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

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I. Introduction

- Since 1996 to 2020, there are many volunteers from natural disasters and numbers of death in Cambodia. Over than 15 million people are directly and indirectly effected to households by National Committee for Disaster Management (NCDM). This means that disasters occurred and impacted so much on livelihoods, income and their lives.
- Other issue occurred on the farmers is credit access and its impacts in rural areas while they demand more funds to farm.



Hence, this research examines two sections:

1- The Relationship between geographic diversification which mainly focused with natural disaster such flood and storm and rural credit impacted on the farmers in Cambodia.

2- The Impacts of Total Private Domestic Credits on the agriculture sector and the GDP growth in Cambodia by using the ADB data, 1993- 2019.



II. Literature Reviews

- Many financial institutions are showing the altered types of risk including credit, interest rate, market risk, currency liquidity, operation, natural risks and country risks.
- Credit risk is the most significant for microfinance Institutions because their main products are providing microcredits to farmers(Armendariz and Morduch, 2010).
- The microcredit risks is the risk of cash flows from loan given by financial institutions which might be not fully paid in the time schedule (Saunders and Cornett, 2011).
- By this challenge, the contingent instalment does not work during the covariate shock s such as natural disaster occurred on the farmers or group members (Khan and Kurosanki, 2007).



- Therefore, MFIs might actually diminish risk by geographic diversifications such as urban and rural areas and seasons.
- Hence, the diversification can limit the MFIs' likelihood of insolvency by reducing credit and liquidity risk and as well as increasing the income of farmers while they faced with post-natural disasters.
- The effect of natural disasters on the farmers or poors can be occurred while drought and other disasters in a specific area such as villages in a limited regions, and so on(Liang and Rhoades, 1988).



III. Research Methodology

- This study employs CSES, 2015 from Ministry of Planning in order to examine the influence of natural disaster risk and rural credit on farmers and poors and ADB data, 1993-2019, to investigate the effects of domestic credits on GDP growth in Cambodia.
- To response the research questions, we use some econometric tools such as LPM-OLS, Probit, Logit and pSEM models are used to estimate these regressions.



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

$$Y_{it} = \beta_0 + \beta_1 x_{i1} + \dots + \beta_k X_{it} + u_i \quad (1)$$

- 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, the amount of the rural credit of MFIs, and electricity access and credit score.



- Based on the (1) equation, OLS or LPM equation will be added up in this regression too. Due to the Y_{it} is Dependent variables at time t. So a semi-log form function is placed in this model as follows:

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

- Whereas, X_{it} is independent variables such as rural credits, disaster variable and others households characteristics variables.



- Logit and Probit model are functioned as following.

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

- Whereas, X_{it} is independent variables such as rural credits, disaster variable and others households characteristics variables.
- Where Y_{it} is dummy variable, taking the value of one and Zero. C is the firm unobserved effect.



- Hence, we can rewrite as following:

- $$Y_{it} = \begin{cases} 0 & \text{if } Y^* \leq 0 \\ 1 & \text{if } Y^* > 0 \end{cases}$$

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



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

- $\Pr (Y_{it} > 0|x_i) = \Pr (Y_{it} > 1|x_i) = \Pr \left(\frac{u_i}{\sigma} > \frac{-\beta'x_i}{\sigma} \right)$
 $= \Phi\left(\frac{-\beta'x_i}{\sigma}\right)$
- Similar function as probability function as $\Pr(Y=1)$
- $\Pr (Y_{it} = 1|x_i) = 1 - \Phi\left(\frac{-\beta'x_i}{\sigma}\right)$
- Where x_i is the vector of all variables in this model.



IV. Data 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

Farmers experienced in drought, flood and loan source

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: Author's calculation based on CSES, 2015



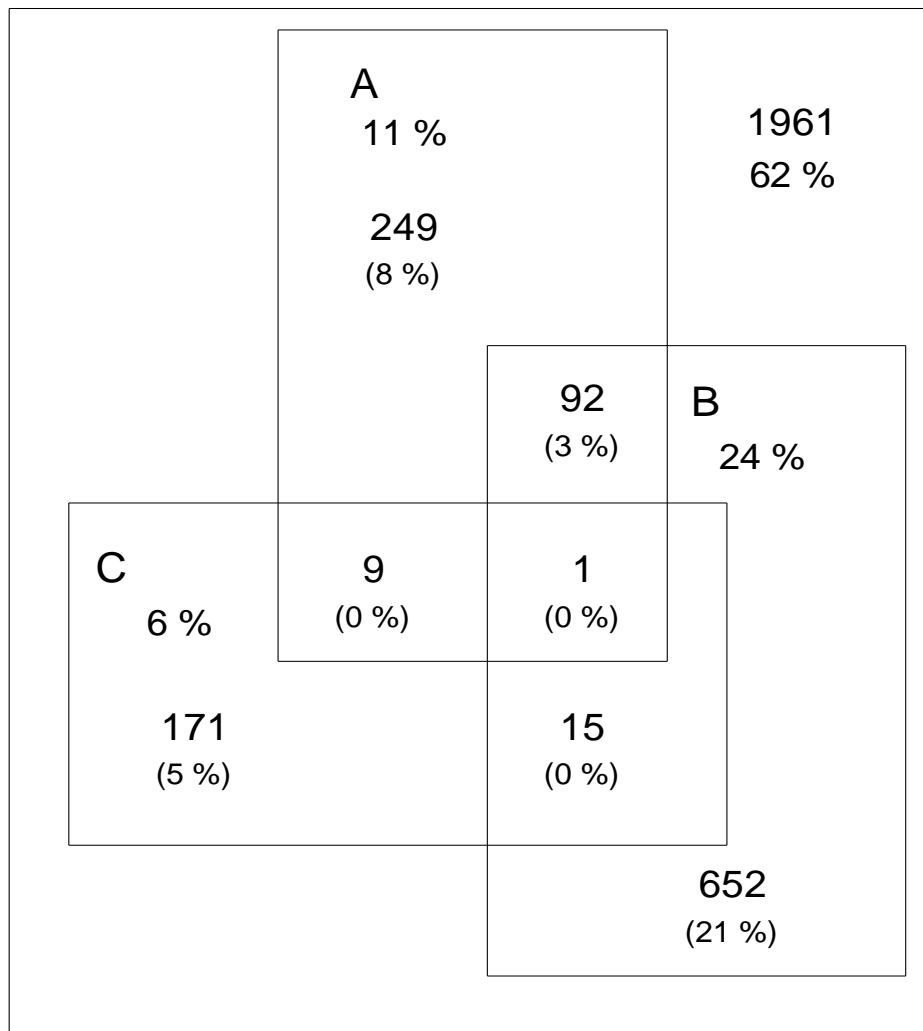
Type of Farmer's Saving and Technology

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 based on the CSES,2015



Figure 1: Farmers' loans Access and loan sources in 2015



N = 3150

A Credit informal

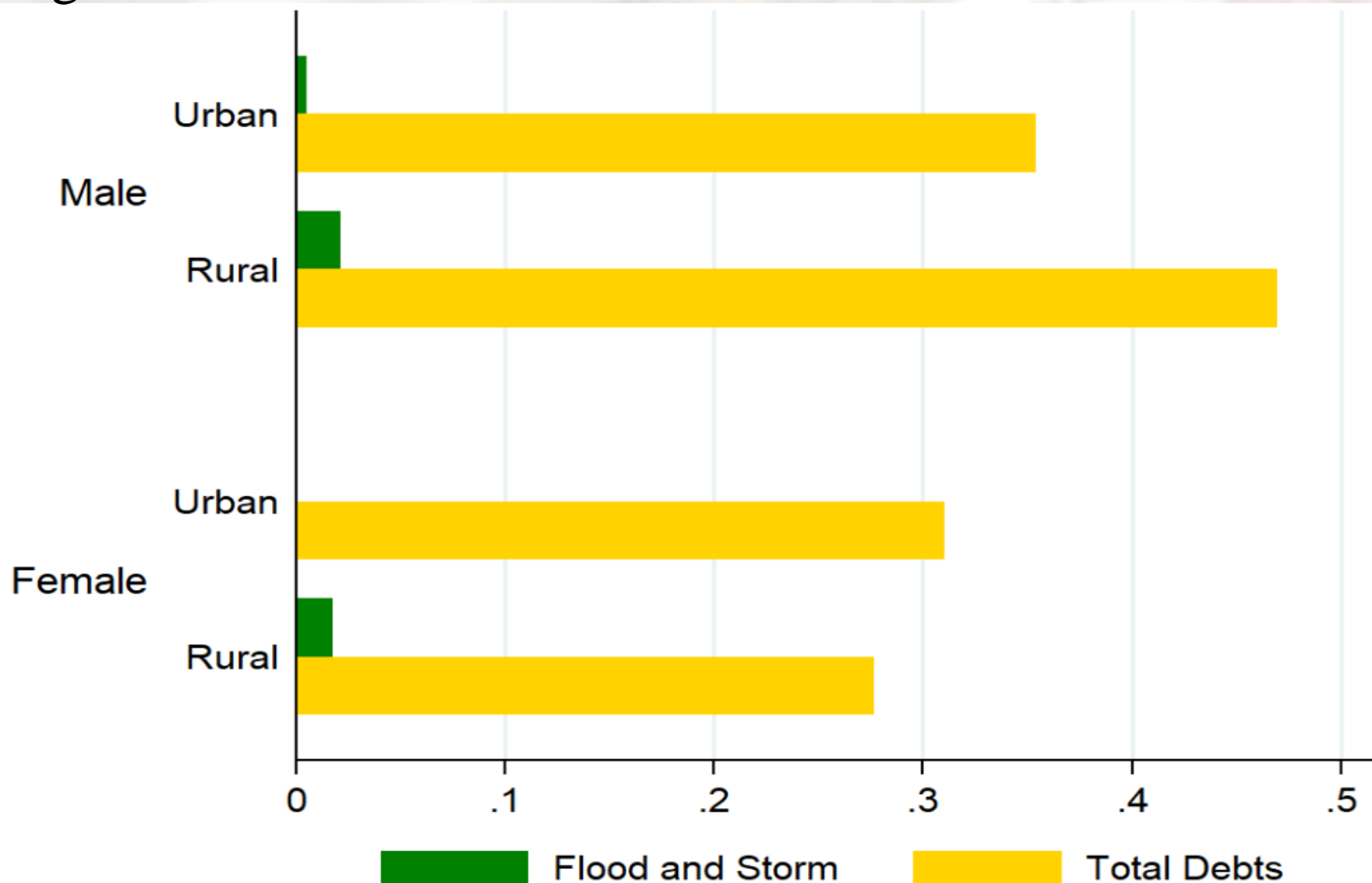
B Credit at other formal (non-bank)

C Credit at bank



Source: Author 's Calculation based on the CSES,2015

Figure 2: Natural Disasters area and Genders with loan Access



Source: Author's calculation based on CSES, 2015

Table 2: Poverty line for farmers and Non-farmers 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



V. Regressions and Results

- The results show that natural disasters such as flood and storms have negative correlation with land ownership from both farmer and Nonfarmers while natural disasters are negatively and statistically significant with income status and Food consumption.
- Rural credits is positively and statistically significant on land ownership in Cambodia. This can be said that rural credits can increase the land title and land ownership of farmers in Cambodia. While others are insignificant on income, and food consumptions.



- The loan has positively and statistically significant on the primary school level while technical school is negatively and statistically significant correlations.
- The highest demand of loan from non-farmers than farmer is impacted from flood and storm in Cambodia.
- This might be farmers who have adopted well from this natural disaster than nonfarmers.



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

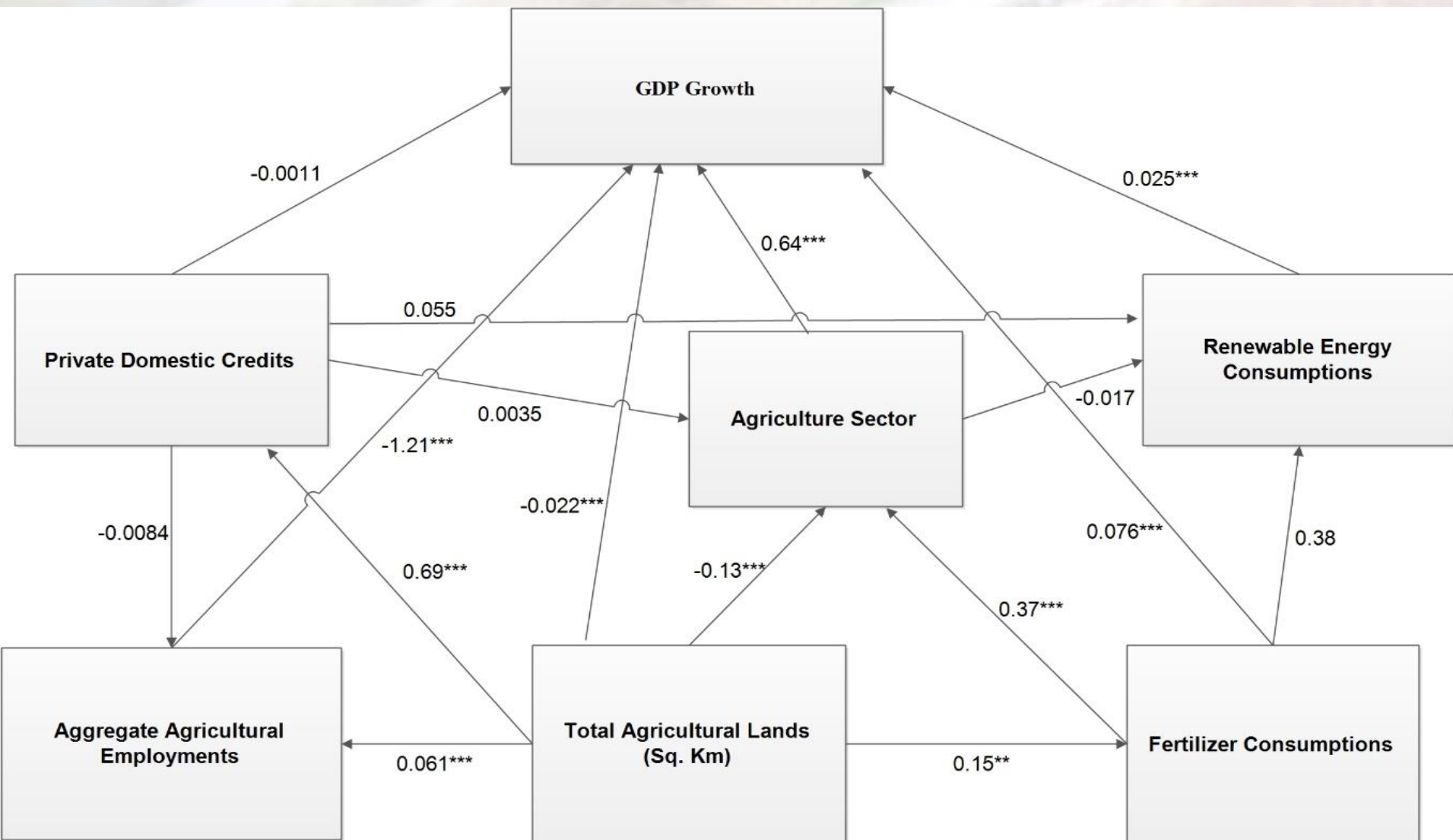
Variables	Total Debts		Poverty		
	Farmer	NonFarmers	Farmer	NonFarmers	
Flood and Storm =1	0.832 (-1.76)	1.673** (-2.83)	0.35 (-0.68)	-0.976 (-1.32)	
Total Debts	N/a	N/a	0.0795 (-0.99)	0.125 (-1.4)	
Age	-0.00267 (-0.97)	-0.0113*** (-3.99)	-0.00457 (-1.61)	-0.0111*** (-3.76)	
Gender	-0.0962 (-1.20)	-0.048 (-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	

The Role of Agricultural Sector and Domestic Credits to Economic Growth:

*Panel Structural Equation Model(pSEM) with
STATA*



II. pSEM Model results with STATA



Source: Author's calculation based on ADB data, 1993-2019

II. pSEM model with STATA

- After running the regression using ADB data, 1993-2019, pSEM result shows direct and indirect effect as follows:
- The Agricultural Sector is the largest impacts directly to GDP growth if compare to credits, renewable energy and others.
- Hence, this reveals that agricultural sector is very important to soar the growth in Cambodia from 1993 to 2019.



- Fertilizer consumptions is very important to growth the agriculture sector (Coef=0.37).
- Whereas, Domestic Credit has positively correlated to agriculture sector but It is not statistically significant.
- The land agriculture have positively increased the agricultural employment by 6.1%.
- Agricultural land is positively and statistically significant correlation with domestic credits.
- This can say that financial institutions might need more collaterals (land title) from farmer in order to release the loan. This same finding as Shaaban et al.2016 in Tanzania.



VI. Conclusion

- Disaster Risk is very concerned by farmers in rural areas and it strongly effects on their livelihood of households.
- Nonfarmers need more loans than farmers whenever, they faced the storm and flood in area.
- Most farmers have less education on financial technology by using the telephone such as saving money (0.03%).



- About 71% of farmers have more incomes higher than \$1.90 per day.
- Rural finances have positively increased on the farmers' status in terms of education, income generating, land ownership and consumptions in rural areas of Cambodia.



- In pSEM model, the finding shows that agricultural land is very important to access the credit in Cambodia by securing the land title.
- Renewable energy has positively correlate to GDP growth.
- And Agriculture sector has the highest and positively correlation on growth(0.64) among other sectors.



VII. Recommendations

- Government should generate more robust policies to promote more agricultural labor in rural area in order to foster agriculture sector.
- Renewable energy should be encouraged in order to reduce the any risks.
- Fertilizer utility is very good tools for agriculture sector but it might last short term only.
- Building more farmers' capacity and diversified products are very important to reduce the poverty for farmers.
- Financial technology should be placed more for borrowers or farmers in order to reduce the poverty in Cambodia, especially in this pandemic.



Thank you so much !

