group as well as the difference in outcomes between them at both waves. For most of the cases, the borrowing group seem to have higher outcomes than their non-borrowing counterparts, but only some of the difference in these indicators are statistically significant. Most of average outcomes of both groups tend to increase over time. For instance, treatment group appear to have significantly higher total output value and income from agricultural activities than control group at both waves. Further investigations on sub-sector of agriculture show that treatment group have greater total output value from crop production (significant in both waves) but there is no significant difference between these groups in terms of income from crop production. Treatment group have significantly higher total output and income from livestock than control group at baseline, but there is no difference at follow-up. There is no significant difference between two groups in terms of output value or income from self-employment and common property resources. Treatment group appear to have lower wage income than control groups and this difference is significant at both waves. There is no significant difference between the two groups in terms of total output value and income from earned sources (including and excluding wage income).

Table 2 - Variables for Estimation of Participation in Microcredit

Variable	T=0			T=1		
	Treated	**Control**	**Diff**	**Treated**	**Control**	**Diff**
Education of HHH (Grade)	6.21	6.30	-0.093	6.68	6.56	0.128
Age of HHH	47.22	49.76	-2.54**	48.63	51.46	-2.835***
Marital Status of HHH (1=Married)	0.86	0.83	0.032	0.87	0.82	0.056*
Gender of HHH (1=Male)	0.86	0.82	0.0408	0.85	0.80	0.053*
Ethnic of HHH (1=Kinh)	0.58	0.66	-0.081**	0.58	0.66	-0.075**
Microcredit (1=Yes)	0.29	0.15	0.145***			
Non-Microcredit (1=Yes)	0.32	0.25	0.062*	0.13	0.29	-0.158***
Poverty Status (1=Yes)	0.27	0.25	0.012	0.20	0.19	0.016
Saving Value (Mil dong)	17.40	27.83	-10.43	20.22	30.75	-10.53*
Agricultural Land (hectare)	1.03	0.76	0.266***	1.03	0.73	0.309***
Residential Land (hectare)	0.14	0.10	0.043**	0.13	0.10	0.035*
Household Size	4.89	4.47	0.427***	4.86	4.41	0.451***
Dependence Ratio	0.30	0.35	-0.051**	0.29	0.36	-0.068***
Agricultural Labor	3.05	2.45	0.597***	3.19	2.49	0.704***
Self-employment Labor	1.09	1.02	0.0735	1.18	1.20	-0.024
Wage Labor	0.41	0.45	-0.042	0.44	0.37	0.068
Distance to main road (km)	2.03	2.15	-0.115	1.80	1.86	-0.054
Social Capital	7.27	7.43	-0.156	7.60	7.36	0.246
Poor Commune	0.61	0.51	0.095**	0.48	0.38	0.095**
Market (1=Yes)	0.52	0.57	-0.043	0.63	0.67	-0.049
Red River Delta (1=Yes)	0.13	0.17	-0.038	0.13	0.17	-0.038
North East (1=Yes)	0.16	0.19	-0.030	0.16	0.19	-0.030
North West (1=Yes)	0.21	0.17	0.033	0.21	0.17	0.033
North Central (1=Yes)	0.04	0.07	-0.032*	0.04	0.07	-0.032*
South Central Coast (1=Yes)	0.04	0.13	-0.096***	0.04	0.13	-0.096***
Central Highlands (1=Yes)	0.34	0.19	0.150***	0.34	0.19	0.150***
Mekong River Delta (1=Yes)	0.10	0.09	0.012	0.10	0.09	0.012
Obs	313	3231		313	3231	

Note: Difference = Mean (Treatment) - Mean (Control)

Continuous variables are tested using ttest; Dummies in Italic at the bottom are tested using prtest.

*, ** and *** : Significant at 10%, 5% and 1%, respectively.

Table 3 – Outcome Variables for Estimation of Micro-Impact of Microcredit

	T=0			T=1		
Variables	**Treated**	**Control**	**Diff**	**Treated**	**Control**	**Diff**
INCOME						
Agriculture	33.950	23.411	10.54***	35.030	26.935	8.094*
Crop	4.172	4.311	-0.139	2.925	5.116	-2.191
Rice	10.486	6.581	3.905***	11.054	7.099	3.955**
Maize	2.012	1.616	0.396	2.278	1.460	0.817*
Livestock + Aqua	13.060	6.776	6.284**	10.571	8.076	2.496
Livestock	8.323	4.735	3.588**	4.839	5.295	-0.456
Aquaculture	4.737	2.040	2.696	5.732	2.781	2.951
Self-employment	7.534	15.085	-7.551	16.051	16.488	-0.437
Common property resources	2.002	1.614	0.388	1.925	1.885	0.041
Wage	16.530	22.971	-6.441***	23.464	30.437	-6.973*
Total Earned Sources	60.016	63.081	-3.065	76.470	75.745	0.725
TOTAL OUTPUT VALUE						
Agriculture	72.048	47.714	24.33***	79.293	53.576	25.72***
Crop	45.528	32.011	13.52**	52.359	35.133	17.23***
Rice	18.678	11.524	7.154***	19.868	12.435	7.433***
Maize	2.840	2.328	0.511	3.607	2.342	1.265*
Livestock + Aqua	26.519	15.703	10.82**	26.934	18.443	8.491
Livestock	22.682	14.224	8.457*	22.628	16.433	6.195
Aquaculture	3.838	1.479	2.358*	4.306	2.011	2.296
Self-employment	30.019	69.311	-39.29	60.543	70.953	-10.41
Common Property Resources	2.315	1.715	0.600	2.078	2.125	-0.047
Wage	16.530	22.971	-6.441***	23.464	30.437	-6.973*
Total Earned Sources	120.912	141.712	-20.80	165.378	157.092	8.286
Obs	313	3231		313	3231	

Note: Difference = Mean (Treatment) - Mean (Control)
The dummies in Italic. ; Unit in Million VND
*, ** and *** : Significant at 10%, 5% and 1%, respectively.

4. RESULTS AND DISCUSSIONS

4.1. Participation in Microcredit Program (Propensity Score) and Balancing Test

Table 4 shows the estimation results on determinants of accessibility to microcredit using probit model as the first stage of estimation using PSM-DID. These results are used for the calculation of propensity score. Khandker et al. (2010) suggests that the independent variables used for estimating the probability of participation in a program should be in T=0. Therefore, most of characteristics for

estimating propensity score as T=0, except for Non-microcredit, which include the information in T=0 and T=1. The estimations using *probit*, *pscore* or *diff* give the same results. Therefore, we only report one estimated result. Max VIF equals to 4.32, which indicates that there is no multi-colinearity in this model. The result on balancing test is satisfied.

The results on common support regions specify that 296 households (using *diff* command) or 302 households (using *pscore*) fall in off-support region. A further investigation reports that difference using these commands is 8 households. Due to the second stage using *diff* to estimate the average impact of microcredit, 6792 households in common support regions specified by *diff* will be used for analysis.

4.2. Micro Impact of Microcredit Program

Table 5 show that total income from earned sources (agriculture, self-employment, common property resources and wage) seem to be unchanged when households have access to microcredit. This finding is somewhat similar to Takahashi et al. (2010) and Phan et al. (2014), who find no role of microcredit in improving total income, but contrary to Khandker and Koolwal (2016) and Li et al. (2011), who conclude that microcredit significantly increase total earned income. However, the total production value from earned sources are found to increase when households can borrow from microcredit sources and this effect is significant at 5 percent. A plausible explanation is that households can simply raise output via increasing input, but they can not gain the optimal input mix to improve raise profits (Takahashi et al., 2010)

Table 4 – Probit Estimations on Determinants of Accessibility to microcredit.

Variable	Coef.	t-stat
Microcredit (1=Yes)	0.4612***	5.77
Non-Microcredit at T=1 (1=Yes)	-0.6867***	-8.04
Non-Microcredit at T=0 (1=Yes)	0.1881**	2.54
Education level of HHH (Grade)	0.0066	0.63
Age of HHH	-0.0079***	-2.69
Marital Status of HHH (1=Married)	-0.1677	-1.32
Gender of HHH (1=Male)	0.0542	0.44
Ethnic of HHH (1=Kinh)	0.1068	1.01
Poverty Status (1=Yes)	0.0195	0.24
Saving Value (Mil dong)	-0.0020**	-2.37
Agricultural Land (hectare)	-0.0101	-0.18
Residential Land (hectare)	0.1523	1.07
Total Land (hectare)	0.0211	0.44
Household Size	0.0094	0.37
Dependence Ratio	-0.2620*	-1.79
Agricultural Labor	0.1123***	3.59
Non-Wage (Non-farm) Labor	-0.0249	-0.74
Wage Labor	-0.0360	-0.9
Distance to main road (kilometer)	-0.0183*	-1.89
Social Capital	0.0088	1.52
Poor Commune	0.0004	0.01
Market (1=Yes)	0.0675	0.91
Mekong River Delta (Base)		
Red River Delta (1=Yes)	-0.3074**	-2.08
North East (1=Yes)	-0.3874**	-2.57
North West (1=Yes)	-0.1281	-0.81
North Central (1=Yes)	-0.5288***	-2.72
South Central Coast (1=Yes)	-0.7818	-4.4
Central Highlands (1=Yes)	0.0288	0.21
Constant	-1.0333***	-4.00
Max VIF	**4.53**	
Balancing test	**Satisfied**	
Off-support	**296 [302]**	
On-Support	**6792 [6786]**	

Note: The dummies in Italic.
*, ** and *** : Significant at 10%, 5% and 1%, respectively.
Common support region is identified using such commands as *diff* and *pscore* [in bracket].

Moreover, rural households may choose to diversify their income sources and may concentrate in one or some main activities to do investment to optimize the return. Moreover, microcredit may be effective in some sectors at disaggregate but not aggregate level. Therefore, the next section will investigate the impact of microcredit on sub-categories of earned income sources, including agriculture, self-employment and common property resources.

Table 5 – Micro-Impact of Microcredit on Income and Total Output Value by Main Sectors

VARIABLE	Total Production Value		Income	
	Coef.	t-stat	Coef.	t-stat
Total Earned Sources	24.279**	2.00	1.991	0.54
Agriculture	0.157	0.03	-3.612	-1.35
Crop	1.935	0.53	-3.378**	-2.34
Rice	-0.288	-0.15	-0.354	-0.32
Maize	0.672	1.21	0.397	1.06
Livestock + Aqua	-1.778	-0.47	-2.737	-1.09
Livestock	-2.452	-0.72	-3.989***	-2.94
Aquaculture	0.674	0.43	1.252	0.60
Self-employment	25.444**	2.25	6.488***	2.86
Common Property Resources	-0.698**	-2.04	-0.453	-1.53
Wage	-0.433	-0.25	-0.433	-0.25

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

Regarding agricultural sector, the results show that microcredit seems to reduce income and increase total output value ; however, neither of these effects are statistically significant. This is quite consistent with Takahashi et al. (2009), who find that microcredit does not improve sale or profit from agricultural activities. More specifically, Takahashi et al.'s (2010) findings show that the effect of microcredit on these outcomes is negative but statistically insignificant. However, the findings in this research are different with Khandker and Faruqee's (2003) in Pakistan, in which conclude that the impact of credit on net value from agricultural activities are significantly positive.

However, Karlan and Goldberg (2007) state that microcredit may have no impact on outcomes in short term, for instance, one year. Because some crops or

animals take time to gain the returns, it is better to divide agricultural sectors into sub-sector to investigate in details.

When investigating further on some sub-sectors of agricultural, microcredit is found to have no impact on improvement of income and total output value from raising animal, including livestock and aquaculture. However, further investigation find that microcredit have negative impact on income from raising livestock. That may be because some livestock consume high investment in inputs (including Production loan interest payment) but take time to gain returns (for instance, cow, buffalo, etc.). Thenceforth, the borrowing households can not benefit from raising livestock in short term.

Meanwhile, microcredit is found to reduce income from crop, which is in contrast with hypothesis. A plausible explanation for the decrease is that households may shift their income-generating activities from crop production to other activities such as raising livestock, aquaculture or self-employment when they borrow from microcredit sources. This may be proved via no significant change in cost or production value when households have access to microcredit.

The coefficients of net income and production for some main annual crops such as rice or maize are found to be insignificant, which indicates no role of microcredit in production of rice and maize. The first reason is that for the farmers who cultivate rice or maize, these agricultural products seem to be a long-established and traditional cultivation activity. Therefore, no matter whether they have access to microcredit, they may still continue to cultivate these products.

Moreover, in order to improve output from these products, new agricultural technology should be invested, which incur great cost and high risk. Therefore, it may explain why microcredit, characterized by a small amount, plays no role in the improvement of income from rice or maize. It is interesting to investigate further on the impact of microcredit on each sub-sectors of crop production, but there is lack of information on production cost of the other crops in detail. However, it may be inferred that microcredit leads to a reduction in income from crops other than rice and maize. Another plausible explanation is that crop production is riskier than livestock production since climate shocks (i.e. flood, drought) seem to affect crop rather than

livestock production (Vilhelm et al., 2015). Thenceforth, the output from crop production may not yield the high outputs.

In summary, for agricultural activities, including crop and livestock production, another conceivable explanation is that the investment using microcredit may be not effectives due to difference in agricultural skills across households, thereby affecting the output to crop and livestock agriculture (Dearcon, 1998). The findings are inconsistent with Khandker and Koolwal's (2016), who found that microcredit has no impact on crop income but significantly positive effect on livestock income.

Microcredit is found to have no impact on the difference in income from common property resources; meanwhile it is found that microcredit borrowers have lower total output value than the non-borrowers and this effect is significant at 5 percent level. The lower total output can be simply explained by the less investment in inputs. It is somewhat in contrast with the statement that credit finances deforestation (Ozorio de Almeida and Campari, 1995; Barbier and Burgess, 1996; Andersen, 1997; Pfaff 1997; cited in Angelsen and Kaimowitz, 1999). Meanwhile, this finding is similar to the works by Godoy et al. (1997) who find that families with credit may be less dependent on forest-based activities or may choose to invest in off-farm activities. In other words, access to credit may reduce exploitation of common property resources such as forest clearance. The poor households seem to be greatly dependent on common property resources such as pasture or forests (Jodha, 1992). In this research, a large proportion of the rural poor (around 56.47%) depend on common property resources for generate income. With access to credit, the rural households, especially the poor, may have more opportunities to get a more decent jobs via non-farm activities as suggested by Godoy et al. (1997), thereby being less dependent on common property resources. Another explanation is that borrowers may commit to comply with environmental requirement as a condition of rural credit (Assunçãoa et al., 2013).

As strongly expected, microcredit has strong positive effect on self-employment income and total output value. The result is quite consistent with Khandker and Koolwal's (2016) research in Bangladesh; specifically microcredit is found to improve self-employment income because this is the original purpose of

microcredit program. A research in Vietnam by Lensink and Pham (2012) also find that microcredit truly improves self-employment profit.

However, the estimated results in this research are partly different with the findings in Indonesia by Takahashi et al. (2010), who find that microcredit only have improved sale of self-employment but have no impact of self-employment profit. In Takahashi et al.'s (2010) research, the estimation is also conducted using PSM; however, the time length between two surveys is short (one year). Thenceforth, that may partly explain why microcredit only contributes to the expansion of self-employment but not improve the profit from this activity within one year.

As expected, microcredit is found to have no significant effect on households' wage income. There is no firm theory on the relationship between microcredit and wage income activities in rural areas.

For the estimation of macro impact of microcredit, this section also briefly reports some results on the effect of microcredit on Total Output Value of sub-sectors categorized based on Vietnam Input-Output table 2007.

For the case of agriculture, aquaculture and forestry, microcredit is found to have significant impact on some sectors. In particular, microcredit is significant and positively associated with the increase in total output value of sugarcane, other livestock, and aquaculture. Meanwhile, microcredit is found to have negative impact on total output value of timber. Microcredit seems to increase total output value of such sector as other annual crop, rubber, coffee, tea, cow and buffalo and other forestry activities; however, these effects are not statistically significant. Similarly, there is no evidence to conclude that microcredit has negative impact on such sectors as other perennial crop, pig, or poultry.

Table 6 – Micro-Impact of Microcredit on Total Output Value by Sub-sectors of Agriculture, Forestry and Aquaculture

VARIABLE	Coef.	t-stat
Paddy	-0.288	-0.15
Sugarcane	1.178**	2.00
Other Annual Crop	0.752	0.92
Rubber	0.206	0.47
Coffee	0.278	0.11
Tea	0.192	1.16
Other Perennial Crop	-0.472	-0.33
Cow, Buffalo	0.108	0.12
Pig	-2.882	-1.21
Poultry	-0.303	-0.40
Other Livestock	2.203**	2.28
Aquaculture	4.999**	2.13
Timber	-1.203***	-4.44
Other Forestry	3.601	1.13

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

Table 7 – Micro-Impact of Microcredit on Total Output Value by Sub-sectors of Self-Employment

VARIABLE	Coef.	t-stat
Case 1		
Manufacture of Beverage	0.344	1.138
Manufacture of Fabricated Metal Product	0.059	0.092
Manufacture of Furniture	5.406	1.607
Repair	0.293	0.891
Wholesale, Repair of Motor Vehicles	1.391	0.546
Wholesales	9.104***	3.118
Retail	0.15	0.024
Food and Beverage Service	-0.312	-0.190
Other Services	3.092*	1.672
Case 2		
Manufacture of Food products & Beverage	2.548	1.216
Manufacture of Wood & Furniture	6.439*	1.770
Wholesale & Retail, Repair of Motor Vehicles	10.645	1.381
Case 3		
Wood & Furniture, Paper, Printing	6.369*	1.743
Other Services	-1.346	-0.390

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

For self-employment activities, microcredit is found to have positive impact on most of sub-sectors but its effect is significant for some sector including wholesales, Manufacture of wood and furniture (both including and excluding paper and printing) and other services (Case 1). Microcredit seems to reduce total output value of some sectors such as Food and beverage service and other services (Case 3), but these effects are not significant.

4.3. Macro-Impact of Microcredit Program

As stated in the introduction, we have two aims: the examination of the effect of microfinance at the micro level and the evaluation of the effect on economic growth. This section is devoted to the second objective. In the previous sections, we have examined the effect of microfinance at the household level with using the method of project evaluation and found that the output values of some production activities (for instance, wholesale) are increased significantly by microcredit.

Table 8 shows the output change in significantly affected sectors. Since the coefficient is the average change in output value, we multiply the estimated number of household which are using microfinance.

What is the macroeconomic consequence of these output change? We use modified input output model, since it is easier to evaluate the result from econometric study conducted in previous sections. And this is, to our best of knowledge, the first attempt for evaluating macroeconomic effect of microfinance with input output framework. Vietnamese Input output table of 2007 is used. This table contains 138 sectors

Exogenous sectors[4] whose outputs are set exogenous are shown in **Table 8**. Other sectors are set as endogenous sectors. The marginal propensity to consume is assumed to 0.7. The model used for evaluation macroeconomic impact of microfinance is explained in previous section. **Table 9** shows the macroeconomic impact of microfinance on output value and Value added. Exogenous output increase is 180,262,332 million VND, and induced output increase is 4,670,194 million VND.

[4] Other service in Table 8 is not considered as an exogenous sector, since it is very hard to identify the corresponding activities in sectors in Input Output Table.

Total increase in output value is 8,896,714 million VND, which is 0.31% of total output value. It is small in percentage. Since the direct effect of microfinance (exogenous output change) is 4,226,512 million VND, the indirect effect is about 115% of direct effect; that is, 115% of direct effect is spillover effect generated by the interindustrial linkage. If we take into consider the income linkage, total output increase is 10,655,906 million VND. It is 1.20 times of the output increase without income linkage. The effect through income flow is 1,759,192 million VND (41.6% of direct effect).

Table 10 shows the macroeconomic effect of microfinance by four main industrial classifications. Relatively larger effect is on agriculture, forestry and fishery sector. Though mining sector is considered as an independent sector of microfinance, its output increases. The per cent change in output of this sector is only 0.05% and is relatively small comparing to other classifications. This is because of the interindustrial linkage. More interesting is that the ratio of output increase with income linkage to that without income linkage is 1.38 which is second following to service sector. The interindustrial linkage and income linkage cannot be captured by the micro-econometric method. Even if the effect of microfinance on income is negative which is reported for example in **Table 5**, it might be positive if we take into account the interindustrial linkage and income linkage[5].

Agricultural sector includes many poor farmers, and we would infer microfinance might boost the income of poor farmers depending on the magnitude of linkage effect (a kind of trickle down effect).

Though large macroeconomic impact of microfinance is reported in literatures using CGE model, our input-output model shows relatively small macroeconomic impact of microfinance. One reason that the macroeconomic impact is small is that the data set we used in econometric study includes only rural household. If we take into account urban households, the macroeconomic impact is surely larger. In addition, the productivity increase in production sector and financial sector is not taken into account in our model. Only the effect of output increase is considered. Our model

[5] Value added in a sector is assumed to be proportional to the output level in Input-Output Analysis. Thus the value added of the sector in which output value increases is "by definition" increases. This fact may be contradict to the findings we got in previous sections.

evaluates the short run effect. Other reason for small macroeconomic impact is that we select only industries with statistically significant effects as exogenous sector.

Since the output change in exogenous sector is estimated as the products of coefficients from project evaluation estimated in previous section and the number of household using microfinance. Thus the exogenous output change depends on the value of coefficients and the estimated number of household using microfinance. The value of coefficients which is an average output change in each production activity depends on the measurement period of the estimation (it takes longer period to get full effect of investment via microfinance), level of the production and entrepreneur skill of the farmers who use microfinance, and the amount of microfinance. The number of household using microfinance depends on the transaction cost and procedure for acquiring microfinance, attitude toward risks of borrowers and opportunity for other source of credits.

The target client of microfinance programs are typically the poor or the near-poor households. These households normally lack of production assets, knowledge, or skills (production and entrepreneurship), and thereby they cannot take best advantage of the loan. Thus in order to boost the macroeconomic effect, improving production skill and entrepreneur skill is necessary. The average amount of microfinance loan, in this research, is around 31 million VND which is quite small, thus flexible determination of the amount of finance may be required in some case. In order to increase the number of microfinance users, it may be effective to simplify the procedure and reduce the transaction cost for getting microfinance.

Table 8 - Impact of Microfinance (MF) on Output value of selected production Activities

	Sugarcane	Other Livestock	Timber	Aquaculture	Wholesales	Manufacture of Wood & Furniture
Coefficients from Impact Analysis	1.178	2.203	-1.203	4.999	9.104	6.439
Number of Household using MF in sample	5	200	9	82	4	5
Total Increase in output value in sample	5.9	440.6	-10.8	409.9	36.4	32.2
Estimated Number of HH used MF in rural Vietnam[a]	23,116	924,646	41,609	379,105	18,493	23,116
Total Increase in output value in rural Vietnam	27,230.8	2,036,995.1	-50,055.71	1,895,145.2	168,359.5	148,844.9
Average Amount of MF	47.2	34.9	34.8	35.7	66.3	35.3

Source: Authors' estimation. (Unit in million VND)

[a]16,384,727 households in rural Vietnam (GSO, 2016) and 3544 in research sample

Table 9 - Macro impact of Microfinance

	Output Value	Change in Output		Value Added	Change in VA	
		No income linkage	With income linkage		No income linkage	With income linkage
Exogenous sector	180,262,331.9	4,226,519.8	4,226,519.8	175,606,608.7	1,227,576.6	1,227,576.6
Endogenous sector	2,680,853,720.9	4,670,193.7	6,429,386.1	918,635,549.5	1,060,226.2	1,728,121.7
Total	2,861,116,052.8	8,896,713.5	10,655,905.9	1,094,242,158.2	2,287,802.8	2,955,698.3

Source: Authors' estimation. (Unit in million VND)

Table 10 Macro impact of Microfinance by sectors

	Output Value	Change in Output		Value Added	Change in VA	
		No income linkage	With income linkage		No income linkage	With income linkage
Agriculture, Forestry and Fishery	340,573,962.9	5,514,975.6	5,767,719.3	134,300,317.3	1,750,030.7	1,860,710.7
Mining	123,266,591.3	42,869.3	59,346.3	91,109,499.6	15,534.4	21,862.6
Manufacturing	1,472,059,271.0	2,975,499.1	3,776,322.1	409,489,182.0	322,249.3	472,356.7
Services	925,216,227.6	363,369.5	1,052,518.3	459,343,159.3	199,988.3	600,768.3
Total	2,861,116,052.8	8,896,713.5	10,655,905.9	1,094,242,158.2	2,287,802.8	2,955,698.3

Source: Authors' estimation. (Unit in million VND)

5. CONCLUSIONS

This article investigates the impact of microcredit at the disaggregate and aggregate level. The micro impact of microcredit on households' income and total output value from various income sources is conducted using PSM-DID method. The macro impact is evaluated using input-output analysis.

At micro level, this paper find that microcredit benefit self-employment rather than activities from agricultural production and common property resources. In particular, microcredit improves income from self-employment, reduce income from crop and livestock production while there is no evidence to conclude the impact of microcredit on income from other activities such as maize or rice production, common property resources, wage income, etc. In addition, microcredit is found to increase total output value from self-employment and total earned sources, reduce total output level from common property resources and there is no significant effect on income from such sources as wage and agricultural activities.

At macro level, we show output and value added increase 0.37% and 0.27% of benchmark level respectively due to microfinance. These effect include direct effect and indirect effect, and show the indirect effect is important as well when we evaluate the macro effect of microfinance. The microfinance contributes macro economy. In this study, we focus only on effect of short-run output increase, but microfinance has much more routes to influence macro economic growth through financial part of the economy. To evaluate these effects is of interest, and will be done by employing computable general equilibrium model with real and financial sectors. This is one of our future studies left for us.

The rural households should be provided with supports so that they can use the microcredit loan more effectively or improve their income better. Therefore, in addition to credit, the poor need to be equipped with knowledge and skills in investment in farm/ non-farm activities. Without knowledge and skills, they may not take best advantage of microcredit or may misuse the loan, and thereby microcredit may result in negligible or

even no outcomes. Moreover, rural households, especially the poor, are very risk-averse and have low resources. Despite their high demand for cash, they do not borrow from any sources because they may perceive their low ability of repayment. With more knowledge or skills, they can be more exposed to risks, thereby increasing their demand for more credit for production or self-employment. Thenceforth, such supplementary supporting activities as training in entrepreneurial skills or agricultural productions should be implemented.

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