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Credit constraint and household income: a quantile analysis approach

Abstract. Using a quantile regression approach, this study contributes to the literature by analyzing the first time of role of credit constraints on household income in Vietnam. Using the latest version of Vietnam household living standard survey in 2016, our results show a negative impact of credit constraint on income of household when using OLS. Whereas using a quantile approach, a negative impact of credit constraint on household income is still recorded, the linkage shows a decreasing trend of the impact of credit constraint on income through various points of income distribution. These results might suggest that access to household microfinance can be a way to help Vietnam improve in their welfares.
Keywords: Credit Constraints; Quantile Regression; Vietnam; Household Income

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Кредитне обмеження й дохід домогосподарств: кількісний аналіз
Анотація. У статті вперше використано квантильну регресію для аналізу впливу кредитних обмежень на доході домашніх господарств у В'єтнамі. Інформаційну базу дослідження склала остання версія обстеження рівня життя домашніх господарств у В'єтнамі 2016 року. Результати аналізу з використанням методу найменших квадратів (OLS) доводять негативний вплив кредитних обмежень на дохід домашніх господарств. Однак, хоча при використанні кількісного підходу реєструється негативний вплив обмежень кредитування на дохід домогосподарства, спостерігається тенденція до зменшення цього впливу при різних варіантах розподілу доходів домогосподарств. Результати дослідження свідчать про те, що доступ до мікрофінансування домашніх господарств у В'єтнамі може бути способом поліпшення їх добробуту.
Ключові слова: кредитні обмеження; квантильна регресія; домогосподарство; дохід; В'єтнам.

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Аннотация. В статье впервые использовано квантильную регрессию для анализа влияния кредитных ограничений на доход домашних хозяйств во Вьетнаме. Информационную базу исследования составляет последняя версия обследования уровня жизни домашних хозяйств во Вьетнаме 2016 года. Результаты анализа с использованием метода наименьших квадратов (OLS) доказывают отрицательное влияние кредитных ограничений на доход домашних хозяйств. Однако, хотя при использовании количественного подхода регистрируется отрицательное влияние ограничений кредитования на доход домохозяйства, наблюдается тенденция к уменьшению этого влияния при различных вариантах распределения доходов домохозяйств. Результаты исследования свидетельствуют о том, что доступ к микрофинансированию домашних хозяйств во Вьетнаме может быть способом улучшения их благосостояния.
Ключевые слова: кредитные ограничения; квантильная регрессия; домохозяйство; доход; Вьетнам.

1. Introduction

There are various theoretical arguments toward the relationship between microcredit and household welfare. On the one hand, some researchers show that microcredit helps the poor to create employment, and this in turn improves income, consumption and reduces poverty (MkNelly & Dunford, 1998, 1999). In addition, female-targeted microcredit programs have impressively positive impact on household consumption and income in Bangladesh (Khandker, 1998)[1]. Furthermore, borrowers from microcredit program may gain from better healthcare practices. As a result, the aforementioned leads to a decrease in incidence of illness and an increase in productivity (Armendariz & Morduch, 2010; Barnett, 2011; de Aghion & Morduch, 2004).

On the other hand, some studies found that the impact of microcredit on income or consumption is weak or insignificant (Coleman, 1999, 2006; Khandker, 2005). More specifically, Elahi and Danopoulos (2004) criticize strongly that microcredit cannot be a model for poverty alleviation in the third world. Also, they argue that an increase in female employment may be

a result of microcredit program, but it may decrease children's schooling because children have to replace their mothers to take care of their younger siblings, or help their parents to do some other work like animal caring, housework, and farming. Consequently, children may face adverse effects on schooling enrolment and child labour that influence strongly children's future livelihood.

While theoretical arguments are clearly understandable, many recent empirical studies indicate that the impact of microcredit on borrowers' welfare is sceptical. Some rigorous research found that the participants were not better off (Yamauchi, 2005), and that a small amount of loan alone can lift the poor from poverty is a «naïve belief». In contrast, other researchers e.g. Nguyen (2007), Nghiem (2007), Quach et al (2005), Rahman et al (2007), and especially Khandker (2005) and Islam (2007), Nguyen (2007), strongly believe that microcredit borrowers' welfare in term of consumption was improved considerably relative to that of non-borrowers. Clearly, the impact of microcredit is mixed. An overview of this topic for different countries is displayed in the table 1.

For the case of Vietnam, although some studies on the impact of microcredit on household outcome, such as

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1 The Bangladesh Rural Advance Committee

Tab. 1: **An overview of the impact of credit constraint in income/expenditure**

Author/year	Title/ country	Findings
Sebu (2012)	Decomposition analyses of credit constraint and household consumption inequality in **Malawi**	Results suggest that access to credit can improve households' productivity, farm profits, income, and can, hence, directly lead to higher consumption.
Nguyen (2007)	Determinants of credit participation and its impact on household consumption: evidence from **Vietnam**	The study uses fixed effect panel approach and PSM that show a positive impact of formal credit on consumption while informal does not.
Grawe (2001)	in search of intergenerational credit constraints among **Canadian** men: quantile versus mean regression tests for binding credit constraints	Using quantile approach, the study shows that there are non-linearities between income of parents and their children, which is driven by sons having low credit constraints.
Eravadeekul (2013)	The household at risk in **Thailand**: the quantile regression analysis over average propensity to consume and debt servicing burden	The study indicates that debt positively influences households' consumption by using quantile regression approach. By contrast, debt burden has a negative effect on income, and low income household is at risk.
Li, Gan, & Hu (2011)	The welfare impact of microcredit on rural households in **China**	Using the difference-indifference approach with a two-year panel dataset, the empirical findings favour the popular belief of the positive linkage between credit access and the households' welfare. Specifically, they show that microcredit programme helps improve households' welfare, such as income and consumption.
Gibbons, Quinones, Remenyi, & Seibel (2000)	Microfinance for and by the poor: lessons from experience in microfinance and poverty alleviation: case studies from Asia and the Pacific (Indonesia, Sri Lanka, and India)	Findings reveal that the microcredit not only reduced poverty, but also improved the welfare of households, participating in credit program.
Kumar et al. (2013)	The impact of credit constraints on farm households: survey results from **India** and **China**	Using mean approach for household dataset, the research shows that credit constraints are attributed to decrease in households' income.

Source: Compiled by the author

consumption and income (Cuong, 2008; Doan, Gibson, & Holmes, 2014), and many studies of credit impacts on income using the average treatment effect method (ATE) have been done so far, the policy-makers may want to see the effects at different points of outcome distribution or on various individuals and groups of households to target policies properly to eligible individuals or households. For example, a policy, aiming at groups or individuals at a lower tail of outcome distribution of healthcare expenditure, to improve their income. Quantile Treatment Effect estimator (QTE) can be used to meet such kind of policy-makers' need. It may help show heterogeneity in the treatment impact which varies along the outcome distribution.

Policies aiming at a particular component of welfare may not work properly if one does not know how households respond to each shock of credit when having an intervention, such as credit constraint. Moreover, households' responses to credit constraint depend on where households are on the income distribution. However, most credit impact studies focus on measuring ATE, and there are not so many evaluation studies on impact of household credit focusing on non-homogeneous distribution of outcome have been done so far. The main objective of the current paper is, hence, to provide an analysis for heterogeneity in the impact of households' credit on income using the quantile treatment effect method in a combination with a mean approach.

The remainder of the paper is organised as follows. Section 2 discusses the data source, the methodology, and econometric models for considering the relationship between credit access and households' income. The empirical results are displayed in the section 3. A summary of findings and policy implications is presented in the conclusions.

2. Data and Analytical Framework
2.1. Data source
This study relies on data source coming from the latest dataset of 2016 round of the Vietnam Household Living Standards Survey (VHLSS). This data were conducted by the General Statistical Office of Vietnam (GSO) with technical support from the World Bank. The sample sizes were selected carefully, so that they were representative at the regional level. The surveys offer a large number of household members (over 40,000 individuals in 2016).

A consistent method of randomly stratified sampling across rounds of the survey ensures that the information in the dataset is representative for the whole population of Vietnam. The surveys collected information through household and community level questionnaires. Information on households includes basic demography, employment and labour force participation, education, health, income, expenditure, housing, fixed assets and durable goods, participation of households in poverty alleviation programs, and especially information on access to credit, individual characteristics and income during the 12 months before the interview. This enables for us to conduct the study of the role of microcredit constraint on income. More specifically, the statistical description of main covariates in the model is described in the table 2.

Tab. 2: **Definition and measurement of variables in the model of the impact of households' credit on income**

Variables	Definitions	Obs	Mean	Sd
Income in log	The income per capita	47,258	7.76	0.66
Tribe	The ethnicity of household member	47,259	0.83	0.37
School year	The number of years in school	45,569	10.10	4.17
Experience	The number of years of working	45,569	18.72	11.61
Sex	1 if the sex of household member is male; 0 otherwise	47,259	0.592	0.49
Age	The period of time someone has been alive	47,259	36.14	11.05
Credit constraint	1 If households have any unpaid loan; 0 otherwise	47,259	0.321	0.47
Foreign sector	If an individual works for foreign sector employers; 0 otherwise	47,259	0.084	0.27
State sector	If an individual works for state sector; 0 otherwise	47,259	0.209	0.4

Source: Calculations of the author from VHLSS 2016

2.2 Analytical Frameworks
OLS estimation or Propensity score matching are conventional methods for considering the role of credit access on household welfare (e.g., Cuong, 2008). However, such approach estimates the conditional mean of the outcome distribution, and the effect of credit constraints on household income may be different across points on the outcome distribution of households. The quantile approach provides a «much more complete picture» (Koenker & Hallock, 2001, p. 144),

and helps to see how effect of a particular factor (e.g. credit participation) varies across the percentiles of outcome distribution.

The Quantile regression (QR) can also help to show the tendency of the dispersion of particular income increases (Deaton, 1997; Koenke & Hallock, 2001). The QR estimator provides a «much more complete picture» of the relationship between the outcome and independent variables (Koenker & Hallock, 2001). Hence, the model specifies the qth - quantile (0< q <1) of conditional distribution of the dependent variable (Q_q), given a set of variables X_i as follows:

$$Q_q(y_i / x_i) = a_q + x_i . \beta_q + u_i \alpha_q , \qquad (1)$$

where y_i is the income per capita, x_i is a vector of independent variables, including credit constraint, and covariates for households and sector characteristics as discussed in the model specification section, and u_i represents unobservable factors such as product quality or management quality. Cameron and Trivedi (2009, p. 207) show that the estimation of equation (1) based on the qth quantile regression is to minimize the absolute residual value with the objective function as below:

$$Q(\beta_q) = \min_\beta \sum_{i=1}^{N} \left[|y_i - x_i \beta_q|\right] = \min \left[\sum_{i: y_i \geq x_i \beta} q |y_i - x_i \beta_q| + \sum_{i: y_i < x_i \beta} (1-q)|y_i - x_i \beta_q| \right]. \qquad (2)$$

The model minimizes the sum of the absolute value of the residuals. β_q is estimated for a particular quantile of distribution rather than β.

3. Empirical results

As shown by column 1 of Table 3, the credit constraint has a negative impact on income. Specifically, credit constraint causes a loss of 18% of net income in Vietnam, and these results are consistent with findings in China by Rui and Xi (2010) and in India by Kumar, Turvey, and Kropp (2013). However, the role of credit constraint for household income is different across various points of the distribution. The impact is heterogeneous across the residual distribution of the outcome. Except very top (extreme observations) and below the 25th percentile, the impact is detected higher at the level of 60th to 80th percentiles, and lower at approximately 10th to 40th percentiles. The results of the role of credit constraint for income calculation are shown in the figure 1.

Regarding the effect of school year, table 3 shows that it has a positive and significant impact on income distribution. Similarly, an increase in experience goes together with improvement in income. However, the magnitude of impact of experience on income decreases from the lower percentile (10th) of the distribution to the higher percentile (90th) of the distribution of income. The effect of credit participation appears to be larger at the lower (below 50th) percentiles of the distribution of income. However, the credit constraint decreases and is below the OLS impact as the budget share increases, except the very top percentiles (above 85th). This supports the findings of the studies of Jia, Heidhues, and Zeller (2010). As explained by Barslund and Tarp (2008), households with more education are capable of making better investment decision, thus, they have higher income than their counterparts.

Tab. 3: **The role of credit constraint for household income**

VARIABLES	OLS	Quantile regression				
		q10	q25	q50	q75	q90
	(1)	(2)	(3)	(4)	(5)	(6)
Tribe	0.5193**	0.5358**	0.5847**	0.5457**	0.4715**	0.4351**
	(0.008)	(0.014)	(0.010)	(0.010)	(0.012)	(0.012)
School year	0.0275**	0.0272**	0.0308**	0.0294**	0.0268**	0.0221**
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Experience	-0.0655**	-0.0685**	-0.0590**	-0.0607**	-0.0649**	-0.0759**
	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
Experience squared	0.0002**	0.0001	0.0002**	0.0003**	0.0003**	0.0003**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.0629**	0.0731**	0.0582**	0.0560**	0.0584**	0.0696**
	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Sex	0.0006	0.0000	-0.0079	0.0026	0.0087	0.0091
	(0.005)	(0.009)	(0.007)	(0.006)	(0.006)	(0.009)
Credit constraint	-0.1809**	-0.2294**	-0.2018**	-0.1685**	-0.1552**	-0.1526**
	(0.005)	(0.011)	(0.008)	(0.007)	(0.007)	(0.010)
State sector	0.0874**	0.1031**	0.0834**	0.0904**	0.0753**	0.0593**
	(0.007)	(0.016)	(0.010)	(0.008)	(0.009)	(0.013)
Foreign sector	0.2741**	0.3204**	0.2823**	0.2780**	0.2362**	0.2305**
	(0.009)	(0.014)	(0.010)	(0.010)	(0.010)	(0.015)
Constant	5.9451**	5.0707**	5.6066**	6.0264**	6.4219**	6.6161**
	(0.029)	(0.056)	(0.039)	(0.035)	(0.035)	(0.044)
Observations	45,568	45,568	45,568	45,568	45,568	45,568
R-squared	0.387					

Notes: Robust standard errors in parentheses; with 1000 replicated bootstraps
** p<0.01, * p<0.05, + p<0.1

Source: Calculations of the author from VHLSS 2016

However, contrary to Tran, Gan, and Hu (2016) study, our result indicates that sex does not affect income. The results also show that experience has a non-linear relationship with income of households that contrasts to previous findings.

Finally, we also observe positive effects of age and ethnicity on income, and the effect is decreased with higher percentiles on the income distribution (see Table 3 and Figure 1). The finding is consistent across models, as we controlled it for a full set of covariates. Furthermore, the income elasticities at the lower and upper percentiles are different. The demand at the higher percentiles of the distribution is more elastic than at the lower ones, varying from 1.1 at the 25th percentile to 1.19 at the 75th percentile. Clearly, there is a diversion in income of amongst individuals working in different sectors. The significantly positive effect of age on the household's income at 1 per cent level indicates that older household heads have higher propensity of income. This may be explained by the fact that younger people often accumulate less capital. The comparable results also are
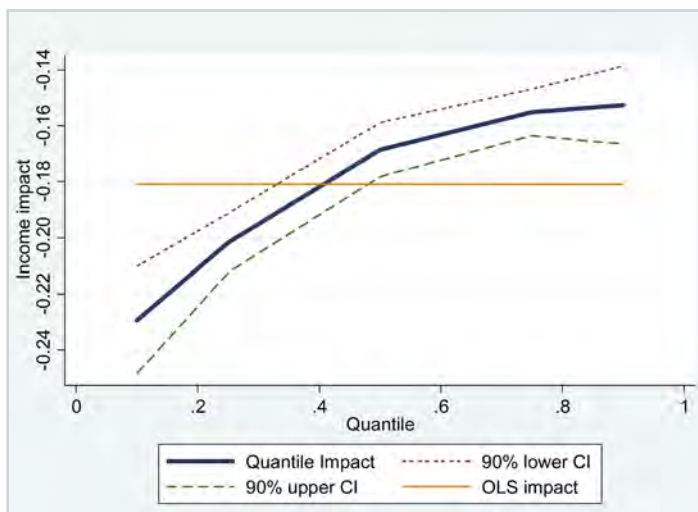

Fig. 1: **Credit constraint and income**
Source: The calculations of the author from VHLSS 2016

found by Freeman, Ehui, and Jabbar (1998) who showed that older labours gained higher income.

4. Conclusions

Unlike the previous studies, the present study uses a combination between the mean and quantile approach to consider the role of credit constraint for household income. Findings show that credit constraint impacts nega-tively and significantly on household income by both OLS and Quantile regression. Also, the quantile regression pro-vides a detailed picture about a decreasing trend between credit constraint and household income. Such findings im-ply that it is necessary to provide target households with sufficient credit, and this in turn improves their income and welfares.

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