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The Child-Schooling Effects of Microcredit: Evidence from Cambodia

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This article analyses the effects of microcredit on child-schooling investment expenditure via formal and informal sectors by using data from the Cambodia Socio-Economic Survey conducted in 2014. The analysis is carried out with an econometric approach that combines the endogenous treatment effect model and the bivariate discrete choice model to control for endogenous selection bias resulting from unobserved factors that potentially affect both/either households' uptake of formal and/or informal microcredit and household spending on child-schooling investment. The findings suggest that the uptake of formal microcredit is very likely to reduce child-schooling investment expenditure.

Keywords: microcredit, child education, expenditure, endogenous, Cambodia

1. Introduction

Microfinance—the provision of financial services offered by microfinance institutions (MFI)—is widely touted for its great potential to overcome the shortcomings of credit market for the poor in the developing world. Microcredit—the lending of small amount of money to the needy at the low interest—is the main element of microfinance and found to make a tremendous contribution to poverty reduction (e.g., Imai, Arun, & Annim, 2010; Montgomery & Weiss, 2011; Deloach & Lamanna, 2011; Imai & Azam, 2012; Imai, Gaiha, Thapa, & Annim, 2012; Kislat, 2015; Akotey & Adjasi, 2016) and enhance child education in developing countries (e.g., Behrman & Rosenzweig, 2002; Maldonado & González-Vega, 2008; Becchetti & Conzo, 2014; Mazumder & Lu, 2015). It helps minimise households' socio-economic risk through producing women empowerment, relaxing credit constraints, acquiring needed inputs and necessary assets, and helping them in a timely manner to incur certain unexpected spending (Kulb, Hennink, Kiiti, & Mutinda, 2015; Akotey & Adjasi, 2016). It also allows the poor to take control of their lives and avoid less desirable factory jobs and insecure wage labour (Bornstein, 1996), by bankrolling microbusinesses, raising household income and smoothing household consumption (Seng, 2018b). Such a pro-poor mission is underpinned by the success of Yunus's Grameen Bank in Bangladesh.

The formation of human capital is broadly expected to have main role to play in alleviating poverty which is the major challenge for the development (Bils & Klenow, 2000; Krueger & Lindahl, 2000). Nevertheless, in the rural communities of developing countries, children's access to education remains

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limited due to insufficient schooling infrastructure and resources (e.g., schools, teachers, materials), and the needy households' preferences and budget constraints for their investment in child schooling (Maldonado & González-Vega, 2008). Access to microcredit is likely to help reduce household financial constraints on child schooling. Human capital cannot be used as collateral because it cannot be seized in case of default, causing the poor to finance their children's schooling investment through past wealth or abstention from current consumption spending rather than credit (Maldonado & González-Vega, 2008). Then, credit market shortcomings point up a joint causality between child schooling and needy households' income generation. Together with increasing returns on investment in education, the credit shortcomings are likely to plunge poverty-stricken households into poverty trap (Bardhan & Udry, 1999).

Literature has identified four main potential channels through which microcredit can affect child schooling (Maldonado & González-Vega, 2008). First, if households take up credit for income-generating projects with returns above credit cost (interest rate), the income augments. Under the parental altruism assumption (Basu & Van, 1998), the increased income is likely to allow them to overcome the threshold triggering parents' decisions to invest in their child education (Becchetti & Conzo, 2014). Nevertheless, if the returns are postponed in time, the income may fall and even do not increase in the short run due to loan repayment obligations. Moreover, parents may behave strategically towards household expenditure by not prioritising the investment in child schooling with the incremental income. Thus, the income effects on child schooling is determined by the bargaining between parents and children (Basu & Ray, 2002; Moehling, 2006). Second, if microcredit helps smooth household consumption (Pitt & Khandker, 1998; Khandker, 2005; Islam, 2008; Akotey & Adjasi, 2016), the borrowers would be likely to smooth consumption without dropping their children from school (Kanbur & Squire, 2001) or/and even reducing their spending on child investment. Third, it can enhance child schooling investment whenever empowering women who have stronger preferences for child education than do men (Thomas, 1990; Pitt & Khandker, 1998; Behrman & Rosenzweig, 2002). Fourth, if promoting household productive activities, it may increase the opportunity cost of dispatching children to schools (Becchetti & Conzo, 2014). Similarly, if it brings about an increase in parents' working hours, children may be deliberately or undeliberately forced to do household chores. In these cases, the use of microcredit increases the demand for child labour, thereby reducing child schooling or schooling performance (Jensen & Nielsen, 1997; Psacharopoulos, 1997; Psacharopoulos & Patrinos, 1997; Becchetti & Conzo, 2014).

Nevertheless, the most recent studies documented that microcredit is very likely to drift away from its social mission—generating income and employment, smoothing consumption, empowering women, and so forth—failing to hold its welfare-enhancing and poverty-reducing promise (e.g., Bateman, 2017; Seng, 2018a & 2018b). Using microcredit as a "cure-all" to fight poverty has weakened rather than empowered women and has even trapped badly-off borrowers into a vicious cycle of poverty (Ganle, Afriyie, & Segbefia, 2015; Seng, 2018a & 2018b). Some other studies have found the

mixed impacts and yet advocated the use of microcredit as poverty alleviation strategy, arguing that it should be implemented with "cautious optimism" (e.g., Banerjee, Dufio, Glennerster, & Kinnan, 2009; Karlan & Zinman, 2010; Duvendack & Palmer Jones, 2012). Such an unfavourable effect raises concerns over the effects on child education. Regardless of the controversial conclusions from these studies, which may illustrate the diverse settings because of the different methods and geographical focuses, evaluating the impacts remains nevertheless one of the most powerful tools for estimating the effects of microcredit on child schooling.

Microfinance in Cambodia has over the past two decades grown rapidly and has been argued to promote socio-economic development and to help alleviate poverty, in particular in out-of-the-way communities. In the early 1990s, the sector emerged from not-for-profit microcredit projects initiated by international donors and non-governmental organisations (NGO) with the purpose of creating jobs for demobilised soldiers and filling the nonexistent banking sector (Seng, 2018a). It has developed over time into more commercial and profitable models, in particular since 2000, the year when five major microfinance institutions (MFIs) provide an average microcredit of approximately US$ 137 to approximately 175,051 borrowers (Bylander, 2015). Five years later, it has nearly doubled in size (Seng, 2018a), with 14 MFIs in 2005, 39 MFIs and 6 NGOs in 2014, offering microloans to approximately 366,000 household borrowers in 2005 and to approximately 1,921,000 household borrowers in 2016 (Lam, 2017). By 2014, 100,342 reported village offices operated nationwide (National Bank of Cambodia [NBC], 2014), with US$ 1140 average microloan (Seng, 2018a). Nevertheless, in 2018, the NBC shut down 32 MFIs on their request, after the NBC imposed the interest rate cap at 18 percent in April 2017. The improvement in rural livelihoods is partly attributed to the contribution of MFI microloans expanding cultivated land (Eliste & Zorya, 2015). Moreover, the extension of MFI services benefited approximately 3,878,618 Cambodians, or on average almost 5 people per household, allowing impoverished households to have easier access to microcredit to run new micro-businesses or/and expand existing ones (Cambodian Microfinance Association [CMA], 2018). Furthermore, it is argued by the CMA that the MFI microcredit is 'the key to breaking the poverty cycle' through empowering women as the household heads to run their own micro-businesses and manage cash. The MFIs in Cambodia and the CMA are optimistic about the MFIs' mission to lift the needy out of the poverty trap, in the rural communities in particular, through these ways and a substitute for the informal credit. Consistent with the findings by some empirical studies examining the socio-economic effects of microfinance in Cambodia that the MFI microloans contribute to poverty alleviation in rural localities (e.g., Teng, Prien, Mao, & Leng, 2011; Phim, 2014).

Nonetheless, the household borrowers are likely over-indebted, epitomised by the steadily rising ratio of average outstanding loan to GNI per capita, in particular from 2012 to 2014, with the higher rates than 100% (Seng, 2018a). Furthermore, alongside the growth of MFI microloans and poverty reduction achievement, the most recent studies (e.g., Bylander, 2015; Bateman, 2017; Seng, 2018a & 2018b; Green & Estes, 2018; Bylander et al., 2018) found the unfavourable socio-economic effects of

MFI microcredit on household borrowers, doubting its human-capital-promoting effects. Microloans in Cambodia become a "symbiosis of formal and informal lending" (Ovesen & Trankell, 2014), whereby the poverty-stricken borrowers take up both formal and informal microloans together, with the informal one being frequently used to meet the formal obligations (Bylander, 2015). Half of the MFI borrowers still took up loans from informal institutions, showing the MFIs' failure to "elbow out" informal loans across the Kingdom (Renzenbrink, 2013; Song, 2013).

The controversial conclusions about the unfavourable effects of microcredit raise concerns about the child-schooling effects. The basic objective of the current study is to analyse the effects of microcredit on child-schooling investment expenditure via formal and informal sectors, with a particular attention to the issues of sample selection or endogeneity regarding the uptake of microcredit. A statistical test is conducted to indicate if the use of formal and/or informal microcredit enhances the child-schooling expenditure. To accomplish this objective, an econometric procedure that combines the strengths of the bivariate discrete choice and the endogenous treatment effects models (BDC–ETE) is adopted with data from the Cambodia Socio-Economic Survey (CSES) conducted in 2014. While Cambodia is one of the top five MFI penetration economies (Bylander, 2015), with 13 percent of the Cambodians actively taking up MFI microloans (Gonzalez, 2010),[1] little is known about the pro-education effects of microloans. Moreover, this article contributes to the literature by using the BDC–ETE model to address endogeneity and other estimation challenges and also to describe the effects by formal and informal sectors at the household level. The article concludes that microloans reduce the household borrowers' expenditure on child-schooling investment.

The remainder of this article is structured as follows. Section 2 describes the empirical framework. Section 3 presents data and variables used in the analysis. Section 4 discusses the estimated results, and the final section concludes the article.

2. Empirical Framework

The empirical analysis in this article is carried out with an econometric approach that combines the bivariate discrete choice and the endogenous treatment effects models (BDC–ETE). A two-stage framework is used to estimate the models. In the first stage, the bivariate probit model describing the households' uptake of formal and informal microloans is estimated. From the first stage, two inverse Mills Ratios (IMRs) are predicted to control for potential endogenous selection bias. In the second stage, the estimated IMRs, together with two binary indicators representing the uptake of formal and informal microcredit and other regressors, are included in the education expenditure equation.

2.1. Uptake of Microcredit

Because the households are very likely to take up formal alongside informal microloans, the analysis of factors determining the uptake of formal and informal microcredit should be jointly carried out. That is, the uptake of formal microcredit would be correlated with that of informal microcredit. The determinants are built on the empirical models proposed by Akotey and Adjasi (2016) and scrutinised

with the bivariate probit model describing the households' uptake of formal and/or informal microloans being specified as follows[2]:

$$M_1^* = \alpha_1 Z_1 + \varepsilon_1; \qquad M_1 = 1(M_1^* > 0) \tag{1}$$

$$M_2^* = \alpha_2 Z_2 + \varepsilon_2; \qquad M_2 = 1(M_2^* > 0) \tag{2}$$

$$E(\varepsilon_1) = E(\varepsilon_2) = 0$$

$$Var(\varepsilon_1) = Var(\varepsilon_2) = 1$$

$$Cov(\varepsilon_1, \varepsilon_2) = \rho$$

where M_1^* and M_2^* are binary indicators for the uptake of formal and informal microloans, respectively, with M_1 being equal to 1, if a household uses formal microloan, and zero otherwise; and M_2 being equal to 1, if a household uses informal microloan, and zero otherwise. Z_1 and Z_2 are covariates correlated with the uptake of formal and informal microloans, respectively. α_1 and α_2 are parameters to be estimated. ε_1 and ε_2 are error terms with a standard bivariate normal distribution. ρ is parameter capturing the correlation between Equations (1) and (2).

The bivariate probit model has four possible regimes: (1) the household uses both formal and informal microloans; (2) the household uses only formal microloans; (3) the household uses only informal microloans; and the household uses neither formal nor informal microloans. Thus, estimating Equations (1) and (2) needs the identification of the probabilities that the household uses microloans in these possible regimes. The probability of each regime can be specified as follows (Greene, 2003):

$$P_{11} = \Pr(M_1 = 1, M_2 = 1 | Z_1, Z_2) = F(\alpha_1 Z_1, \alpha_2 Z_2; \rho) \tag{3}$$

$$P_{12} = \Pr(M_1 = 1, M_2 = 0 | Z_1, Z_2) = F(\alpha_1 Z_1, -\alpha_2 Z_2; -\rho) \tag{4}$$

$$P_{21} = \Pr(M_1 = 0, M_2 = 1 | Z_1, Z_2) = F(-\alpha_1 Z_1, \alpha_2 Z_2; -\rho) \tag{5}$$

$$P_{22} = \Pr(M_1 = 0, M_2 = 0 | Z_1, Z_2) = F(-\alpha_1 Z_1, -\alpha_2 Z_2; \rho) \tag{6}$$

where $F(.)$ is the cumulative density function of the standard bivariate normal distribution. With these probabilities being specified, Equations (1) and (2) can be simultaneously estimated by using a maximum likelihood method with the log-likelihood function as follows (Greene, 2008; Chang & Mishra, 2008):

$$\mathrm{Ln}L = \mathrm{Ln}F\left[(2M_1 - 1)\alpha_1 Z_1, (2M_2 - 1)\alpha_2 Z_2, (2M_1 - 1)(2M_2 - 1)\rho\right] \tag{7}$$

If the parameter ρ equals zero, Equation (7) is the sum of the log-likelihood functions of the tow binary probit models specifying the uses of formal and informal credit. Thus, a likelihood ratio (LR) test can be carried out, with the null hypothesis that ρ is statistically equal to zero, to justify if the bivariate probit model is better than the tow independent univariate probit models.

2.2. Child-Schooling Effects of Microcredit

To quantify the child-schooling effects of uptake of formal and/or informal microloans, these two binary variables are regarded as the special treatments for the household borrower and are used for estimating a schooling expenditure function. Because individual household borrowers' child-schooling expenditure in the four possible regimes can be observed, the expenditure model is estimated with endogenous treatment effects approach, accounting for the fact that unobserved factors may be correlated with both/either the use of formal and/or informal microloans and the expenditure (Chang & Mishra, 2008).[3] Albeit at first used for the binary choices, this procedure can be generalized into multiple choices (Chang & Mishra, 2008). Either instrumental variables (IV) or control function (CF) approaches can be applied to the estimation of the endogenous treatment effects. Nevertheless, in terms of yielding consistent estimates, the latter is more efficient than the former (Vella & Verbeek, 1999; Chang & Mishra, 2008). Then, this study adopts the CF approach to estimating the expenditure function.[4]

Although the CF method extends the sample selection approach, being applied to the whole sample, it is necessary to use covariates that directly determine the uptake of credit but not the schooling expenditure as selection instruments to properly identify the model. Imai et al. (2010) used the availability of formal banks in village as an instrument for the treatment effects model to evaluate the effects of microcredit on poverty. Following Imai et al. (2010), a dummy for availability of micro-bank offices in village (it equals 1 if the household lives in the village with at least one micro-bank office and 0 otherwise) is used as the possible instrument in the current study. Then, this instrument is key determinant of the uptake of microcredit because it facilitates the household access to formal credit but is very likely to reduce the use of informal loans. The study hypothesises that the availability of village micro-bank offices influences the household uptake of microcredit but does not affect the child-schooling expenditure.

To account for selection bias, the generalized residuals, so-called Generalized Inverse Mills Ratios (GIMRs), are built for individual household decisions concerning the uptake of formal microcredit and that of informal one in the whole sample. These two GIMRs in the bivariate probit model for formal and informal microcredit can be obtained from the following (Greene, 2008):

$$GIMR_1=\left(2M_1-1\right)\frac{\phi\left(\left(2M_1-1\right)\alpha_1 Z_1\right)}{F(.)}\Phi\left[\frac{\left(2M_2-1\right)\alpha_2 Z_2-\left(2M_1-1\right)\alpha_1 Z_1}{\sqrt{1-\rho^{*2}}}\right] \tag{8}$$

$$GIMR_2=\left(2M_2-1\right)\frac{\phi\left(\left(2M_2-1\right)\alpha_2 Z_2\right)}{F(.)}\Phi\left[\frac{\left(2M_1-1\right)\alpha_1 Z_1-\left(2M_2-1\right)\alpha_2 Z_2}{\sqrt{1-\rho^{*2}}}\right] \tag{9}$$

where $GIMR_1$ and $GIMR_2$ denote the generalized residuals of individual household borrowers and non-borrowers of formal and informal credit, respectively. The coefficient ρ^* is computed by the formula $\rho^*=(2M_1-1)(2M_2-1)\rho$. $\Phi(.)$ and $\phi(.)$ are the cumulative distribution function of the stan-

dard normal distribution and the standard normal probability density function, respectively. $GIMR_1$ and $GIMR_2$ are included in the schooling expenditure equation as regressors to account for the selection bias and applying an Ordinary Least Squares (OLS) procedure to the estimation of the equation yields consistent and unbiased estimates (Vella & Verbeek, 1999; Wooldridge, 2015). Then, the expenditure model can be specified as follows:

$$Y=\beta_0 X+\beta_1' M_1+\beta_2' M_2+\beta_1'' GIMR_1+\beta_2'' GIMR_2+u \tag{10}$$

where Y is the child-schooling expenditure. β_0 is the vector of parameters to be estimated. X includes exogenous controlling factors expected to affect the expenditure. M_1 and M_2 are binary indicators specifying the household borrower's decisions regarding the uses of formal and informal credit, respectively. β_1' and β_2' are the parameters to be estimated, capturing the effects of uptake of formal and informal microcredit on the schooling expenditure. u is the random error term.

In addition, there are two main statistical justifications for the effects given by the consistent estimates of Equation (10). First, for the household borrowers taking out both formal and informal loans, it is whether the uses of formal credit and that of informal one produce the significant joint impacts on the outcome of interest, with the effects being tested under the null hypothesis: H_0: $\beta_1'=\beta_2'=0$. Second, the statistical evidence on whether there is a need to correct for the selection bias is necessarily provided to justify the consistent and unbiased estimates. Therefore, the null hypothesis: H_0: $\beta_1''=\beta_2''=0$ is tested to justify if M_1 and M_2 are correlated with the expenses due to unobserved heterogeneity.

3. Data and Variables

This section describes the source of data and defines main variables used in the regression analysis. The section ends by carrying out a descriptive statistical analysis, in particular with a simple statistical tests of the differences in means between households that take up microcredit and those that do not.

3.1. Data

The CSES data conducted by the National Institute of Statistics (NIS) in 2014 are used for the empirical analysis in this study. Actually, the NIS has carried out the CSES since 1993, in particular the survey has been annually done since 2007. However, the 2014 CSES sampled up to 12,096 households in 25 provinces, while the survey sample in 2011–2013 and 2015–2016 counted only 3600 households each year. Thus, the 2014 CSES samples among the CSESs the largest size and can serve as the nationwide representative sample. Still, there are some missing observations in the regression analysis because some sampled households did not offer full information on the variables of interest related to the current study. Thus, adjusting for the missing, the total sample size is 8504 households for the regression estimation.

3.2. Variables

A binary variable for the use of formal microloans and a binary variable for the use of informal microloans are selected as the dependent variables in the selection equations. In the outcome equation,

the annual total expenditure on child schooling is used as the dependent variable.[5] Following the most recent empirical studies (e.g., Akotey & Adjasi, 2016; Seng, 2018a & 2018b), a set of independent variables included in the regression equations consists of household characteristics, household head's characteristics, farm characteristics, and financial characteristics of village captured by availability of micro-bank offices in the village.

Household characteristics include family members under 15 years of age, members over 64 years of age, working-age members (i.e., between 15 and 64 years of age), and remittances. The variable of family members under 15 years of age and that of those over the age of 64 years are incorporated in the models to control for the potential effects of household dependents on the household borrowers' decisions to take up microcredit and the schooling spending. The variable of working-age members is included in the models to capture the potential influence of active family members on the decisions to use microcredit and the child-schooling spending. Furthermore, the remittances would facilitate the access to microcredit by helping remove household credit constraints (Akotey & Adjasi, 2016) because they are mostly used to meet debt obligations (Bylander, 2015) and equally raise household earnings and spending. Nonetheless, they can be used by the recipient households instead of microloans to incur other necessary household expenditure (Seng, 2018a) and/or child-schooling spending. In this case, the households is likely to make more investment in their child education.

Household head's characteristics consist of age, gender and ethnicity. The heads are equally clustered into four groups according the educational status—illiteracy, vocational training, primary schooling, secondary schooling, and higher education. In a similar fashion, the heads' occupations are grouped into five categories—farmer, agricultural wage-paid worker, nonagricultural salaried worker, professional (including lawyer, teacher, doctor, and other salaried employee), and other career (such as armed force, student, unemployed, retired person etc.).

The potential impacts of farm characteristics are captured by the variables of household landholding in hectares and availability of irrigation in the village. There may be a concern over the endogeneity issue of landholding. Yet, it is potentially low because the sampled households in this study represent those in the rural communities where the markets for land are underdeveloped (Azam, Imai, & Gaiha, 2012). Nonetheless, although the households can put up land as collateral once applying for microcredit from the MFIs and/or moneylenders, the current study finds it difficult to hypothesise about the impacts of landholding on household decisions to take out microcredit and the schooling expenditure. In Cambodia, under the weather conditions there are 6-mohth wet season and 6-month dry season for the agriculture per year. Farmers very often see a water shortage due to the limited development of irrigation infrastructure in the communities. Hence, the availability of irrigation in the village would induce farmers to take up microcredit because the access to irrigation can encourage them to make more agricultural investments. Furthermore, it would facilitate the access to microloans through creditors' expectation of the borrowers' higher agricultural yields (Seng, 2018b). All these variables are summarised in Table A1.

3.3. Descriptive Statistics

The results of descriptive statistical analysis presented in Table 1 indicate that approximately 21% and 25% of the borrowers use loans offered by banks/MFIs and NGOs, respectively—these loans are categorised as formal loans in the current study—while 54% remainders use credit provided by informal lenders such as their relatives, friends, moneylenders, traders, landlords, employers, and so forth to meet certain spending. These results indicate that the majority of borrowers take up informal loans. Further detail on microloans and households' borrowing purpose by sectors can be found in Table A2.

Table 1. Types of lenders

Lenders	Percentage
Formal	
Banks & MFIs	20.86%
NGOs	25.30%
Informal	
Relatives	22.59%
Friends	6.74%
Moneylenders	19.17%
Traders	3.40%
Landlords	0.17%
Employers	0.11%
Others	1.67%

Source: Author's computation from the 2014 CSES dataset

The summary statistics reported in Table 2 illustrate remarkable differences between the borrowers and the non-borrowers in terms of child-schooling expenditure in both sectors. With an average expenditure of approximately 503,670 riels (US$125.92) per year, the borrowers' child-schooling expenditure in the formal sector is significantly lower than the non-borrowers' expenditure, with an average of approximately 559,560 riels (US$139.89) per year.[6] Similarly, with an average expenditure of approximately 576,140 riels (US$144.04) per year, the borrowers' schooling expenditure in the informal sector is significantly lower than the non-borrowers' expenditure, with an average of approximately 851,680 riels (US$212.92) per year. However, these results do not necessarily reveal that using formal and/or informal microcredit reduces the child-schooling expenditure due to such issues as the endogeneity of the decision to take up credit, which results from selection bias and household heterogeneity (Seng, 2018a).

Table 2. Schooling expenditure by borrowing status

Variables	Borrowers		Non-borrowers		Differences in Mean
	Mean	SD	Mean	SD	
Formal credit					
Schooling expenditure	503.67	1862.91	559.56	3126.33	−355.89***
Informal credit					
Schooling expenditure	576.14	3059.18	851.68	2910.13	−275.54***

Notes: The child-schooling expenditure is the total annual expenses in thousand riels.
*** denotes test statistic significance at 1% level.
Source: Author's computation from the 2014 CSES dataset

4. Results and Discussion

The descriptive statistical analysis suggests the significant differences in child-schooling expenditure between the household borrowers and the non-borrowers in both sectors. The econometric analysis is further conducted with BDC–ETE model to quantify the effects of microcredit on child education expenditure.

4.1. Determinants of Microcredit Use

Table 3 reports the estimated results of the bivariate probit model for both formal and informal sectors. The parameter ρ indicating the correlation between the use of formal credit and that of informal credit is significantly nonzero, showing that the use of formal microloan is dependent on that of informal one, furt her confirmed by the significance of likelihood ratio test of independence equations (i.e., Equations (1) and (2)). This result suggests that the two independent univariate probit models are inappropriate.

For the formal sector, the household head's life-cycle impacts on the probability of using microloans are quadratic. The likelihood that the household uses formal credit increases but starts to gradually decline after the head reaches 52 years of age. This is confirmed by the significantly positive coefficient of age and the significantly negative coefficient of age-squared term. As he/she gets older, the head gains more experience and enjoys growing economic opportunities but starts to gradually lose those opportunities after the age of 52, then affecting the access to credit. Consistent with the findings by Seng (2018a and 2018b), the ethnicity has a significantly positive correlation with the uptake of formal credit, illustrating that Khmer-headed households are very likely to take up formal microloans to meet household financial needs. The heads' occupations such as agricultural and nonagricultural jobs, are very likely to increase the likelihood of using formal microcredit; however, households headed by professional person are very likely to decrease the probability of using informal credit. Furthermore, the head's illiteracy, vocational training, primary and secondary education are likely to increase the probability of using formal credit.

Consistent with Seng (2018a & 2018b), the numbers of family members under 15 years of age are likely to increase the likelihood of taking up formal and informal microloans, while the members over the age of 65 years are likely to decrease the probability of using informal credit. Furthermore, the availability of village bank offices is also very likely to induce the use of formal microcredit but also increase the uptake informal loans. This result somewhat supports the arguments by Bylander (2015) that some Cambodian household borrowers use formal and informal credit together.

4.2. Effects of Microcredit on Child-schooling Expenditure

The effects of uptake of formal microcredit and/or informal microcredit on child-schooling expenditure represented by Equation (10) are reported in the last column of Table 4. Because the particular objective of this study is to quantify the child-schooling effects of formal and informal credit, the discussion of the estimated results starts with the test of hypothesis about these effects. The null hypothesis that the use of formal credit and that of informal credit have no joint effects on the

Table 3. Bivariate probit estimates of microcredit uptake

Variables	Formal			Informal		
	Coef.	SE	*P*-value	Coef.	SE	*P*-value
Age	0.02**	0.01	0.03	−0.01	0.01	0.10
Age squared	−0.0001*	0.00	0.05	0.00004	0.00	0.62
Gender	0.09*	0.05	0.05	−0.01	0.04	0.80
Ethnicity	0.55***	0.11	0.00	−0.05	0.08	0.50
Farmer	0.10	0.08	0.23	−0.11	0.07	0.14
Agricultural worker	0.32**	0.15	0.03	0.11	0.14	0.43
Nonagricultural workers	0.17*	0.10	0.08	−0.22**	0.09	0.01
Professional	−0.02	0.12	0.84	−0.20*	0.11	0.07
Small business owner	−4.26	0.14	0.98	−4.88	0.14	0.99
Other career	0.00	0.21	0.99	−0.02	0.18	0.89
Illiteracy	1.01**	0.47	0.03	0.60	0.37	0.10
Vocational training	1.01*	0.55	0.07	0.08	0.48	0.87
Primary	1.11**	0.47	0.02	0.47	0.37	0.21
Secondary	1.11**	0.47	0.02	0.41	0.37	0.27
Higher	0.30	0.18	0.10	0.05	0.19	0.78
Members＜15	0.09***	0.01	0.00	0.04***	0.01	0.00
Members＞64	−0.09**	0.04	0.04	0.00	0.04	0.91
Working-age members	0.02	0.01	0.13	0.02	0.01	0.15
Landholding	0.001	0.00	0.17	0.00	0.00	0.72
Irrigation infrastructure	0.00	0.05	0.98	0.07	0.04	0.10
Village bank offices	1.15***	0.04	0.00	0.85***	0.04	0.00
Constant	−3.43***	0.52	0.00	−0.83*	0.41	0.05
Observation	8504					
/athrho	−1.03	0.04	0.00			
LR test of indep. eqns	rho＝0	Prob＞chi2＝0.00				
Log likelihood	−7373.27					

* denotes test statistic significance at 10% level.
** denotes test statistic significance at 5% level.
*** denotes test statistic significance at 1% level.

schooling spending (H_0: $\beta_1' = \beta_2' = 0$) reported at the bottom of Table 4 is accepted. However, the significantly negative coefficient of formal credit suggests that the uptake of formal credit is very likely to reduce the household borrowers' child-schooling expenditure. This result reveals that microcredit is unlikely to increase household income, smooth household consumption and empower women as documented by previous studies (e.g., Imai & Azam, 2012; Imai et al., 2012; Kislat, 2015; Akotey & Adjasi, 2016), but to reduce household spending on investments in child education. This result is

consistent with unfavourable conditions for the socio-economic effects of microcredit under which the borrowers would be likely to drop their children from school (e.g., Thomas, 1990; Pitt & Khandker, 1998; Kanbur & Squire, 2001; Behrman & Rosenzweig, 2002; Becchetti & Conzo, 2014). The result confirms the most recent findings by Seng (2018a and 2018b) that microcredit worsens household welfare and does little to reduce poverty in Cambodia. These unwanted effects produced by Seng's studies can somewhat help explain these child-schooling effects of microloans. The negative child-schooling effects can explain the fact that interest rate charged on formal microcredit is still too high (see Table A2) and the credit is used not for income-generating activities, coupled with borrowers' limited financial literacy.

As mentioned earlier, the main issue of interest is also to determine whether the endogenous selection bias happens between the uptake of microcredit and the expenditure under the null hypothesis: H_0: $\beta_1''=\beta_2''=0$. The joint nonsignificance test result reported at the bottom of Table 4 suggests the absence of a self-selection bias issue accounted for by the GIMRs. However, the coefficient of each GIMR is significant at 10% level, revealing that either the decision to use formal credit or that of informal credit is very likely to be subject to a self-selection bias issue. Then, incorporating GIMRs into the schooling expenditure equation is more appropriate to secure the estimated result against bias and inconsistent issues.

Other explanatory variables are found to have a significant correlation with the expenditure. For example, different from expectation, the coefficient of household head's gender is significantly negative, suggesting that households headed by women are unlikely to invest more in child education. The coefficients of heads' education levels, except for higher education, are significantly negative. These results are different from existing findings (e.g., Seng, 2015). These unwanted results can explain the fact that the expected private returns on child-schooling investment in are below parents' expectation in Cambodia, due to lower payment in labour market. Furthermore, the numbers of household members under the age of 15 years have a significantly negative correlation with the expenditure. This result can somewhat explain the fact that households with more children need to bear huger burden on household spending, reducing expenses allocated to child schooling. Nevertheless, the numbers of household members over 64 years of age and working-age members have a significantly positive association with the spending, illustrating these old household members and working-age members are likely to have an influence on households' decision to make investments in child schooling. The fact that working-age members are likely to increase child-schooling spending can somewhat relate to roles of remittances from working-age members working in either other urban areas or other countries (e.g., Bucheli, Bohara, & Fontenla, 2018; Binci & Giannelli, 2018).

5. Conclusion

The different and controversial conclusions about the socio-economic effects of microcredit raise concerns about the consequences for child schooling. This article quantifies the effects of microcredit

Table 4. Effects of microcredit on child-schooling spending

Variables	Coef.	SE	*P*-value
Formal microcredit	−108.95**	57.55	0.05
Informal microcredit	−28.20	53.23	0.60
Age	−27.17	39.65	0.49
Age squared	0.07	0.27	0.79
Gender	−257.07**	119.20	0.03
Ethnicity	−1121.35	676.14	0.10
Farmer	−430.32	270.74	0.11
Agricultural worker	−351.83	265.81	0.19
Nonagricultural workers	104.24	506.44	0.84
Professional	417.94	290.37	0.15
Small business owner	−4805.99	3283.44	0.14
Other career	226.99	241.62	0.35
Illiteracy	−3309.38***	484.83	0.00
Vocational training	−2837.06**	1115.92	0.01
Primary	−3654.05***	679.36	0.00
Secondary	−3474.62***	740.41	0.00
Higher	−286.25	339.27	0.40
Members < 15	−107.11**	39.37	0.01
Members>64	209.67*	113.49	0.07
Working-age members	257.38***	16.30	0.00
Landholding	2.10	3.61	0.56
Irrigation infrastructure	18.92	113.72	0.87
$GIMR_1$	−2230.51*	1315.93	0.09
$GIMR_0$	3050.03*	1774.90	0.08
Constant	5020.10**	2155.94	0.02
Observation	8504		
Adj. *R*-squared	0.11		
Joint significance test[a]			0.17
Joint significance test[b]			0.22

Note: dependent variable is household expenditure on child schooling per year.
[a] H_0: $\beta_1' = \beta_2' = 0$, the critical value $F = 1.53$.
[b] H_0: $\beta_1'' = \beta_2'' = 0$, the critical value $F = 1.80$.
* denotes test statistic significance at 10% level.
** denotes test statistic significance at 5% level.
*** denotes test statistic significance at 1% level.

on household expenditure on child-schooling investment via formal and informal sectors in Cambodia, with special attention given to the endogeneity issue by applying BDC–ETE to data from the CSES carried in 2014. The findings suggest that the uptake of formal microcredit is very likely to reduce child-schooling investment spending. Overall results illustrate that microcredit has at best no impacts on child-schooling spending, and may have an adverse effect. These results are consistent with the findings by Seng (2018a & 2018b) that microcredit, both formal and informal, is very likely to worsen household welfare and do little to alleviate poverty in Cambodia.

The unwanted effects are likely attributed to the high interest rates and the households' use of credit for nonproductive activities. The high interest rates and the nonproductive use are more likely to plunge the borrowers into a vicious cycle of high-interest indebtedness, particularly when the earnings are too low to cover the credit costs (Seng, 2018a & 2018b). Seng (2018b) also attributed such an unfavourable effect to borrowers' financial illiteracy. This reveals that, in line with the findings by Schicks (2013), Coleman (1999), and Pytkowska and Spannuth (2012), microcredit growth may give rise to over-indebtedness which imposes a heavy debt burden on the borrowers, then more likely to produce an adverse effect on child schooling. Therefore, the formal microcredit is unlikely to serve as a substitute for the informal sector in Cambodia, harming human capital development. These results provide insights into how the expansion of microcredit affects child education and in particular underscore the need for a reconsideration of microcredit as a strategy to enhance sustained poverty reduction in the Kingdom.

To promote child schooling through microcredit, the policy should focus on credit costs and borrowings for the productive purposes, coupled with financial literacy enhancement. To reduce credit costs, a special attention should be paid to interest on loans. According to the studies by Shankar (2007) and Vong & Song (2014), transaction and administrative costs of supplying many microloans and monitoring many small borrowers are the major contributors to the high interest rates. Mobility technology can serve as a new approach to reducing MFIs' transaction and administrative expenses and in turns lowers costs of borrowing for the needy borrowers. In Cambodia's microcredit market, the lack of transparency distorts the actual price of MFI credit. Borrowers, especially those with limited knowledge, are usually not aware of all the charges imposed on them or overall costs of microcredit (Seng, 2017); and thus the MFIs should be more transparent. Alternatively, an appropriate interest rate cap temporally applied to microcredit to be used for productive purposes, with a specific basis on which the cap is to be computed, should be taken into consideration in policy.

Finally, the article has its limitations in the data because the panel data are unavailable and the data used in the analysis are not ideal enough for estimating treatment effects. With accurate data, the study can be improved with more appropriate instruments to address the issues of endogeneity concerning microcredit when quantifying treatment effects. This is left for future studies when there are such better data.

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Notes

[1] The highest MFI penetration country is Bangladesh (25%) followed by Bosnia Herzegovina (15%), Mongolia (15%), Cambodia (13%), and Nicaragua (11%) (Gonzalez, 2010).

[2] In the first stage of the standard treatment effect model, a probit model is usually estimated (e.g., Chang & Mishra, 2008; Akotey & Adjasi, 2016) because the error terms ε_1 and ε_0 are assumed to be normally distributed with zero means and variances $\sigma^2_{\varepsilon 1}$ and $\sigma^2_{\varepsilon 0}$ normalized to 1 (e.g., Heckman, 2001).

[3] If, for instance, households are wealthier, their spending on child schooling is higher, irrespective of whether they use loans (Seng, 2018a). These unobserved confounders would, in this case, result in biased and inconsistent estimates of the effects of credit if not controlled for.

[4] The detailed discussion of the control function methods can be found in Wooldridge (2015).

[5] The annual total expenses on child education, both formal and informal, include the payment for school fees, tuition, textbooks, other school supplies, allowances for children studying away from home, transport cost, gifts to teachers, and school building fund.

[6] The amount is converted into US dollar at the exchange rate of US$1＝4000 riels.

References

Akotey, J. O., & Adjasi, C. K. D. (2016). Does microcredit increase household welfare in the absence of microinsurance? *World Development*, *77*, 380–394. doi:10.1016/j.worlddev.2015.09.005

Asad K. G., Issam M., & Imai K. S. (2014). Microfinance and household poverty reduction: Empirical evidence from rural Pakistan. *Oxford Development Studies*, *43*(1), 84–104. https://doi.org/10.1080/13600818.2014.980228

Azam, M. S., Imai, K. S., & Gaiha, R. (2012). Agricultural supply response and smallholders market participation—The Case of Cambodia (Discussion Paper DP2012-09). Kobe, Japan: Kobe University, Research Institute for Economics and Business Administration.

Banerjee, A. V., Dufio, E., Glennerster, R., & Kinnan, C. (2009). *The miracle of microfinance? Evidence from a randomized evaluation*. Cambridge, MA: MIT Poverty Action Lab.

Bardhan, P., & Udry, C. (1999). *Development microeconomics*. Oxford: Oxford University Press.

Basu, K., & Van, P. H. (1998). The economics of child labor. *American Economic Review*, *88*, 412–427.

Basu, K., & Ray, R. (2002). *The collective model of the household and an unexpected implication for child labor: Hypothesis and an empirical test* (The World Bank Policy Research Working Paper Series No. 2813). Washington, DC: World Bank. Retrieved from http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-2813

Bateman, M. (2017). Post-war reconstruction and development in Cambodia and the destructive role of microcredit. Paper presented at the 8th International Scientific Conference "*Future World by 2050*." Pula, Croatia, June 1–3rd, 2017. Retrieved from https://www.researchgate.net/publication/315788551_Post-war_reconstruction_and_development_in_Cambodia_and_the_destructive_role_of_microcredit

Becchetti, L., & Conzo, P. (2014). The effects of microfinance on child schooling: A retrospective approach. *Applied Financial Economics*, *24*(2), 89–106. https://doi.org/10.1080/09603107.2013.856998

Behrman, J. R., & Rosenzweig, M. R. (2002). Does increasing women's schooling raise the schooling of the next generation? *American Economic Review*, *92*, 323–334.

Bils, M., & Klenow, P. (2000). Does schooling cause growth? *American Economic Review*, *90*, 1160–1183.

Binci, M., & Giannelli, G. C. (2018). Internal versus international migration: Impacts of remittances on child labor and schooling in

Vietnam. *International Migration Review*, *52*(1), https://doi.org/10.1111/imre.12267

Bornstein, D. (1996). *The price of a dream. The story of the Grameen Bank and the idea that it is helping the poor to change their lives*. New York, NY: Simon and Schuster.

Bucheli, J.R., Bohara, A. K., & Fontenla, M. (2018). Mixed effects of remittances on childeducation. *IZA Journal of Development and Migration*, 8: 10. https://doi.org/10.1186/s40176-017-0118-y

Bylander, M. (2015). Credit as coping: Rethinking microcredit in the Cambodian context. *Oxford Development Studies*, *43*(4), 533–553. DOI: 10.1080/13600818.2015.1064880

Bylander, M., Res, P., Jacoby, L., Bradley, P., & Pérez, A. B. (2018). Over-indebtedness and microcredit in Cambodia: Moving beyond borrower-centric frames. *Development Policy Review*, https://doi.org/10.1111/dpr.12399

Chang, H. H., & Mishra, A. (2008). Impact of off-farm labor supply on food expenditures of the farm household. *Food Policy*, *33*(6), 657–664. doi: 10.1016/j.foodpol.2008.02.002

CMA (2018). *Microfinance environment*. Phnom Penh: Cambodia Microfinance Association. Retrieved from https://www.cma-network.org/en/microfinance-in-cambodia

Deloach, S. B., & Lamanna, E. (2011). Measuring the impact of microfinance on child health outcomes in Indonesia. *World Development*, *39*(10), 1808–1819. doi: 10.1016/j.worlddev.2011.04.009

Duvendack, M., & Palmer Jones, R. (2012). High noon for microfinance impact evaluations: Re-investigating the evidence from Bangladesh. *The Journal of Development Studies*, *48*(12), 1864–1880.

Eliste, P., & Zorya, S. (2015). *Cambodian agriculture in transition: Opportunities and risks*. Washington, D.C.: World Bank. Retrieved from http://documents.worldbank.org/curated/en/2015/08/24919384/cambodian-agriculture-transition-opportunities-risks

Ganle, J. K., Afriyie, K., & Segbefia, A. Y. (2015). Microcredit: Empowerment and disempowerment of rural women in Ghana. *World Development*, *66*, 335–345. doi: 10.1016/j.worlddev.2014.08.027

Green, W. N., & Estes, J. (2018). Precarious debt: Microfinance subjects and intergenerational dependency in Cambodia. *Antipode*, https://doi.org/10.1111/anti.12413

Greene, W. H. (2008). *Econometric analysis*. Upper Saddle River, NJ: Prentice Hall.

Imai, K. S., Arun, T., & Annim, S. K. (2010). Microfinance and household poverty reduction: New evidence from India. *World Development*, *38*(12), 1760–1774. doi: 10.1016/j.worlddev.2010.04.006

Imai, K. S., & Azam, M. D. S. (2012). Does microfinance reduce poverty in Bangladesh? New evidence from household panel data. *The Journal of Development Studies*, *48*(5), 633–653. DOI: 10.1080/00220388.2012.661853

Imai, K. S., Gaiha, R., Thapa, G., & Annim, S. K. (2012). Microfinance and poverty—A macro perspective. *World Development*, *40*(8), 1675–1689. doi: 10.1016/j.worlddev.2012.04.013

Islam, N. (2008). Vietnam's lesson for China: An examination of the Sachs—Woo hypothesis, *Comparative Economic Studies*, *50*, 111–157.

Jensen, P., & Nielsen, H. S. (1997). Child labour or school attendance? Evidence from Zambia. *Journal of Population Economics*, *10*, 407–424.

Kanbur, R., & Squire, L. (2001). The evolution of thinking about poverty. In Meier, G., & Stiglitz, J. (Eds.), *Frontiers of development economics: The Future in perspective*, pp. 183–226. Washington, DC: World Bank.

Karlan, D., & Zinman, J. (2010). Expanding credit access: Using randomized supply decisions to estimate the impacts. *Review of Financial Studies*, *23*(1), 433–464.

Khandker, S. R. (2005). Microfinance and poverty: Evidence using panel data from Bangladesh. *World Bank Economic Review*, *19*, 263–286.

Kislat, C. (2015). Why are informal loans still a big deal? Evidence from North-East Thailand. *The Journal of Development Studies*, *51*(5), 569–585. DOI: 10.1080/00220388.2014.983907

Krueger, A., & Lindahl, M. (2000). Education for growth: Why and for whom? National Bureau of Economic Research Working Paper No. W7591.

Kulb C., Hennink, M., Kiiti, N., & Mutinda, J. (2015). How does microcredit lead to empowerment? A case study of the Vinya wa Aka group in Kenya. *Journal of International Development*, *2*8(5), 715–732. DOI: 10.1002/jid.3130

Maldonado, J. H., & González-Vega, C. (2008). Impact of microfinance on schooling: Evidence from poor rural households in Bolivia. *World Development*, *36*(11), 2440–2455. doi: 10.1016/j.worlddev.2008.04.004

Mazumder, M. S., & Lu, W. (2015). What impact does microfinance have on rural livelihood? A comparison of governmental and non-governmental microfinance programs in Bangladesh. *World Development*, *68*, 336–354. doi: 10.1016/j.worlddev.2014.12.002

Moehling, C. (2006). *Children's pay envelopes and the family purse: the impact of children's income on household expenditures*

(unpublished paper). Rutgers University: New Brunswick, NJ.

Montgomery, H., & Weiss, J. (2011). Can commercially-oriented microfinance help meet the millennium development goals? Evidence from Pakistan. *World Development*, *39*(1), 87–109. doi:10.1016/j.worlddev.2010.09.001

NBC (2014). *Annual report*. General Directorate of Banking Supervision, Phnom Penh: National Bank of Cambodia. Retrieved from http://www.nbc.org.kh/english/publications/supervision_annual_reports.php

Ovesen, J., & Trankell, I.-B. (2014). Symbiosis of microcredit and private moneylending in Cambodia. *The Asia Pacific Journal of Anthropology*, *15*(2), 178–196. doi: 10.1080/14442213.2014.894116

Phim, R. (2014). The impacts of microcredit on poverty reduction: Evidence from Cambodian rural villages. *The Philippine Review of Economics*, *LI*(2), 121–150.

Pitt, M., & Khandker, S. (1998). The impact of group-based credit programs on the poor in Bangladesh: Does the gender of participants matter? *Journal of Political Economy*, *106*, 958–996.

Psacharopoulos, G. (1997). Child labor versus educational attainment. Some evidence from Latin America. *Journal of Population Economics*, *10*, 377–386.

Psacharopoulos, G., & Patrinos, H. (1997). Family size, schooling and child labor in Peru—An empirical analysis. *Journal of Population Economics*, *10*, 387–405.

Rahman M. W., Luo, J., & Minjuan, Z. (2014). Welfare impacts of microcredit programmes: An empirical investigation in the state-designated poor counties of Shaanxi, China. *Journal of International Development*, *27*(7), 1012–1026. doi: 10.1002/jid.3020

Renzenbrink, A. (2013). Informal lending still thriving. Phnom Penh Post, July 2.

Seng, K. (2015). The effects of nonfarm activities on farm households' Food consumption in rural Cambodia. *Development Studies Research*, *2*(1), 77–89. doi: 10.1080/21665095.2015.1098554

Seng, K. (2017). Financing failure: Does microcredit hold its poverty-reducing promise for Cambodia? *APPS Policy Forum*, 26th April. Retrieved from https://www.policyforum.net/financing-failure/

Seng, K. (2018a). Rethinking the effects of microcredit on household welfare in Cambodia. *The Journal of Development Studies*, *54*(9), 1496–1512. https://doi.org/10.1080/00220388.2017.1299139

Seng, K. (2018b). Revisiting microcredit's poverty-reducing promise: Evidence from Cambodia. *Journal of International Development*, *30*(4), 615–642. https://doi.org/10.1002/jid.3336

Shankar, S. (2007). Transaction costs in group microcredit in India. *Management Decision*, *45*(8), 1331–1342. doi.org/10.1108/00251740710819069

Song, S. (2013). Cambodia's informal money lending is competing with banks and microfinance institutions. International Business Times, July 2.

Teng, S., Prien, S., Mao, N., & Leng, B. (2011). Impacts of micro-credit on household economies. *International Journal of Environment and Rural Development*, *2*(1), 108–114.

Thomas, D. (1990). Intra-household resource allocation: An inferential approach. *Journal of Human Resources*, *25*, 635–664.

Vella, F., & Verbeek, M. (1999). Estimating and interpreting models with endogenous treatment effects. *Journal of Business and Economic Statistics*, *17*(4), 473–478. DOI: 10.2307/1392404

Vong, J., & Song, I. (2014). Mobility technology solutions can reduce interest rates of microfinance loans. In: *Emerging technologies for emerging markets*. Topics in Intelligent Engineering and Informatics, 11. Springer, Singapore. doi: 10.1007/978-981-287-347-7_2

Wooldridge, J. M. (2015). Control function methods in applied econometrics. *The Journal of Human Resources*, *50*(2), 420–445. doi: 10.3368/jhr.50.2.420

Appendix

Table A1. Variables

Variables	Definition	Mean	SD
Dependent			
Child-schooling expenditure	Total annual expenses on formal and informal child education in thousand Riel	795.704	2942.981
Formal microcredit	= 1 if the household uses credit offered by MFIs and NGOs	0.179	0.384
Informal microcredit	= 1 if the household uses loans offered by informal financial providers	0.203	0.402
Independent			
Age	The age of the household head	45.528	14.069
Gender	= 1 if the household is woman-headed	0.216	0.412
Ethnicity	= 1 if the household head is Khmer	0.959	0.197
Farmer	= 1 if the household head is farmer	0.578	0.494
Agricultural worker	= 1 if the household head is agricultural wage-paid worker	0.045	0.207
Nonagricultural workers	= 1 if the household head is nonagricultural wage-paid worker	0.202	0.401
Professional	= 1 if the household head is professional	0.061	0.240
Small business owner	= 1 if the household head is small business owner	0.003	0.054
Other career	= 1 if the household head is other than these careers	0.020	0.139
Illiteracy	= 1 if the household head is illiterate (cannot read and write Khmer language)	0.246	0.431
Vocational training	= 1 if the household head joined any vocational training	0.008	0.086
Primary	= 1 if the household head completed primary education	0.443	0.497
Secondary	= 1 if the household head completed secondary education	0.291	0.454
Higher	= 1 if the household head completed higher education	0.018	0.133
Members <15	Total family member under 15 years of age	1.528	1.288
Members >64	Total family members over 64 years of age	0.212	0.491
Working-age members	15 years of age ≤ total family members ≤ 64 years of age	3.030	1.545
Landholding	Land areas in hectare owned by the household	1.750	7.434
Irrigation infrastructure	= 1 if the household live in the village with adequate irrigation infrastructure	0.144	0.351
Village bank offices	= 1 if the household head live in the village with at least one micro-bank office	0.103	0.304

Table A2. Microloans and households' borrowing purpose by sectors

	Formal	Informal
Loans		
Borrowed amount (riel)	2,741,025.18	2,049,375.04
Outstanding loans (riel)	1,885,687.59	1,638,545.21
Monthly interest rate (%)	2.89	2.98
Duration (months)	8.61	8.87
Purpose (%)		
Agricultural activities	30.49	24.22
Nonagricultural activities	12.13	8.01
Household consumption	35.94	39.44
Illness, injury, accidence, and so forth	6.23	13.42
Other urgencies	0.0001	0.08
Rituals (marriage, funeral ceremony etc.)	1.79	3.14
Purchasing/building dwelling	5.63	7.03
Purchasing durable goods	2.79	1.73
Servicing and existing debts	4.30	2.04
Others	0.69	0.90

Notes: The amounts are in Cambodian currency (riel).
Source: Adopted from Seng (2018a).