The Impacts of Natural Disaster and Rural Finances on the Farmers: A Case Study of Cambodia and Inclusive Policy

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Abstract

This study aims to explore the impacts of micro-credits and natural disasters on the farmers' livelihoods in Cambodia, applying with the two datasets such as from ministry of planning, CSES, 2015, and ADB, 1993- 2019. This research is separated into two parts which are focused on 1- The impacts of microcredits and disasters on households' characteristics and livelihoods using the household survey of CSES, 2015 and 2- The effects of private domestic credits and agricultural sector on the GDP growth in Cambodia with using the macro level data of ADB data, 1993 to 2019. To respond to the research questions, some econometric tools such as Ordinary Least Squared (OLS)-LPM, Probit and logit model are used in order to find the impacts of the natural disaster and credit on the households in Cambodia as in section 1. Furthermore, panel Structural Equation Model(pSEM) is employed to investigate the impacts of private domestic credits on the GDP growth in Cambodia via indirect and direct on agriculture sector and renewable energy sector and other sectors.

The foremost finding shows that there is the highest natural disaster occurred around Tonle Sap while the households have had the highest demands of credits too. Most farmers have less knowledge on financial technology due their usages of telephone. In addition, farmers prefer to save their cash in hands about 96%, 2.92% saving in accounts and 0.03% using telephone for saving money. Interestingly, rural credits improved the land ownership and

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education in households in Cambodia. Furthermore, natural disasters force households to increase their credit's demands , especially to the non-farmers than farmers in rural areas. When looking at macro data level, domestic credit is not effective directly to the growth and agriculture sector but it has main tools to foster the financial access and the households' consumptions with their land titles.

Keywords: Micro-credit, Agriculture, Financial literacy and Financial technology

1. Introduction

This study examines the relationship between geographic diversification which is mainly said with natural disasters such as flood and storm and other credit impacts of microfinance on farmers in Cambodia. Whether financial institutions and banks might diversify their operations and products have yet to be answered clearly while some risks such as natural disasters occurred. There are many literatures on whether geographic diversification increases or decreases the risk such as natural risks and MFIs risk, but there is no updated view in the financial institutions. In Cambodia, a study of the ministry of agriculture, forestry and fisheries of Cambodia(2017) mentioned that it is around 40 percent of populations working in farms while agriculture accounted for about 22 percent of GDP.

In addition, traditional farms in Cambodia face many challenges and risks such as flood and drought, storm and other risks. The World Bank (2015) said that farmers who have less land than 1 hectare are mainly affected from these risks while some challenges with poor infrastructures, limited irrigations, technology and electricity access as well as natural disasters are the main issues for Cambodian farmers. Furthermore, the financial access is also a main issue for rural farmers too because farmers or poor usually do not have enough collaterals to finance while most MFIs and banks need more solid collaterals.

The National Committee for Disaster Management (NCDM, 2018) mentioned that there are many volunteers from disasters such as floods, fire, epidemic, lightning and Storm. Surprisingly, numbers of death are very high and if we take a look with direct and indirect effect from this disaster which is more than 15 million people due to table 1. This means that disaster occurred and impacted so much to households via livelihoods, income and their lives.

Table 1: disasters and its impacts to households in Cambodia since 1996 to 2020

Name	Deaths	Injured	Houses Destroyed	Houses Damaged	Directly affected	Indirectly Affected	Relocated	Evacuated
Drought					2,818,433	204,050		

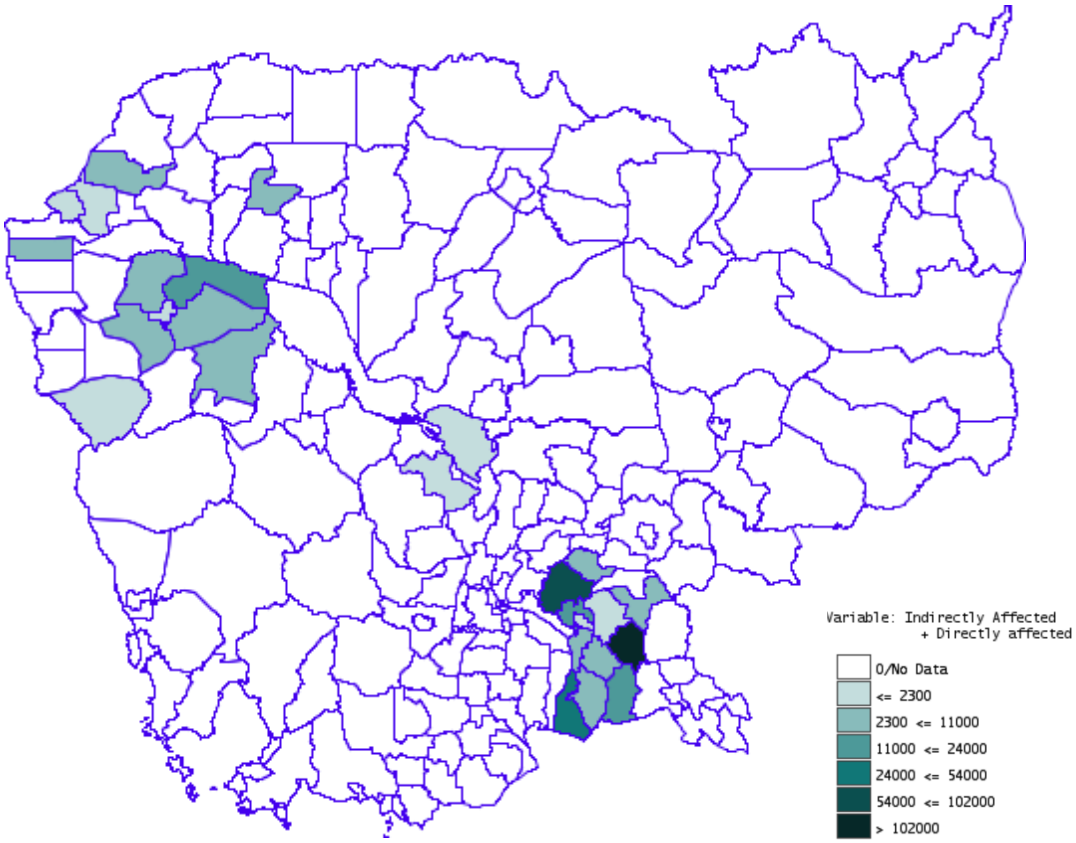
Epidemic	37				19			
Fire	137	123	4279	647	37,970	9		69
Flood	1,177	993	2,397	39,487	12,798,549	299,365	17,186	683,604
Lightning	1,038	544	38	177	2252	36		1
Pest Outbreak					2378			
River Bank Collapse	3	2	101	526	1222		292	46
Storm	115	543	12,241	28,646	113,417	1,716		3,111
TOTAL	**2,507**	**2,205**	**19,056**	**69,483**	**15,774,240**	**505,176**	**17,478**	**686,831**

Source: NCDM (2018)

In order to get more details about this disaster, figure 1 states clearly about geographies and proportions in each province which have been affected from disaster to households. Figure 1 presents well the direct and indirect impacts of disasters to each province. Through this graph shows that the effects of natural disasters on people are an unsimilarity of geographies in Cambodia. It reveals that some provinces such as Kampong Cham, Svay Rieng, Prey Veng, Takeo, Kandal, Battambong and Pursat province are more effective from disasters than other provinces in Cambodia. It can be said that households living in those areas affect more than others such as their incomes lost, lives, and other opportunities for growth. Due to the Samphantharak, K. and S. Chantarat (2015) mentioned that the poor in developing countries' changes in preference may have significant impacts on their safety net in life. These above cases might be more challenges for households to access the finance in their areas due to their income deficits affecting from these disasters. If we take a look in table 2 shows that most farmers experienced natural disasters taking more informal loan sources (0.49) than formal loan sources (0.300). This might be the reason that vulnerable farmers faced with natural disasters might find it difficult to access the finance because they are challenged with their incomes and other collaterals. In addition, yes means that farmers used to face natural disasters such as drought, flood and others in those provinces and No otherwise. In order to find the impacts of natural disasters and micro credit on farmers. This paper will handle to deepen more on above challenges by using some econometric tools to respond to these research questions. Furthermore, this paper can contribute to this growing literature by observing the consequences

of natural disasters in Cambodia and behaviors of farming households affected by disasters and micro credits in their areas.

Figure 1: Geography of indirect effect and direct effect of disaster in Cambodia



Source: NCDM

Table 2: Farmers experienced in drought, flood and other disasters in last 12 months

Drought, flood or others	Formal Loan Sources			Informal Loan Sources		
	Mean	Std. Dev.	Frequency	Mean	Std. Dev	Frequency
Yes	0.300	0.459	326	0.4938	0.500	326
No	0.234	0.423	2,824	0.3551	0.4786	2,824

Source: CSES, 2015

This study is organized into six sections. Following the introduction, section 2 presents the literature reviews. Section 3 describes the data and variables. Section 4 describes the econometric model. Section 5 presents and discusses the empirical findings, and Section 6 concludes.

2. Literature Reviews

2.1 Background of Microfinance Institutions

Microfinance initiatives have been mentioned widely across the world and Asia for almost a decade and this idea might be adopted in many developing countries in regions (Sophat, 2019). Microfinance Institutions are hybrid institutions with two issues, social and financial rationalities (Battilana and Dorado 2010). This relates to the financial services provision to the unbanked populations in the world. Goal of microfinance institutions is to always target the uncollateralized small loans to economically poor people, who have few collaterals for loans from any sources. MFIs are usually registered either as shareholders such as banks and non-bank financial institutions or as non-profit organizations (cooperatives and non-governmental organizations or NGOs) (Mersland 2009). Cooperatives (and so-called "credit unions," which are similar to cooperatives) are member-based organizations and are therefore funded by the members. That is, cooperatives are controlled by the members, who are at once the customers and the recipients of any profits generated from the operations of the organization. NGOs are organizations without legally recognized owners (Mersland 2009). They are mostly financed by international impact investors as well as benevolent donors like the World Bank, the Inter-American Development Bank, government agencies, and private individuals. Since NGOs do not have owners, they are exposed to diverse influences from many stakeholders.

Some cooperatives and NGOs generate the vast majority of MFIs (Misra and Lee 2007), though they normally serve fewer clients compared to shareholder-owned MFIs, which have easier access to the finances from depositors (Ledgerwood 1999, D'Espallier et al. 2017). Some institutions (NGOs & cooperatives) are mainly offering the financial products to

In Cambodia, poor living in rural areas have no capacity to escape from the poverty trap. The farmers who have a limit of resources or collaterals need to access the credits in order to invest in farming activities or small non-farming businesses. Especially farmers who used to face natural disasters and other challenges seem hard to access this finance due to their less income activities.

2.2 Risk Divergence of Microfinances

Many financial institutions are showing the altered types of risk, including credit, interest rate, market, currency, liquidity, operational, natural risks and country risks. In addition, credit risk is usually the most significant for microfinance institutions because their main products are the providing microcredit (Armendáriz and Morduch 2010). Saunders and Cornett (2011)

describe the micro credit risk as the "risk of cash flows from loans apprehended by financial institutions might not be fully paid in time schedule." Though, credit risk affects financial institutions failure (Fang and Lelyveld 2014). Moreover, the shorter repayment periods around 12 months from MFIs might be riskier than banks. Furthermore, in provinces, group loans or joint-liability groups[2] are also very popular for households or farmers who do not have the collateral to borrow money from financial institutions. A special case in this group said that if a member cannot pay the instalment on time, they must ask the other member in the group to reimburse that payment. Townsend et.al. 2003 mentioned that the joint liability system theoretically plays a major role of contingent repayments. This contingent instalment does not work during the covariate shocks such as natural disaster when members in a group face from that shock at the same duration (Khan and Kurosanki 2007).

Therefore, MFIs might actually diminish risk by geographic diversification. Specifically, Liang and Rhoades, 1988 stressed that diversification can limit MFIs' likelihood of insolvency by reducing credit and liquidity risk and as well as increasing the income of farmers while they faced post- natural disasters. The natural risk occurrence can be reckoned that it might affect farmers and poor but when loans are well dispersed among borrowers in different geographic locations. The farming-related crisis such as a drought might be limited to a specific geographic area, a factory closure might hit borrowers in a certain locale, a natural disaster might befall cities and villages in a limited region, and so on (Liang and Rhoades 1988).

3. Methodology

This study employs Cambodia panel data from Socio-Economic Survey or CSES, 2015 of the Ministry of Planning to examine the influences of natural disaster risk and rural credit of farmers in rural areas. According to Baltagi (2015), the use of panel data has several advantages over cross-sectional data. One advantage is that panel data helps to control for individual heterogeneity and provides more information, degrees of freedom, variability and efficiency with reducing the influence of multicollinearity. Furthermore, panel data helps account for unobserved effects that are not detectable in cross-sectional level.

By Wooldridge (2011), our empirical model is stated as follows:

$$Y_{it} = \beta_0 + \beta_1 x_{i1} + \ldots . + \beta_k X_{it} + u_i \qquad (1)$$

[2] A group loans for poor or farmers who do not have any solid collateral to access the loans. This group loan might have members from 2 to 10 people within loan period up to 36 months and loan size up to KHR 10 million or others per member. In this scene, the interest rate might be higher than 14% to 18% per year in Cambodia.

Where Y_{it} represents the dependent variables at time *t*., as discussed above. X_{it} is a vector of control variables, namely, household's characteristics variables, farm size, households' health condition, natural disaster risk like flood and storm, and electricity access and credit score. β_0 is the mean of unobserved heterogeneity, and β_1 to β_t are coefficient. u_{it} is the remaining error term that varies across both *t* and *i*. Based on the (1) equation, LPM –OLS equation will be added up in this regression too. So a semi-log form function is placed in this model as follows:

$$log(Y_{it}) = \beta_0 + \beta_1 x_{i1} + \ldots . + \beta_k X_{it} + u_i \quad (2)$$

In order to get more accuracy with the above model and robustness results, the probit model is used accordance with the OLS function with MLE regression. So Probit and Logit model are functioned as following:

$$Y_{it} = \beta_0 + \beta_1 x_{i1} + \ldots . + \beta_k X_{it} + C_t + u_{it} \quad (3)$$

Where Y_{it} is a dummy variable, taking the value of one and zero otherwise. Other variables are defined as the same as in equation (1) and C_i is the firm unobserved effect and u_i is the i.i.d term.

Hence, we can rewrite as following:

$$Y_{it} = \begin{cases} 0 \text{ if } Y^* \leq 0 \\ 1 \text{ if } Y^* > 0 \end{cases} \quad (4)$$

The possible values of error term can be transferred as

$$Y_{it} > 0$$

$$\beta' x_i + u_i > 0$$

$$u_i > -\beta' x_i$$

So $\Pr(Y_{it} > 0|x_i) = \Pr(Y_{it} > 1|x_i) = \Pr(u_i > -\beta' x_i)$ (5)

Hence, above function divides with **σ** as follow:

$$\Pr(Y_{it} > 0|x_i) = \Pr(Y_{it} > 1|x_i) = \Pr\left(\frac{u_i}{\sigma} > \frac{-\beta' x_i}{\sigma}\right)$$

$$= \Phi\left(\frac{-\beta' x_i}{\sigma}\right) \quad (6)$$

Similar function as probability function as Pr(Y=1)

$$\Pr(Y_{it} = 1|x_i) = 1 - \Phi\left(\frac{-\beta' x_i}{\sigma}\right) \quad (7)$$

Where x_i is the vector of all independent variables in this model. The Linear Probability Model(LPM), Probit and Logistic regression and other robustness check in this model are used in CSES (2015) with unbalanced panel. The standard Errors are adjusted for clustering at the village levels in all regression models.

4. Data and Variable Definitions

4.1 Data and Descriptive Statistics

There are two datasets used in this paper. First part is used the CSES data while the other part employs the ADB data source in order to regress in this section.

Our dataset is an unbalanced panel sample of 3,150 households from entire provinces in Cambodia. These datasets are called Cambodia Socio-Economic Survey 2015 (CSES, 2015) covering entire provinces in 2015 and ADB data, 1993 to 2019. The datasets are compiled based on a report of the Ministry of Planning of Cambodia. The CSES data is separated data and matched by villages only. This CSES dataset is separated into 10 sets such as demographic characteristics, housing, agricultures, education, labour forces, health, victimization, households' income and liability, household consumptions and vulnerability. It describes so many details about households in Cambodia and their characteristics. But some missing datasets also occurred in this data about microfinance information. But there is no perfect dataset to precisely signify the microfinance sector (Strøm, D'Espallier, and Mersland 2014, Hartarska, Shen, and Mersland 2013). However, I strongly have faith that our dataset is mostly well-matched to this study. Table 3 mentions about the descriptive variables which will be regressed in this model. This descriptive data cites well about the household's characteristics, natural disaster (flood and storm), households' educations, good health, farm size, poverty line, poor and total incomes of household in 2015. Natural disasters such as storm and flood states about the households experienced in storm and flood in the past 12 months.

Table 3: Variables and Descriptive Statistic

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	3,150	43.67048	15.03313	18	97
Gender	3,150	0.374603	0.484097	0	1
Marital Status	3,150	0.749841	0.433173	0	1
Farmers	3,150	0.5374603	0.4986739	0	1
Total Household members	3,150	3.202222	1.522582	1	12
Total Household migrants	3,150	4.943175	2.02013	1	19
Illiteracy Households	3,150	3.202222	1.522582	1	12
Primary School	3,150	0.168571	0.374432	0	1

Secondary School	3,150	0.473651	0.499385	0	1
High School	3,150	0.294603	0.455937	0	1
Technical School	3,150	0.022857	0.149472	0	1
Farm Size(m^2)	3,150	0.038413	0.192221	0	3,000,000
Good Health	3,150	0.342222	0.474529	0	1
Experienced Illness	3,150	0.187619	0.39047	0	1
Natural Disaster: Floods or Storms	3,150	0.015556	0.123768	0	1
Electricity Access	3,150	0.834286	0.371883	0	1
Total loans	3,150	3408028	1.62E+07	0	600,000,000
Total Monthly Income	3,150	1078300	8323398	0	410,000,000
House Ownership	3,150	0.746666	0.4349892	0	1
Livestock	3,150	0.7628571	1.128157	0	6
Value of Savings	3,150	58161.9	954731	0	38,000,000
Poverty line	3,150	0.7025397	0.4572133	0	1

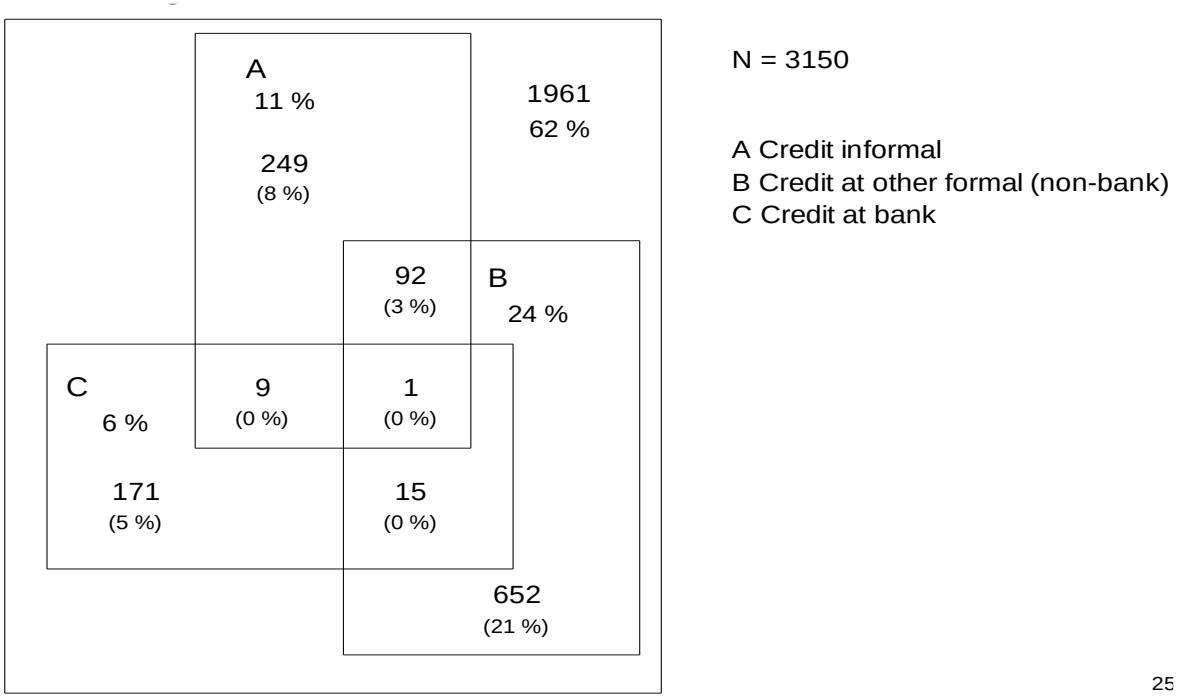
Source: CSES, 2015

Poverty line variable is dummy variables which was generated from World Bank estimation[3] sample and CSES data is based on the Cambodia Socio-Economic Survey, 2009. All the variables with zero have been cleaned and added up 1 before putting the logarithm. The logarithm is used with some variables such as farm size, total loans and monthly income variables in the regression. Figure 2 states clearly on the loan sources of farmers in Cambodia. The total samples are 3150 observations which are mentioned A for informal credit, B for other formal credits but it is not bank, and C for credits at banks.

The above Venn diagram shows that there are 1,961 households about 62% of total household surveys who are farmers. In this parity, 11% of total households are using the informal credits and 24% of households employs the other formal loan or non-bank. Whereas, 6% uses the loan from the banks. In addition, only 3% of households have used both loan sources from informal and other formal loan sources.

[3] See more details http://www.dataforall.org/dashboard/ophi/index.php/

Figure 2: Cambodian Farmers' loans access and its sources in 2015



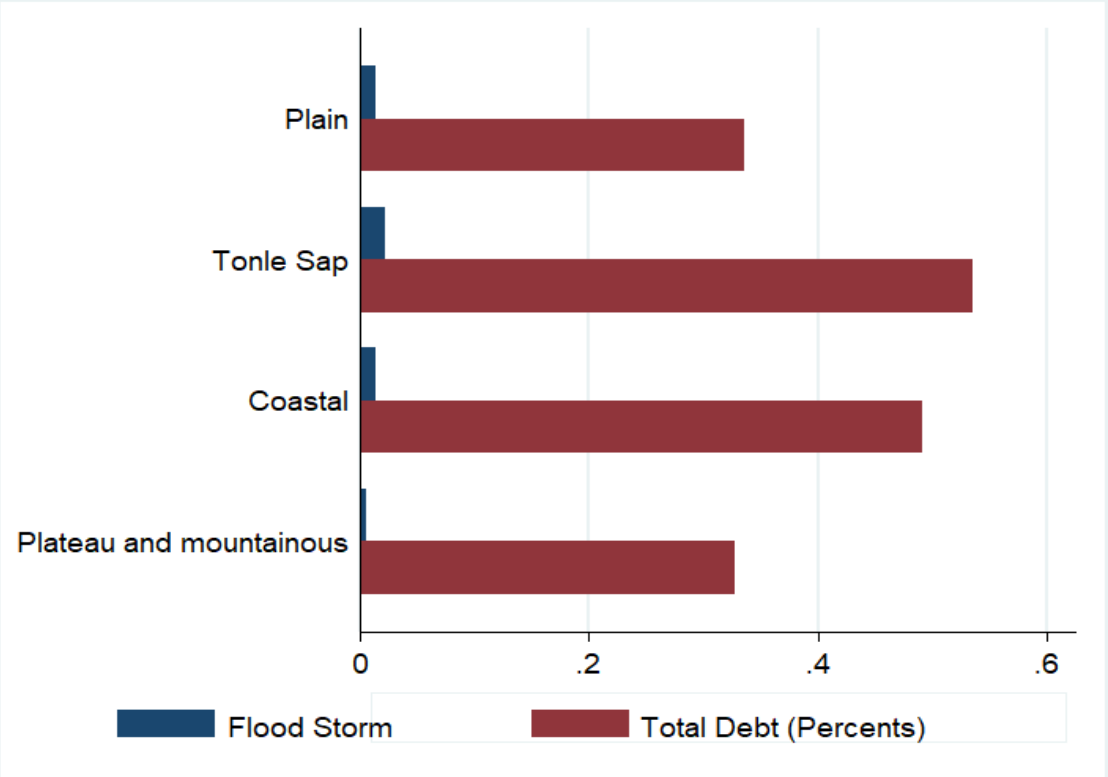
Source: Author's calculation from CSES, 2015

Other formal loan sources state that 21% or 652 households can access only formal loan sources or non-bank sources. There are 15 households using the other formal loan source and banks in Cambodia.

Interestingly, only 1 household employs the loan from all sources as formal and informal loan sources. As this above mentioned that more households use informal loan sources and it determines that rural farmers still use more informal loan sources from any sources such as loans from friends, relatives, landlords, neighbours, money lenders, traders, employers and others. This diagram totally shows that informal loan sources in rural areas of Cambodia is still significant for farmers in Cambodia by 11% due to this figure. This might show that higher interest rates are usually charged from the rural farmers in Cambodia. This informal loan source can be the more pressures or challenges to rural farmers while getting less income from farming activities. This is one of the challenges or risks usually occurring on the rural farmers, whereas, natural disasters are also a huge problem too in their farming activities in 2015. Figure 3

determines well about the natural disasters (flood and storm) by geographies and loan access of farmers. In this graph states well about the natural disasters areas and total debts in Cambodia. This shows that the households living along the Tonle Sap river are having higher debts and facing more natural disasters like floods and storms in Cambodia if compared to other areas. This is the same result of Johnstone, G. et al. (2019) said the 40%-50% of households along the Tonle Sap river are in debt. Mostly they used the loan for buying the agricultural inputs and fishing gears.

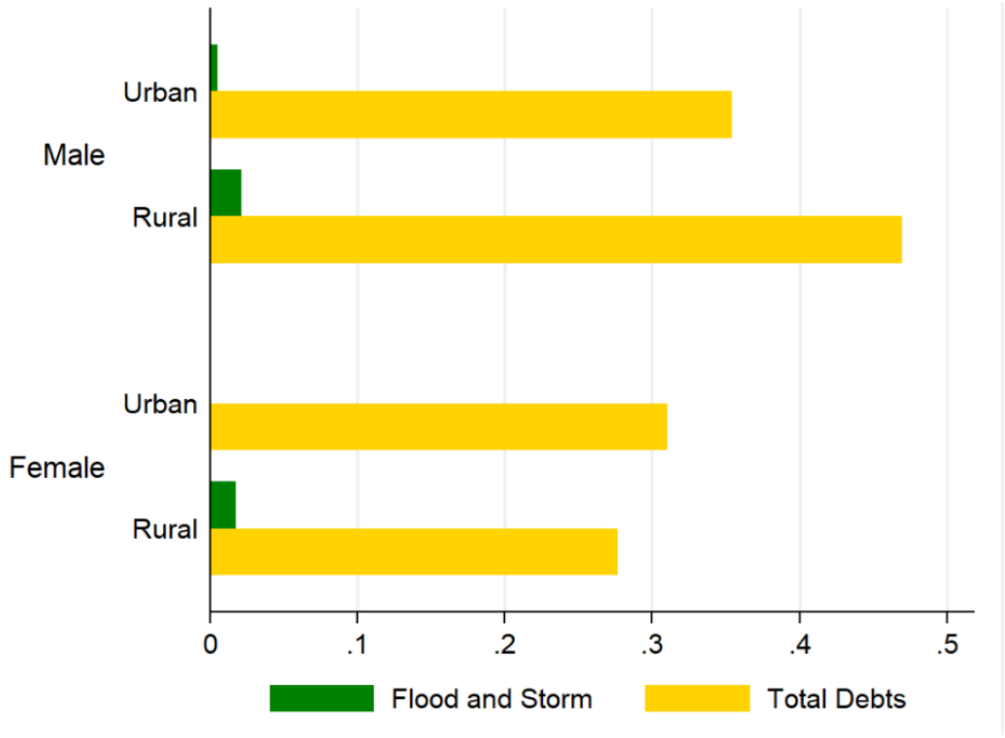
Figure 3: Natural Disasters area and Total Debts in percent



Source: CSES, 2015.

In addition, those households still borrow money from informal sources which are nearby their locations such as from friends, neighbours, relatives and others. With these informal loan sources, mostly collaterals are not needed to back up this loan at all but it has very high interest. The natural disasters such as floods and storms in these areas are also higher among other areas. Rationally there are many floods and storms in the Tonle Sap area while the demand for loans in this area is higher than others too. This might be said that households need more money to invest in agricultural inputs while they can access more water to plant and more irrigations in that places than other areas. If we take a look more at the loan, natural disasters and areas by genders. Figure 4 claimed in detail about the challenges below.

Figure 4: Natural disasters area and genders with loan in percent



Source: CSES, 2015

Figure 4 proclaims that male farmers as a household's head need more debts than females in rural areas than urban areas in Cambodia. In addition, floods and storms seem to have the same occurrences with both genders in rural areas. In contrast, male in urban areas seem to face storms and flood more than females in urban Cambodia. Due to the table 2 shows that most farmers like saving the money in hands about 96% more than others. About 2.92% of farmers choose to save the money in bank accounts and less than 1% with use of a phone to save money and others.

Table 4: Type of Farmer's Saving and technology

Types of Savings	*Farmers*		
	Frequency	Percent	Cumulative
Cash in Hand	132	96.35	96.35
Into a bank account	4	2.92	99.27
Use of phone to Save Money	1	0.03	0.03
In Kinds	1	0.70	100
Total	**138**	**100**	**295.65**

Source: Author's calculation from CSES, 2015

This shows clearly that most farmers in Cambodia might have less financial education and knowledge to use their efficient money for family. Interestingly, farmers might not trust the banks or MFIs to save due to the historical occurrences. Less farmers can use the phone to save money, this reveals that farmers have less education on financial technology and phone. This can be said that financial technology strategy might not affect much on the farmers in rural areas in Cambodia. In order to know more details on farmer's status, especially on income or poverty status. Table 5 mentions the percent of poverty line for farmers and nonfarmers in Cambodia. This table compares the farmer and nonfarmer with the poverty line in 2015.

Table 5: Poverty line[4] for farmers and Nonfarmers in Cambodia

Poverty line using $1.90/day	**Farmers**			**NonFarmers**		
	Frequency	*Percent*	*Cumulative*	*Frequency*	*Percent*	*Cumulative*
Below poverty line ($1.90 per day)	483	**28.53**	28.53	454	**31.16**	31.16
Above poverty line	1,210	71.47	100	1,003	68.84	100
Total	**1,693**	**100**		**1,457**	**100**	

Source: Author's calculation based on CSES, 2015

It absolutely determines that around 29% of farmers have generated income below the poverty line or income less than $1.90 per day while there are 71% of farmers having more incomes than $1.90 per day. We can say that Cambodian farmers face many challenges in generating their income such as high costs of agricultural inputs, less irrigations and other disasters. Furthermore, issue is farmer capacity to farm and type of rice demand in market. Surprisingly, if compared to nonfarmers with poverty line, it shows that 31% of nonfarmers have less income than $1.90 per day. Whereas, 69% of nonfarmers are getting more income than $1.90 per day.

If we compare both figures, we can say that nonfarmers and farmers seem similar in terms of poverty line based on the world bank calculation. To know more clearly about the farmers and nonfarmers status in their households. Some econometric methods[5] are measured well such as the Linear Probability Model(LPM) , Logistic Model and Probit Regression Model. Based on its results, the Probit regression model is superior to the LPM and Logistic Regression in terms

[4] Poverty line set by World Bank in 2015.

See more details: https://www.worldbank.org/en/topic/poverty/overview

[5] Linear Probability Model (LPM) and Logistic results from this regression for robustness check are in appendix

of results comparisons. Therefore, we choose the Probit model estimator with the supporting results of specification tests such as the R-square, Pseudolikelihood, AIC, the weighted sum of squared errors (WSSE) and Chen and Tsurumi (2010), Chambers and Cox (1967).

5. Empirical Results

5.1 Statistics and Regression Results

Table 6 presents the statistics of the result from regression on natural disasters and loans impacted on the land ownership, income status and food consumption of farmers and non-farmers in Cambodia. The results of Probit regression show that natural disasters have negative correlation with land ownership of farmers. This means that whenever the flood and storms occur it might reduce the land ownership of farmers in rural areas. This can show the real practices in Cambodia when the flood and storm happened to their agricultural lands and non-agricultural lands. As the experience occurred in 2011, there were 97 people killed by floods. Around 90,300 families in 15 flood-hit provinces had been affected, and 170,000 hectares of rice fields were flooded and more than 300 schools were closed down due to the National Committee for Disaster Management (NCDM, 2011).

Table 6: Probit Model with robustness (Land Ownership, Income and Food Consumptions)

Variables	Land Ownership		Income Status		Food Consumptions	
	Farmer	NonFarmer	Farmer	NonFarmer	Farmer	NonFarmer
Total Outstanding Loans	0.0151*	-0.000959	0.00953	0.00981	0.00805	0.0103
	(2.11)	(-0.14)	(1.20)	(1.48)	(0.90)	(1.01)
Floods and Storms=1	-0.526	-0.919	0.380	-2.473*	-2.493*	-20.09***
	(-0.88)	(-1.56)	(0.44)	(-2.53)	(-2.04)	(-18.36)
Age	0.0244***	0.00760*	-0.00749	-0.00438	-0.0117*	-0.0132**
	(6.46)	(2.24)	(-1.78)	(-1.29)	(-2.35)	(-2.74)
Gender	-0.185	-0.235*	0.424***	0.321**	-1.182***	-1.130***
	(-1.75)	(-2.19)	(3.43)	(3.07)	(-9.07)	(-8.06)
Marital Status	0.220	0.473***	0.325*	0.0293	0.359*	0.402**
	(1.85)	(4.28)	(2.57)	(0.28)	(2.24)	(2.71)
Total Member Migrants	-0.0328	-0.0151	-0.00484	-0.0484*	-0.0797**	-0.00779
	(-1.41)	(-0.64)	(-0.19)	(-2.16)	(-2.70)	(-0.27)
Illiteracy	-3.702***	-0.100	-3.481***	-5.119***	-4.612***	-4.492***
	(-8.54)	(-0.14)	(-7.16)	(-10.27)	(-7.17)	(-8.46)
Primary School	-3.082***	0.137	-3.417***	-4.777***	-4.536***	-4.217***
	(-7.04)	(0.20)	(-7.18)	(-9.85)	(-7.00)	(-7.76)
Secondary School	-3.002***	0.408	-3.773***	-4.962***	-4.786***	-4.155***
	(-6.71)	(0.58)	(-7.79)	(-10.09)	(-7.12)	(-7.72)
High School	-3.046***	1.026	-3.584***	-4.800***	-4.154***	-4.400***
	(-5.26)	(1.42)	(-6.35)	(-8.85)	(-5.82)	(-7.89)
Technical School	-3.061***	0.335	-3.625***	-4.942***	-4.403***	-4.403***
	(-6.00)	(0.46)	(-6.12)	(-9.53)	(-5.42)	(-7.02)
Good Health=1	0.310*	0.273**	-0.0428	0.173	0.162	-0.227
	(2.46)	(2.74)	(-0.33)	(1.76)	(1.04)	(-1.62)

Experienced Illness=1	0.147 (1.21)	0.107 (0.86)	0.266 (1.86)	-0.0141 (-0.10)	0.705*** (4.13)	0.130 (0.67)
Electricity Access =1	0.0639 (0.41)	0.464 (1.74)	0.107 (0.56)	-0.0891 (-0.37)	-0.189 (-0.91)	0.00170 (0.001)
Food Consumptions	0.154 (1.89)	-0.0470 (-0.67)	0.251** (3.28)	0.204** (3.25)	-	-
Land Ownership	-	-	0.235 (1.53)	0.115 (0.85)	0.143 (0.69)	-0.135 (-0.80)
Livestock Ownership	-0.0736 (-1.73)	0	0.0213 (0.43)	0	0.0278 (0.50)	0
Floods and Storms x Villages	-0.00289 (-0.84)	0.00180 (0.59)	0.164** (2.87)	0.0859** (2.70)	0.0102 (1.75)	0.168*** (14.53)
Constants	2.386*** (3.73)	-2.371* (-2.51)	3.876*** (4.83)	6.177*** (7.52)	-24.37 (-1.13)	18.46 (1.59)
District Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1102	1272	916	1114	736	626
Pseudo R2	0.1873	0.1631	0.1829	0.1732	0.2518	0.2439
t statistics in parentheses						
* p<0.05, ** p<0.01, *** p<0.001						

Source: Author ‘s calculation based on the CSES, 2015

Considering these non-farmers with land ownership, the result shows that floods and storms are not significant and have a negative correlation to land ownership. But this negative number seems bigger than the farmer side. So we might say that whenever the flood and storm occurred it might affect more nonfarmers than farmers. It might be about adapting to the natural disaster from both farmers and nonfarmers in rural areas. Looking at income status, if compare farmer and nonfarmer, it shows that nonfarmers have affected more than farmers in terms of income generating activities. Whereas, the loan is not significant correlation but positive trend to farmers (coef=0.0095) and nonfarmers (coef=0.0098). This means that rural credits might have less impact on the farmer than nonfarmers in terms of utilization and income generation activities.

In terms of the food consumption of households, floods and storms have strongly and negatively correlated with food consumptions to both farmers and nonfarmers. Actually, floods and storms from nonfarmers (coef=-20.09) seems to have a higher correlation to food consumption than farmers(coef=-2.49). This result shows the same as above mentioned too. Among the variables, only storms and floods have highest and insignificant correlation with food consumption to the nonfarmers. In order to know more details on the farmers’ characteristics, education levels might be the best observations to see more. As table 7 mentions clearly that if we compare all levels of education of farmers determine that loan has positively correlated and significantly on primary school. This means that total loan in rural areas fostered the education at primary levels while it has a negative correlation with illiteracy, secondary and high school. In addition, loan has negatively and significantly correlated to technical training level. This rural loan makes the farmers decrease their education in technical levels. In this real

practice, farmers borrowed money to utilize other things such as agricultural inputs and other income generating activities.

Table 7: Probit Model with VCE cluster: Effect of loans and disasters on farmers' educations

Variables	Farmers				
	Illiteracy	*Primary School*	*Secondary School*	*High School*	*Technical School*
Total Outstanding Loans	-0.00014 (-0.02)	0.0109* (2.17)	-0.00381 (-0.66)	-0.0178 (-1.04)	-0.0372* (-1.98)
Floods and Storms=1	-0.256 (-0.33)	-0.262 (-0.60)	0.967* (2.22)	-63.73 (-0.57)	-1871.9*** (-9.94)
Age	0.0390*** (12.16)	0.0104*** (4.34)	-0.0399*** (-13.31)	-0.0251** (-2.88)	-0.0390*** (-5.06)
Gender	-0.652*** (-6.36)	-0.0653 (-0.90)	0.443*** (5.38)	0.150 (0.59)	1.343*** (5.70)
Marital Status	-0.229* (-2.16)	0.389*** (4.53)	-0.0219 (-0.22)	0.133 (0.42)	-1.136*** (-5.30)
Total Member Migrants	0.0174 (0.80)	-0.000700 (-0.04)	-0.000720 (-0.04)	-0.0367 (-0.53)	0.0367 (0.75)
Households' Incomes	-0.00436 (-0.37)	0.0112 (1.21)	-0.0111 (-1.04)	0.0302 (1.04)	0.0171 (0.50)
Good Health=1	0.0322 (0.29)	-0.135 (-1.57)	0.221* (2.28)	-0.145 (-0.49)	0.406 (1.43)
Experienced Illness=1	0.190 (1.75)	-0.0606 (-0.71)	-0.0246 (-0.25)	0.0651 (0.21)	-0.533 (-1.78)
Electricity Access =1	-0.456*** (-3.50)	0.152 (1.39)	0.220 (1.58)	0.200 (0.41)	0.477 (0.96)
Food Consumptions	-0.256 (-0.33)	-0.00385 (-0.07)	-0.0490 (-0.75)	0.359 (1.21)	0.402 (1.85)
Land Ownership	-0.609*** (-4.93)	0.263* 2.51)	0.195 (1.59)	0.0830 (0.23)	0.116 (0.38)
Livestock Ownership	0.00874 (0.22)	0.00629 (0.20)	-0.0125 (-0.34)	-0.0666 (-0.69)	-0.160 (-1.41)
Floods and Storms x Villages	-0.0000704 (-0.02)	0.00277 (1.09)	-0.00772** (-2.61)	-0.252* (-2.12)	7.926*** (9.96)
Constants	-1.280* (-2.45)	-1.376** (-3.16)	0.0934 (0.18)	-1.373 (-1.09)	-2.320 (-1.93)
District Fixed Effect	Yes	Yes	Yes	Yes	Yes
No. of Observations	1412	1662	1577	285	337
Pseudo R2	0.2110	0.1100	0.1100	0.1723	0.3955
t statistics in parentheses					
* p<0.05, ** p<0.01, *** p<0.001					

Source: Author 's calculation based on the CSES, 2015.

This can be said that rural finance or loan helps the farmers to improve the educations via direct and indirect mechanisms like their own educations and their households' members

such as children in family in Cambodia. Other hand, we can say that higher education of farmers might need lesser loans than others. The other things are natural disasters such as floods and storms in rural areas show that farmers have most impacted negatively on their education with technical levels if compared to other levels. Total debts and poverty with farmers and nonfarmers in this table 8 are revealed well in this below section.

Table 8: The Impact of Loan and Natural Disasters on farmers and nonfarmers' poverty

Variables	*Total Debts*		*Poverty*	
	Farmer	**NonFarmers**	**Farmer**	**NonFarmers**
Flood and Storm =1	0.832 (-1.76)	1.673** (-2.83)	0.35 (-0.68)	-0.976 (-1.32)
Total Debts	N/a	N/a	0.0795 (-0.99)	0.125 (-1.4)
Age	-0.00267 (-0.97)	-0.0113*** (-3.99)	-0.00457 (-1.61)	-0.0111*** (-3.76)
Gender	-0.0962 (-1.20)	-0.048 (-0.55)	0.399*** (-4.79)	0.232* (-2.53)
Marital Status	0.574*** (-6.04)	0.331*** (-3.72)	0.286** (-3.14)	0.0358 (-0.39)
Illiteracy	4.722*** (-10.76)	-0.187 (-0.20)	-0.351 (-0.43)	0.000309 (0.001)
Primary School	4.837*** (-11.24)	-0.132 (-0.14)	-0.122 (-0.15)	0.227 (-0.33)
Secondary School	4.677*** (-10.71)	-0.336 (-0.35)	0.0994 (-0.12)	0.308 (-0.44)
High School	4.374*** (-8.86)	-0.675 (-0.70)	0.534 (-0.61)	0.433 (-0.59)
Technical School	4.353*** (-8.41)	-0.79 (-0.82)	0.39 (-0.45)	0.342 (-0.48)
Total Migrants	0.0171 (-0.89)	0.0450* (-2.35)	0.0129 (-0.67)	-0.0283 (-1.43)
Land Ownership	0.269* (-2.42)	-0.0758 (-0.69)	0.128 (-1.11)	0.181 (-1.5)
Households' Incomes	0.0102 (-1.04)	0.0113 (-1.46)	N/a	N/a
Food Consumptions	0.0645 (-1.09)	0.0951 -1.44	0.244*** (-4.02)	0.210*** (-3.43)
Livestock Ownership	0.0471 (-1.45)	0	0.00326 (-0.1)	0
Good Health	0.0385 (-0.42)	0.202* (-2.38)	0.112 (-1.15)	0.15 (-1.73)
Experienced Illness=1	0.349*** (-3.9)	0.164 (-1.5)	-0.201* (-2.21)	-0.0251 (-0.22)
Electricity Access =1	-0.249* (-2.07)	0.12 (-0.65)	0.233* (-2.02)	0.337 (-1.84)
Floods and Storms x Villages	0.0142 (-0.31)	-0.0114 (-2.02)	0.0927* (-2.04)	0.0528 (-1.81)
District Fixed Effect	Yes	Yes	Yes	Yes
Constant	-5.269*** (-8.16)	-0.147 (-0.14)	-0.146 (-0.15)	0.548 (-0.61)
No. of Observations	1553	1372	1552	1333

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Source: Author 's calculation based on the CSES, 2015.

These poverty and total debts are also determined well in table 8, it shows that flood and storm in Cambodia has positively and significantly correlated with farmers 'debts. This means that whenever the farmers faced floods and storms, farmers might need more loans to farm again. So we can say that the more floods, the more loans demanded by farmers to re-invest in their farms. Furthermore, this result claims that more floods and storms force farmers to increase poverty more than nonfarmers in Cambodia. But most farmers have been impacted by the natural disasters such as floods and storms lesser than nonfarmers in terms of food consumptions and asset ownership.

In coherence, to broaden details of macro levels in agriculture and domestic credits to the private sector and growth, we shall use the macroeconomic data from ADB from 1993-2019 as in 5.2 with panel structural equation (pSEM) model from Application STATA (version 14.0). Direct and indirect effects of agricultures and loan to dollarized economy growth in Cambodia.

In order to know more about the structural power of each component to growth and its competitiveness to growth in Cambodia.

5.2 pSEM Result: The Role of Agriculture Sector and Loans to Economic Growth.

This section is figured out about the role of agriculture and loan on the growth in Cambodia. Hence, to broaden more details on these above challenges, direct and indirect effect from pSEM model. Some variables such as GDP growth, agriculture, fertilized usage, domestic credits, renewable energy consumption, Agricultural Lands and agricultural employment. Table 8 mentions well about the direct and indirect effect of above variables to growth since 1993 to 2019. First, the largest impact on the GDP growth in Cambodia being an agricultural sector if compared to other variables. Hence, it reveals that the agricultural sector has positively and significantly impacted on the GDP growth (Coef=0.64) at 10% levels but it has small limited impact. This means that the agriculture sector has very vital to push up the growth in Cambodia from 1993 to 2019 while people around 85% (World Bank 2008a) are farmers.

If we see the above result, we can say that even the agricultural sector is very important but the distribution of this sector has still low due to the farmer productions and their traditional agricultural activities in Cambodia. Most farmers face many challenges such as lack of source of fund, capacity, costs, natural disasters and others. If we take a look at the funds of farmers to plant, domestic credit from any financial sources is very important to broad up to discuss. Due to this result shows that domestic credit has positively correlated but insignificant impacts on the agriculture sector. This can be said that farmers or the agriculture sector in Cambodia

might not refer much to funds. It might be from other sectors such as the capacity of farmers to farm and other relations.

Looking at the panel Structural Equation Model(pSEM) result determines that fertilizer usages of farmers in the agriculture sector is very important to positive growth directly (Coef=0.37). This mentions that the more farmers have used the fertilizer in their land, it might push up the agricultural outcome by 37%. More interestingly, agricultural land variable is positively and significantly impacted on the fertilizer usages in Cambodia. This shows that whenever the farmers have more land in the agriculture sector, it might push up the fertilizer usages to 15% and this land agriculture could positively surge the agricultural employment by 6.1% due to this data.

Moreover, whenever the farmer has more agricultural lands which seems to positively correlate with domestic credit usage(Coef=0.69). Thus we can say that most financial sources need more collateral from farmers, especially their land title in order to release the loans to them. This reason applies well with the real situations in Cambodia now about finance sources in rural areas. This finding has the same findings of many researches such Sophat, Phon (2019)[6] and Shaaban et al.2016[7]. Surprisingly agricultural land is significantly and negatively correlated to the agriculture sector (Coef=- 0.13). This can say that one unit increases in agricultural land making the decline of total agriculture about 0.13%. This means that the agriculture sector in Cambodia is not referred to the agricultural land but it is on the farmer ‘s capacity to plant like the complementary and modern technical tools to farm such as tractor and other fertilizers and other technical support for their farms. Furthermore, land has negatively correlated with GDP growth (Coef=-0.022).

This can be said that the GDP growth is not based on the lands but it might be on the high-quality personnel and capital and other industries. This result is a similar finding of Wanfu et al. 2018[8] about the land and growth in China.

More interestingly, agricultural land has increased agricultural employment by 6.1% due to this diagram. Whereas, domestic credit has negatively and insignificantly correlated on agricultural employments. Other findings, agricultural employment have negatively and

[6] See more http://www.th-rsai.org/prsco-2019/

[7] See more https://www.researchgate.net/publication/309714596_Tenure_Security_Land_Titles_and_Access_to_Formal_Finance_in_Upgraded_Informal_Settlements_The_Case_of_Dar_es_Salaam_Tanzania

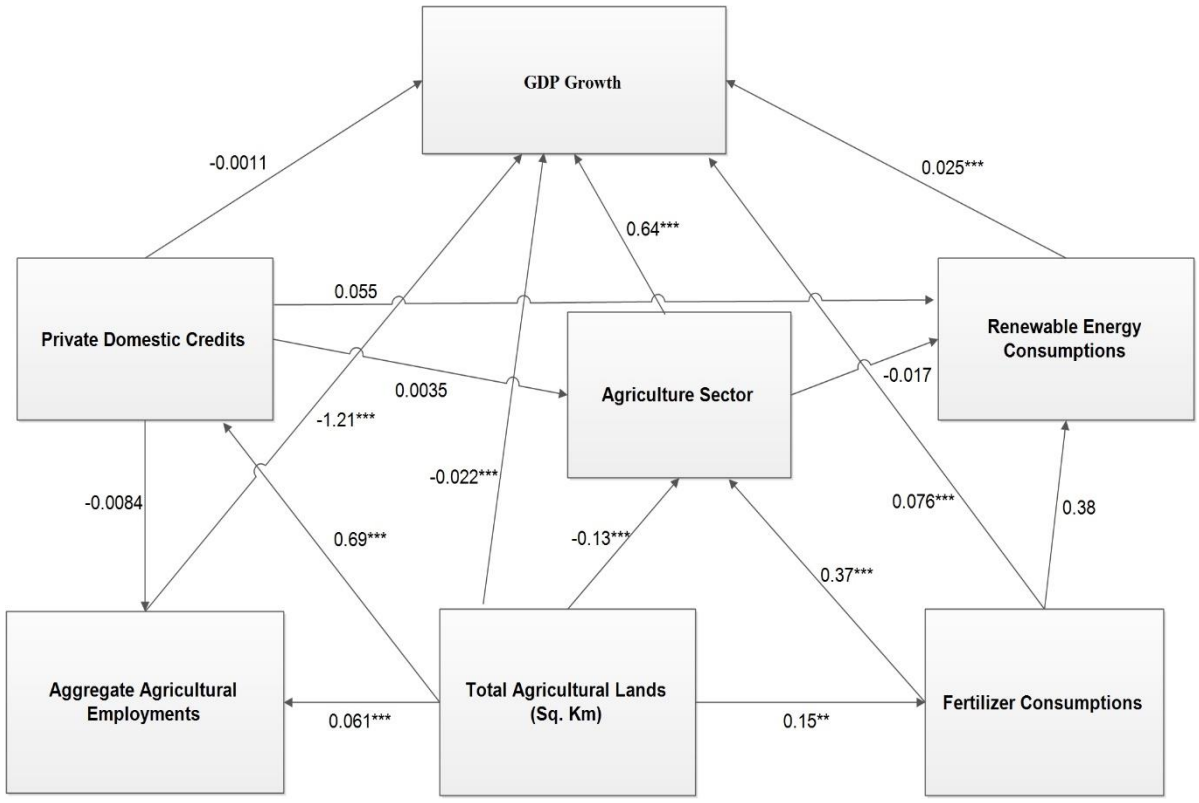
[8] See more https://www.mdpi.com/2071-1050/10/8/2847

significantly impacted on growth (Coef= -1.21). Due to Cambodia is the agricultural country, if the labour force in agriculture declines one unit and it forces to decrease the growth by 1.21 units. This presents that agricultural labour is very important in Cambodia's economy to growth. The lack of agriculture labour in Cambodia forces to extremely decline the growth. This finding has similar results of Pavol et al. 2012[9] about The impact of employment in agriculture on overall employment and development: a case study of the district of Topol'čany, Slovakia.

Surprisingly, domestic credit has negatively impacted on GDP growth and insignificantly correlated. This broadens that credit does not directly foster the growth but it is significant tools to push up the growth via household livelihoods and their daily consumptions. Furthermore, renewable energy generation has statistically significant and positively correlated with growth. It can be said that renewable energy generation can foster growth by 2.5% in Cambodia. Some energies from solar, hydro power, wind power, biomass, geothermal energy are very useful for households' consumptions which might reduce costs and improve energy security, lower the cost of power, and reduce carbon emissions to all stakeholders such as governments, households and others. Due to the ADB defines that domestic credit is given by the financial sector includes all credit to various sectors. This finding shows that domestic credit has positively impacted on the renewable energy generation but it is insignificant(Coef=0.055). This reveals that financial institution has limited the credits to renewable energy generation in Cambodia. Or we can say other meaning that less financial institution has the diversified loan products on renewable energy generation in Cambodia. This really applied to the real situation in Cambodia due to our current observation.

[9] See more https://www.jstor.org/stable/43293489

Table 9: The Effects of domestic credit and Agriculture sector on the GDP growth in Cambodia



Note: * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% .
Source: Author's calculation by ADB, 1993- 2019 from pSEM model

5.3 Conclusion

By using above two datasets, Probit and pSEM model in this paper are separated into two parts such as 1-the impacts of rural credits on farmers' livelihoods, 2- the effects of significant variables (agricultural sector, credits and renewable energy) on GDP growth in Cambodia. Natural disasters are very concerned by farmers and it strongly affects livelihoods such as income, land ownership and expenditures of households. Furthermore, most farmers have less knowledge on financial technology. The more farmers save the money in cash in hands, 3% saving in accounts and 0.03% using telephone for saving money. About 71% of farmers have higher incomes than US$1.90 per day and the other 29%, consisting of lower incomes than US$1.90 per day in Cambodia.

Notably, rural finances have positively increased the farmers' status in terms of the educations such as children education, income generating, land ownership and consumptions in rural areas in Cambodia. This seems well-practiced of farmers who use the loan to improve their children's education. The demands of loan for nonfarmers seem higher than farmers whenever they experienced the natural disasters in their areas.

In the pSEM model, it shows that domestic credit has positive correlation and indirectly impacted on the GDP growth. The agriculture sector is very vital for farmers to access the credit by securing this credit with the land title. Agricultural sector has the highest positively and significantly correlated GDP growth, where renewable energy has positively and significantly correlated to growth too. This means that the agricultural sector is a tremendously important pillar in the direct economic growth. The agricultural labor has negatively and significantly correlated to growth. This sign reveals that the agriculture sector in Cambodia is very lacking in laborers to grow the agricultural sector in the near future.

Due to these findings, the government should generate more policies to promote more agricultural labor in rural areas in order to foster the growth through the agricultural sector. Some renewable energy policies should be encouraged well in order to reduce any costs and risks of households. The fertilizer usage is a very good tool for agriculture activities but it lasts only short term. Building more farmers 'capacity and diversified products are very important to grow for farmers such as financial literacy and technology. These challenges might enhance the government to rethink robust policies such as strengthening the social welfare funds to assist the farmers to avoid them from the poverty trap.

References

Armendariz, B., & Morduch, J. (2010). *The economics of microfinance*: MIT press.

Baltagi, B. H. (2015). *The Oxford handbook of panel data*: Oxford Handbooks.

Battilana, J., & Dorado, S. (2010). Building sustainable hybrid organizations: The case of commercial microfinance organizations. *Academy of management Journal, 53*(6), 1419-1440.

Chambers, E. A., & Cox, D. R. (1967). Discrimination between alternative binary response models. *Biometrika, 54*(3-4), 573-578.

Chen, G., & Tsurumi, H. (2010). Probit and logit model selection. *Communications in Statistics—Theory and Methods, 40*(1), 159-175.

D'Espallier, B., Goedecke, J., Hudon, M., & Mersland, R. (2017). From NGOs to banks: Does institutional transformation alter the business model of microfinance institutions? *World Development, 89*, 19-33.

Fang, Y., & van Lelyveld, I. (2014). Geographic diversification in banking. *Journal of Financial Stability, 15*, 172-181.

Gerard, K., & Johnston, M. (2019). Explaining microfinance's resilience: the case of microfinance in Australia. *Globalizations, 16*(6), 876-893.

Giné, X., & Townsend, R. (2003). *Evaluation of financial liberalization: a general equilibrium model with constrained occupation choice*: The World Bank.

Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Kane, T., Narloch, U., . . . Vogt-Schilb, A. (2015). *Shock waves: managing the impacts of climate change on poverty*: The World Bank.

Huber, C. (2014). Introduction to Structural Equation Modeling Using Stata.

Khan, H. U., & Kurosaki, T. (2007). Vulnerability of microfinance to natural disasters: Evidence from the 2005 Pakistan Earthquake. *Unpublished paper: www. ier. hit-u. ac. jp/~ kurosaki/mf_eq0. pdf*.

Liang, N., & Rhoades, S. A. (1988). Geographic diversification and risk in banking. *Journal of Economics and Business, 40*(4), 271-284.

Mersland, R., & Strøm, R. Ø. (2009). Performance and governance in microfinance institutions. *Journal of Banking & Finance, 33*(4), 662-669.

Samphantharak, K., & Chantarat, S. (2015). The effects of natural disasters on households' preferences and behaviours: Evidence from Thai farmers during and after the 2011 mega flood. *Disaster Risks, Social Preferences, and Policy Effects: Field Experiments in Selected ASEAN and East Asian Coutries*, 57-84.

Saunders, A., & Cornett, M. M. (2011). *Financial markets and institutions*: McGraw-Hill Education.

Sophat, P.(2019). Microfinance Development in Cambodia: Challenges and A case study of AMK: TRIP journal, Thailand.

Wooldridge, J. M. (2016). Introductory econometrics: A modern approach: Nelson Education.

Appendix

***** Structural Equation Model (SEM)*****

STATA code

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use "C:\Users\User\Desktop\Phon Sophat\NBC Research\okokokok.dta", clear

xtset  ID Year

estat teffects
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sem (lnDomesticCredit -> lnGDP, ) (lnDomesticCredit -> lnAgriculture, ) (lnDomesticCredit -> lnRE, ) (lnDomesticCredit -> lnAgriEmployment, ) (lnAgriculture -> lnGDP, ) (lnRE -> lnGDP, ) (lnRE -> lnAgriculture, ) (lnAgriEmployment -> lnGDP, ) (lnLandAgric -> lnDomesticCredit, ) (lnLandAgric -> lnAgriculture, ) (lnLandAgric -> lnAgriEmployment, ) (lnLandAgric -> lnFertizerUSE, ) (lnFertizerUSE -> lnGDP, ) (lnFertizerUSE -> lnAgriculture, ) (lnFertizerUSE -> lnRE, ), nocapslatent

sem (lnDomesticCredit -> lnGDP, ) (lnDomesticCredit -> lnAgriculture, ) (lnDomesticCredit -> lnRE, ) (lnDomesticCredit -> lnAgriEmployment, ) (lnAgriculture -> lnGDP, ) (lnRE -> lnGDP, ) (lnRE -> lnAgriculture, ) (lnAgriEmployment -> lnGDP, ) (lnLandAgric -> lnGDP, ) (lnLandAgric -> lnDomesticCredit, ) (lnLandAgric -> lnAgriculture, ) (lnLandAgric -> lnAgriEmployment, ) (lnLandAgric -> lnFertizerUSE, ) (lnFertizerUSE -> lnGDP, ) (lnFertizerUSE -> lnAgriculture, ) (lnFertizerUSE -> lnRE, ), nocapslatent

graph export "C:\Users\User\Desktop\SEM_2.png", as(png) replace

graph export "C:\Users\User\Desktop\SEM_1.png", as(png) replace

label variable lnGDP "GDP Constants"

label variable lnAgriculture "Agriculture(Current$)"

label variable lnAgriEmployment "Agricultural Employments"

label variable lnDomesticCredit "Domestic Credits"

des lnDomesticCredit lnCredits

sum lnDomesticCredit lnCredits

label variable lnCredits "Com"

label variable lnCredits "Commercial Bank and Other Credit"

label variable lnLandAgric "Land for Agriculture"

label variable lnFertizerUSE "Fertizer Usage "

sum lnLandAgric

gen LandAgric=0

replace LandAgric=1 if lnLandAgric>0

sum LandAgric

sem (LandAgric -> lnGDP, ) (LandAgric -> lnAgriculture, ) (lnAgriculture -> lnGDP, ), nocapslatent
```

```
sem (lnDomesticCredit -> lnGDP, ) (lnDomesticCredit -> lnAgriculture, ) (lnDomesticCredit -> lnRE, ) (lnDomesticCredit -> lnAgriEmployment, ) (lnAgriculture -> lnGDP, ) (lnRE -> lnGDP, ) (lnRE -> lnAgriculture, ) (lnAgriEmployment -> lnGDP, ) (lnLandAgric -> lnDomesticCredit, ) (lnLandAgric -> lnAgriculture, ) (lnLandAgric -> lnAgriEmployment, ) (lnLandAgric -> lnFertizerUSE, ) (lnFertizerUSE -> lnGDP, ) (lnFertizerUSE -> lnAgriculture, ) (lnFertizerUSE -> lnRE, ), nocapslatent

sem (lnDomesticCredit -> lnGDP, ) (lnDomesticCredit -> lnAgriculture, ) (lnDomesticCredit -> lnRE, ) (lnDomesticCredit -> lnAgriEmployment, ) (lnAgriculture -> lnGDP, ) (lnRE -> lnGDP, ) (lnRE -> lnAgriculture, ) (lnAgriEmployment -> lnGDP, ) (lnLandAgric -> lnGDP, ) (lnLandAgric -> lnDomesticCredit, ) (lnLandAgric -> lnAgriculture, ) (lnLandAgric -> lnAgriEmployment, ) (lnLandAgric -> lnFertizerUSE, ) (lnFertizerUSE -> lnGDP, ) (lnFertizerUSE -> lnAgriculture, ) (lnFertizerUSE -> lnRE, ), nocapslatent

graph export "C:\Users\User\Desktop\SEM_2.png", as(png) replace

graph export "C:\Users\User\Desktop\SEM_1.png", as(png) replace

label variable lnCredits "Commercial Bank and Other Credit"

label variable lnLandAgric "Land for Agriculture"

label variable lnFertizerUSE "Fertizer Usage "

replace LandAgric=1 if lnLandAgric>0

*** End **
```