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Effect of Microfinance on Poverty and Welfare: New Evidence from 9 provinces in Cambodia

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L'impact des Microcrédits sur la Pauvreté et le Bien-être: le cas de 9 provinces du Cambodge

Résumé

Les études les plus récentes au niveau national mettent l'accent sur l'échec des microcrédits au Cambodge étant donné que la mauvaise pratique est liée au taux d'intérêt élevé, au prêt non productif, au surendettement, à la sans-terre et à la migration. Cet article examine l'effet des microcrédits, en focalisant également sur l'accès aux prêts formels et productifs, en utilisant des données en 2015 de 411 ménages, qui sont bénéficiaires de la communauté de Coopérative Agricole (CA) soutenue par le World Vision, dans 9 provinces du Cambodge. Le modèle à variables qualitatives binaires ainsi que le modèle de Tobit, en adressant l'effet du traitement endogène, ont été appliqués. Les résultats montrent que l'accès aux microcrédits réduit la pauvreté et améliore le bien-être des ménages, mesuré par le revenu par habitant. Par contre, il n'y a pas l'effet significatif sur les actifs économiques et les dépenses sur le bien-être des enfants après que le test d'exogénéité de Wald et l'estimateur de khi-carré minimum de Newey a été estimé. Néanmoins, ces résultats doivent être interprétés avec prudence, car les données sont sujettes à une sélection d'échantillon spécifique.

Mots-clés: Microcrédit, pauvreté, bien-être, Cambodge

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Abstract

The most recent studies at national level give emphasis to the failure of microfinance services in Cambodia since the bad practice is subordinate to high interest rate, non-productive loan, over-indebtedness, landless and migration. This paper examines the effect of microfinance, also putting weight on access to formal and productive loans, by using cross-sectional data in 2015 of 411 households, who are beneficiaries of the Agriculture Cooperative (AC) community supported by the World Vision, in 9 provinces of Cambodia. The binary choice model as well as bivariate and censoring model along with addressing the endogenous treatment effect were applied. The findings show that access to microfinance services in every aspect reduces poverty and promotes household's welfare, proxied by per capita income, except there is insignificant effect on per capita economic assets and expenditure on child's well-being after the Wald test of exogeneity and the Newey's minimum chi-squared estimator with the twostep option were computed. However, these results must be interpreted with caution because the data is subject to specific sample selection.

Keywords: Microfinance, poverty, welfare, Cambodia

JEL: D33, D63, F16, F15, I24, I3

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<p>http://ideas.repec.org/p/grt/wpegrt/2018-12.html.</p>

1. INTRODUCTION

It is not possible to comprehend the socioeconomic conditions of Cambodia today without mentioning the impact of not only the Vietnam War, but also the country's nearly thirty years of concurrent internal conflicts and civil wars from 1970 to 1999 (Sobrado et al., 2013). These historical phenomena were left by many horrible consequences such as the great loss of both public and private property, forced workers, migration, imprisonment, and killings. It was estimated that there were at least two million of Cambodians who died, mostly due to execution, famine and sickness. It was until the year of 1999, when the military force using to challenge political opponents appeared to end the decades of internal conflicts and wars in the Kingdom. Up to the present, Cambodia has become one of the world's leaders in poverty reduction and shared prosperity. Cambodia sustained an average growth rate of 7.6 percent in 1994 to 2015, ranking sixth in the world, and has now achieved status of lower middle-income economy (World Bank, 2017a). The poverty by far has reduced from 53.2% in 2004 of total population to 13.5% in 2014.

To reach the poorest and the most vulnerable households, promoting access to microfinance has been regarded as the significant mechanism in improving socio-economic environments in Cambodia's post-war reconstruction and rehabilitation. The microfinance sector got its start in Cambodia in the early 1990s. Since then, the sector has grown very impressively. In 2016, two-third of Cambodian households is involving in micro-credit, serving by around 70 Microfinance Institutions (MFIs), which had a shared loan amounts of \$US 3.1 billion. At macro-level, the combined banks assets across Cambodia's banking and financial sector in 2017 equaled 150 percent of Cambodia's annual GDP, with loans and deposits representing 92 percent and 85 percent respectively (Hor, 2017).

Despite the widespread practice and rising microfinance sector, its effectiveness and cost-effectiveness are open questions whether it helps to reduce substantially poverty and increase welfare of Cambodian's households as its original objective. The existing literature in direct cases of Cambodia provided mixed inconclusive results. Some scholars found positive effect of microfinance while others found negative or insignificant effect. The interesting notice is that the positive effect of microfinance are frequently found at sub-national levels such as in target villages or provinces where those areas are sometimes supported by the international development programs. In contrast to these findings, however, the negative or insignificant effect of microfinance are detected at national level (see for example, Seng, 2017; 2018 and Bateman, 2017). Moreover, the failure of poverty-reducing promise is often linked to the issues of over-indebtedness, landless and migration.

This paper aims to examine the effect of microfinance on poverty and welfare in Cambodia using dataset of 410 AC members from the socio-economic survey of the World Vision Cambodia. The survey was conducted in 2015 under the CSBD program in 9 provinces of Cambodia, including Battambang, Kampong Chhnang, Kampong Speu, Kampong Thom, Kandal, Phnom Penh, Preah Vihear, Siem Reap and Takeo.

The main contribution of this paper is to provide new evidence into the existing literatures in Cambodia where quantitative researches are still less explored. This paper complements the literature in three other ways. First, it uses the updated sample of AC members in 9 provinces of Cambodia. Notably, since the sampling is related to only beneficiaries, who are involved in the development programs supported by World Vision Cambodia since 2012; these data must be therefore interpreted with caution. Second, it might be the first updated empirical study in Cambodia, which takes into account simultaneously all welfare index such as income, wealth as well as expenditure. Third, it contributes to the literature by using two econometric approaches, both the binary choice model as well as bivariate and censoring model, along with addressing the endogenous

binary treatment effects in order to evaluate the poverty-reducing effect and welfare-improving effects of microfinance.

The rest of the paper is organized as follows. Section 2 describes, theoretically and empirically, the literature review on the effect of micro microfinance on poverty and welfare as well as giving the synthesized overview on the macro-economic situation, microfinance sector, poverty, and welfare environments in Cambodia. Section 3 examines the study design and description of CSBD programs as well as explaining in brief survey methodology and data description. Section 4, then, summarizes descriptive statistics. Section 5 lays out the empirical methodology. Section 6 presents empirical results and discussions. Section 7 looks at the concluding remarks and policy recommendations.

2. LITERATURE REVIEW

For the last few decades, although the global poverty as well as regional or national poverty have been considerably reduced, the concern of poverty reduction, in the strict meaning, or households' welfare improvement, in the large meaning, has always been the matter of one of the most priority focuses of any governments in less developed countries, and Cambodia is no exception.

2.1. The effect of microfinance on poverty and household's welfare

The international literature on financial access and development has not yet identified a direct, unequivocal connection between household-level credit and improvements in poverty and inequality indicators (Alessandra et al., 2016). The empirical results are changed, due to the studying periods, the setting of data sources, and the context of each country's economic development. In the meanwhile, the results are also different in the context of applied methodologies. Many empirical studies used different interesting methodologies such as cross-sectional data analysis and panel data set model in addition to randomized controlled trials (Katsushi et al., 2012). Theoretically, randomized controlled trials has been perceived as gold standard as it has power to deal with endogeneity issues (Jonathan, 2011). This methodology allows to estimate the impact of access to microcredit by comparing outcomes among a random sample of individual borrowers to those of non-borrowers with similar socioeconomic characteristics during a period of observation (Karlan & Zinman, 2010; Banerjee et al., 2015). However, this technique is also come up with few limitations of small sample size plus short duration of evolution programs, which cannot potentially capture full dynamism of the effects (Deaton & Cartwright, 2017). It can be suggested consequently that there is no consensus on the issue.

Numerous studies have shown the positive effect of microfinance with the following logical reasoning. First, microfinance, which is almost known as microcredit with low interest rate, is a potential tool to encourage the existing and/or new business opportunities that can subsequently create employment, extra income, and individual monthly income for the communities as well as the poor (Karlan & Zinman 2010; Bateman, 2010; Kaboski & Townsend, 2012). These ideas are consistent with other studies founding microfinance as a major force in allowing households to spend on durable goods and/or productive assets such as¹ house, water pump, hand tractor, bicycle, motorbike, TV, radio, battery (for power), cars, jeep, van, rice mill, threshing machine, harvest machine, boat, cattle / buffalo, etc. to support their agricultural activities or fund their small non-farm investments (Bateman, 2010; Kaboski & Townsend 2012; Banerjee et al., 2015). To own all

¹ Here, it lists down almost goods and assets that are very practical for Cambodian households.

these goods and assets, they require a big amount of money; therefore, access to microfinance is their solution. According to Pitt and Khandker (1998), access to credit influences significantly economic incentives at the household level and improves their expenditures. However, the logic is applicable only if the borrowing is transacted with low interest (Bateman, 2010). In another word, the rate of profit needs to be economically higher than the rate of interest of microcredit. Second, other several scholars hold the view that microfinance may occasionally help to decrease household's financial constraints by funding their urgent needs or with unanticipated expenditures. This allows them to project their lives and avoid the problems of jobs with insecure wages (David, 1997). It is assumed commonly that people's life might not go smoothly all the time, and few unpredictable accidents could be very vulnerable for them. For that reason, the urgent needs from microfinance could possibly survive them sometimes; then, this might push them to work harder to compensate the costs. According to Jonathan (1998), the potential effect of microfinance is positively associated with a decrease in vulnerability. The consumption-smoothing effect seems to be probably driven by income-smoothing. Other researches have suggested that the borrowing pattern is linked to raise expenditure level (Giang et al. 2015; Akotey & Adjasi, 2016) and food consumption (Karlan & Zinman 2010; Kaboski & Townsend, 2012); and certainly allows households to obtain basic payment, as well as access to small saving and basic insurance. It is reported that poor household would benefit from basic payments, savings, and insurance services; however it is also highlighted that microcredit experiments draw a mixed picture about the benefits of microfinance projects, targeting specific population groups (World Bank, 2014). Third, there is some evidence to suggest that microfinance has also been seen as the catalyst to empower women (Akotey & Adjasi, 2016; Vathana et al., 2017) and enhance capital investment (Kaboski & Townsend 2012). In developing countries, funding in education requires a big investment. Therefore, households could access to microfinance in order to fund their children's education and health as well as for seeking any new skills or vocational training, which promote human capital at the later stage. This idea is in accord with recent study of Amendola et al., (2016), which explains that an access to finance has positive impact on investment in human capital in Mauritania. Finally, the joint results of microfinance promising as explained above will certainly lead to poverty reduction (Burgess & Pande, 2003; Honohan, 2004; Beck et al., 2007) and welfare improvement (Mahjabeen, 2008). This further supports the idea of lower income and wealth inequality within a society (Khandker & Faruqee, 2003; Beck et al., 2007; Mahjabeen, 2008), which results in harmonized society and lower risk of social, economic, and political issues, due to a divided society.

In contrast to earlier findings, however, the negative or insignificant effect of microfinance has been detected in some contexts as promising failure in poverty reduction and welfare improvement. First, the reasoning may be due to the facts that households often access to loans with high interest rate and use for non-productive purposes (Brett, 1999), or even in productive purposes, but they invest in low-profit activities. From supply and demand sides of microfinance, the easy loans providing by MFIs or involving in new multiple loans from both formal and informal sources (money lender) to pay for previous loans will lead almost certainly to heavy indebtedness or over indebtedness (Bateman, 2017). Second, Garikipati (2008) found that the microcredit may not empower the women concerned in rural India. The author explained that loans procured by women are often diverted into enhancing household's assets and incomes. This combined with woman's lack of co-ownership of family's productive assets. Additionally, the failure is probably related to an increase in child labor, migration of family members, and landless because households had to sell those assets to pay for their heavy debts. Maldonado and Gonzalez-Vega (2008) found the negative effects of increased child-labor demand in case of microfinance organizations in Bolivia. Finally, the failure of microfinance sectors, on the one hand, would often not only decrease household's welfare,

but also trap them in over indebtedness and poverty cycle. This logic confirms an argument by Adams and Von Pischke (1992) that microfinance cannot lift poverty-stricken households out of the poverty traps nor it can enhance the vulnerable households, but it is very likely worsening welfare. Some analyses failed to show a relationship between microfinance and household welfare, and found that access to credit has a limited impact on per capita incomes, food security and on the nutritional status of credit program beneficiaries (Diagne and Zeller 2001). On the other hand, an increase in number of non-performing loans because of reckless lending practices, which has given rise to over-indebtedness of an individual and household, could potentially threaten to collapse the entire microcredit sector (Bateman, 2017).

To summarize, the survey on existing literature may support the hypothesis that the positive promising of microfinance needs to go along with conditions, which households have to access to loan for the right purposes (productive loan), in right sectors (earning from investment either farming or non-farming activities is required to be higher than interest payment) and from the right institutions with low interest rate. Or else, they are likely to risk their lives in over-indebtedness and landless. In the bargain, in technical perspective, it found mostly the analysis on income indicator using to measure household's welfare. However, when households improve their welfare, it does not mean that they improve only their income, but possibly their asset and expenditure. The challenging of including all relevant key components of welfare index in order to reflect the whole global picture of Cambodian household is the primitive objective in this paper.

2.2. Country context: Cambodia

With the total population of 15.76 million (World bank, 2016) and one among the 10 members of the Association of Southeast Asian Nations (ASEAN), Cambodia's economic development is in group of the top 10 fastest-growing economics in the world during last two decades. This high growth performance is the result of hard-won macroeconomic stability, which is reflected in relatively low inflation, increasing international reserves, modest fiscal deficits and low public debt, and prudent economic policies (Mitsuhiro, 2017). According to the World Bank report in 2016 (Cuesta & Negre, 2016), Cambodia was classified as one of most successful performers in poverty and income inequality reduction. This general trend is evident from the household survey data no matter what poverty line or inequality index is used: government, the World Bank, or international (Asian Development Bank - ADB, 2014).

Before 2016, Cambodia was still one among the other 7 non-African nations of the World's poorest countries, including Afghanistan, Bangladesh, Haiti, Myanmar, Nepal, North Korea, and Tajikistan (Deaton, 2013); nevertheless, after 2016, Cambodia has classified in lower-middle income economies, and currently named as Asia's New Tiger Economy by the ADB (2016). Cambodia has all reasons to be very optimistic of its economic performance. This very good performance is surely one major catalyst leading Cambodia to dream its way forward for upper middle income economy by 2030 and high income economy by 2050². However, there remains many social and economic challenges ahead.

Cambodia: a bird's eye optimistic view under vulnerable situation

Comparing to the rest of the World, the human development index (HDI) of Cambodia is very poor, ranking 138 of 184. The fruit of high economic growth is seen to benefit hugely only the top elites

² This is according to Cambodia's Macroeconomic Progress - A Journey of 25 Years, published on October 2016 by the Ministry of Economy and Finance of Cambodia under the support of Asian Development Bank (ADB) for its 50th birthday. Retrieved from: https://www.mef.gov.kh/documents/shares/Macroeconomic_Progress_at_ADB.pdf

along with those who live in urban areas and have opportunities to involve in service and industrial sectors. The majority of Cambodia's people, 80 percent, is living in rural areas. They are mostly involving in agricultural sectors. However, the agricultural sectors have stagnated in recent years because the agricultural commodity prices continued to remain low; this is according to the World Bank (2017b).

If we take a deeper look, we found that the poverty reduction is not very far from poverty line. The Cambodian people escaped from poverty only slightly: they remain highly vulnerable, even to small shocks, which could quickly bring them back into poverty (Sobrado et al., 2014). At the same time, most of them is involving in debt from multiple sources. Based on Cambodia Microfinance Association (2018)³, there are more than 2 million people in debt. This data is approximately equal to two-third of Cambodian households in the whole country if we assume that one borrower represents one household. Poorer households are more likely to borrow from informal moneylenders, have a high ratio of outstanding debt to average annual per capita consumption, and borrow for unproductive purposes such as consumption, medical expenses, cultural and religious ceremonies, or to service existing debts (ADB, 2014). The evidence also reports that Cambodian households often underreport their debt levels. This paper investigates accordingly the indebtedness issue in the following sections.

Financial globalization and Cambodia financial system dynamics

The microfinance model⁴ was introduced in Cambodia in the early 1990s. It was provided by non-for-profit microfinance institutions (MFIs), following the Grameen Bank model with the primary objective to reduce poverty and stimulate economic development after post-war period.

In the early 2000s, because of financial sustainability constraints (Bateman, 2017), the MFIs has transformed its model to be commercialized. Over past two decades from 1995 to 2017, the microfinance sectors in Cambodia have risen impressively⁵. The number of MFIs borrowers has increased from 50,000 to more than 2 million Cambodians. It is a very profitable industry, which has been attractively by both local and foreign investors. Presently, Cambodia is ranked among the top five for MFI penetration rates (Bylander, 2015), and accounts for 10 percent of the world's total investment in microfinance sector. According to Sanjay (2018), international NGOs, international private investors and DFIs between them own 87% of the shares of the largest 15 MFIs (excluding ACLEDA which is a bank). During the past decade, the size of the microfinance industry has grown more than four-fold and nearly 40 fold in terms of portfolio, largely enabled by this inflow of foreign capital.

Microfinance sector and its role on poverty and welfare in Cambodia

Since its first introduction, microfinance sector has been viewed as a major source in contributing to Cambodia's economic growth and poverty reduction. We can confirm simply this assumption if we just look at high growth rate of MFIs sector, linking to rate of GDP growth and poverty reduction

³ Please see official website of Cambodia Microfinance Association via <https://www.cma-network.org/>

⁴ In Cambodia, presently, microfinance can be split into 3 major categories: first, microfinance who does bigger loan or so calls SME (Small and medium-sized enterprises) lending. The average size of outstanding loan per client is over \$US 2000, second, microfinance who does small loan or group lending. This group of MFIs heavily lends in KHR (Cambodian currency) and small loan. The average size of outstanding loan is normally less than \$US 500, third, the last type is the mix between the two above (hybrid) where they capture both small loan and SME loan.

⁵ Please see Appendix 3 (Figure 3.1, 3.2 and 3.3) to review the growth in microcredit outstanding in Cambodia in \$US from 2005 to 2016.

since the early 2000s⁶. The positive effect of microfinance is supported by many studies. Bylander (2015) suggested that the microfinance sector had a central role in Cambodia's economy. Prior to GDP, it was found that the microcredit is allowed to improve households' living standards and decreases poverty in rural areas (Phim, 2014; Sivchou et al., 2011). Other recent studies showed that MFI microcredits help to expand the cultivated land area, boosting the agricultural production, and rural livelihoods (Eliste & Zorya, 2015) and increase in paddy income, expenditure on inputs of paddy production as well as allows women to benefit more from credit programme (Vathana et al., 2017).

Nevertheless, at national level, the findings of the current studies do not support the previous research. Using Cambodia Socio-Economic Survey (CSES) in 2014, Seng (2017, 2018) suggests that micro-credit in both sectors reduces household expenditure. The author holds the view that the negative effects are very likely attributable to the high interest rate on both formal and informal microcredit and the household's use of microcredit for non-productive activities. The high interest rates and non-productive use of microcredit are more likely to plunge borrowers into a vicious cycle of high interest indebtedness, in particular when the earning are too low to cover the credit costs. The results corroborate the ideas of Batemen (2017), who suggested that microcredit, after the transformation into profit-oriented objectives rather poverty-reducing objective at the primary state, has contributed to frustrating and blocking Cambodia's post-war reconstruction and development objective while, not coincidentally, spectacularly enriching the narrow domestic, expatriate and foreign elite that now manage and own Cambodia's microcredit sector. This global leading expert of microfinance also linked the issue to over-indebtedness and landless of Cambodian households, which potentially threatens the stability of the entire economy.

Based on the most recent data, the level of over-indebted household is getting more serious. The study of Seng (2017) also shows that Cambodia's debt-to-income ratio, which is an indicator of over-indebtedness at the macro level, has increased remarkably. The ratio went from approximately 32% in 2005 to 92% in 2011. From 2012 to 2014, the ratio grew at rates higher than 100% (from 107% to 162% respectively), revealing that microfinance borrowers were more likely to already be over-indebted⁷. There are also the facts that they tend to borrow more money from multiple sources or sell their land, which they use only to pay for the previous debts. The issues of over indebtedness and landless are also suspected to correlate with mutual dependency within the family and migration. The family members need to depend on each other and sometimes decide to migrate in urban or abroad, just to earn money to pay back their high interest borrowing. According to Dickson and Koenig (2016), one of the top 3 major reasons for male and female migrants to leave Cambodia is financial debt⁸. Up to the present, according to the Ministry of Labor and Vocational Training of Cambodia in 2017, Cambodian migrants to only Thailand, Cambodia's neighbor country, is estimated to be higher than 1.5 million (more than 10% of Cambodia total population). This does not include the informal migrants.

The negative effects of microcredit at national level might perhaps not just be seen by some earlier scholars, but also the royal government of Cambodia, including the National Bank of Cambodia (NBC), that has often appreciated market mechanism by following the weak regulatory frameworks. In early 2017, the government, instructed directly by the Cambodia's prime minister,

⁶ Please see Appendix 3 (Figure 3.4 and 3.5) to review the evolution of Microcredit growth, GDP and Poverty rate in Cambodia (2000s to 2016).

⁷ Please see Appendix 3 (Table 3.1) to review how Seng (2017) calculated average loan outstanding / GDP per capita (%) from 2005 to 2014.

⁸ According this survey (Dickson & Koenig, 2016), most migrants came from Kampong Cham (13%), Banteay Meanchey and Siem Reap (each 12%). Most men came from Siem Reap (15%) and Prey Veng (14%), whereas female migrants mostly came from Kampong Cham (15%) and Banteay Meanchey (16%), a province at the Cambodian-Thai border with Poipet international checkpoint.

required all MFIs and banks to inform their clients and the public by media outlets and mobile phone companies that: “All microfinance institutions are private, not state-owned.”⁹ One month later, the NBC announced a ceiling of 18% interest rate on loan per month.¹⁰

Assuming that effect of microfinance at national level in Cambodia has positive (negative) impact on welfare improvement (destruction). It does not suggest that it is applied to every sub-national segmentation of Cambodian households, who are currently living in different geographies with highly different socio-economic situations. On that account, further researches in different contexts is required to better understand why microfinance in the specific context is failed or successful and what we can learn from it.

3. DESCRIPTION OF CSBD PROGRAM AND STUDY DESIGN

3.1. CSBD program

Supported by the Australian Government and the World Vision, the Cambodia Sustainable Business Development (CSBD) program was initiated under the project period during 2012-2019. The project is expected to benefit directly 12,705 AC members living in disadvantaged rural communities across Cambodia with many aspects such as (1) increasing capacity of ACs to self-manage and improve their own business and market access, (2) increasing saving behavior among cooperative members, (3) increasing and expanding business models and practices of cooperatives, and (4) business skills of cooperatives are strengthened (World Vision, 2016). Prior to running this CSBD program, the World Vision Cambodia has also focused on other activities, including child rights and equity, development, disaster management, education and life skills, health, justice for children, resilience and livelihood, urban programming, vision fund as well as water and sanitation¹¹.

3.2. Study setting and sample selection

The survey methodology was designed and executed by the independent consultants, engaged by the World Vision in 2015. The questionnaire was in English and Cambodian languages. This cross-sectional economic survey research was undertaken in order to assess the progress and the effectiveness of the CSBD program’s implementation in Cambodia. The survey respondents came across 48 districts from the target 9 provinces including Kampong Chhnang, Siem Reap, Kampong Thom, Preah Vihear, Battambang, Kandal, Takeo, Phnom Penh and Kampong Speu. These 9 provinces cover more than 50 percent of total population in Cambodia. In total, 411 households resulted from the survey and were employed in the analysis. Please see in detail Appendix 2 for the sample selection from AC members on surveyed target locations.

It is worth noting that the original database were treated with a very careful audit in order to adapt to the objective of the study, and some errors are found. It was checked, technically, data validation, consistency verification and missing values. The results reported in this present paper are therefore based on the cleaned data set.

⁹ Matt, S. (2017, 24 February). ‘We Are Private Institutions’—Banks and MFIs Heed Prime Minister. *The Cambodia Daily*. Retrieved from: <https://www.cambodiadaily.com/news/we-are-private-institutions-banks-and-mfis-heed-pm-125749/>

¹⁰ National Bank of Cambodia (2017). *Prakas on Interest Rate Ceiling on Loan*. NBC: National Bank of Cambodia.

Retrieved from: https://www.nbc.org.kh/download_files/legislation/prakas_eng/Prakas-on-Interest-Rate-Cap-Eng.pdf

¹¹ Please go through <https://www.wvi.org/cambodia>

3.3. Data and definition of the variables

This section starts with a description of variables along with the rationale why it is selected and how it is measured. As shown in detail in Appendix 1, the dependent variables include poverty and welfare indicators. To measure poverty, this paper uses the poor status that is identified by the royal government of Cambodia. In addition, it uses welfare indicators including income, economic assets, and child expenditure on health and education. Welfare indicators are a matrix of per capita household income (in Cambodian riels unit), economic assets (in hectare unit), and expenditure on child education and child health (in Cambodian riels unit). Due to the unavailability of data, it uses expenditure on child's wellbeing instead of data on household's whole expenditure. However, the idea goes along with the fact that those two indicators are theoretically associated and paralleled with each other.

The rationale of choosing these indicators is corresponding to the study of Amendola et al. (2016), which employed consumption as the primary indicator of household welfare¹². Glewwe and Hall (1998) and Dimova and Wolff (2008) use the logarithm of per capita expenditures as a stylized measure of living standards and the variance of per capita expenditures as a related measure of inequality in living standards. These authors argued that a comprehensive understanding of household welfare requires an analysis of both income and consumption patterns. These studies are in line with the thesis of Deaton (2013), which suggested that the term "welfare" refers to all of the things that are good for a person, that make for a good life. It is explained that welfare includes material wellbeing, such as income and wealth; physical and psychological well-being, represented by health and happiness; and education and the ability to participate in civil society through democracy and the rule of law. This emphasizes significantly that using only income or consumption alone is not enough for capturing the full picture of welfare.

For treatment variables, this paper employs the borrowing indicators to measure the role of microfinance. Three different definitions of access to microfinance services are used: (a) whether a household is a client¹³ of any microfinances from any sources, (b) whether a household has taken a loan from formal microfinance institutions and (c) whether a household has taken a loan for any productive purposes. The indebtedness variable is measured to represent the number of loans taken out by the household in the target regions during the last 3 years. The role of access to formal loans, providing from a saving group in AC, MFIs and banks, is also considered. Yet, the informal loan sources are from private loan providers, relatives, saving groups outside AC, which is normally characterized by high interest rates. In addition, access to productive loans is linked to the following purposes: agriculture inputs and small scale business, leading to an increase in production, for example, buying inputs for agriculture or investment in non-farm business. In contrast, the non-productive loans are for the following purposes: daily food, child health, child education, household materials, social events, health for land, charges for migration, and others. According to Katsushi et al., (2010), the definition of microfinance is used to observe with the effect of simply accessing microfinance on poverty. Moreover, Johnson and Nino-Zarazua (2011), and Claessens (2006) defined access to finance as a dummy variable, taking the value of 1 if the household head either has a bank account, or has used the credit facility of a formal financial institution.

¹² Amendola et al. (2016) viewed consumption rather than income as the primary indicator of household welfare and considering the role of resilience. Their analysis considers the following welfare indicators: (1) consumption of household production, particularly agricultural produce; (2) total spending on nondurable goods, excluding food and education; (3) food spending; (4) education spending; and (5) a dummy variable representing household poverty status.

¹³ The term "being a client" means that any member of the household has either a savings or loan account with MFIs at the time of survey.

Last but not least, this paper also includes the multidimensional indicators, which have impact, theoretically and empirically based on the existing literature, on the independent variables (Drèze & Srinivasan, 1997; Buvinic & Gupta, 1997; Stanley & Jarrell, 1998; Pezzin & Schone, 1998; Alwang & Siegel, 1999; Adebawale & Ralitza, 2017). Those variables include: (1) household characteristics (age, sex, marital status, education level, and address of household head), (2) household member details (household size, average age of members, dependency ratio, percentage of migrant members and percentage of members who generate income permanently), (3) role of gender decision in family (involving in decision of spending the major part of the family income, purchasing agricultural input, selling agricultural input and speaking in public), (4) AC membership (duration of being a member, and the opportunities of getting vocational training or business training from AC group) and (5) provincial characterizes (provincial poverty rate).

4. DESCRIPTIVE STATISTICS

Appendix 4 highlights the summary descriptive statistics of the variables for the survey sample, explained by household's poor status, borrowing characteristic and target provinces. In overall, the findings show that the average members of household are 5 members, of whom about 50 percent are female. About 29 percent of the surveyed households were in poor status, which is identified by the royal government of Cambodia.

4.1. Poverty and welfare indicators

As shown in Table 4.1 and 4.2 of Appendix 4, the households in the sampling generate respectively monthly average income per member about 224,160.7 Cambodian riels (~\$US 54.67)¹⁴, or 155,443.2 Cambodian riels (~\$US 37.91 for poor households) and 252,165.4 Cambodian riels (~\$US 61.50) for non-poor households. Nearly half of the surveyed households are living with a net income over \$US 1 per day per capita. The major source of their income are from off-farm activities. It represents over 66 percent while on-farm income represents one-third, and less than one percent from other activities. The poor households generate nearly 90 percent from off-farm activities and over 60 percent for non-poor households. This indicates that off-farm activities played greater role since households cannot depend only on agricultural activities, that they can generate only small earning. Next, in term of economic assets, poor households own around 0.98 hectare as long as non-poor households own more than 2.7 hectare. Combining together, the surveyed households own around 2 hectare. Finally, in term of expenditure on child's wellbeing, the households spent annually in average per capita around 174,110.1 Cambodian riels (~\$US 42.47), 128,881.3 Cambodian riels (~\$US 31.43) and 192,542.4 Cambodian riels (~\$US 46.96) for poor and non-poor households respectively. Both poor and non-poor households spent around two-third of total spending on child's education. The present results are significant that they value very much on education of their next generation.

4.2. Microfinance indicators

Access to microfinance is quite common in Cambodia. As displayed in Table 4.1 and 4.2 of Appendix 4, more than 80 percent of the surveyed households have access to at least one loan from multiple sources during last 3 years. Around 9 percent of households has account at banks, 3 percent for poor households and 12 percent for non-poor households. The average loan size is estimated approximately 5.3 million riels (~\$US 1,294.60) while it is reduced to 2.87 million riels (~\$US 700.78) for the poor households. Almost loans are taken from formal institutions with lower interest rate,

¹⁴ \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

where MFIs or banks were the most common sources of loans; it represents around 90 percent. The interest rate is significantly correlated to loan size and the sources of loans; higher interest rate were charged for lower amount of loan size. Informal loans given by private money lenders are commonly charged with higher interest rate. In addition, the average and non-poor households used loans for both productive and non-productive nearly at the same percentage. However, loans were used for higher percentage in non-productive purpose for poor households. The finding explains a high need of loans for households to improve their livelihood situation as well as emergency needs.

4.3. Household's characteristics by microfinance and province

The table 4.3 to 4.5 as well as figure 4.1 to 4.4 (in Appendix 4) emphasize the descriptive statistics of households, categorized by microfinance and province characteristics. The households with access to microfinance or formal loan are at higher percentage of being poor, except for access to productive loan.

In term of access to microfinance in overall, there is no significant difference between the descriptive statistics of each variable for the households with access to microfinance and for those without, except in a few cases. For example, there are higher proportions of households' per capita economic asset, households who are living in Battambang province, and household size among those receiving microfinance. On the other hand, the proportion of age of household head, percentage of dependency ratio are significantly greater among those without receiving microfinance. Next, in term of access to formal loan, the proportion is significantly higher for number of households who are living in Battambang, Preah Vihear, and Siem Reap and household size among those receiving formal loan. However, the proportion is significantly lower of household among those receiving microfinance in cases of age of household head, number of household living in Kampong Chhnang and Kandal, percentage of dependency ratio and average years of education of members. Lastly, in term of access to productive loan, there is also a relatively small difference between the descriptive statistics of each variable. For instance, there are higher proportion of per capita economic asset, and households of living Battambang among those receiving productive loan. Yet, the proportion is relatively significantly greater for households of living Kandal, percentage of dependency ratio among those without receiving productive loan.

5. EMPIRICAL METHODOLOGY

This paper applies the binary choice model, specifically probit regression, to examine the effect of access to microfinance, formal loan and productive loan on poverty reduction, proxied by household's welfare index of per capita income, economic assets and expenditure on child's well-being. In order to get unbiased and consistent results, this paper also addresses the issues of treatment endogeneity. Then, it uses bivariate and censoring model, namely tobit model, to investigate the poverty reducing effects of the amount of access to microfinance, formal loan and productive loan.

5.1. Binary choice model and endogenous treatment effects

This paper aims, in the first stage, in testing the hypothesis that access to microfinance¹⁵ reduces poverty. With the cross-sectional data set, it could compare the difference between households'

¹⁵ With the same logic, this paper applies the same empirical strategy to the cases of formal and productive loan. Therefore, the model is constructed only with the variable of access to microfinance.

welfare among those receiving microfinance and those without. The positive effect of access to finance can be statistically obtained if household's welfare with access to microfinance is higher than those without. However, these results are applicable only if the samples of the survey households are randomly selected and other statistical issues are addressed cautiously. In this study, however, there are two major statistical issues, which lead potentially to bias and inconstant results if the traditional estimators, like the ordinary least squares (OLS), were applied. Those statistical issues are related to (1) sample selection bias and (2) treatment endogeneity.

Sample selection bias occurs when the availability of data are influenced by a selection process related to the value of dependent variable (James & Mark, 2012). According to Katsushi et al., (2010) who focuses on microfinance and household poverty reduction in India, the sample selection bias may be due to a number of factors including (1) self-selection, where the households themselves decide whether to participate in microfinance programmes, which depend on observable and unobservable households characteristics and (2) endogenous program placement, where those who implement microfinance program select (a group of) households with specific characteristics (e.g. high poverty rates or reasonably good credit records depending on the programme specification).

Treatment endogeneity occurs when the unobserved factors affect the outcome and be endogenous, i.e. they influence the treatment variables. Alessandra et al., (2016) explained this issue in their study of financial access and household welfare in Mauritania as follows: the treatment endogeneity may be caused by (1) unobserved area-level fixed effects that influence both demand for credit and household income and consumption, such as local prices, infrastructure quality, cultural norms, environmental conditions and natural-disaster risks; and, (2) unmeasured household characteristics that affect both demand for credit and household income and consumption, such as the health, ability, and fecundity of household members, as well as preference heterogeneity. Seng (2017) explained in more simple way that if, for instance, households are wealthier, their expenditure would be higher, regardless of whether they use microcredit. Furthermore, the household heads' entrepreneurial skills and motivation for expanding existing income-generating activities or investing in new activities with higher profit can stimulate both the uptake of microcredit and household income levels, the more likely increasing household expenditure. In this case, these unobserved factors would, if not account for, lead to biased and inconsistent estimates of the effects of microcredit.

In order to deal with sample selection bias, it might consider to apply the Heckman sample selection model (Heckman, 1979). Heckman's solution was to specify a preliminary equation with a binary dependent variable indicating whether responder is in or out of the subsample and treat the equation and treatment equation as a system of simultaneous equations (James & Mark, 2012). Moreover, to deal with the endogenous treatment affects, it can use either the control function method or the instrumental variable approach. Chang and Mishra (2008) and Seng (2017), on the one hand, applied the control function methods by using the variable as instrument that has direct effect on access to microfinance but not household's welfare. Those variables can be professional identity card, birth certificate, national identity or formal bank account, which is required to access to formal loan. On the other hand, Alessandra et al., (2016) addressed the potential endogeneity by an instrumental variable strategy, following the concept of the household isolation level. The author used the instrument as the average value of the households' distance from the vital infrastructure and facilities, including water source, primary and secondary school, government offices, transportation services, healthcare facilities, mobile phone and internet services. This present study estimates the results only with the instrumental variable approach, called probit model with continuous endogenous regressor, by using the logarithm of provincial total population of

household's address as instrument. The other methods as explained above are not applied since it cannot give any accurate results.

The empirical strategies can be explained as the simple following steps. First, the poverty function is built, estimated by the binary variable of access to microfinance and other controlled variables. Second, access to microfinance is estimated by probit model to measure the effect of explanatory variables. Finally, the instrumental variable approach is applied to address the issues of treatment endogeneity effect.

The determinants of poverty reducing effects can be structured as the following linear regression model (Greene, 2012):

$$Poverty_i = \beta X_i + \alpha MF_i + \varepsilon_i \quad (1)$$

For the equation (1), $Poverty_i$ is the poverty indicator. X_i measures the matrix of controlled variables of the i household, which assumed to have theoretically and empirically impact on poverty reduction. Those variables include: household characteristics, household member details, gender decision in family, AC membership, and provincial poverty rate. MF_i is the treatment variable, proxied by access to microfinance. β and α represent respectively the coefficient of controlled variables and treatment variables of access to microfinance. Finally, ε_i is an error term, following the normal distribution $\varepsilon_i \sim (0, \sigma)$. Moreover, because MF_i^* depends on a complex of household characteristics, the econometric equation can be structured as follows (please see Greene, 2012):

$$MF_i^* = \gamma Z_i + \eta_i \quad (2)$$

And

$$MF_i^* = 1 \text{ if } MF_i^* = \gamma Z_i + \eta_i > 0$$

$$MF_i^* = 0 \text{ Otherwise}$$

In the question (2), MF_i^* is binary dependent variable that is qualitative in nature, taken one of only two possible values, representing "access to microfinance", coding 1 and "without access to microfinance", coding 0. Z_i is a vector of explanatory variables. At the same time, γ_i is a vector of related coefficients and η_i is assumed to be normally distributed ($\eta_i \sim N(0, \sigma)$). To estimate the econometric model in the question (2), the traditional linear regression, linear probability model (LPM), cannot be used, since the LPM is heteroscedastic, where the variance of η_i depends on Z_i . Therefore, the estimations by the ordinary least squares (OLS) could lead to bias results.

This problem could be solved by using probit regression, which is nonlinear regression models, particularly designed for binary depend variables. Because a regression with a binary dependent variable MF_i^* models the probability that $MF_i^* = 1$, it makes sense to adopt a nonlinear formulation that forces the predicted values to be between 0 and 1 (James & Mark, 2012). In this model, probit regression applied the standard normal cumulative probability distribution function (c.d.f.'s). It is then assumed that the probability of the choice depends on covariates through a function Φ as follows:

$$\Pr(MF_i^* = 1 | Z_i) = \Phi(\gamma' Z_i) \quad (3)$$

$$\Pr(MF_i^* = 0 | Z_i) = 1 - \Phi(\gamma' Z_i)$$

It is needed to define Φ such that $\Pr(MF_i^* = 1 | Z_i)$ stays between 0 and 1, where $\Phi(\cdot)$ is a normal distribution function. The interesting solution is to apply a function, which has the similar properties that the cumulative distribution function:

$$\begin{aligned} \lim_{x \rightarrow -\infty} \Phi(Z) &= 0 \\ \lim_{x \rightarrow +\infty} \Phi(Z) &= 1 \\ \frac{d\Phi(Z)}{dZ} &> 0 \end{aligned} \quad (4)$$

The equations (1) and (2) are estimated simultaneously to address the problem of sample selection bias. By using a formula for the joint density of bivariate normally distributed variables and controlling for the inverse Mill's ratio¹⁶ which reflects the degree of sample selection bias (Katsushi et al., 2010), the expected per capita welfare index for households with access to microfinance and those without can be structured respectively as:

$$E(Poverty_i | MF_i = 1) = \beta_i X_i + \alpha + E(\varepsilon_i | MF_i = 1) = \beta_i X_i + \alpha + \rho \sigma_\varepsilon \frac{\varphi(\gamma_i' Z_i)}{\Phi(\gamma_i' Z_i)} \quad (5)$$

$$E(Poverty_i | MF_i = 0) = \beta_i X_i + E(\varepsilon_i | MF_i = 0) = \beta_i X_i - \rho \sigma_\varepsilon \frac{\varphi(\gamma_i' Z_i)}{1 - \Phi(\gamma_i' Z_i)} \quad (6)$$

Where, φ is the normal density function. Therefore, the difference in per capita welfare index between households with access to microfinance and those without access to microfinance is given as follows:

$$E(Poverty_i | MF_i = 1) - E(Poverty_i | MF_i = 0) = \alpha + \rho \sigma_\varepsilon \frac{\varphi(\gamma_i' Z_i)}{\Phi(\gamma_i' Z_i)[1 - \Phi(\gamma_i' Z_i)]} \quad (7)$$

In order to produce the unbiased estimates of β ; α and Z_i , it is estimated with the full maximum likelihood method in Equation (7).

Probit model with continuous endogenous regressors

To address the endogenous treatment effect, the probit model with continuous endogenous regressors is applied by stata command, *ivprobit*. This estimator fits models with binary dependent variables with endogenous regressors. The model is structured as follows:

$$\begin{aligned} Poverty_i^* &= \alpha MF_i + \beta X_i + \varepsilon_i \\ MF_i &= \xi_1 X_i + \xi_2 Y_i + v_i \end{aligned} \quad (8)$$

Where, $i = 1$ to 411, MF_i is $1 \times p$ vector of endogenous variables, X_i is a $1 \times x$ vector of exogenous variable, Y_i is $1 \times y$ vector of additional instruments. By the assumption, $(\varepsilon_i, v_i) \sim N(0, \sigma)$, where σ_{11} is normalized to one to identify the model. α and β are vectors of structural parameters, and ξ_1 and ξ_2 are matrices of parameters. (ε_i, v_i) is independent and identically distributed multivariate for all i . The equation $Poverty_i$ is observed then:

$$Poverty_i = \begin{cases} 0 & Poverty_i^* < 0 \\ 1 & Poverty_i^* \geq 0 \end{cases} \quad (9)$$

For the question (8), the Wald test of the exogeneity of the instrumented variables is applied. According to StataCorp (2013), if the test statistic is not significant, there is not sufficient information in the sample to reject the null that there is no endogeneity. Then a regular probit regression may be appropriate; the point estimates from *ivprobit* are consistent, though those from probit are likely to

¹⁶ Please take note that the terms in brackets explains the inverse Mills ratio, which indicate the direction of selectivity bias.

If its value is negative, it explains the overestimate welfare levels because of sample selection bias of households in the access to microfinance treatment. In contrast, it is true for positive selection bias. However, the correct estimation of the impact of access to microfinance on poverty is estimated by net of the selectivity bias.

have smaller standard errors. Finally, the Newey's (1987) minimum chi-squared estimator with the two-step estimators will be computed for the endogenous probit model.

5.2. Bivariate and censoring model with endogenous treatment effects

This paper, in the next stage, estimates the effect of amount of access to microfinance on the poverty reduction, proxied by the natural logarithm of the dependent variable Wf . In this case, the observed Wf data were considered as censored data, which the limit values are available. It is when the value of the dependent variable is replaced by some threshold value if its true value crosses the threshold. For instance, the net income data are often top-corded, meaning that if an individual's net income is higher than some value (let's say, at least \$US 0 per day), it will be then observed only y equal or higher than 0 instead of the true income because some households might generate net negative income because of their debt. To estimate censored data, the traditional model of OLS would produce biased and inconsistent results for the major reason that it fails to deal with qualitative difference between limit (zero) observations and non-limit (continuous) observations. According to the literature, the bivariate and censoring model, specifically the Tobit model, a contraction between Jame TObin and proBIT model, is therefore considered as the alternative reliable estimated method. The model can be structured as follows:

$$Wf_i = \beta'X_i + \alpha MF_i + \varepsilon_i \quad (10)$$

And

$$\begin{aligned} Wf_i &= 0 \quad \text{if } I_i \leq 0 \text{ with } Wf_i^* = \beta'X_i + \alpha MF_i + \varepsilon_i \\ Wf_i &= Wf_i^* \text{ if } I_i > 0 \\ \varepsilon_i &\rightarrow N(0, \sigma^2) \end{aligned}$$

Where, Wf_i is the dependent variable. X_i is vector of controlled variables, which are presumed to have impact on the dependent variable. MF_i is vector of treatment variables. β' and α are coefficient and ε_i is error term, which is assumed to be normally distributed. In this model, the dependent variable Wf_i is assumed to be related as linear regression to the variables of X_i and MF_i .

Tobit model with continuous endogenous regressors

With the same logical reasoning as the probit model, the tobit model also faces endogeneity problems. To deal with these issues, the tobit model with continuous endogenous regressors is applied using stata comment, *ivtobit*. The model is structured as follow:

$$\begin{aligned} Wf_i^* &= \alpha MF_i + \beta X_i + \varepsilon_i \\ MF_i &= \xi_1 X_i + \xi_2 Y_i + v_i \end{aligned} \quad (11)$$

Where, $i = 1$ to 411, MF_i is $1 \times p$ vector of endogenous variables, X_i is a $1 \times x$ vector of exogenous variable, Y_i is $1 \times y$ vector of additional instruments. By definition, $(\varepsilon_i, v_i) \sim N(0, \sigma)$, where σ_{11} is normalized to one to identify the model. α and β are vectors of structural parameters, and ξ_1 and ξ_2 are matrices of parameters. (ε_i, v_i) is independent and identically distributed multivariate for all i . The equation Wf_i is observed then:

$$Wf_i = \begin{cases} a & Wf_i^* < a \\ Wf_i^* & a \leq Wf_i^* \leq b \\ b & Wf_i^* \geq b \end{cases} \quad (12)$$

For the overall assumption, the Wald test of the exogeneity of the instrumented variables, and the Newey's (1987) minimum chi-squared estimator with the twostep option will be applied with the same logic in probit model (StataCorp, 2013; Newey, 1987).

6. RESULTS AND DISCUSSIONS

Appendix 5 to 8 reports detailed regression results of the binary choice model (probit regression) as well as the bivariate and censoring model (tobit regression) with addressing the endogenous treatment effects from cross-sectional dataset of 411 Cambodian households in 2015. The findings will be explained in three parts: (1) determinants of access to microfinance services, (2) the effect of access and its amount to microfinance services on poverty reduction, and (3) the effect of the amount of access to microfinance services on household's welfare Wf .

6.1. Determinants of microfinance services

The appendix 5 provides the results of the probit regression implying the sort of characteristics, which are the major determinants predicting the use of microfinance services, including access to microfinance, access to formal loan and access to productive loan.

Almost all explanatory variables have the same direction in explaining the variable of interest of microfinance (also for access to formal and productive loans), but only few variables have statistically significant impacts. The results, however, do not change even when it is added the instrumental variables of provincial total population. The household head with older age is more likely to access microfinance services; yet, its trend is in non-linear positive effect since the coefficient of age square is negative. The likelihood of access to microfinance services were found to be driven by the household with female and married head, having higher number of migrant members as well as having longer membership and getting many training in vocational skills and business in the AC community. This result may be explained by the fact that microfinance programs is highly accessible for targeting women. And, the households, who have involved frequently in activities of AC community, tend to access more to microfinance services. The households with higher percentage of dependency member, whose ages are under 15 and over 60 years old, are statistically less likely to access to microfinance services. The access to microfinance services is also less likely for the households, having higher education level of household head and members, having more members who generate income permanently, and having higher female role in decision of family affairs such as spending, buying, selling and speaking in publics as representative of the family. However, the other interesting finding is that the households, who are living in province with higher provincial rate of poverty, are more likely to access to microfinance services.

In brief, only few variables are the significant determinants of access to microfinance services. The households having higher percentage of dependency ratio and average years of member's education determine statistically less likelihood to access to microfinance services as long as married household head and older household head are likely to access to formal and productive loans respectively.

In the next stage, this paper will investigate and discuss the effect to microfinance services relating to poverty and welfare indicators and question whether the effects were varied for which access to microfinance becomes access to formal and productive loans. It is worth noting that the positive value of dependent variable would be explained by higher poverty (since the poverty indicator is measured as 1 for the poor and 0 otherwise) and higher welfare (measured by the

logarithm value in Cambodian riels of per capita income, economic asset, and expenditure on child's well-being).

6.2. Effect of microfinance services on poverty

The results in appendix 6 to 7 show respectively the effect of access to microfinance services and its amount on poverty indicator. Access to microfinance and formal loan, as shown in appendix 6, increases poverty rate (but not statistically significant), except it is opposite for productive loan. Yet, the results turn to reduce poverty rate when it is estimated with the amount of microfinance services or include other controlled variables as well as addressing logarithm of the provincial total population as the instrumental variable, as shown in appendix 7.

At the bottom of the table 7.1 and 7.2 (in appendix 7), the results of the Wald test of exogeneity are reported. However, it is found that the test statistic is not significant; therefore, there is not sufficient information in the sample to reject the null that there is no endogeneity. Consequently, the results of a regular probit regression can be used, which may be appropriate and consistent because the results are likely to have smaller standard errors (StataCorp, 2013).

The household with higher access to microfinance services in all aspect (access to microfinance, formal loan and productive loan) is less likely to be poor. The households, having higher educated members, higher percentage of members who generate permanently income, and higher female role in decision of family affairs, are less likely to be in poor family. As member of AC group, getting more vocational skills and business training, the households are more likely not to be poor. Nonetheless, they are more likely to be poor if the duration of their membership is longer. The possible explanation for this might be due to the fact that the longer they are in AC membership, it means the longer they were already in disadvantageous situation in the earlier stage; therefore, the longer they can receive many training programmes. Least but not last, the household living in province with higher rate of poverty are more likely to be poor; yet, it is opposite for households who are living in province with higher population.

6.3. Effect of microfinance services on welfare

The appendix 8 (table 8.1 to 8.6) shows the results computing from tobit regression model on the effect of the amount of microfinance on welfare indicators. The sample for regressing was restricted only to households who had access to microfinance services. At the bottom to table 8.1 to 8.6, the results of the Wald test of exogeneity are also reported. The significant test statistic is obtained only for economic asset as dependent variable. Therefore, for other dependent variables, the results of a regular tobit regression will be used.

In overall, the results reveal that access to microfinance services in every aspect including both formal and productive loans promotes statistically household's per capita income after controlling all the relevant socio-economic characteristics; except there is non-statistically relationship for economic assets and expenditure on child's wellbeing. The further comprehensive explanations are as follows:

First, on the question of household's per capita monthly income as shown in table 8.1 and 8.2, the positive effects were driven by the households having female and married head as well as having higher educated members and higher percentage of members who could generate income permanently. The finding also shows that longer membership in AC group and joining more vocational skills and business training programmes allow households to promote significantly their higher monthly income. The rest of controlled variables revealed non-statistical relationship. Second, on the question of household's per capita economic assets as shown in table 8.3 and 8.4, measured

by the average size of household's land, the positive effects in promoting the assets were statistically due to the fact that households have higher female role in decision of family affairs and where they live. The households, who are currently living in regions with higher provincial poverty rate, seem to have higher economic assets. The negative effect was caused by having higher number of dependency members. However, there is no significant effect of all explanatory variables as long as the results were estimated with instrumental variable approach. Finally, on the question of per capita expenditure on child well-being as shown in table 8.5 and 8.6, households with higher age tend to expend significantly more on child's well-being; yet, the coefficient of age square is positive, which explains non-linear negative effect. The lower expenditures are statistically due to the fact that household head has lower years in school. Moreover, the expenditures are seemed to increase highly by households with longer membership in AC group and households whose percentage of dependency ratio and migrant members are higher.

To summarize the key findings, access to microfinance services reduces poverty and promotes welfare of Cambodian households, who have been involving in the international development project supported by the Australian Government through Austrian Aid and the World Vision Cambodia. In this development community, the households could participate in many practical vocational skills and business training programmes as well as access to financial supports to improve their livelihoods and living standards such as management of the cooperatives, farm business practices and their access to markets. According to World Vision report (2016), the AC cooperatives have supported to enhance their business skills, farming knowledge and negotiating power. The project aims to help farmers to increase their productivity, diversify their agribusinesses, thus increasing income to give their families, especially their children, a better quality of life. Furthermore, each cooperative establishes a social welfare fund to support the most vulnerable members of the community, and all community members can seek small low-interest loans from the cooperatives. Lastly, it is also found that all attending primary school, secondary school, high school and higher education are associated with better welfare index of all dimensions (income, assets, and expenditures). This reflects clearly that higher rate of literacy generates upper household's living standard. The role of women in involving in any decisions of the family affairs plays positively significant role in promoting household's welfare. This is revealed traditionally in Cambodian society that women has been seen as a major person to manage family financing. It is because they could manage more effectively comparing to men who normally focus only working and earning income.

7. CONCLUSION AND POLICY IMPLICATIONS

This paper investigates theoretically and empirically the effect of microfinance services in three dimensions (access to microfinance, access to formal loan as well as access to productive loan) on poverty and welfare, proxied by per capita income, economic assets and expenditures on child's well-being. For empirical investigation, this paper applies two major econometric specifications, both binary choice model as well as bivariate and censoring model, along with addressing the endogenous treatment effects, by using the cross-sectional data of Cambodian household survey in 2015. The survey is carried out by the World Vision Cambodia under CBSD programs in 48 districts of 9 provinces in Cambodia: Battambang, Kampong Chhnang, Kampong Speu, Kampong Thom, Kandal, Phnom Penh, Preah Vihear, Siem Reap and Takeo.

The findings show that, at sub-national level of the survey households, receiving access to microfinance services including both formal and productive loans reduces poverty and promotes household's welfare, proxied by per capita monthly income, but there is no significant effect on per

capita economic assets and expenditure on child's well-being. However, at national level, it reveals that there are more relevant studies, in regard to the existing literature, emphasizing the failure of microfinance, which is subject to high interest rate, non-productive loan, over-indebtedness, landless and migrations. Based on the empirical findings and the survey on existing literature, several policy implications are suggested as follows:

First, receiving microfinance by Cambodian households, who are beneficiaries of any international development programs, has been often seen to promote household's welfare and reduce poverty. Practically, the households have generally opportunities to involve in many useful vocational skills and business training series, consulting services and access to financial services such as saving, basic insurance, as well as borrowing with lower interest rate. In Cambodian society, there is one traditional proverb, "Give them fish, you feed them a day; teach them to fish, you feed them for a whole life". It is suggested therefore to (1) spread these good practices to national wide so that many more Cambodian people in other provinces could benefit from it, (2) increase longer period of implementation, and (3) train key people such as head or management team of villages, communes or communities so that those positive virus could lead effectively their villages, communes and communities even after the end of the project implementation.

Second, despite receiving financial access and other consulting services from the World Vision, the results also show that the households have access to microfinance services at high percentage for non-productive purposes. The non-productive loan in average is higher than 50 percent for all households and reaches nearly 60 percent for the poor households. At national level, this unproductive practice is also drawn high attention from the World Bank (Sobrado et al., 2013) and ADB (2014) that households could potentially use financial services in ineffective ways, especially for long term perspective. Therefore, it is required to have better regulation and financial assessment on good practices of productive loan from both public authorities and private MFIs respectively.

Third, based on the most recent observation, there is high distress over the bad practices or the failure of microfinance sector in the Kingdom. The introduction of interest gap 18 percent to the MFIs by Cambodian authorities, regulated by the NBC in 2017, has been widely discussed; then, alternative solutions could be also considered. Actually, the idea of interest gap 18 percent per year was introduced with the major objective to limit too much profit generating by the MFIs, which was seen to give huge benefit to only top CEOs, and foreign investors with the expense of Cambodian households' welfare, who had to bear with high interest rate. This tool is also expected to reduce the number of easy loans to the households. According to the results in this paper, the average households have to pay yearly interest rate of 30.44 percent for formal loan and 31.84 percent for informal loan. The average poor households will have to pay higher rate, 32.02 percent for formal loan, and 39.73 percent for informal loans. Therefore, this regulation would mean a lot to reduce interest payment for the households. However, it has been extensively debated as it is not the right treatment for the heart of disease and it can potentially provide negative effects. So, what is the heart of disease? And, what can be the alternative solutions? According to many leading experts, the over-indebtedness, irresponsible borrowing or lending, multi-borrowing, overstretched MFIs capacity, and a loss of lending discipline are the heart of the problems. Yet, the regulation would make the loan cheaper and irresponsible borrowers would want to borrow more. In addition, for short term, this regulation will also lead the new MFIs to die because they can generate lower profit or losses if their operation cost is too high. Therefore, the alternative solutions to deal with the over-indebtedness and irresponsible borrowing / lending should be related to (1) limit to debt / income ratio, for instance, borrower cannot borrow more than one-third of their income for consumer loans, and (2) increase the MFIs's capital requirement so that small MFIs can consolidate and improve their

efficiency, which can help to reduce irresponsible lending since too much competition when there are too many MFIs often leads to irresponsible lending.

Fourth, the informal money lender or private loan provider, which is out of system and charges very high interest rate, seems to be so active in Cambodia. In this survey, average informal loan were charged by over 5 percent per month and it reached sometimes over 10 percent per month. This leads households to easily multiply their loans and trap in over-indebtedness. Although this informal credit is estimated to represent only 5 to 10 percent comparing to formal ones, making 60 to 70 percent in Cambodia's microfinance sector, it is required to highly regulate from the public authorities. For instance, the government might announce not to be responsible for any failed loans if lenders decide to provide this kind of loans to the poor households.

Fifth, the disagreement on the key problematic on how microfinance sectors should be regulated in Cambodia is perhaps due to the fact that it is lacking of complete statistical database. This leads easily to the misunderstanding of the real issues. Unlike the CSES, which has been conducted annually since 2007 in order to collect data from household and individuals in Cambodia on different areas relating to poverty, there are no this type of survey for the microfinance sector although Cambodia's banking and financial sector is equal to 150 percent of Cambodia's annual GDP in 2017. For the medium and long term perspective, we should consider to conduct the Cambodia Microfinance and Households Survey (CMHS) at national level to observe the dynamism of microfinance sector in Cambodia. The core idea can be focused on the following perspectives: trend of number of borrowers, especially the small borrowers, trend of average loan size, big loan, and small loan, dynamics of commissions and additional fees charged by the MFIs, consolidation and exits of the MFIs, trend of non-performance loan, trend of repayment and sources of payment, growth of pawnshops and other informal lenders, trend of land ownership, trend of migrant members, etc. This survey should be done by independent researchers to obtain the reliable results.

Sixth, promoting household's financial literacy is a key challenging policy for long term perspective. According to the Standard & Poor's Ratings Services Global Financial Literacy Survey (2013), only 18 percent of Cambodian households has financial knowledge in managing their income effectively. Currently, in Cambodia, financial education is done by the MFIs themselves to the households because they are the only institutions who have both human and financial resources. Even though we don't have any monitoring and evaluation system to evaluate the effectiveness of this policy, it is believed that it is not effective mechanism because the MFIs might not want to increase household's financial literacy if it converts to lower number of loan access. For that reason, the other relevant stakeholders, primarily the public authorities like the NBC, must be the one who is responsible for this. From 2016, the NBC has initiated one educational campaign, called "Let's Talk Money". Yet, there is concern over the limit number of public who can access to. The other idea that maybe strange but it can be applicable in Cambodia is to cooperate with the Ministry of Education, Youth and Sport. Every year, there are over 100,000 high school students who have to take national examination of baccalaureate. If this financial education series are included in standard school curriculums at every level of Cambodian education system, they would spread the positive virus to their family. It is like we educate the people in understanding "HIV and AIDS". The higher financial literacy it is, the higher chance the household can use the microfinance services effectively; therefore, and irresponsible borrowing would be reduced.

Finally, in order to fund financial budget for the projects of the CMHS and financial education campaigns, it is suggested to use, for example, 1 percent of tax on profit from MFIs. To do that, we will have the financial sustainability because it will be ended only if there is no more profit for the MFIs or the end of this sector.

Despite many significant results provided in this paper, there is abundant room for further progress. First, it is related to our sample selection. Taking into account the limited timeframe and resources, the researchers applied the clustered random samples rather the simple randomly selection. In this survey, there is consequently only 29 percent of the poor households against 71 percent of non-poor households. As explained in the empirical methodology session, there is high concern over the statistical problems of sample selection bias and endogenous treatment effects. Second, to estimate the effect of microfinance services on poverty and welfare, this paper uses only access to credit as the determinant variable, by neglecting other indicators such as payments, money transfers, saving, and insurance. The introduction of those variables would provide further insight. Third, the analysis is drawn from one time period in 2015, which cannot capture the dynamics of the effect. Therefore, to develop a full picture of the problematic, additional studies will be needed.

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Appendix 1: Definition of variables

Variable	Definition
Dependent	
<i>poor status</i>	1 poor and 0 otherwise. The poor status is identified by the royal government of Cambodia.
<i>per capita welfare</i>	<p>Per capita welfare is a matrix of household's per capita income, economic assets, and expenditure on child's well-being. First, per capita income (in Cambodian riels) is measured by average net income per month of household by livelihood activities. The households generate income from three livelihood activities: (1) income from on-farm including rice crop, upland crop, vegetable, poultry raising and pig raising, (2) income from off-farm including fishing selling, daily or occasional wage, monthly wage/salary work, self-employment, sale of land/other assets, remittances, or pension, and (3) income from other sources including dividend in AC, interest from saving in AC or interest from saving outside of AC saving group.</p> <p>Second, per capita economic asset (in hectare) is measured by all types of assets, owned by household, including total production land, non-production land, housing land and other land.</p> <p>Third, per capita expenditure on child's well-being (in Cambodian riels during the last 12 months) is measured by expenses on child's education (including materials, school fee, extra class, etc) and child's health (including cost of treatment, medical check, medicine, treatment services at private clinic, treatment services at HC/public, health care facilities).</p>
Treatment	
<i>loan access</i>	1 if the households have outstanding loans for the last 3 years and 0 otherwise.
<i>bank account</i>	1 if the households have account in bank and 0 otherwise
<i>loan number</i>	Number of loans taken by the households for the last 3 years
<i>loan amount</i>	Total amount of outstanding loans for the last 3 years.
<i>official loan access</i>	1 if the households access to formal outstanding loans providing from saving group in AC, MFIs and banks for the last 3 years and 0 otherwise.
<i>official loan amount</i>	Total amount of formal outstanding loans for the last 3 years. The informal loans include loans from private loan provider, relatives and saving group outside AC.
<i>productive loan access</i>	1 if the households access to productive outstanding loans for the following purposes (agriculture inputs and small scale business) for the last 3 years and 0 otherwise. The non-productive loans include loans for daily food, child health, child education, household materials, social event, health for adult, purchase land, charge for migration, repay the loan, construct dwelling, marry children, give to relatives, etc.
<i>productive loan amount</i>	Total amount of productive outstanding loans for the last 3 years.
Controls	
Household characteristics	
<i>age</i>	Age of household head
<i>age square</i>	Age square of household head in years

<i>sex of household head</i>	Female = 1 and otherwise = 0
<i>marital status of household head</i>	Married = 1 and otherwise = 0
<i>education level of household head</i>	Highest level of education that household head has completed (in years of schooling)
<i>address of household head</i>	Reported data of household residence is divided into nine groups of provinces (dummy variable): Battambang, Kampong Chhnang, Kampong Speu, Kampong Thom, Kandal, Phnom Penh, Preah Vihear, Siem Reap and Takeo
Household member details	
<i>household size</i>	Number of household's members
<i>dependency ratio</i>	Dependency ratio (ratio of household members under ages of 15 years or over 60 years to total members)
<i>% of migrant members</i>	Percentage of migrant members (both internal and international)
<i>% of permanently income</i>	Percentage of members who generate income permanently
Gender decision in family	
<i>female role in decision of family affairs</i>	Percentage of female role in decision of family affairs such as income spending, purchasing agricultural input, selling agricultural input and speaking in public.
AC membership	
<i>duration of member</i>	Duration of AC group membership (in year)
<i>access to vocational and business training</i>	Percentage of households in access to vocational skills and business trainings. The vocational skill and practices training include weaving, handmade craft, food processing, grow mushroom, and others. The business training include entrepreneur / business concept, market assessment, customer relation and others. The programs were trained by the World Vision, Cooperative Agriculture, government agencies or relevant governmental department, institution or school, neighbour or relative and others.
Province characteristics	
<i>provincial total population</i>	Number of population in the province as of survey date. The database is taken from the report of the National Institute of Statistics and the Ministry of Planning of Cambodia (2013, page 17) *
<i>provincial poverty rate</i>	Percentage of poor people in the province. The database is taken from ADB (2014, page 32) **

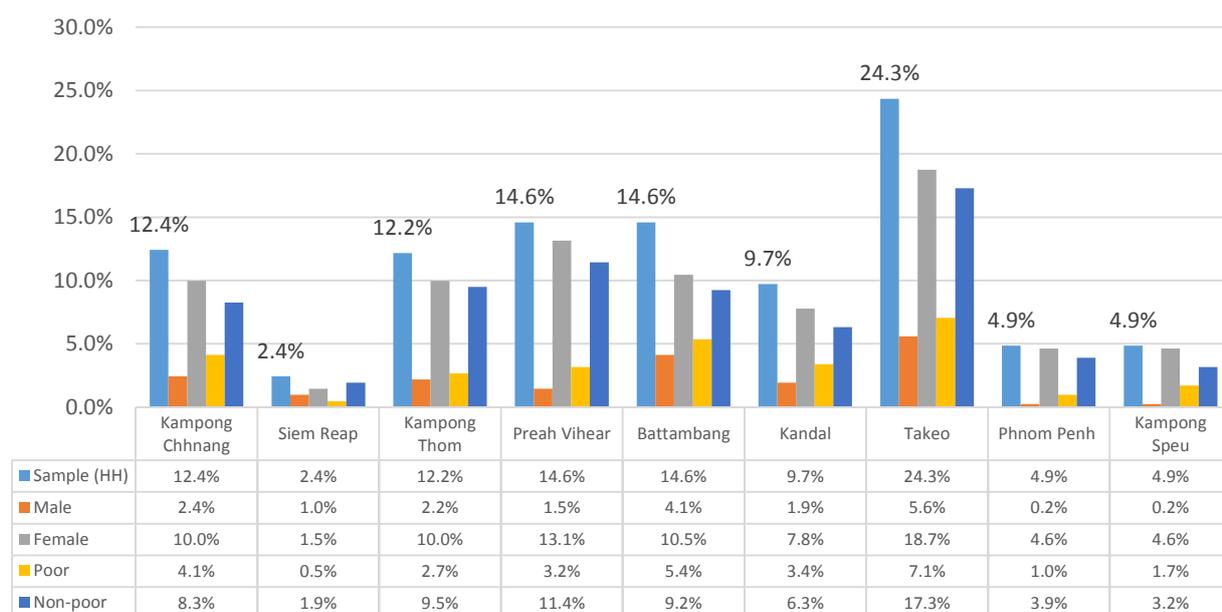
Source: Author's own elaboration

Note:

* National Institute of Statistics and Ministry of Planning (2013). *Cambodia Inter-Censal Population Survey 2013 Final Report*. National Institute of Statistics and Ministry of Planning. Retrieved from: http://www.stat.go.jp/info/meetings/cambodia/pdf/ci_fn02.pdf

** Asian Development Bank (2014). *Cambodia: Country poverty analysis 2014*. ADB: Asian Development Bank.

Appendix 2: Sample selection from AC members on surveyed target locations (N = 411)

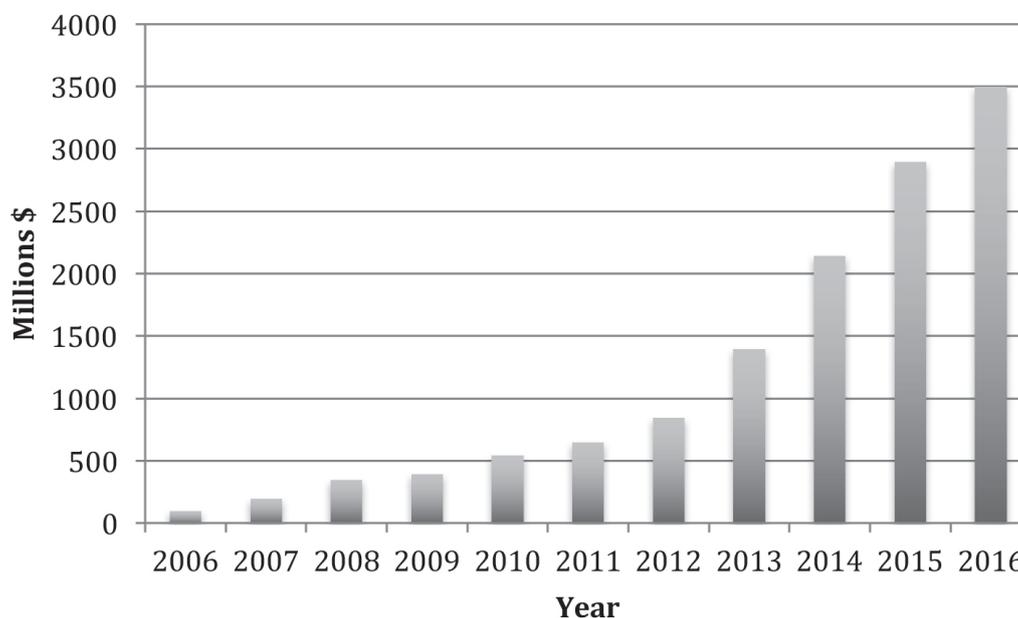


Source: The CSBD project beneficiary list (World Vision Cambodia, 2015)

Note: To determine the sample selection, which could be used to draw a representative conclusion for the 12,705 beneficiaries of AC community, the independent researchers, engaged by the World Vision Cambodia in 2015, applied the clustered random samples method rather the simple randomly selection, due to the limited timeframe and resources. The survey adopted a two-stage sampling methods to select the locations and respondents for the household interviews: (1) the first stage was the random selection of clusters (AC) and (2) the second stage was random selection of households within those clusters (AC).

Appendix 3: Microfinance sector and macroeconomic indicators in Cambodia (2000s to present)

Figure 3.1: Growth in microcredit outstanding in Cambodia in \$US millions from 2005 to the end of 2016 (excluding ACLEDA)



Source: Cambodia Microfinance Association

Table 3.1: Microcredit growth and GDP per capita (%), 2005-2014

Year	Loan Outstanding (\$US millions)	MFI Borrowers	Average Loan Outstanding	GNI per Capita (con. 2005 \$US)	Average Loan Outstanding / GNP per Capita (%)
2005	50.13	351,096	142.78	450.88	31.67
2006	86.86	446,489	194.54	492.90	39.47
2007	154.28	601,691	256.51	538.40	47.62
2008	277.06	825,238	335.73	561.12	59.83
2009	298.62	871,401	342.69	553.42	61.92
2010	425.92	992,452	429.16	575.84	74.53
2011	644.64	1,151,339	559.90	606.42	92.33
2012	892.66	1,316,265	678.18	635.83	106.66
2013	1,325.2	1,566,526	845.95	667.09	126.81
2014	2,028.56	1,779,171	1140.17	702.39	162.33

Source: Seng (2017)'s computation from CAM (2014) and the World Bank (WB, 2015) for GNI per capita

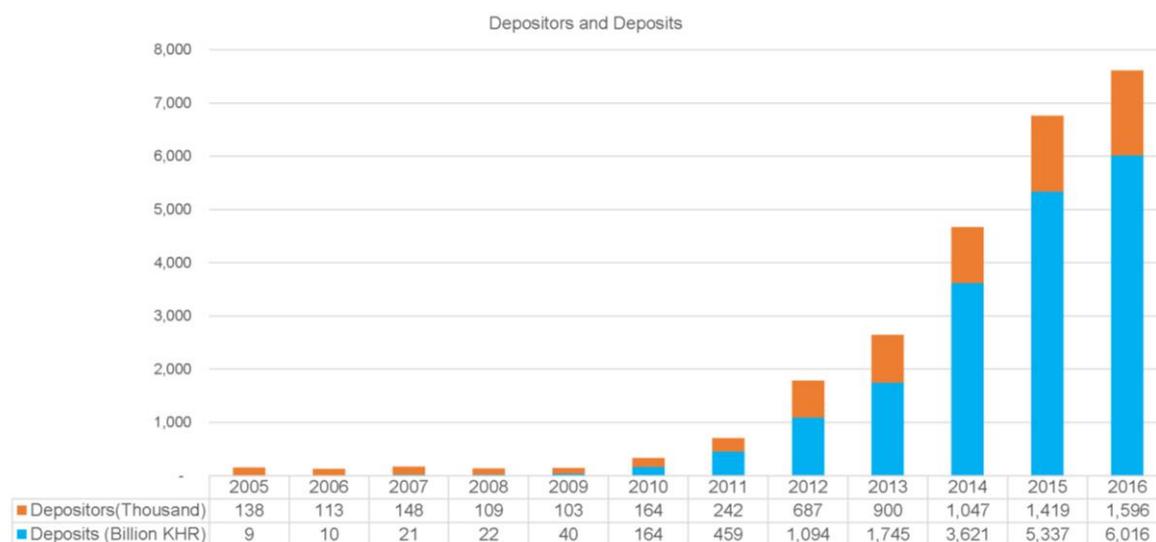
Figure 3.2: Borrowers (thousand) and loan portfolio (billion KHR) from 2005 to 2016



Source: Cambodia Microfinance Association

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

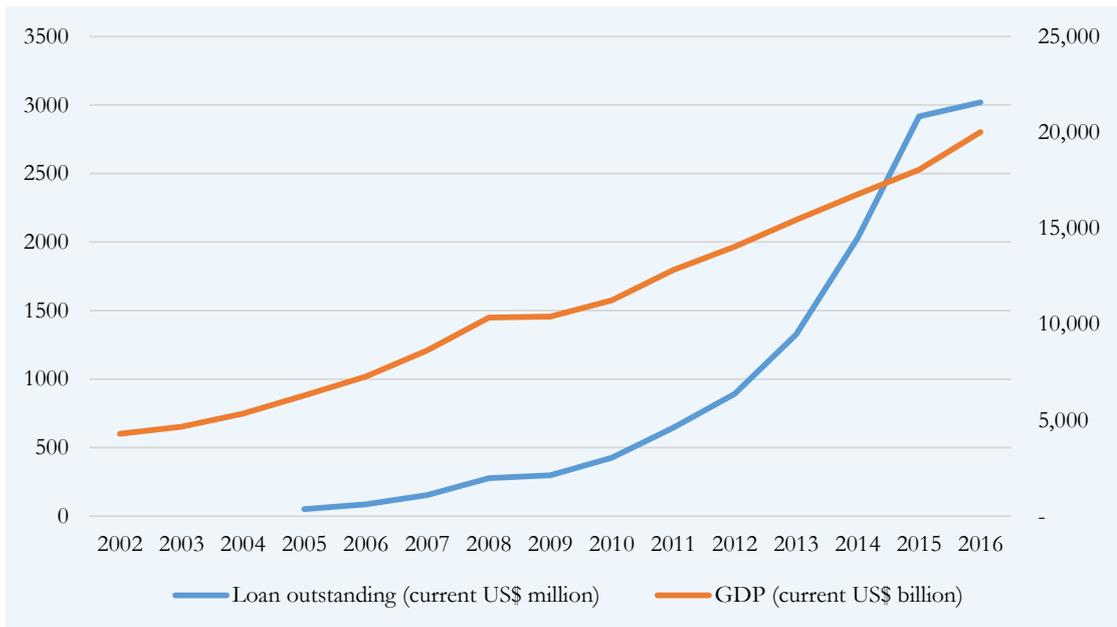
Figure 3.3: Depositors (thousand) and deposits (billion KHR) from 2005 to 2016



Source: Cambodia Microfinance Association

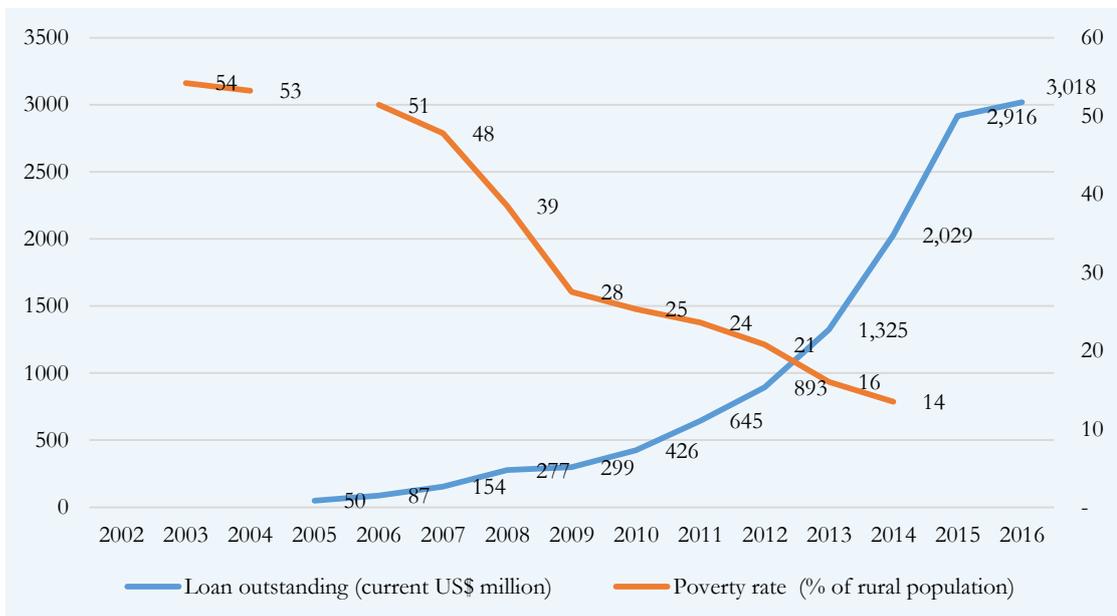
Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

Figure 3.4: Microcredit growth and GDP in Cambodia (2002 – 2016)



Source: Author's computation from CMA (2017) and the World Bank (2017)

Figure 3.5: Microcredit growth and poverty rate in Cambodia (2002 – 2016)



Source: Author's computation from CMA (2017) and the World Bank (2017)

Appendix 4: Results of the descriptive statistics (N = 411)

Table 4.1: Household's characteristics by poor status (N = 411)

Variables	Total		Non-Poor		Poor		Difference In Mean
	Mean	SD	Mean	SE	Mean	SE	
Dependent							
Per capita net income	210,080.6	(312,011.2)	235,983.4	(20,514.6)	146,520.7	(15,735.6)	89,462.7***
<i>On-farm income</i>	72,112.83	(258,611.2)	93,066.0	(17,415.4)	20,698.3	(9,267.9)	72,367.8***
<i>Off-farm income</i>	136,688.1	(185,281.2)	141,598.6	(11,565.2)	124,638.9	(13,828.9)	16,959.7
<i>Income from other sources</i>	1,279.6	(4,065.5)	1,318.8	(254.3)	1,183.5	(302.0)	135.3
Per capita economic assets	0.474	(0.653)	0.579	(0.039)	0.216	(0.048)	0.363***
<i>Total production land</i>	0.368	(0.550)	0.462	(0.036)	0.137	(0.022)	0.325***
<i>Non-production land</i>	0.065	(0.263)	0.070	(0.012)	0.052	(0.034)	0.018
<i>Housing land and other land</i>	0.041	(0.146)	0.047	(0.010)	0.027	(0.005)	0.020
Per capita expenditure on child's well-being	174,110.1	(236,647.6)	192,542.4	(15,469.4)	128,881.3	(12,754.3)	63,661.2**
<i>Expenditure on child education</i>	118,429.3	(185,708.9)	132,385.7	(12,209.2)	84,183.2	(9,537.3)	48,202.5**
<i>Expenditure on child healthcare</i>	55,680.9	(131,259.6)	60,156.7	(8,647.4)	44,698.0	(7,008.1)	15,458.7
Treatment							
Credit	0.813	(0.391)	0.805	(0.023)	0.832	(0.034)	-0.027
Account at banks	0.092	(0.290)	0.116	(0.019)	0.034	(0.017)	0.083***
Number of loan	1.635	(1.205)	1.620	(0.070)	1.672	(0.113)	-0.052
Loan Amount	5,307,865.0	(9,823,760.0)	6,300,075.0	(657,058.4)	2,873,197.0	(366,884.9)	3,426,878.0***
Loan sources							
<i>Formal loan</i>	4,731,685.0	(8,239,464.0)	5,596,651.0	(545,465.8)	2,609,248.0	(357,822.7)	2,987,403.0***
<i>Informal loan</i>	576,180.0	(5,511,069.0)	703,424.7	(380,486.7)	263,949.6	(97,953.94)	439,475.1
Purposes of loans							
<i>Productive loan</i>	2,555,510.0	(8,072,936.0)	3,120,733.0	(547,695.8)	1,168,576.0	(254,476.8)	1,952,157.0**
<i>Non-productive loan</i>	2,752,355.0	(5,775,547.0)	3,179,342.0	(382,375.3)	1,704,622.0	(275,868.4)	1,474,721.0
Interest rate							
<i>Formal loan</i>	2.537	(0.543)	2.482	(0.038)	2.668	(0.339)	-0.186***
<i>Informal loan</i>	2.653	(2.752)	2.307	(0.054)	3.311	(0.527)	-1.005

Source: Author's own calculation

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

Data in parentheses indicates standard errors

Table 4.2: Household's characteristics in percentage by poor status (N = 411)

Variables	Total	Non-Poor	Poor
Dependent			
Per capita net income (monthly in riels)	210,080.6	235,983.4	146,520.7
<i>On-farm income</i>	34.33%	39.44%	14.13%
<i>Off-farm income</i>	65.06%	60.00%	85.07%
<i>Income from other sources</i>	0.61%	0.56%	0.81%
Per capita economic assets (in hectare)	0.474	0.579	0.216
<i>Total production land</i>	77.65%	79.81%	63.40%
<i>Non-production land</i>	13.64%	12.09%	23.91%
<i>Housing land and other land</i>	8.71%	8.10%	12.69%
Per capita expenditure on child's well-being (yearly in riels)	174,110.1	192,542.4	128,881.3
<i>Expenditure on child education</i>	68.02%	68.76%	65.32%
<i>Expenditure on child healthcare</i>	31.98%	31.24%	34.68%
Treatment			
Loan Amount (last 3 years in riels)	5,307,865.0	6,300,075.0	2,873,197.0
Loan sources			
<i>Formal loan</i>	89.14%	88.83%	90.81%
<i>Informal loan</i>	10.86%	11.17%	9.19%
Purposes of loans			
<i>Productive loan</i>	48.15%	49.53%	40.67%
<i>Non-productive loan</i>	51.85%	50.47%	59.33%

Source: Author's own calculation

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

Table 4.3: Household's characteristics by microfinance status (N = 411)

Variables	Without access to microfinance		With microfinance access to		Difference
	Mean	SE	Mean	SE	In Mean
Dependent variable					
<i>Poor status</i>	0.2597	(0.0501)	0.2964	(0.0250)	-0.0367
<i>Per capita net income</i>	196,851.4	(28,554.4)	213,130.4	(17,771.3)	-16,279.02
<i>Per capita economic assets</i>	0.341	(0.042)	0.504	(0.038)	-0.1629**
<i>Per capita expenditure on child's well-being</i>	149,410.7	(20300.7)	179,804.3	(13,573.4)	-30,393.6
Household characteristics					
<i>Age of household head</i>	50.620	(1.640)	46.710	(0.690)	3.92**
<i>Sex of household head</i>	0.221	(0.048)	0.251	(0.238)	-0.031
<i>Marital status of household head</i>	0.753	(0.049)	0.790	(0.022)	-0.037
<i>Education level of household head</i>	5.455	(0.408)	4.841	(0.184)	0.613
<i>Battambang</i>	0.078	(0.031)	0.162	(0.020)	-0.084*
<i>Kampong Chhnang</i>	0.156	(0.042)	0.117	(0.018)	0.039
<i>Kampong Speu</i>	0.039	(0.022)	0.051	(0.012)	-0.012
<i>Kampong Thom</i>	0.143	(0.040)	0.117	(0.018)	0.026
<i>Kandal</i>	0.169	(0.043)	0.081	(0.015)	0.088**
<i>Phnom Penh</i>	0.026	(0.018)	0.054	(0.012)	-0.028
<i>Preah Vihear</i>	0.117	(0.037)	0.153	(0.020)	-0.036
<i>Siem Reap</i>	-	-	0.030	(0.009)	-0.030
<i>Takeo</i>	0.273	(0.051)	0.237	(0.023)	0.036
Household member details					
<i>Household size</i>	4.558	(0.185)	5.084	(0.101)	-0.525**
<i>% of dependency ratio</i>	0.427	(0.028)	0.340	(0.012)	0.0867***
<i>% of migrant members</i>	0.087	(0.021)	0.106	(0.010)	-0.020
<i>Average years of members' education</i>	5.249	(0.265)	4.930	(0.120)	0.319
<i>% of mb generat. income permanently</i>	0.553	(0.027)	0.540	(0.012)	0.016
Gender decision in Family					
<i>Female involving in decision of family affairs</i>	0.854	(0.025)	0.835	(0.013)	0.0193
AC membership					
<i>Years of AC group membership</i>	1.952	(0.138)	2.090	(0.073)	-0.134
<i>Access to business & vocational skill trainings</i>	0.074	(0.025)	0.093	(0.012)	-0.019

Source: Author's own calculation

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

Data in parentheses indicates standard errors

Table 4.4: Household's characteristics by access to formal loan (N = 411)

Variables	Without access to formal loan		With access to formal loan		Difference
	Mean	SE	Mean	SE	In Mean
Dependent variable					
<i>Poor status</i>	0.274	(0.041)	0.296	(0.027)	-0.022
<i>Per capita net income</i>	175,129.1	(20,315.6)	223,989.9	(19,899.9)	-48,860.8
<i>Per capita economic assets</i>	0.322	(0.033)	0.534	(0.043)	-0.212
<i>Per capita expenditure on child's well-being</i>	136,124.1	(15,334.5)	189,227.0	(15,058.5)	-53,103.0
Household characteristics					
<i>Age of household head</i>	49.803	(1.310)	46.500	(0.726)	3.303**
<i>Sex of household head</i>	0.274	(0.041)	0.235	(0.025)	0.039
<i>Marital status of household head</i>	0.718	(0.042)	0.810	(0.023)	-0.092
<i>Education level of household head</i>	5.393	(0.328)	4.782	(0.194)	0.611
<i>Battambang</i>	0.077	(0.025)	0.173	(0.022)	-0.097**
<i>Kampong Chhnang</i>	0.214	(0.038)	0.088	(0.017)	0.125***
<i>Kampong Speu</i>	0.034	(0.017)	0.054	(0.013)	-0.020
<i>Kampong Thom</i>	0.145	(0.327)	0.112	(0.018)	0.033
<i>Kandal</i>	0.145	(0.033)	0.078	(0.016)	0.067**
<i>Phnom Penh</i>	0.025	(0.014)	0.058	(0.014)	-0.032
<i>Preah Vihear</i>	0.077	(0.025)	0.173	(0.022)	-0.097**
<i>Siem Reap</i>	-	-	0.034	(0.011)	-0.034**
<i>Takeo</i>	0.282	(0.042)	0.228	(0.025)	0.054
Household member details					
<i>Household size</i>	4.573	(0.149)	5.150	(0.109)	-0.577***
<i>% of dependency ratio</i>	0.404	(0.023)	0.337	(0.013)	0.067***
<i>% of migrant members</i>	0.113	(0.019)	0.098	(0.010)	0.015
<i>Average years of members' education</i>	5.283	(0.212)	4.873	(0.127)	0.410*
<i>% of mb generat. income permanently</i>	0.551	(0.023)	0.535	(0.013)	0.018
Gender decision in Family					
<i>Female involving in decision of family affairs</i>	0.844	(0.021)	0.836	(0.014)	0.008
AC membership					
<i>Years of AC group membership</i>	1.927	(0.102)	2.114	(0.081)	-0.187
<i>Access to business & vocational skill trainings</i>	0.088	(0.022)	0.090	(0.013)	-0.003

Source: Author's own calculation

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

Data in parentheses indicates standard errors

Table 4.5: Household's characteristics by access to productive loan (N=411)

Variables	Without access to productive loan		With access to productive loan		Difference
	Mean	SE	Mean	SE	In Mean
Dependent variable					
<i>Poor status</i>	0.315	(0.032)	0.263	(0.031)	0.052
<i>Per capita net income</i>	193,846.0	(15,528.7)	227,545.1	(27,223.6)	-33,699.1
<i>Per capita economic assets</i>	0.356	(0.027)	0.600	(0.059)	-0.244***
<i>Per capita expenditure on child's well-being</i>	165,255.5	(16,057.2)	183,635.6	(17,008.1)	-18,380.14
Household characteristics					
<i>Age of household head</i>	48.371	(0.964)	46.439	(0.836)	1.931
<i>Sext of household head</i>	0.244	(0.030)	0.247	(0.031)	-0.003
<i>Marital status of household head</i>	0.765	(0.029)	0.803	(0.028)	-0.038
<i>Education level of household head</i>	5.136	(0.244)	4.763	(0.229)	0.374
<i>Battambang</i>	0.103	(0.021)	0.192	(0.028)	-0.089**
<i>Kampong Chhnang</i>	0.127	(0.023)	0.121	(0.023)	0.006
<i>Kampong Speu</i>	0.047	(0.015)	0.051	(0.016)	-0.004
<i>Kampong Thom</i>	0.113	(0.022)	0.131	(0.024)	-0.019
<i>Kandal</i>	0.127	(0.023)	0.066	(0.018)	0.061**
<i>Phnom Penh</i>	0.051	(0.015)	0.045	(0.015)	0.006
<i>Preah Vihear</i>	0.169	(0.026)	0.121	(0.023)	0.048
<i>Siem Reap</i>	0.028	(0.011)	0.020	(0.010)	0.008
<i>Takeo</i>	0.235	(0.029)	0.253	(0.031)	-0.018
Household member details					
<i>Household size</i>	4.887	(0.118)	5.091	(0.135)	-0.204
<i>% of dependency ratio</i>	0.380	(0.016)	0.331	(0.015)	0.049**
<i>% of migrant members</i>	0.094	(0.013)	0.112	(0.013)	-0.017
<i>Average years of members' education</i>	5.146	(0.159)	4.821	(0.149)	0.325
<i>% of mb generat. income permanently</i>	0.541	(0.016)	0.538	(0.016)	0.004
Gender decision in Family					
<i>Female involving in decision of family affairs</i>	0.845	(0.016)	0.831	(0.017)	0.014
AC membership					
<i>Years of AC group membership</i>	2.010	(0.083)	2.116	(0.100)	-0.106
<i>Access to business & vocational skill trainings</i>	0.094	(0.016)	0.085	(0.016)	0.007

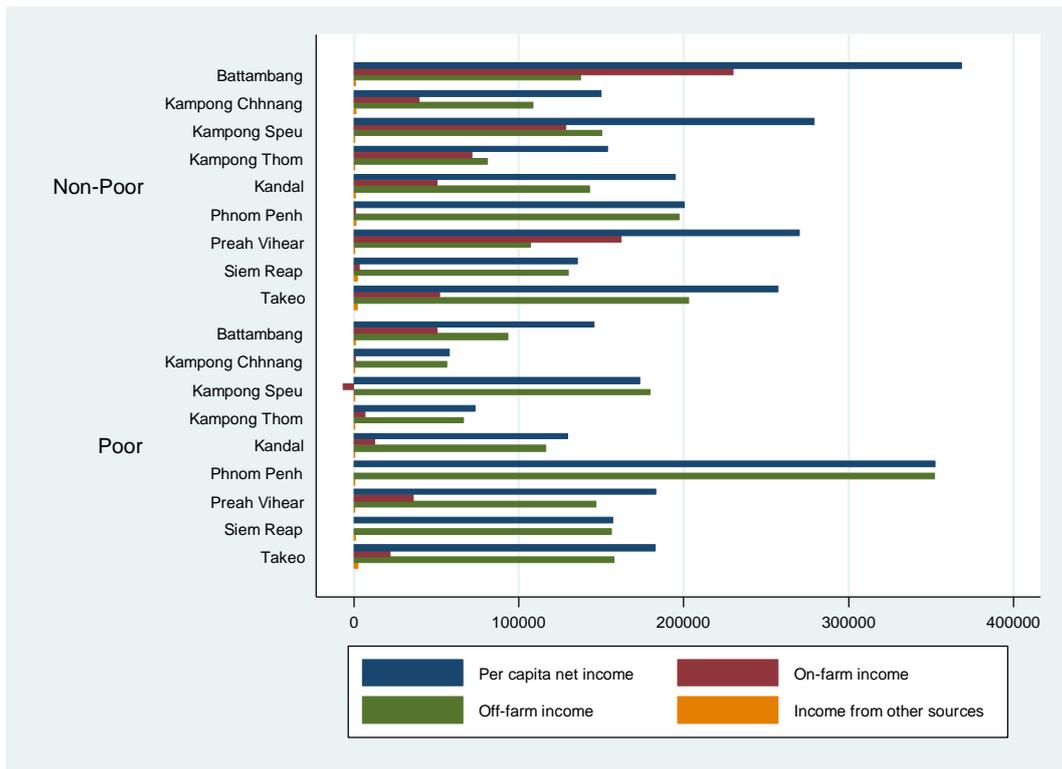
Source: Author's own calculation

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

Data in parentheses indicates standard errors

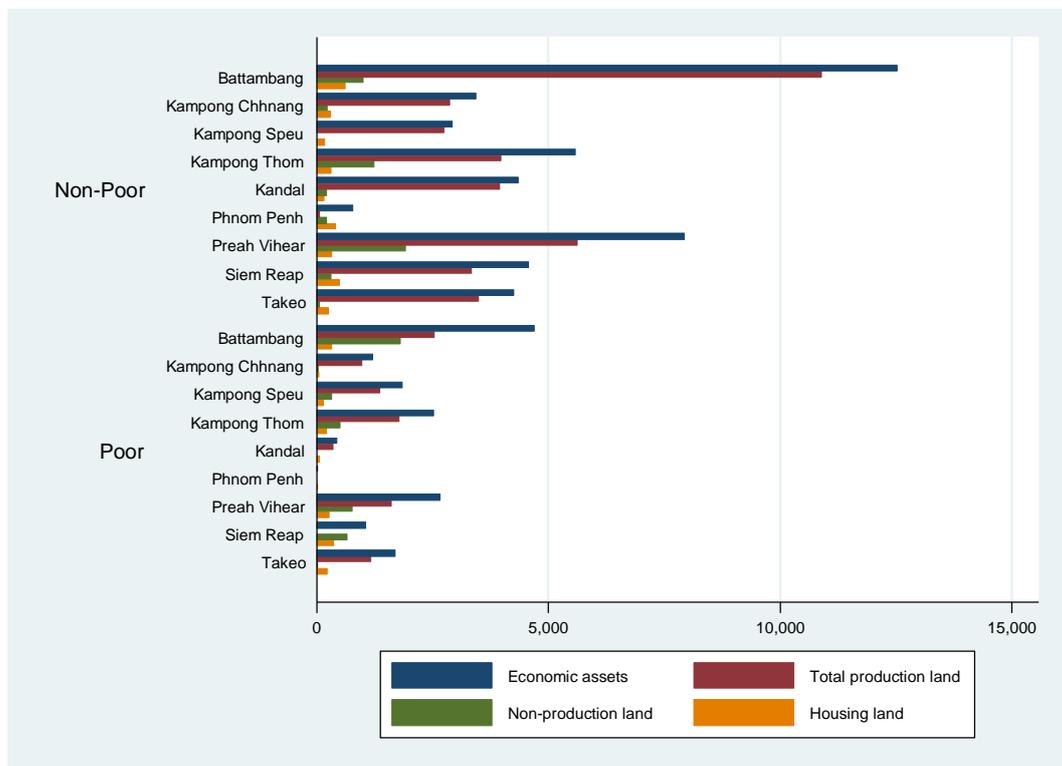
Figure 4.1: Per capita monthly income by province (in riels) (N=411)



Source: Author's computation

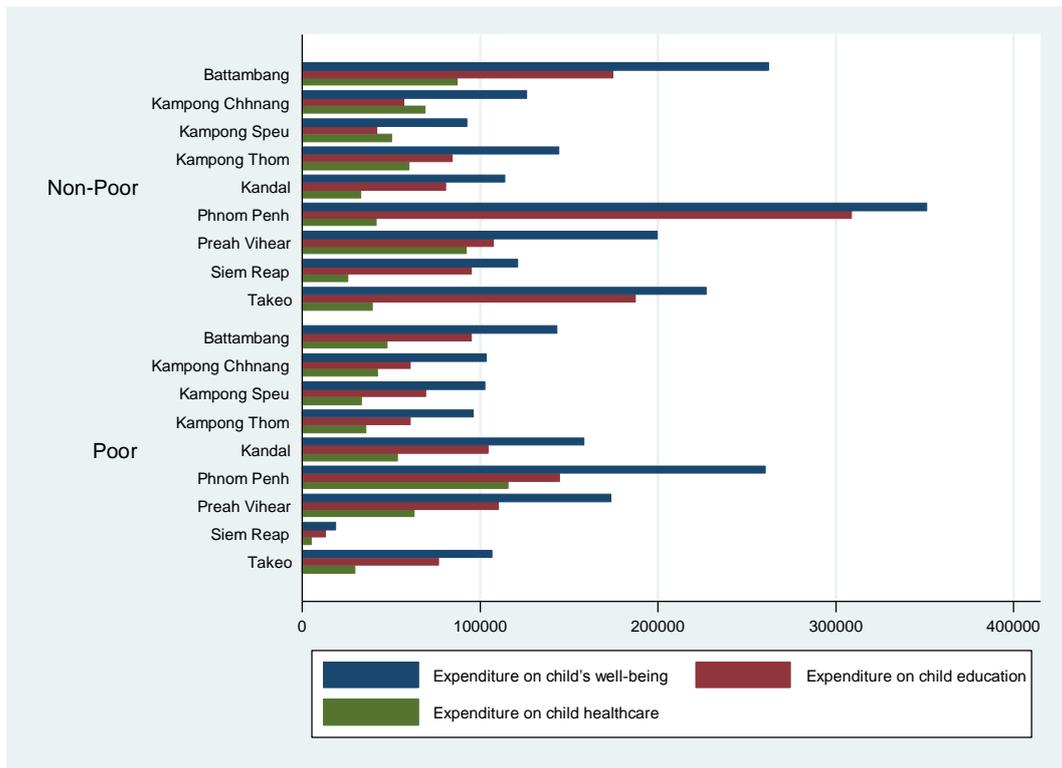
Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

Figure 4.2: Per capita economic assets by province (in m2) (N=411)



Source: Author's computation

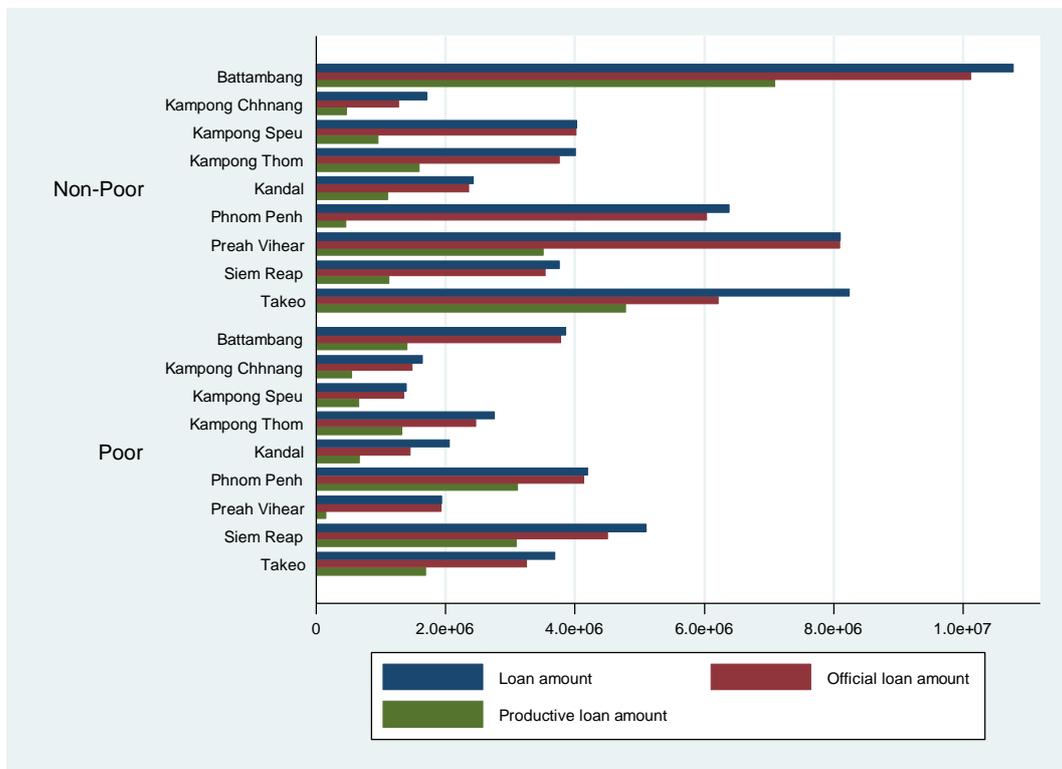
Figure 4.3: Per capita expenditure on child's wellbeing by province (N=411)



Source: Author's computation

Note: \$US 1 = KHR 4,077.30 (US Dollars (USD) to Cambodian Riels (KHR) exchange rate for December 31, 2015)

Figure 4.4: Household's access to microfinance services by province (N=411)



Source: Author's computation

Appendix 5: Results on the determinants of access to microfinance services

Dependent variables Explanatory variables	Access to microfinance				Access to formal loan				Access to productive loan			
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Household characteristics												
Age of household head	0.005	(0.046)	0.008	(0.047)	0.031	(0.043)	0.036	(0.044)	0.091**	(0.041)	0.089	(0.041)
Age square of household head	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	-0.001**	(0.000)	-0.001	(0.000)
Sex of household head	0.423	(0.367)	0.443	(0.373)	0.285	(0.275)	0.299	(0.280)	0.326	(0.265)	0.323	(0.265)
Marital status of household head	0.423	(0.366)	0.448	(0.371)	0.574**	(0.289)	0.594**	(0.293)	0.335	(0.285)	0.330	(0.285)
Education level of household head	-0.023	(0.027)	-0.024	(0.027)	-0.037	(0.025)	-0.038	(0.025)	0.003	(0.024)	0.003	(0.024)
Household member details												
% of dependency ratio	-1.393***	(0.453)	-1.361***	(0.459)	-1.306***	(0.428)	-1.271***	(0.434)	-0.725*	(0.398)	-0.740	(0.404)
% of migrant members	0.466	(0.482)	0.469	(0.484)	-0.306	(0.411)	-0.302	(0.411)	0.358	(0.384)	0.354	(0.384)
Average years of members' education	-0.080*	(0.043)	-0.075*	(0.044)	-0.080*	(0.042)	-0.075*	(0.043)	-0.091**	(0.041)	-0.093	(0.042)
% of mb generat. income permanently	-0.532	(0.373)	-0.532	(0.372)	-0.484	(0.354)	-0.485	(0.353)	-0.153	(0.323)	-0.152	(0.323)
Gender decision in family												
Female involving in family decision	-0.455	(0.316)	-0.498	(0.334)	-0.332	(0.288)	-0.386	(0.300)	-0.391	(0.278)	-0.371	(0.288)
AC membership												
Years as AC member	0.010	(0.055)	0.005	(0.057)	0.041	(0.051)	0.035	(0.052)	0.025	(0.050)	0.028	(0.050)
Access to voc. and business training	0.108	(0.364)	0.158	(0.394)	-0.093	(0.327)	-0.034	(0.349)	-0.172	(0.296)	-0.195	(0.308)
Province characteristics												
Provincial poverty rate			0.006	(0.010)			0.007	(0.009)			-0.002	(0.009)
Constant	2.204*	(1.293)	1.971	(1.398)	1.019	(1.150)	0.749	(1.240)	-1.234	(1.120)	-1.134	(1.183)
Number of observation	402		402		402		402		402		402	
Wald chi2	24.21		24.89		31.06		32.27		24.36		24.36	
Prob > chi2	0.0190		0.0239		0.0019		0.0022		0.0182		0.0280	
Pseudo R2	0.0686		0.0696		0.0635		0.0646		0.0435		0.0436	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

Data in parentheses indicates standard errors

Appendix 6: Results on impact of access to microfinance services on poverty and welfare estimate

Table 6.1: Access to microfinance (with robust estimates)

Variables	Poverty		Income		Economic Assets		Expenditure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Access to microfinance	0.1093843 (0.17044)		-0.0305 (0.15061)		0.28188 (0.20911)		0.11431 (0.15516)	
Amount of microfinance		-0.191*** (0.04707)		0.2234*** (0.046206)		0.188*** (0.0628)		0.07590 (0.04747)
Constant	-0.644*** (0.15433)	2.271*** (0.69646)	11.71*** (0.13233)	8.3741*** (0.69103)	7.499*** (0.19028)	4.997*** (0.9252)	11.75*** (0.14082)	10.741*** (0.70306)
Number of observation	411	334	395	322	389	317	321	262

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

Data in parentheses indicates standard errors.

Table 6.2: Access to formal loans (with robust estimates)

Variables	Poverty		Income		Economic Assets		Expenditure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Access to formal loans	0.066073 (0.14603)		0.1515761 (0.13533)		0.4146** (0.17220)		0.1874171 (0.1361)	
Amount of formal loans		-0.211*** (0.05232)		0.222*** (0.04928)		0.1494** (0.06971)		0.06163 (0.05278)
Constant	-0.602*** (0.12399)	2.583*** (0.78153)	11.575*** (0.1115)	8.422*** (0.74108)	7.433*** (0.14444)	5.608*** (1.03475)	11.708*** (0.11786)	10.973*** (0.7869)
Number of observation	411	294	395	284	389	277	321	235

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

Data in parentheses indicates standard errors.

Table 6.3: Access to productive loans (with robust estimates)

Variables	Poverty		Income		Economic Assets		Expenditure	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Access to produc. loans	-0.152287 (0.13143)		0.01084 (0.1278)		0.4326*** (0.15720)		0.0707 (0.1182)	
Amount of produc. loans		-0.172*** (0.0580)		0.2466*** (0.060979)		0.2856*** (0.08207)		0.14731** (0.06336)
Constant	-0.483*** (0.08973)	1.835** (0.8354)	11.679*** (0.0820)	8.127*** (0.89897)	7.5184*** (0.1091)	3.8061*** (1.20302)	11.811*** (0.0847)	9.7486*** (0.91529)
Number of observation	411	198	395	190	389	189	321	156

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

Data in parentheses indicates standard errors.

Appendix 7: Results of the impact of access to microfinance services on poverty

Table 7.1: Poverty as dependent variable

Explanatory variables	Access to microfinance		Access to formal loan				Access to productive loan					
	probit		IV - probit		probit		IV - probit		probit		IV - probit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Treatment variables												
Access to microfinance services	-0.179***	(0.053)	9.274	(56.443)	-0.207***	(0.061)	4.731	(21.207)	-0.168***	(0.062)	3.304	(8.365)
Household characteristics												
Age of household head	0.063	(0.050)	0.051	(0.501)	0.029	(0.052)	0.086	(0.362)	0.136*	(0.076)	0.205	(0.325)
Age square of household head	-0.001	(0.001)	0.000	(0.006)	0.000	(0.001)	0.000	(0.003)	-0.002*	(0.001)	-0.002	(0.003)
Sex of household head	0.341	(0.293)	-3.828	(25.076)	0.339	(0.306)	-2.553	(12.508)	0.355	(0.395)	-0.575	(2.726)
Marital status of household head	-0.079	(0.319)	-10.444	(61.956)	-0.008	(0.336)	-4.633	(19.926)	-0.246	(0.423)	-3.054	(6.958)
Education level of household head	0.030	(0.031)	0.413	(2.306)	0.028	(0.033)	0.054	(0.195)	0.071	(0.043)	0.300	(0.572)
Household member details												
% of dependency ratio	0.545	(0.552)	-0.563	(8.587)	0.389	(0.603)	-0.836	(6.113)	0.562	(0.785)	-2.718	(8.533)
% of migrant members	0.862*	(0.478)	0.469	(5.087)	1.205**	(0.522)	0.353	(4.515)	1.470**	(0.624)	-1.199	(6.934)
Average years of members' education	-0.186***	(0.054)	-1.341	(6.901)	-0.188***	(0.059)	-0.746	(2.404)	-0.182**	(0.075)	-0.973	(1.909)
% of mb generat. income permanently	-0.621	(0.477)	-1.023	(4.874)	-0.775	(0.523)	-2.499	(7.737)	-0.492	(0.617)	-2.208	(4.647)
Gender decision in family												
Female involving in family decision	-0.830**	(0.321)	-0.358	(4.367)	-0.810**	(0.344)	-1.647	(3.955)	-0.694	(0.423)	0.036	(2.472)
AC membership												
Years as AC member	0.093*	(0.054)	-1.291	(8.258)	0.076	(0.056)	-0.582	(2.828)	0.049	(0.070)	-0.717	(1.851)
Access to voc. and business training	-0.647	(0.429)	2.012	(16.375)	-0.582	(0.472)	1.001	(7.150)	-0.129	(0.536)	-1.138	(3.096)
Constant	1.899	(1.616)	-122.9	(745.3)	3.134*	(1.716)	-62.819	(283.3)	-0.115	(2.434)	-44.700	(107.6)
Number of observation	328		328		288		288		194		194	
Wald chi2	50.53		0.65		42.30		2.08		27.06		2.12	
Prob > chi2	0.0000		1.0000		0.0001		0.9997		0.0122		0.9997	
Pseudo R2	0.1501				0.1525				0.1341			
Wald test of exogeneity												
chi2(1)			2.35				1.21				1.96	
Prob > chi2			0.1255				0.2713				0.1616	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

IV - probit: Probit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Table 7.2: Poverty as dependent variable with provincial poverty rate

Explanatory variables	Access to microfinance		Access to formal loan				Access to productive loan					
	probit		IV - probit		probit		IV - probit		probit		IV - probit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Treatment variables												
Access to microfinance services	-0.183***	(0.053)	2.046	(6.807)	-0.208***	(0.061)	0.583	(2.066)	-0.165***	(0.062)	0.095	(0.673)
Household characteristics												
Age of household head	0.053	(0.050)	0.050	(0.129)	0.022	(0.052)	0.030	(0.074)	0.119	(0.076)	0.122	(0.083)
Age square of household head	-0.001	(0.001)	0.000	(0.001)	0.000	(0.001)	0.000	(0.001)	-0.001*	(0.001)	-0.001	(0.001)
Sex of household head	0.339	(0.299)	-0.651	(3.112)	0.329	(0.310)	-0.141	(1.291)	0.298	(0.404)	0.209	(0.486)
Marital status of household head	-0.093	(0.327)	-2.548	(7.524)	-0.027	(0.343)	-0.778	(2.007)	-0.317	(0.438)	-0.551	(0.763)
Education level of household head	0.030	(0.031)	0.121	(0.287)	0.028	(0.033)	0.033	(0.043)	0.065	(0.043)	0.082	(0.062)
Household member details												
% of dependency ratio	0.475	(0.550)	0.207	(1.596)	0.319	(0.603)	0.109	(0.938)	0.428	(0.775)	0.161	(1.077)
% of migrant members	0.825*	(0.478)	0.737	(1.186)	1.171**	(0.523)	1.032	(0.763)	1.422**	(0.634)	1.222	(0.830)
Average years of members' education	-0.200***	(0.055)	-0.476	(0.846)	-0.199***	(0.060)	-0.291	(0.250)	-0.198**	(0.077)	-0.262	(0.183)
% of mb generat. income permanently	-0.598	(0.473)	-0.694	(1.132)	-0.755	(0.519)	-1.030	(0.937)	-0.433	(0.609)	-0.567	(0.707)
Gender decision in family												
Female involving in family decision	-0.702**	(0.331)	-0.571	(0.956)	-0.717**	(0.354)	-0.832	(0.557)	-0.578	(0.421)	-0.509	(0.518)
AC membership												
Years as AC member	0.105*	(0.058)	-0.219	(1.001)	0.087	(0.060)	-0.018	(0.283)	0.067	(0.073)	0.010	(0.172)
Access to voc. and business training	-0.837*	(0.429)	-0.227	(2.108)	-0.740	(0.471)	-0.502	(0.833)	-0.377	(0.524)	-0.477	(0.625)
Province characteristics												
Provincial poverty rate	-0.015	(0.011)	-0.017	(0.028)	-0.012	(0.011)	-0.014	(0.016)	-0.023	(0.015)	-0.026	(0.018)
Constant	2.577	(1.665)	-26.780	(89.74)	3.647**	(1.763)	-6.840	(27.48)	0.909	(2.554)	-2.234	(8.490)
Number of observation	328		328		288		288		194		194	
Wald chi2	52.25		9.29		43.57		26.24		27.89		22.65	
Prob > chi2	0.0000		0.8122		0.0001		0.0241		0.0147		0.0662	
Pseudo R2	0.1546				0.1555				0.1443			
Wald test of exogeneity												
chi2(1)			0.63				0.23				0.16	
Prob > chi2			0.4264				0.6309				0.6891	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

IV - probit: Probit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Appendix 8: Results of the impact of microfinance amount on welfare estimate

Table 8.1: Income as dependent variable

Explanatory variables	Treatment variables		Access to microfinance				Access to formal loan				Access to productive loan			
			tobit		IV - tobit		tobit		IV - tobit		tobit		IV - tobit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE		
Treatment variables														
Access to microfinance services	0.146***	(0.046)	-3.456	(22.92)	0.132***	(0.048)	-20.556	(797.92)	0.159***	(0.059)	-18.791	(201.26)		
Household characteristics														
Age of household head	-0.044	(0.035)	-0.123	(0.540)	-0.042	(0.037)	-0.273	(8.970)	-0.003	(0.051)	-0.633	(6.863)		
Age square of household head	0.001	(0.000)	0.001	(0.005)	0.001	(0.000)	0.001	(0.017)	0.000	(0.001)	0.003	(0.038)		
Sex of household head	0.417**	(0.191)	2.472	(13.13)	0.436**	(0.192)	12.559	(467.64)	0.597**	(0.273)	4.921	(46.689)		
Marital status of household head	0.500**	(0.228)	4.843	(27.66)	0.475*	(0.243)	20.212	(761.28)	0.957***	(0.313)	16.282	(163.00)		
Education level of household head	0.030	(0.024)	-0.131	(1.031)	0.041*	(0.023)	-0.112	(5.927)	-0.002	(0.033)	-1.348	(14.312)		
Household member details														
% of dependency ratio	-0.318	(0.450)	-0.204	(2.228)	-0.183	(0.504)	5.205	(208.19)	0.602	(0.622)	10.412	(105.49)		
% of migrant members	0.420	(0.344)	0.562	(2.024)	0.309	(0.371)	0.934	(26.625)	0.052	(0.466)	11.918	(126.74)		
Average years of members' education	0.137***	(0.042)	0.550	(2.633)	0.143***	(0.046)	2.321	(84.002)	0.190***	(0.064)	3.834	(38.731)		
% of mb generat. income permanently	0.578	(0.350)	0.490	(1.768)	0.606	(0.388)	7.279	(257.58)	1.157**	(0.470)	5.384	(46.585)		
Gender decision in family														
Female involving in family decision	-0.139	(0.246)	-0.174	(1.282)	0.011	(0.264)	2.303	(88.687)	-0.129	(0.350)	-4.176	(43.963)		
AC membership														
Years as AC member	0.156**	(0.051)	0.690	(3.406)	0.156***	(0.053)	2.887	(105.36)	0.191***	(0.069)	3.881	(39.215)		
Access to voc. and business training	0.341	(0.226)	0.045	(2.346)	0.416*	(0.237)	-5.960	(246.07)	0.559*	(0.286)	6.587	(64.817)		
Constant	8.473***	(1.090)	57.658	(312.97)	8.460***	(1.135)	285.589	(10688.9)	6.073***	(1.611)	265.193	(2752.3)		
/sigma	1.104	(0.059)			1.107	(0.065)			1.145	(0.079)				
Number of observation	316		316		278		278		186		186			
Wald chi2	6.89		3.93		5.72		0.12		4.59		0.11			
Prob > chi2	0.0000		0.9920		0.0000		1.0000		0.0000		1.0000			
Pseudo R2	0.0835				0.0809				0.0942					
Wald test of exogeneity														
chi2(1)			0.57				0.45				5.77			
Prob > chi2			0.4504				0.5001				0.0163			

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

IV - tobit: Tobit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Table 8.2: Income as dependent variable with provincial poverty rate

Explanatory variables	Access to microfinance		Access to formal loan				Access to productive loan					
	tobit		IV - tobit		tobit		IV - tobit		tobit		IV - tobit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Treatment variables												
Access to microfinance services	0.148***	(0.046)	-1.499	(6.751)	0.134***	(0.048)	-1.363	(3.769)	0.170***	(0.057)	0.582	(0.719)
Household characteristics												
Age of household head	-0.051	(0.037)	-0.083	(0.161)	-0.051	(0.040)	-0.064	(0.099)	-0.031	(0.057)	-0.023	(0.070)
Age square of household head	0.001	(0.000)	0.001	(0.001)	0.001	(0.000)	0.001	(0.001)	0.000	(0.001)	0.000	(0.001)
Sex of household head	0.405**	(0.189)	1.352	(3.928)	0.421**	(0.190)	1.304	(2.291)	0.510	(0.271)	0.397	(0.426)
Marital status of household head	0.474**	(0.225)	2.475	(8.228)	0.444*	(0.238)	1.885	(3.680)	0.833*	(0.301)	0.475	(0.748)
Education level of household head	0.032	(0.024)	-0.043	(0.311)	0.042*	(0.024)	0.030	(0.062)	-0.008***	(0.033)	0.020	(0.062)
Household member details												
% of dependency ratio	-0.380	(0.463)	-0.289	(1.111)	-0.281	(0.527)	0.154	(1.504)	0.394	(0.675)	0.136	(0.872)
% of migrant members	0.390	(0.342)	0.474	(0.958)	0.273	(0.363)	0.335	(0.942)	-0.041	(0.445)	-0.318	(0.772)
Average years of members' education	0.125***	(0.042)	0.322	(0.810)	0.129***	(0.046)	0.293	(0.423)	0.170***	(0.063)	0.087	(0.160)
% of mb generat. income permanently	0.598*	(0.357)	0.546	(0.857)	0.631	(0.397)	1.102	(1.435)	1.239**	(0.493)	1.166	(0.574)
Gender decision in family												
Female involving in family decision	-0.028	(0.269)	-0.114	(0.741)	0.137	(0.292)	0.243	(0.683)	0.019	(0.347)	0.140	(0.469)
AC membership												
Years as AC member	0.168***	(0.055)	0.404	(0.976)	0.170***	(0.058)	0.360	(0.492)	0.215***	(0.074)	0.141	(0.147)
Access to voc. and business training	0.203	(0.236)	0.154	(0.755)	0.269	(0.239)	-0.123	(1.210)	0.274	(0.310)	0.080	(0.579)
Province characteristics												
Provincial poverty rate	-0.012	(0.009)	-0.004	(0.037)	-0.013	(0.010)	-0.007	(0.025)	-0.030**	(0.013)	-0.037	(0.018)
Constant	8.936***	(1.183)	31.125	(90.982)	9.003***	(1.247)	28.781	(49.894)	7.460***	(1.820)	2.176	(9.457)
/sigma	1.101	(0.059)			1.103	(0.064)			1.126	(0.074)		
Number of observation	316		316		278		278		186		186	
Wald chi2	6.42		16.36		5.31		17.80		4.58		54.78	
Prob > chi2	0.0000		0.2917		0.0000		0.2158		0.0000		0.0000	
Pseudo R2	0.0854				0.0832				0.1040			
Wald test of exogeneity												
chi2(1)			0.34				0.72				0.43	
Prob > chi2			0.5618				0.3953				0.5101	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$; IV - tobit: Tobit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Table 8.3: Economic Assets as dependent variable

Explanatory variables	Treatment variables		Access to microfinance				Access to formal loan				Access to productive loan			
			tobit		IV - tobit		tobit		IV - tobit		tobit		IV - tobit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE		
Treatment variables														
Access to microfinance services	0.171***	(0.061)	-9.639	(30.014)	0.133*	(0.069)	-9.190	(22.438)	0.273***	(0.077)	-3.583	(7.748)		
Household characteristics														
Age of household head	-0.087*	(0.052)	0.005	(0.596)	-0.051	(0.058)	-0.112	(0.605)	-0.053	(0.071)	-0.115	(0.344)		
Age square of household head	0.001*	(0.001)	0.000	(0.007)	0.001	(0.001)	0.000	(0.006)	0.001	(0.001)	0.001	(0.003)		
Sex of household head	-0.358	(0.311)	3.240	(11.505)	-0.300	(0.315)	4.064	(10.674)	-0.348	(0.469)	0.434	(2.409)		
Marital status of household head	-0.111	(0.339)	10.466	(32.572)	-0.246	(0.353)	8.003	(19.715)	0.179	(0.507)	3.399	(6.774)		
Education level of household head	0.018	(0.031)	-0.433	(1.415)	0.027	(0.032)	-0.085	(0.397)	0.000	(0.044)	-0.267	(0.564)		
Household member details														
% of dependency ratio	-1.314**	(0.506)	-1.107	(5.631)	-1.160**	(0.567)	-1.235	(5.993)	-0.506	(0.775)	1.662	(5.520)		
% of migrant members	-0.496	(0.458)	-1.351	(5.407)	-0.347	(0.519)	-1.347	(5.917)	-0.762	(0.608)	1.476	(5.238)		
Average years of members' education	-0.028	(0.047)	1.186	(3.751)	-0.033	(0.050)	1.062	(2.520)	0.023	(0.067)	0.828	(1.646)		
% of mb generat. income permanently	0.440	(0.426)	-0.275	(5.095)	0.554	(0.469)	2.281	(6.312)	0.562	(0.624)	1.130	(2.816)		
Gender decision in family														
Female involving in family decision	1.886	(0.417)	-0.177	(7.205)	1.792***	(0.465)	0.927	(3.587)	1.222***	(0.502)	-0.417	(3.806)		
AC membership														
Years as AC member	0.085	(0.054)	1.373	(3.989)	0.105*	(0.055)	1.161	(2.786)	0.113*	(0.057)	0.870	(1.557)		
Access to voc. and business training	-0.615	(0.460)	-2.321	(6.479)	-0.867	(0.539)	-1.410	(5.210)	-0.958	(0.719)	0.329	(3.413)		
Constant	5.889	(1.619)	136.9	(401.2)	5.765***	(1.780)	-0.035	(0.312)	3.435	(2.524)	55.292	(104.6)		
/sigma	1.390	(0.073)			1.416	(0.080)			1.397	(0.105)				
Number of observation	312		312		272		272		185		185			
Wald chi2	6.33		0.70		4.69		1.32		3.77		1.74			
Prob > chi2	0.0000		1.0000		0.0000		1.0000		0.0000		0.9999			
Pseudo R2	0.0575				0.0526				0.0572					
Wald test of exogeneity														
chi2(1)			12.03				18.95				4.80			
Prob > chi2			0.0005				0.0000				0.0285			

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

IV - tobit: Tobit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Table 8.4: Economic Assets as dependent variable with provincial poverty rate

Treatment variables	Access to microfinance				Access to formal loan				Access to productive loan			
	tobit		IV - tobit		tobit		IV - tobit		tobit		IV - tobit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Explanatory variables												
Treatment variables												
Access to microfinance services	0.184***	(0.058)	-10.806	(37.429)	0.161**	(0.064)	-9.190	(22.438)	0.274***	(0.078)	4.537	(5.367)
Household characteristics												
Age of household head	-0.026	(0.044)	0.011	(0.611)	0.014	(0.048)	-0.112	(0.605)	0.020	(0.064)	0.091	(0.368)
Age square of household head	0.000	(0.000)	-0.001	(0.007)	0.000	(0.001)	0.000	(0.006)	0.000	(0.001)	0.000	(0.004)
Sex of household head	-0.296	(0.327)	3.663	(13.995)	-0.193	(0.341)	4.064	(10.674)	-0.086	(0.497)	-0.953	(2.291)
Marital status of household head	0.006	(0.359)	11.715	(40.097)	-0.085	(0.381)	8.003	(19.715)	0.453	(0.534)	-3.127	(4.979)
Education level of household head	0.014	(0.029)	-0.486	(1.738)	0.023	(0.030)	-0.085	(0.397)	0.013	(0.043)	0.307	(0.419)
Household member details												
% of dependency ratio	-0.768	(0.466)	-1.123	(6.446)	-0.400	(0.521)	-1.235	(5.993)	0.218	(0.760)	-2.172	(4.827)
% of migrant members	-0.213	(0.450)	-1.473	(6.823)	0.028	(0.534)	-1.347	(5.917)	-0.431	(0.641)	-2.931	(4.278)
Average years of members' education	0.040	(0.044)	1.325	(4.419)	0.035	(0.047)	1.062	(2.520)	0.065	(0.063)	-0.823	(1.170)
% of mb generat. income permanently	0.370	(0.416)	-0.355	(5.716)	0.446	(0.465)	2.281	(6.312)	0.389	(0.631)	-0.246	(2.944)
Gender decision in family												
Female involving in family decision	1.326***	(0.364)	-0.380	(7.069)	1.253***	(0.400)	0.927	(3.587)	0.991**	(0.410)	2.773	(3.121)
AC membership												
Years as AC member	0.013	(0.051)	1.532	(5.220)	0.025	(0.052)	1.161	(2.786)	0.042	(0.056)	-0.798	(1.116)
Access to voc. and business training	0.188	(0.446)	-2.582	(10.433)	-0.029	(0.501)	-1.410	(5.210)	-0.179	(0.642)	-1.615	(3.084)
Province characteristics												
Provincial poverty rate	0.082***	(0.013)	-0.006	(0.328)	0.086***	(0.013)	-0.035	(0.312)	0.091***	(0.019)	0.092	(0.076)
Constant	2.043	(1.534)	152.796	(513.589)	1.357	(1.666)	135.314	(321.69)	-1.101	(2.525)	-58.428	(73.075)
/sigma	1.281	(0.061)			1.292	(0.066)			1.272	(0.085)		
Number of observation	312		312		272		272		185		185	
Wald chi2	8.39		0.89		6.95		1.32		4.91		3.35	
Prob > chi2	0.0000		1.0000		0.0000		1.0000		0.0000		0.9983	
Pseudo R2	0.1017				0.1020				0.1082			
Wald test of exogeneity												
chi2(1)			14.43				18.95				19.24	
Prob > chi2			0.0001				0.0000				0.0000	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$; IV - tobit: Tobit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Table 8.5: Expenditure on child well-being as dependent variable

Explanatory variables	Access to microfinance		Access to formal loan				Access to productive loan					
	tobit		IV - tobit		tobit		IV - tobit		tobit		IV - tobit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Treatment variables												
Access to microfinance services	0.060	(0.046)	0.224	(0.614)	0.052	(0.051)	0.333	(1.029)	0.077	(0.056)	0.678	(1.024)
Household characteristics												
Age of household head	0.080*	(0.042)	0.095	(0.069)	0.075*	(0.044)	0.095	(0.086)	0.155*	(0.059)	0.187**	(0.094)
Age square of household head	-0.001**	(0.000)	-0.001	(0.001)	-0.001*	(0.000)	-0.001	(0.001)	-0.002***	(0.001)	-0.002**	(0.001)
Sex of household head	-0.383	(0.258)	-0.551	(0.677)	-0.384	(0.262)	-0.682	(1.123)	-0.329	(0.365)	-1.031	(1.274)
Marital status of household head	-0.110	(0.282)	-0.395	(1.105)	-0.039	(0.281)	-0.409	(1.391)	0.227	(0.405)	-0.934	(2.040)
Education level of household head	-0.045*	(0.023)	-0.042*	(0.025)	-0.048**	(0.024)	-0.054	(0.033)	-0.027	(0.029)	-0.009	(0.051)
Household member details												
% of dependency ratio	1.482***	(0.422)	1.609**	(0.663)	1.525***	(0.459)	1.609**	(0.623)	1.325**	(0.526)	0.818	(1.243)
% of migrant members	-0.777	(0.547)	-0.818*	(0.413)	-0.337	(0.394)	-0.533	(0.849)	-0.488	(0.438)	-1.113	(1.257)
Average years of members' education	0.238***	(0.042)	0.229***	(0.056)	0.222***	(0.043)	0.207***	(0.073)	0.189***	(0.050)	0.085	(0.191)
% of mb generat. income permanently	-0.500	(0.410)	-0.548	(0.436)	-0.496	(0.442)	-0.590	(0.567)	0.120	(0.458)	-0.446	(1.209)
Gender decision in family												
Female involving in family decision	-0.144	(0.252)	-0.188	(0.305)	-0.174	(0.272)	-0.290	(0.515)	-0.047	(0.320)	-0.154	(0.513)
AC membership												
Years as AC member	0.102***	(0.038)	0.078	(0.099)	0.107***	(0.039)	0.070	(0.142)	0.115**	(0.045)	-0.022	(0.245)
Access to voc. and business training	0.367	(0.295)	0.365	(0.287)	0.369	(0.316)	0.449	(0.433)	0.043	(0.448)	-0.282	(0.758)
Constant	8.222***	(1.252)	5.826	(9.046)	8.505***	(1.318)	4.479	(14.795)	5.770***	(1.565)	-1.327	(12.302)
/sigma	0.930	(0.052)			0.941	(0.055)			0.906	(0.061)		
Number of observation	256		256		229		229		152		152	
Wald chi2	4.83		65.38		3.95		44.59		4.30		22.16	
Prob > chi2	0.0000		0.0000		0.0000		0.0000		0.0000		0.0529	
Pseudo R2	0.0838				0.0719				0.0898			
Wald test of exogeneity												
chi2(1)			0.08				0.09				0.69	
Prob > chi2			0.7827				0.7667				0.4064	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$

IV - tobit: Tobit model with continuous endogenous regressors

Data in parentheses indicates standard errors

Table 8.6: Expenditure on child well-being as dependent variable with provincial poverty rate

Explanatory variables	Access to microfinance		Access to formal loan				Access to productive loan					
	tobit		IV - tobit		tobit		IV - tobit		tobit		IV - tobit	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Treatment variables												
Access to microfinance services	0.060	(0.047)	0.623	(1.636)	0.052	(0.051)	0.304	(1.229)	0.078	(0.056)	0.384	(0.386)
Household characteristics												
Age of household head	0.080*	(0.042)	0.137	(0.173)	0.073*	(0.044)	0.093	(0.103)	0.151**	(0.058)	0.165**	(0.065)
Age square of household head	-0.001**	(0.000)	-0.001	(0.002)	-0.001*	(0.000)	-0.001	(0.001)	-0.002***	(0.001)	-0.002**	(0.001)
Sex of household head	-0.383	(0.258)	-0.964	(1.718)	-0.383	(0.262)	-0.651	(1.334)	-0.336	(0.367)	-0.696	(0.573)
Marital status of household head	-0.110	(0.281)	-1.096	(2.888)	-0.037	(0.280)	-0.371	(1.655)	0.222	(0.408)	-0.371	(0.846)
Education level of household head	-0.045**	(0.022)	-0.038	(0.036)	-0.048**	(0.024)	-0.053	(0.035)	-0.028	(0.030)	-0.020	(0.035)
Household member details												
% of dependency ratio	1.482***	(0.425)	1.954	(1.495)	1.511***	(0.466)	1.598**	(0.684)	1.301**	(0.528)	1.032	(0.791)
% of migrant members	-0.777	(0.548)	-0.906	(0.618)	-0.340	(0.395)	-0.513	(0.957)	-0.495	(0.442)	-0.817	(0.668)
Average years of members' education	0.238	(0.043)	0.213**	(0.092)	0.220***	(0.045)	0.208***	(0.075)	0.186***	(0.050)	0.133	(0.089)
% of mb generat. income permanently	-0.500	(0.411)	-0.686	(0.742)	-0.493	(0.442)	-0.580	(0.613)	0.134	(0.454)	-0.147	(0.681)
Gender decision in family												
Female involving in family decision	-0.145	(0.268)	-0.370	(0.744)	-0.154	(0.289)	-0.274	(0.657)	-0.024	(0.332)	-0.066	(0.392)
AC membership												
Years as AC member	0.102**	(0.039)	0.015	(0.260)	0.109***	(0.041)	0.074	(0.173)	0.118**	(0.047)	0.049	(0.104)
Access to voc. and business training	0.367	(0.308)	0.428	(0.422)	0.352	(0.333)	0.437	(0.531)	0.016	(0.460)	-0.163	(0.477)
Province characteristics												
Provincial poverty rate	0.000	(0.009)	0.007	(0.023)	-0.002	(0.009)	0.000	(0.011)	-0.004	(0.012)	-0.005	(0.012)
Constant	8.221***	(1.327)	-0.281	(24.760)	8.579***	(1.385)	4.908	(17.931)	5.942***	(1.629)	2.419	(4.813)
/sigma	0.929	(0.051)			0.940	(0.055)			0.905	(0.061)		
Number of observation	256		256		229		229		152		152	
Wald chi2	4.50		40.00		3.66		45.92		4.02		35.38	
Prob > chi2	0.0000		0.0003		0.0000		0.0000		0.0000		0.0013	
Pseudo R2	0.0838				0.0720				0.0901			
Wald test of exogeneity												
chi2(1)			0.21				0.05				0.81	
Prob > chi2			0.6496				0.8261				0.3673	

Source: Author's own calculation

Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$; IV - tobit: Tobit model with continuous endogenous regressors

Data in parentheses indicates standard errors

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