



## Research Article

# Impact of Micro-credit on Child Education in Vietnam: Parametric and Non-parametric Approaches

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## Abstract

**Background and Objective:** Vietnam has gained successfully in poverty reduction through micro-credit program. However, there is few evidence of the impact of micro-credit on child education and hence, this paper presented the first analysis of the role of micro-credit on child education in Vietnam using both parametric and non-parametric approaches. **Materials and Methods:** An instrumental variable method combining Heckman approaches and Lowes smoothing were used for data from the Baseline and End line surveys of Program 135-II. **Results:** Using both parametric and non-parametric methods, this study showed that access to credit only was positively related to the probability of child education for households with per capita monthly income greater than 800,000 VND but negatively related for households earning less than 800,000 VND (approximately 38 USD at the 2012 rate). **Conclusion:** It was recommended that studies of relationship between micro-credit and child education should use both parametric and non-parametric methods. Also, these findings suggest that governmental micro-credit programs are effective when accompanied by strategies to help households exceed the minimum income threshold.

**Key words:** Micro-credit, child education, household income, Heckman approaches, parametric and non-parametric methods

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

Since Grameen bank founder, Professor Muhammad Yunus was awarded the Nobel Peace Prize, micro-credit has become well known in the community of development researchers. On the one hand, a significant number of micro-credit researchers such as Morduch<sup>1</sup> had reached the consensus that micro-credit may help the poor take advantage of economic opportunities to create employment and then improve income and consumption and finally reduce poverty. Credit institutions may also help their clients diversify sources of income by developing self-employment and increasing study hours<sup>1,2</sup> and facilitating or increasing consumption<sup>3-5</sup>. In addition, when micro-credit helped households increase their income and facilitate consumption, it then also improves children's education<sup>6</sup>. The reason was that there are significant improvements in healthcare services for households, such as purified drinking water, health insurance, family planning and pregnant-mother care when households have access to micro-credit<sup>7</sup>. Consequently, children are healthier and are likely to perform better in school and are more productive.

On the other hand, many recent studies indicated that the effect of micro-credit participation on borrowers' welfare is debateable. Some rigorous research had found that participants were not better off<sup>8-10</sup> and that the idea that a small loan alone can lift the poor from poverty is a "naïve belief"<sup>11</sup>. Also, micro-credit may have adverse effects on children's education. For example, small loans often had higher interest rates and short terms for repayment. Poor borrowers reduced their business costs by contributing their own labour, including that of their children<sup>12</sup>. The result of this practice is to force children away from school. In addition, micro-credit can pull children out of school because they have to replace their parents to do housework, farm work or providing care for their younger siblings.

There are a few studies in Vietnam about the effect of micro-credit on child education. However, this research differs from previous studies on this topic in Vietnam in two important respects. First, evaluating the effect of micro-credit on child education must face several empirical challenges, such as sample selection bias, the endogeneity of micro-credit and reverse causality. Thus, this study goes beyond the shortcomings of previous studies by combining instrumental variable estimation with the Heckman approach to solve bias in the estimated results. More importantly, the previous studies of the relationship between micro-credit and child education typically relies on a parametric approach and the evidence is mixed. For example, some studies<sup>13,14</sup> strongly showed that micro-credit improved borrowers' child

education, while other research indicated that the effect of access to micro finance on child education was negligible or insignificant<sup>15</sup>. Going beyond the literature, this study showed the evidence of a nonlinear relationship between micro-credit and child education when using both parametric and non-parametric methods. Hence, current results has the potential to reconcile the ambiguity in the earlier studies.

## MATERIALS AND METHODS

**Secondary data:** The data for this study utilized the Baseline and Endline surveys of Program 135-II, conducted in 2007 and 2012 by the General Statistics Office in Vietnam. Both surveys cover the same sample of 6,000 households living in 400 communes, with standardized questions formulated by the World Bank. The information on the characteristics of individuals is rich at both household and commune level. At household level, the surveys provide information about household members, education and employment, health care, income, housing and ownership of durable goods. At commune level, information was given concerning demography, population and infrastructure. Combined, these surveys can be considered to be the best, most comprehensive data source to study ethnic minority groups in Vietnam. Finally, these surveys include the most important information on household credit, child education and other individual characteristics, enabling us to consider the effect of micro-credit on child schooling and household income.

**Quantitative methods:** This study used regressions to consider the influence of micro-credit on household income and children's education following a standard methodology<sup>16,17</sup>:

$$Y_{ij} = \beta_0 + \beta_1 \text{Credit}_{ij} + \beta_2 X_{ij} + \varepsilon_{ij} \quad (1)$$

where,  $Y_{ij}$  was the interest outcome for household  $i$  in commune  $j$  that denoted the log of real income or denoted children's education.  $\text{Credit}_{ij}$  reflected household credit and was measured a dummy for credit or was measured as the amount of a household loan in the past 4 years.

$X_{ij}$  was the vector of household characteristics as guided by Cuong<sup>18</sup> and Doan *et al.*<sup>19</sup>, including the age of the household head and age-squared to capture the non-linear relationship, household size, household ethnicity, education of the household head, household land and household location.  $\varepsilon_{ij}$  is the error term.

This study used an instrumental variable is used to address the endogeneity issue. The first stage, this study used lagged rather than current values of credit to limit potential

bias from the endogeneity of credit. Specifically, regressions of Eq. 1 were estimated on the basis of the 2012 survey but using loan networks constructed at the commune level in 2007 as an instrumental variable for the credit variable  $V_{ij}$ . The first-stage equation would be as below:

$$V_{ij} = \alpha_0 + \alpha_1 L_{j,2007} + \alpha_2 X_{ijt} + \alpha_3 M_j + \varepsilon_{ij} \quad (2)$$

$L_{j,2007}$  was loan networks constructed in the 2007 survey and constituting the average loan amount per household at commune level in the last 4 years (2004, 2005, 2006 and 2007) of the 2007 survey.

Second, the Heckman selection model was estimated and then the Mill's ratio is calculated by  $\exp(-.5 * p\_hat^2) / (\sqrt{2 * \pi} * \text{normprob}(p\_hat))$ . Finally, the Mill's ratio is added to IV regressions.

## RESULTS

Table 1 reported the estimation results from the instrumental variable models with different specifications about the effects of micro-credit on household income. The credit had a positive, significant effect on the household income and the estimated coefficients for dummy variable

Table 1: Effect of microcredit on household income

	IV	IV	IV-Heckman	IV	IV	IV-Heckman
Variables	1	2	3	4	5	6
Credit	0.6304** (0.239)	0.5336* (0.235)	0.4912* (0.236)			
In_loan_value				0.0633** (0.024)	0.0536* (0.023)	0.0494* (0.024)
Household size	0.1156** (0.008)	0.1087** (0.008)	0.0485** (0.017)	0.1156** (0.008)	0.1086** (0.008)	0.0487** (0.017)
Post office availability		0.1156** (0.038)	0.1186** (0.038)		0.1157** (0.038)	0.1187** (0.038)
Head age	0.0408** (0.006)	0.0385** (0.006)	0.0451** (0.006)	0.0408** (0.006)	0.0385** (0.006)	0.0450** (0.006)
Head age squared	-0.0004** (0.000)	-0.0003** (0.000)	-0.0003** (0.000)	-0.0004** (0.000)	-0.0003** (0.000)	-0.0003** (0.000)
Head ethnicity	0.3222** (0.033)	0.3598** (0.033)	0.3479** (0.033)	0.3164** (0.033)	0.3551** (0.033)	0.3436** (0.033)
Head primary education	0.1672** (0.033)	0.1608** (0.032)	0.0295 (0.046)	0.1652** (0.033)	0.1591** (0.032)	0.0285 (0.046)
Head secondary education	0.4024** (0.037)	0.3951** (0.036)	0.1953** (0.062)	0.3978** (0.037)	0.3912** (0.036)	0.1925** (0.062)
Head with higher education or above	0.6672** (0.055)	0.6785** (0.053)	0.3455** (0.100)	0.6610** (0.056)	0.6732** (0.054)	0.3420** (0.100)
In_annual_land		0.0374** (0.006)	0.0424** (0.006)		0.0375** (0.006)	0.0425** (0.006)
In_perennial_land		0.0351** (0.005)	0.0027 (0.010)		0.0352** (0.005)	0.0029 (0.010)
In_forest_land		0.0000 (0.004)	-0.0121* (0.005)		0.0001 (0.004)	-0.0120* (0.005)
Region dummy	0.0795** (0.025)	0.0701** (0.026)	0.0558* (0.026)	0.0775** (0.025)	0.0682** (0.025)	0.0541* (0.026)
Mills			-1.5322** (0.414)			-1.5256** (0.413)
Constant	7.9936** (0.143)	7.7277** (0.148)	9.7087** (0.563)	8.0085** (0.141)	7.7397** (0.146)	9.7112** (0.560)
Observations	5,635	5,635	5,635	5,635	5,635	5,635
Instrumental variables	Lag of time-commune average amount of loan per household		Lag of time-commune average amount of loan per household			
	Lag of time-commune average amount of loan per household		Lag of time-commune average amount of loan per household			
	Lag of time-commune average amount of loan per household		Lag of time-commune average amount of loan per household			
Weak identification test (Cragg-Donald Wald F statistic) [Stock-Yogo weak ID test critical value at 10%]	78.099 [16.38]	77.41 [16.38]	75.607 [16.38]	85.094 [16.38]	84.421 [16.38]	82.402 [16.38]
Endogeneity test of credit and the amount of loan (p-value)	0.005	0.01	0.02	0.006	0.01	0.02

The dependent variable is the natural log of total household income. Robust standard errors are in parentheses. +Significant at 10%, \*Significant at 5%, \*\*Significant at 1%. Models are controlled for year dummies and technological level dummies. Models are estimated using instrumental variable approaches. Columns 1, 2, 3 of Table 1 showed the impact of credit access (as measured by a dummy) on household income, while columns 4, 5 and 6 of Table 1 indicated the impact of credit access (as measured by the amount of a household loan) on household income

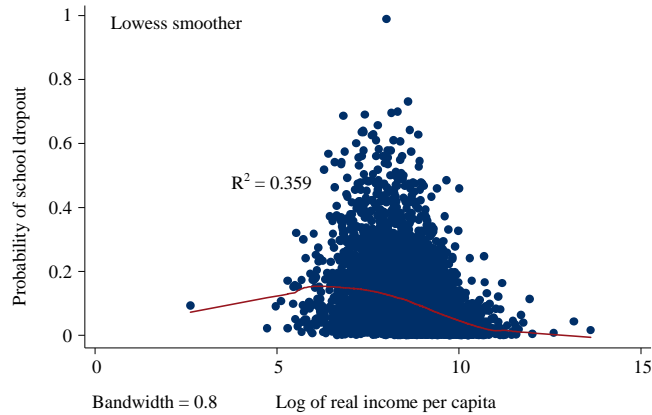


Fig. 1: Relationship between probability of child education and income per capita

Table 2: Bifurcation effect of credit on child education

Variables	Child education			
	Real income per capita <800,000		Real income per capita >800,000	
	IV	IV	IV	IV
	1	2	3	4
Dummy for credit	2.156*** (0.656)		-1.270*** (0.298)	
Log (loan value+1)		0.223*** (0.068)		-0.13*** (0.031)
Observations	127	127	5.538	5.538

Standard errors in parentheses, \*p<0.10, \*\*p<0.05, \*\*\*p<0.01. All regressions control for household size, post-office availability, age and ethnicity of household head, dummy for household head completing high-school education or above, dummy for household head completing middle-school education, dummy for household head completing primary school education, log (annual agricultural land+1), log (perennial agricultural land+1), log (forest land+1) and regional dummy. Models are estimated using the instrumental variable Probit approach

were 0.6304, 0.5336 and 0.4912, respectively (Columns 1, 2, 3), while the estimated coefficients for value of loan were 0.063, 0.0536 and 0.0494 (Columns 4, 5, 6).

Figure 1 and Table 2 reported the results of the effect of micro-credit on the child education. The procedure for this investigation of the role of micro-credit in child education was conducted in two steps<sup>20</sup>. First, the child education was regressed on the characteristics of households, including household size, dummy for Vietnamese language, age, ethnicity and education of the household head and household land. Second, the non-parametrical relationship between the probability of dropping out of school and the log of real income per capita was estimated.

Figure 1 showed an inverted U-shaped relationship between per capita income and the likelihood of dropping out of school. Figure 1 showed that when the log of real income per capita is 6.685 or value of real income per capita is equal to  $e^{6.685}$  (about 800,000 VND), the relationship between child

education and income per capita changed from positive to negative. Hence, the effect of credit on the school dropout rate was investigated parametrically. Based on the turning point of per capita income of 800,000 VND (approximately 38 USD at the 2012 rate), the sample was divided into two sub-samples. The bifurcation effect of credit on the probability of dropping out of school was presented in Table 2, using the instrumental variable method. This showed that the dummy for credit had a positive, significant effect on the probability of dropping out of school for the sub-sample of real per capita income less than 800,000 VND and the estimated coefficient was 2.156 (Column 1). The result was similar to the log of loan value and the estimated coefficient was 0.223 (Column 2). However, credit had a negative, significant effect on the probability of dropping out of school for the sub-sample of real per capita income greater than 800,000 VND (Column 3) and the estimated coefficient was 1.27 for dummy for credit, while the estimated coefficient was 0.13 for value of loan (Column 4).

## DISCUSSION

Table 1 presented the results for the effect of credit on household income using instrumental variable estimations. The results of the dummy for credit were negative and statistically highly significant (Columns 1, 2 and 3). The findings were in line with what was expected and with the results obtained by others in Vietnam<sup>21</sup>. It was also noted that credit is measured as a dummy variable which may not adequately capture loan intensity. Hence, the continuous dependent variable that represents household loan value was considered in relationship to household income. Table 1 indicated that the results were similar to those of the dummy for credit. In particular, the loan value was positively and statistically significant at the 1% level and when the loan value increases by 1%, household income increases around 0.05%, keeping other values constant. The results were in line with others<sup>18</sup> showing that access to micro-credit increased household income and helped household to move out poverty.

Figure 1 indicated that there is an inverted U-shaped relationship between the child education and per capita income. These results implied that the using only a parametric approach<sup>13,14</sup> (as in the literature) had clouded the role of micro-credit on child education. The findings here suggested that in the beginning, the likelihood of dropping out of school increased with per capita income. The explanation was that households need more labor to increase income and maintain a minimum standard of living. The likelihood of dropping out of school declined with per capita income, suggesting that if households were able to secure more than the minimum standard of living, they would invest more in their children by sending them to school and reducing child labor. The turning point of the log of real per capita income was about 800,000 VND.

Table 2 showed that the bifurcation effect of micro-credit on child education. First, the dummy for credit was negatively and statistically significant for the probability of dropping out of school in the sub-sample of log of real per capita income greater than 800,000 VND (approximately 38 USD as of the 2012 rate) (Column 3). The result remained unchanged for loan value (Column 4). However, a positive linkage between micro-credit and the probability of dropping out of school for the sub-sample of log of real per capita income smaller than 800,000 VND. It was worth noting that in 2012, the average monthly per capita income in Vietnam was about 130 USD. Thus, the results implied that government micro-credit

programs do not help the children of the poorest of the poor in Vietnam<sup>12</sup>. In order to improve the general welfare of children and their education in particular, the government needs to help households exceed the threshold of 800,000 VND, the "Turning point" of income per capita. This result supported the findings of Chakrabarty<sup>12</sup> and indicates that access to credit does not really improve the education of children in extremely poor households. Also, this finding was very interesting and significant because our results reconcile the mixed findings of previous studies reported in the literature. Some studies<sup>13,14</sup> showed the positive linkage between micro-credit and child schooling while others<sup>15</sup> indicated a negative or insignificant of micro-credit on child education.

Many other explanatory variables were statistically significant at the 10% level or lower, with their signs as expected. Specifically, household size was positively associated with household income. Holding all other things constant, an additional member increases income from 5-10%, depending on model specifications. A similar finding about the positive linkage between household size and household income in Vietnam was also reported by Imai *et al.*<sup>22</sup>. In addition, the positive sign of the age of the household head and the negative sign of its square implied that the age of the household head had a diminishing effect on household income. Furthermore, education and income move in tandem and are consistent with the majority of previous studies<sup>23</sup>. For example, the income level of households with heads who had completed secondary school is around 2-4% points higher than that of households whose heads had not attained this level of education. The same finding was also reported for rural Vietnam by Haughton *et al.*<sup>24</sup> and for Vietnam's peri-urban areas by Tuyen<sup>25</sup> households with better education was more likely to escape poverty and join the middle class.

## CONCLUSION

In an attempt to reconcile the ambiguous findings in previous studies on the role of micro-credit on child education, this study showed that the empirical linkage between micro-credit and child education has been clouded by the use of a parametric approach. Interestingly, using both parametric and non-parametric methods, this research shows strong, consistent evidence of an inverted U-shaped relationship between micro-credit and the likelihood of a child

dropping out of school. Specifically, access to credit increases the school dropout rate for households with per capita income lower than 800,000 VND and decreases the rate for those earning more than 800,000 VND.

### **SIGNIFICANCE STATEMENT**

This study discovered the role of governmental micro-credit on child education that can be beneficial for policy implications. The government should support the poorest households to help them exceed the minimum level of income because access to credit only helps households with greater income than the minimum, specifically earning more than 800,000 VND per capita per month. The government could transfer money directly to the poorest households in order to increase the opportunity for their children to go to school. Findings of this study are expected will help the researchers to uncover the critical areas of education economics that many researchers were not able to explore by using both parametric and non-parametric approaches.

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