Government Ownership of Banks

Diversifying of Potential Products and Factors to Subsidize Agriculture

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Future Forum

ELADES Alumni Seminar

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Road Map

1. Motivation
2. Data
3. Empirical Methodology
4. Estimation Results
5. Policy Discussions

Motivation

- Agriculture remains the **main sector** contribute to the economic growth in Cambodia. ▸ Agricultural GDP
- But this sector still meets **critical challenges**: the lack of leadership and effective decision-making, lack of technical knowledge and skills, lack of physical and virtual infrastructure, limited financial market development, high inputs prices, deficiency of the market, and others.
- The Agricultural and Rural Development Bank (**ARDB**) is a government-backed monopoly of the public bank to support agriculture and rural economy.
  - More than **75%** of amount ARDB credit went to the **rice** sector.

This Paper

- **Research Question:** What are the **potential products** and **factors** in the crop and livestock subsector that the public bank should focus on providing financial assistance?
  - What **types of policies** are necessary for government ownership of banks to respond to sustainable development in the agricultural industry?
- **Approach:** The usage of the dataset on the agricultural output and input with the two-step estimator of the generalized method of moments (GMM).
- **Main Message:** I challenged to identify the potential products due to the lack of microdata and uncertainty market in the future.

Main Related Literature

- **Government Ownership of Banks:** Altunbas et al. (2001), Andrianova et al. (2010), Demetriades et al. (2008), Galindo and Micco (2004), Iannotta et al. (2007), La Porta et al. (2002), Shen et al. (2014), Stiglitz (1993).
  - *Public banks and good policies play a significant role in economic growth*
- **Agriculture Development:** Sareth et al. (2020), Butler and Moser (2010), Laitner (2000), Costinot et al. (2016), Eliste and Zorya (2015), Aragón et al. (2019), Bareille and Letort (2018), Emerick et al. (2016).
  - *Lack technologies and less resilience to climate change in developing worlds*
- **Public Subsidy:** Doh and Kim (2014), Garrone et al. (2019), Googwin et al. (2011), O'Toole et al. (2014), Sothorn (2020).
  - *A good mechanism for economic development and social well-being*
- **Economic Diversification:** Dissart (2003), Revilla et al. (2015); Shyu and Chen (2019); Kikenny and Nalbarte (2002), Paul and Nehring (2005), Rahman (2009).
  - *Stable economic growth and ability to adapt to future uncertainty changes*

Data

- I used the national-level dataset of agricultural inputs and outputs over 1989-2018.
  - **Agricultural Input:** the FAOSTAT (FAO), the WDI (World Bank), and the National Accounts Statistics (NIS)
  - **Agricultural Production:** the FAOSTAT
- I selected **46 commodities** from the total number of agricultural products in Cambodia, 32 in cultivation and 14 in livestock.
- Linear interpolation, log-linear interpolation and cubic spline multiple interpolation were applied to calculate some missing values of some variables.

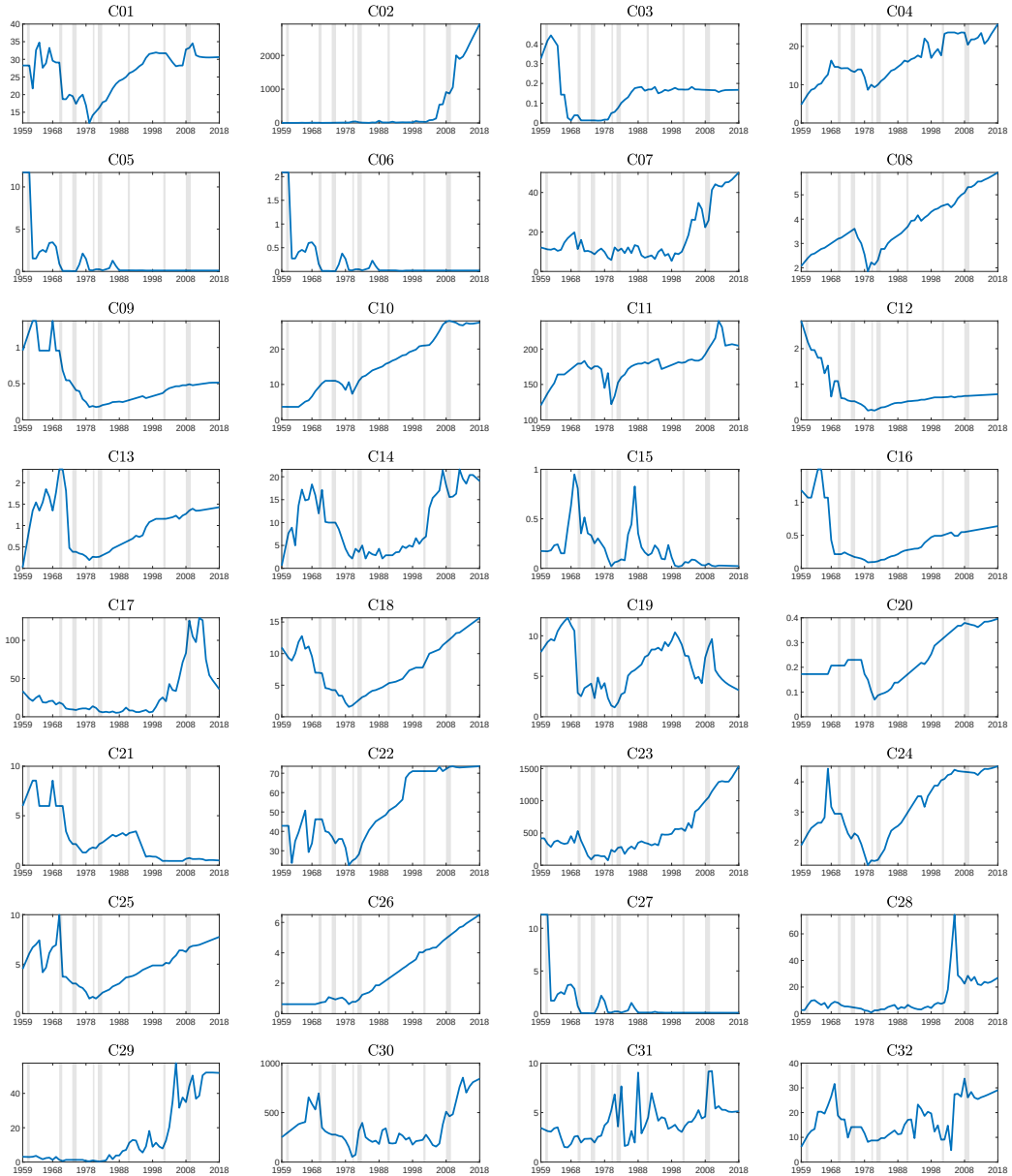
Summary Statistics

Variable	Unit	1989-2018				Source
		Min	Mean	Max	St. Dev.	
CIndex	Number	0.78	0.96	1.14	0.12	Author's Calculation
LIndex	Number	1.65	1.74	1.87	0.07	Author's Calculation
Agriland	1000 Hectares	4435.00	5044.03	5566.00	428.22	FAOSTAT
LandIrrigation	1000 Hectares	230.00	309.72	354.00	44.04	FAOSTAT
Tractors	Number	1190.00	3292.75	5696.98	1747.25	FAOSTAT
Fertilizer	Kg per Hectare	3.00	9.76	26.26	7.57	WDI
Pesticides	Tonnes	17.09	3873.26	16572.33	5473.89	FAOSTAT
Employment	1000 Peoples	3027.09	3845.27	4708.94	490.63	ILOSTAT
Temperature	Celsius (°C)	0.18	0.60	1.37	0.32	FAOSTAT
NCSAgri	Millions US$	559.10	1168.98	2563.57	616.28	FAOSTAT
GFCFAgri	Millions US$	65.00	141.51	289.67	86.13	FAOSTAT
CreditAgri	Millions US$	8.33	328.95	1857.22	558.72	FAOSTAT
RDBFunds	Millions US$	3.28	44.16	104.78	30.30	WDI
TechnicalGrants	Millions US$	24.35	406.63	682.12	188.55	WDI
ForeignAid	Millions US$	1.36	1007.87	3342.84	781.20	FAOSTAT
FDIAgri	Millions US$	1.12	48.72	176.48	53.63	FAOSTAT
VAAgri	Millions US$	1597.77	2907.33	4412.07	974.61	WDI
VAWorker	US$	262.45	727.92	1417.25	301.99	WDI
CFCAgri	Millions US$	31.94	69.94	155.00	36.93	FAOSTAT
FCE	Millions US$	1609.11	5299.44	11377.44	3053.73	NIS
TaxesSubsidies	Millions US$	23.50	448.92	1274.40	376.23	NIS

Variable ID Code

ID Code	Variable Name	ID Code	Variable Name
C01	Bananas	C24	Pepper and piper spp
C02	Cassava	C25	Pineapples
C03	Castor oil seed	C26	Roots and tubers nes
C04	Coconuts	C27	Seed cotton
C05	Cotton lint	C28	Sesame seed
C06	Cottonseed	C29	Soybeans
C07	Dry beans	C30	Sugar cane
C08	Dry chillies and peppers	C31	Sweet potatoes
C09	Fibre crops nes	C32	Unmanufactured tobacco
C10	Fresh nes fruit	L01	Buffalo meat
C11	Fresh nes vegetables	L02	Buffalo meat indigenous
C12	Grapefruit and pomelos	L03	Cattle meat
C13	Green coffee	L04	Cattle meat indigenous
C14	Groundnuts with shell	L05	Chicken meat
C15	Jute	L06	Chicken meat indigenous
C16	Lemons and limes	L07	Duck meat
C17	Maize	L08	Duck meat indigenous
C18	Mangoes, mangosteens and guavas	L09	Hen eggs in shell
C19	Natural rubber	L10	Other bird eggs in shell
C20	Nuts nes	L11	Pig meat
C21	Oilseeds nes	L12	Pig meat indigenous
C22	Oranges	L13	Silkworm coiling cocoons
C23	Paddy rice	L14	Whole fresh cow milk

Crop Production, 1959-2018 (in $ million)



Livestock Production, 1959-2018 (in $ million)

Model

- **Power Market**

the number agricultural commodity in the market $m(N > 1)$

$$AgriDiversity_m = \sum_{i=1}^{N} \chi_{im}^2$$

the share of product i in the market m

  - **Note:** Herfindahl-Hirschman Index (HHI): <0.01 high competitive, <0.15 an unconcentrated industry, 0.15–0.25 moderate concentration, >0.25 high concentration.

- **Production Diversity**

land areas devoted to crops n where $(n[1; N])$

$$Crop(S_t) = -\sum_{i=1}^{N} s_{nt} \ln(s_{nt})$$

S_{nt}/TL_t

$$Livestock(S_t) = -\sum_{i=1}^{N} s_{nt} \ln(s_{nt})$$

Model

- Consider the linear regression model:

ture values of unknown β ← → error terms

$$y_t = x_t'\beta_0 + u_t = x_{1t}'\gamma_0 + x_{2t}'\delta_0 + u_t$$

$K \times 1$ vector of stochastic regressors

- The appropriate moment conditions:

$$g(\beta_0) = \mathbb{E}[\, z_t\, u_t] = \mathbb{E}[z_t(y_t - x_t'\beta_0)] = 0$$

instruments in the $R \times 1$, function $u_t(z_t, \beta)$ maybe linear and non-linear in β

- Thus, the author replaces with sample averages to obtain the analogous sample moments:

$$g_T(\hat{\beta}) = \frac{1}{T}\sum_{t=1}^{T} z_t(y_t - x_t'\hat{\beta})$$

Model

- Now, the author first obtains the first-step GMM estimator by minimizing:

$$\hat{\beta}_{1GMM} = \left[\frac{1}{T_0}\sum_{t=1}^{T_0} z_t(y_t - x_t'\hat{\beta})\right]' \underset{\downarrow}{W_T} \left[\frac{1}{T_0}\sum_{t=1}^{T_0} z_t(y_t - x_t'\hat{\beta})\right]$$

$R \times R$ positive semi definite matrix

- Then, the researcher obtains the second-step GMM estimator by minimizing:

$$\hat{\beta}_{2GMM} = \left[\frac{1}{T}\sum_{t=1}^{T} z_t(y_t - x_t'\hat{\beta})\right]' \underset{\downarrow}{\hat{S}_T^{-1}} \left[\frac{1}{T}\sum_{t=1}^{T} z_t(y_t - x_t'\hat{\beta})\right]$$

$\hat{S}_T = \hat{\Omega}^{-1} = (\hat{\beta}_{1GMM}\hat{\beta}'_{1GMM})^{-1}$

Model

- Last, the author considers the J test statistic:

$$J_T = \left[\frac{1}{\sqrt{T}}\sum_{t=1}^{T} z_t(y_t - \hat{\beta}_T' x_t)\right]' \hat{S}_T^{-1} \left[\frac{1}{\sqrt{T}}\sum_{t=1}^{T} z_t(y_t - \hat{\beta}_T' x_t)\right]$$

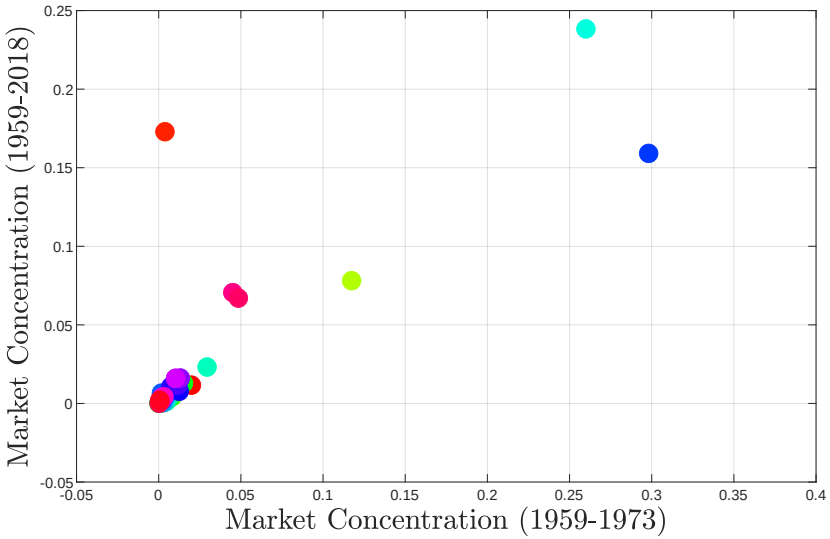
Valid only when the weight matrix is optimal

Hansen's J statistic used to determine the validity of the overidentifying restrictions in a GMM model.

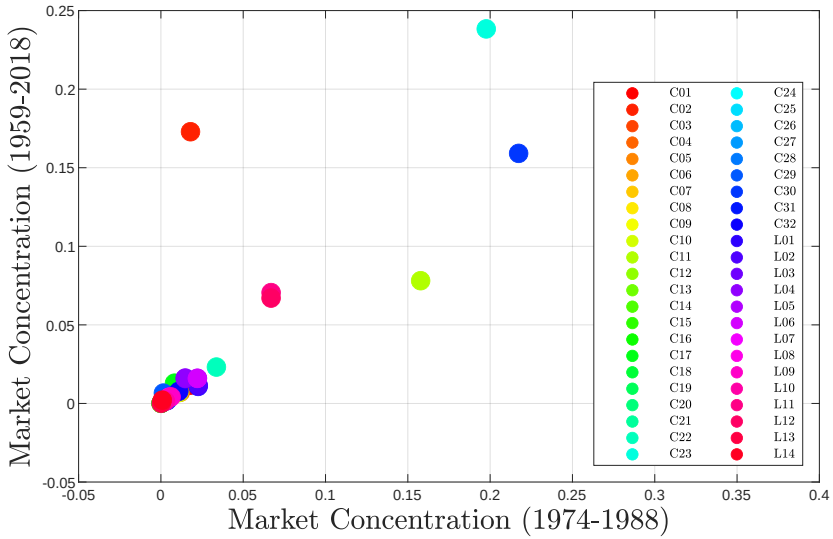
Empirical Results

Market Concentration

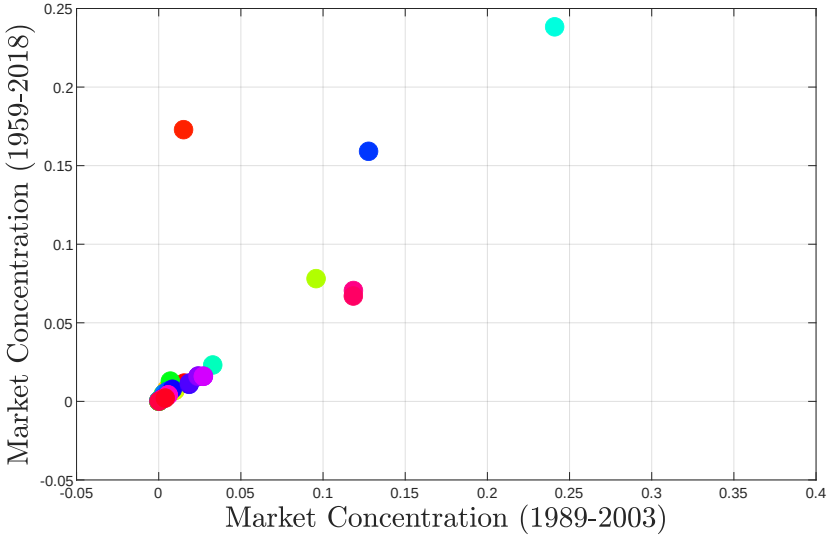
Panel A: 1959-1973



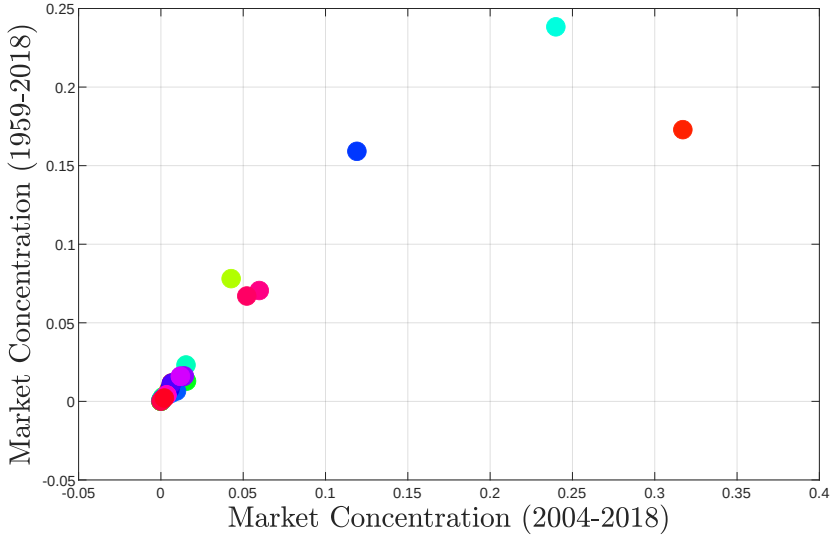
Panel B: 1974-1988



Panel C: 1989-2003



Panel D: 2004-2018



Market Concentration

- The agricultural economic structure in 1959-1973 and 2004-2018 reported a **moderate specialization** which represents **0.17** and **0.18**.
- In 2004-2018, cassava made many contributions to the market (32%), followed by paddy rice represented at 24%, sugarcane (12%), pork meat (6%), indigenous pork meat (5.2%) and fresh vegetables (4.2%). Castor oilseed, cotton lint, seed cotton, jute and cottonseed are less overlapping products on markets with a sharing rate of less than 0.0035%.
- Overall, the agricultural commercialization structure between 1959 and 2018 is **moderately diversified** with a negligible index value at **0.13**. Paddy rice, cassava, sugarcane, fresh vegetables and pork meat remain reserved to be the highest concentration on the market.

Crop Estimation Results

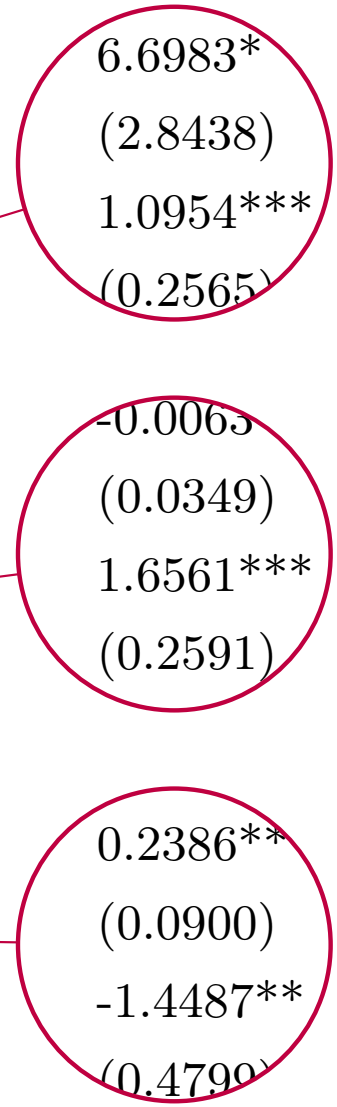
Bananas

Variable	C01	C02	C03	C04	C05	C06	C07	C08
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CIndex	-8.1983	194.4893	-0.1588***	0.4917	0.1208*	-0.0300*	130.7735***	1.7623**
	(7.1843)	(317.0582)	(0.0175)	(16.2212)	(0.0474)	(0.0141)	(36.4040)	(0.5542)
LandIrrigation	-0.0008	-3.0621	-0.0001	-0.1249*	0.0002	-0.00001	-0.1014	0.0007
	(0.0313)	(1.6506)	(0.0001)	(0.0506)	(0.0002)	(0.00005)	(0.1181)	(0.0032)
Tractors	-0.0014	-0.0356	0.000003*	0.0004	0.000002	0.0000008	-0.0059	0.0002**
	(0.0010)	(0.0532)	(0.000002)	(0.0013)	(0.000005)	(0.000001)	(0.0034)	(0.0001)
Fertilizer	-0.1787*	4.0408	-0.0017***	0.4029*	0.0006	-0.0001	0.9544*	0.0128
	(0.0880)	(5.6267)	(0.0003)	(0.1849)	(0.0006)	(0.0002)	(0.4447)	(0.0081)
Pesticides	0.0001	0.0211*	-0.000002**	-0.0010***	0.000001	-0.0000005	-0.0004	0.00003**
	(0.0002)	(0.0107)	(0.0000006)	(0.0003)	(0.000001)	(0.0000003)	(0.0007)	(0.00001)
Employment	0.0092***	0.0639	0.000002	-0.0007	-0.000004	0.000006*	-0.0226***	0.0009***
	(0.0018)	(0.1122)	(0.000007)	(0.0031)	(0.000008)	(0.000002)	(0.0064)	(0.0001)
Temperature	0.6721	-114.3193*	-0.0035	-0.4799	0.0037	-0.0004	4.1952*	-0.0024
	(0.7139)	(51.2306)	(0.0019)	(0.5897)	(0.0029)	(0.0008)	(1.9033)	(0.0647)
NCSAgri	0.1708**	-3.1271	0.0014***	0.1628	-0.0004	0.0006***	-0.3871	0.0143**
	(0.0648)	(5.5452)	(0.0004)	(0.1846)	(0.0004)	(0.0001)	(0.4028)	(0.0051)
GFCFAgri	-0.0597	6.6983*	0.0006***	-0.0990	0.0002	-0.0003***	-0.2556	-0.0037
	(0.0384)	(2.8438)	(0.0002)	(0.1034)	(0.0002)	(0.0001)	(0.2238)	(0.0026)
CreditAgri	-0.0083	1.0954***	-0.0002***	-0.0110	0.0001*	-0.00002	0.0752*	0.0012**
	(0.0075)	(0.2565)	(0.00002)	(0.0150)	(0.00005)	(0.00001)	(0.0312)	(0.0004)
RDBFunds	-0.0109	-0.5203	-0.0003***	0.0570**	0.0001	-0.00003	0.0941	0.0008
	(0.0126)	(0.5805)	(0.00003)	(0.0214)	(0.0001)	(0.00008)	(0.0630)	(0.0009)
TechnicalGrants	-0.0097	0.2688	-0.0001***	-0.0075	0.0001	-0.00002	0.0923***	0.0002
	(0.0057)	(0.1858)	(0.00001)	(0.0073)	(0.00004)	(0.00001)	(0.0236)	(0.0003)
ForeignAid	0.0001	-0.0063	-0.000005**	0.0013	0.000005	0.0000006	0.0036	0.0001*
	(0.0005)	(0.0349)	(0.000002)	(0.0011)	(0.000003)	(0.0000009)	(0.0024)	(0.000006)
FDIAgri	0.0011	1.6561***	-0.00002	0.0169*	0.000007	0.000005	0.0344*	0.0009*
	(0.0049)	(0.2591)	(0.00001)	(0.0068)	(0.00002)	(0.000005)	(0.0144)	(0.0004)
VAAgri	-0.0045	0.2098	-0.0001***	-0.0091	0.00002	-0.00002*	0.0403**	0.0002
	(0.0029)	(0.1780)	(0.00009)	(0.0082)	(0.00002)	(0.000007)	(0.0152)	(0.0003)
VAWorker	0.0306	-0.7168	0.0002***	0.0415*	-0.0002	0.0001*	-0.2116***	0.0029**
	(0.0180)	(0.9590)	(0.0001)	(0.0194)	(0.0001)	(0.000003)	(0.0526)	(0.0009)
CFCAgri	-2.5482*	42.6882	-0.0200***	-2.7361	0.0053	-0.0096***	5.0401	-0.2257**
	(1.0451)	(90.1353)	(0.0058)	(3.0117)	(0.0059)	(0.0023)	(6.4513)	(0.0843)
FCE	-0.0039	0.2386**	0.00004***	0.0069*	-0.00002	0.000001	0.0259***	-0.0008***
	(0.0021)	(0.0900)	(0.000003)	(0.0027)	(0.00001)	(0.000003)	(0.0069)	(0.0001)
TaxesSubsidies	0.0304***	-1.4487**	-0.00004***	-0.0083	0.00003	0.000004	-0.0753***	0.0013**
	(0.0088)	(0.4799)	(0.000009)	(0.0073)	(0.00003)	(0.000008)	(0.0169)	(0.0004)
Constant	0.0886	-146.1604	0.2640***	40.8144**	0.0599	0.0116	23.5871	-1.4612*
	(8.1903)	(517.4292)	(0.0346)	(14.7409)	(0.0387)	(0.0119)	(32.6795)	(0.6881)
Observations	30	30	30	30	30	30	30	30
R-squared	0.9074	0.9979	0.7235	0.8475	0.8034	0.7351	0.9611	0.9940
Hansen test	0.0062	0.0085	0.2300	0.0653	0.0622	0.0246	0.0797	0.0167

Crop Estimation Results

Cassava

Variable	C01 (1)	C02 (2)	C03 (3)	C04 (4)	C05 (5)	C06 (6)	C07 (7)	C08 (8)
CIndex	-8.1983	194.4893	-0.1588***	0.4917	0.1208*	-0.0300*	130.7735***	1.7623**
	(7.1843)	(317.0582)	(0.0175)	(16.2212)	(0.0474)	(0.0141)	(36.4040)	(0.5542)
LandIrrigation	-0.0008	-3.0621	-0.0001	-0.1249*	0.0002	-0.00001	-0.1014	0.0007
	(0.0313)	(1.6506)	(0.0001)	(0.0506)	(0.0002)	(0.00005)	(0.1181)	(0.0032)
Tractors	-0.0014	-0.0356	0.000003*	0.0004	0.000002	0.0000008	-0.0059	0.0002**
	(0.0010)	(0.0532)	(0.000002)	(0.0013)	(0.000005)	(0.000001)	(0.0034)	(0.0001)
Fertilizer	-0.1787*	4.0408	-0.0017***	0.4029*	0.0006	-0.0001	0.9544*	0.0128
	(0.0880)	(5.6267)	(0.0003)	(0.1849)	(0.0006)	(0.0002)	(0.4447)	(0.0081)
Pesticides	0.0001	0.0211*	-0.000002**	-0.0010***	0.000001	-0.0000005	-0.0004	0.00003**
	(0.0002)	(0.0107)	(0.0000006)	(0.0003)	(0.000001)	(0.0000003)	(0.0007)	(0.00001)
Employment	0.0092***	0.0639	0.000002	-0.0007	-0.000004	0.000006*	-0.0226***	0.0009***
	(0.0018)	(0.1122)	(0.000007)	(0.0031)	(0.000008)	(0.000002)	(0.0064)	(0.0001)
Temperature	0.6721	-114.3193*	-0.0035	-0.4799	0.0037	-0.0004	4.1952*	-0.0024
	(0.7139)	(51.2306)	(0.0019)	(0.5897)	(0.0029)	(0.0008)	(1.9033)	(0.0647)
NCSAgri	0.1708**	-3.1271	0.0014***	0.1628	-0.0004	0.0006***	-0.3871	0.0143**
	(0.0648)	(5.5452)	(0.0004)	(0.1846)	(0.0004)	(0.0001)	(0.4028)	(0.0051)
GFCFAgri	-0.0597	6.6983*	-0.0006***	-0.0990	0.0002	-0.0003***	-0.2556	-0.0037
	(0.0384)	(2.8438)	(0.0002)	(0.1034)	(0.0002)	(0.0001)	(0.2238)	(0.0026)
CreditAgri	-0.0083	1.0954***	-0.0002***	-0.0110	0.0001*	-0.00002	0.0752*	0.0012**
	(0.0075)	(0.2565)	(0.00002)	(0.0150)	(0.00005)	(0.00001)	(0.0312)	(0.0004)
RDBFunds	-0.0109	-0.5203	-0.0003***	0.0570**	0.0001	-0.00003	0.0941	0.0008
	(0.0126)	(0.5805)	(0.00003)	(0.0214)	(0.0001)	(0.00008)	(0.0630)	(0.0009)
TechnicalGrants	-0.0097	0.2688	-0.0001***	-0.0075	0.0001	-0.00002	0.0923***	0.0002
	(0.0057)	(0.1858)	(0.00001)	(0.0073)	(0.00004)	(0.00001)	(0.0236)	(0.0003)
ForeignAid	0.0001	-0.0063	-0.000005**	0.0013	0.000005	0.0000006	0.0036	0.0001*
	(0.0005)	(0.0349)	(0.000002)	(0.0011)	(0.000003)	(0.0000009)	(0.0024)	(0.000006)
FDIAgri	0.0011	1.6561***	-0.00002	0.0169*	0.000007	0.000005	0.0344*	0.0009*
	(0.0049)	(0.2591)	(0.00001)	(0.0068)	(0.00002)	(0.000005)	(0.0144)	(0.0004)
VAAgri	-0.0045	0.2098	-0.0001***	-0.0091	0.00002	-0.00002*	0.0403**	0.0002
	(0.0029)	(0.1780)	(0.00009)	(0.0082)	(0.00002)	(0.000007)	(0.0152)	(0.0003)
VAWorker	0.0306	-0.7168	0.0002***	0.0415*	-0.0002	0.0001*	-0.2116***	0.0029**
	(0.0180)	(0.9590)	(0.0001)	(0.0194)	(0.0001)	(0.000003)	(0.0526)	(0.0009)
CFCAgri	-2.5482*	42.6882	-0.0200***	-2.7361	0.0053	-0.0096***	5.0401	-0.2257**
	(1.0451)	(90.1353)	(0.0058)	(3.0117)	(0.0059)	(0.0023)	(6.4513)	(0.0843)
FCE	-0.0039	0.2386**	0.00004***	0.0069*	-0.00002	0.000001	0.0259***	-0.0008***
	(0.0021)	(0.0900)	(0.000003)	(0.0027)	(0.00001)	(0.000003)	(0.0069)	(0.0001)
TaxesSubsidies	0.0304***	-1.4487**	-0.00004***	-0.0083	0.00003	0.000004	-0.0753***	0.0013**
	(0.0088)	(0.4799)	(0.000009)	(0.0073)	(0.00003)	(0.000008)	(0.0169)	(0.0004)
Constant	0.0886	-146.1604	0.2640***	40.8144**	0.0599	0.0116	23.5871	-1.4612*
	(8.1903)	(517.4292)	(0.0346)	(14.7409)	(0.0387)	(0.0119)	(32.6795)	(0.6881)
Observations	30	30	30	30	30	30	30	30
R-squared	0.9074	0.9979	0.7235	0.8475	0.8034	0.7351	0.9611	0.9940
Hansen test	0.0062	0.0085	0.2300	0.0653	0.0622	0.0246	0.0797	0.0167



Crop Estimation Results

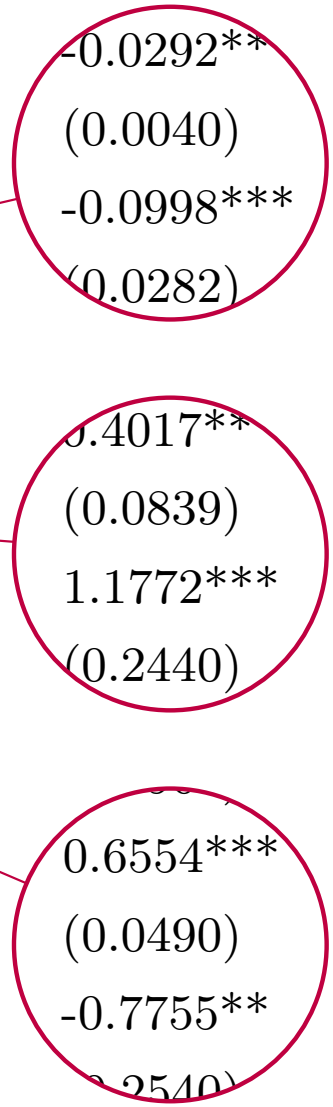
Natural rubber

Variable	C17	C18	C19	C20	C21	C22	C23	C24
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
CIndex	-37.2330	-2.2461	1.6208	-0.1221***	3.0255	-50.8646*	-591.175***	-0.6930
	(56.8386)	(3.2449)	(6.2917)	(0.0242)	(1.9046)	(21.4335)	(99.9941)	(0.5442)
LandIrrigation	-0.9713***	-0.0147	0.0092	-0.0006***	0.0465***	-0.2946***	0.3041	0.0041
	(0.2732)	(0.0086)	(0.0276)	(0.0001)	(0.0066)	(0.0628)	(0.5690)	(0.0030)
Tractors	0.0234***	0.0005***	-0.0018*	0.0001***	0.0001	-0.0003	-0.0480**	0.0005***
	(0.0063)	(0.0002)	(0.0009)	(0.000005)	(0.0002)	(0.0021)	(0.0166)	(0.0001)
Fertilizer	-0.2079	-0.0292	-0.1604	-0.0014**	-0.0597*	-0.1236	4.2471*	-0.0162*
	(0.7943)	(0.0290)	(0.1011)	(0.0005)	(0.0248)	(0.2204)	(2.0970)	(0.0082)
Pesticides	-0.0110***	-0.00002	-0.0001	0.000006***	-0.000006	-0.0001	-0.0292***	0.0001**
	(0.0014)	(0.0001)	(0.0002)	(0.0000009)	(0.00004)	(0.0004)	(0.0040)	(0.00002)
Employment	-0.0227*	0.0004	0.0072***	0.0001***	-0.0004	0.0112***	-0.0998***	0.0008***
	(0.0100)	(0.0007)	(0.0016)	(0.00009)	(0.0003)	(0.0031)	(0.0282)	(0.0001)
Temperature	-11.5304**	0.0970	0.5053	-0.0073***	0.0507	-1.8284	-10.4679	0.0044
	(3.8175)	(0.1091)	(0.4564)	(0.0022)	(0.1320)	(1.1439)	(26.3349)	(0.0379)
NCSAgri	1.6177**	0.0124	0.1963**	0.0007	0.0014	0.2514**	1.2213	-0.0066
	(0.5474)	(0.0250)	(0.0661)	(0.0005)	(0.0143)	(0.0923)	(1.4830)	(0.0066)
GFCFAgri	-0.2106	-0.0115	-0.0765	0.0002	0.0182*	-0.1394	-1.7319*	0.0087
	(0.3096)	(0.0129)	(0.0406)	(0.0003)	(0.0084)	(0.0719)	(0.7153)	(0.0044)
CreditAgri	-0.2371***	-0.0037	-0.0033	-0.0001***	0.0012	-0.0415*	0.4017***	-0.0004
	(0.0515)	(0.0031)	(0.0057)	(0.00002)	(0.0017)	(0.0190)	(0.0839)	(0.0005)
RDBFunds	-0.0102	-0.0064*	-0.0116	-0.0003***	-0.0077*	-0.0395	1.1772***	-0.0023
	(0.0988)	(0.0031)	(0.0110)	(0.0001)	(0.0033)	(0.0297)	(0.2440)	(0.0012)
TechnicalGrants	-0.0445	-0.0022	-0.0062*	-0.0001***	0.0010	-0.0435**	0.1378	-0.0008*
	(0.0292)	(0.0014)	(0.0029)	(0.00001)	(0.0011)	(0.0159)	(0.0782)	(0.0003)
ForeignAid	-0.0107*	-0.0002	0.0004	0.0000004	-0.0001	-0.0012	0.0313**	-0.000009
	(0.0047)	(0.0002)	(0.0005)	(0.000002)	(0.0001)	(0.0012)	(0.0112)	(0.00005)
FDIAgri	-0.0163	-0.0015	0.00005	0.00003	-0.0016	0.0091	0.1682	-0.0004
	(0.0350)	(0.0013)	(0.0040)	(0.00002)	(0.0009)	(0.0089)	(0.0900)	(0.0004)
VAAgri	0.0467	-0.0005	-0.0042	-0.00003*	-0.0027**	0.0032	0.6554***	-0.0009***
	(0.0254)	(0.0014)	(0.0022)	(0.00001)	(0.0010)	(0.0097)	(0.0490)	(0.0002)
VAWorker	0.3463***	0.0056	0.0226	0.0006***	-0.0071**	0.1357***	-0.7755**	0.0042***
	(0.0941)	(0.0038)	(0.0126)	(0.00004)	(0.0027)	(0.0302)	(0.2540)	(0.0010)
CFCAgri	-20.3361*	-0.1885	-2.9954**	-0.0125	0.0795	-4.1325**	-21.1141	0.1119
	(9.0057)	(0.4234)	(1.0979)	(0.0088)	(0.2327)	(1.5574)	(23.3088)	(0.1091)
FCE	-0.0483***	0.0019***	-0.0037*	-0.000003**	-0.0015***	0.0110*	0.0466	-0.0004*
	(0.0097)	(0.0005)	(0.0016)	(0.00001)	(0.0004)	(0.0045)	(0.0391)	(0.0002)
TaxesSubsidies	-0.0059	-0.0016	0.0243***	-0.00004*	0.0030**	-0.0392***	0.0240	-0.0004
	(0.0411)	(0.0014)	(0.0070)	(0.00002)	(0.0010)	(0.0097)	(0.1125)	(0.0006)
Constant	-18.5166	4.3251	-18.3803*	-0.0310	-4.6775**	67.3187***	307.5397	-0.2211
	(62.0870)	(3.2368)	(9.0371)	(0.0375)	(1.5810)	(13.2100)	(171.7835)	(0.7044)
Observations	30	30	30	30	30	30	30	30
R-squared	0.9868	0.9956	0.9100	0.9981	0.9721	0.9690	0.9979	0.9885
Hansen test	0.0024	0.1442	0.0170	0.1122	0.1186	0.1035	0.0647	0.0038

Crop Estimation Results

Paddy rice

Variable	C17	C18	C19	C20	C21	C22	C23	C24
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
CIndex	-37.2330	-2.2461	1.6208	-0.1221***	3.0255	-50.8646*	-591.175***	-0.6930
	(56.8386)	(3.2449)	(6.2917)	(0.0242)	(1.9046)	(21.4335)	(99.9941)	(0.5442)
LandIrrigation	-0.9713***	-0.0147	0.0092	-0.0006***	0.0465***	-0.2946***	0.3041	0.0041
	(0.2732)	(0.0086)	(0.0276)	(0.0001)	(0.0066)	(0.0628)	(0.5690)	(0.0030)
Tractors	0.0234***	0.0005***	-0.0018*	0.0001***	0.0001	-0.0003	-0.0480**	0.0005***
	(0.0063)	(0.0002)	(0.0009)	(0.000005)	(0.0002)	(0.0021)	(0.0166)	(0.0001)
Fertilizer	-0.2079	-0.0292	-0.1604	-0.0014**	-0.0597*	-0.1236	4.2471*	-0.0162*
	(0.7943)	(0.0290)	(0.1011)	(0.0005)	(0.0248)	(0.2204)	(2.0970)	(0.0082)
Pesticides	-0.0110***	-0.00002	-0.0001	0.000006***	-0.000006	-0.0001	-0.0292***	0.0001**
	(0.0014)	(0.0001)	(0.0002)	(0.0000009)	(0.00004)	(0.0004)	(0.0040)	(0.00002)
Employment	-0.0227*	0.0004	0.0072***	0.0001***	-0.0004	0.0112***	-0.0998***	0.0008***
	(0.0100)	(0.0007)	(0.0016)	(0.00009)	(0.0003)	(0.0031)	(0.0282)	(0.0001)
Temperature	-11.5304**	0.0970	0.5053	-0.0073***	0.0507	-1.8284	-10.4679	0.0044
	(3.8175)	(0.1091)	(0.4564)	(0.0022)	(0.1320)	(1.1439)	(26.3349)	(0.0379)
NCSAgri	1.6177**	0.0124	0.1963**	0.0007	0.0014	0.2514**	1.2213	-0.0066
	(0.5474)	(0.0250)	(0.0661)	(0.0005)	(0.0143)	(0.0923)	(1.4830)	(0.0066)
GFCFAgri	-0.2106	-0.0115	-0.0765	0.0002	0.0182*	-0.1394	-1.7319*	0.0087
	(0.3096)	(0.0129)	(0.0406)	(0.0003)	(0.0084)	(0.0719)	(0.7153)	(0.0044)
CreditAgri	-0.2371***	-0.0037	-0.0033	-0.0001***	0.0012	-0.0415*	0.4017***	-0.0004
	(0.0515)	(0.0031)	(0.0057)	(0.00002)	(0.0017)	(0.0190)	(0.0839)	(0.0005)
RDBFunds	-0.0102	-0.0064*	-0.0116	-0.0003***	-0.0077*	-0.0395	1.1772***	-0.0023
	(0.0988)	(0.0031)	(0.0110)	(0.0001)	(0.0033)	(0.0297)	(0.2440)	(0.0012)
TechnicalGrants	-0.0445	-0.0022	-0.0062*	-0.0001***	0.0010	-0.0435**	0.1378	-0.0008*
	(0.0292)	(0.0014)	(0.0029)	(0.00001)	(0.0011)	(0.0159)	(0.0782)	(0.0003)
ForeignAid	-0.0107*	-0.0002	0.0004	0.0000004	-0.0001	-0.0012	0.0313**	-0.000009
	(0.0047)	(0.0002)	(0.0005)	(0.000002)	(0.0001)	(0.0012)	(0.0112)	(0.00005)
FDIAgri	-0.0163	-0.0015	0.00005	0.00003	-0.0016	0.0091	0.1682	-0.0004
	(0.0350)	(0.0013)	(0.0040)	(0.00002)	(0.0009)	(0.0089)	(0.0900)	(0.0004)
VAAgri	0.0467	-0.0005	-0.0042	-0.00003*	-0.0027**	0.0032	0.6554***	-0.0009***
	(0.0254)	(0.0014)	(0.0022)	(0.00001)	(0.0010)	(0.0097)	(0.0490)	(0.0002)
VAWorker	0.3463***	0.0056	0.0226	0.0006***	-0.0071**	0.1357***	-0.7755**	0.0042***
	(0.0941)	(0.0038)	(0.0126)	(0.00004)	(0.0027)	(0.0302)	(0.2540)	(0.0010)
CFCAgri	-20.3361*	-0.1885	-2.9954**	-0.0125	0.0795	-4.1325**	-21.1141	0.1119
	(9.0057)	(0.4234)	(1.0979)	(0.0088)	(0.2327)	(1.5574)	(23.3088)	(0.1091)
FCE	-0.0483***	0.0019***	-0.0037*	-0.000003**	-0.0015***	0.0110*	0.0466	-0.0004*
	(0.0097)	(0.0005)	(0.0016)	(0.00001)	(0.0004)	(0.0045)	(0.0391)	(0.0002)
TaxesSubsidies	-0.0059	-0.0016	0.0243***	-0.00004*	0.0030**	-0.0392***	0.0240	-0.0004
	(0.0411)	(0.0014)	(0.0070)	(0.00002)	(0.0010)	(0.0097)	(0.1125)	(0.0006)
Constant	-18.5166	4.3251	-18.3803*	-0.0310	-4.6775**	67.3187***	307.5397	-0.2211
	(62.0870)	(3.2368)	(9.0371)	(0.0375)	(1.5810)	(13.2100)	(171.7835)	(0.7044)
Observations	30	30	30	30	30	30	30	30
R-squared	0.9868	0.9956	0.9100	0.9981	0.9721	0.9690	0.9979	0.9885
Hansen test	0.0024	0.1442	0.0170	0.1122	0.1186	0.1035	0.0647	0.0038



Livestock Estimation Results

Variable	L01	L02	L03	L04	L05	L06	L07
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LIndex	-30.5980	-26.8487	21.7303	19.8166	-140.2263***	-135.8415***	36.4574***
	(27.6738)	(25.2397)	(45.3714)	(40.1902)	(16.0302)	(11.3303)	(5.7823)
Employment	0.0015	0.0025	0.0171*	0.0127	0.0062	0.0036	0.0056***
	(0.0068)	(0.0058)	(0.0078)	(0.0069)	(0.0039)	(0.0032)	(0.0015)
Temperature	-0.4370	-0.6641	-2.4070	-2.8166*	-1.9736*	-1.9432***	-0.5797
	(1.0327)	(0.9222)	(1.6889)	(1.4006)	(0.8485)	(0.5692)	(0.4544)
NCSAgri	0.1278	0.1743	0.3648	0.3444	-0.0323	-0.0277	0.1555*
	(0.1998)	(0.1673)	(0.2261)	(0.1873)	(0.1694)	(0.1434)	(0.0637)
GFCFAgri	0.0149	-0.0103	-0.2124*	-0.2457**	-0.1729*	-0.1850**	-0.0816**
	(0.0806)	(0.0662)	(0.1064)	(0.0752)	(0.0754)	(0.0607)	(0.0257)
CreditAgri	-0.0097	-0.0094	-0.0030	-0.0147	0.0197**	0.0018	-0.0038
	(0.0061)	(0.0059)	(0.0107)	(0.0100)	(0.0076)	(0.0049)	(0.0032)
RDBFunds	-0.0476***	-0.0404***	0.0223	0.0416	0.0074	0.0128	-0.0010
	(0.0110)	(0.0106)	(0.0284)	(0.0223)	(0.0145)	(0.0080)	(0.0060)
TechnicalGrants	-0.0104	-0.0147**	-0.0022	-0.0011	0.0071	0.0046	-0.0025
	(0.0061)	(0.0054)	(0.0157)	(0.0113)	(0.0069)	(0.0053)	(0.0030)
ForeignAid	-0.0002	-0.0003	0.0012	0.0001	0.0021*	-0.0002	-0.0002
	(0.0009)	(0.0009)	(0.0017)	(0.0014)	(0.0011)	(0.0006)	(0.0004)
FDIAgri	0.0059	0.0095	-0.0036	-0.0054	-0.0071	-0.0115*	-0.0133***
	(0.0094)	(0.0092)	(0.0215)	(0.0194)	(0.0067)	(0.0048)	(0.0026)
VAAgri	-0.0069	-0.0076*	-0.0020	-0.0037	0.0025	0.0019	-0.0010
	(0.0038)	(0.0033)	(0.0048)	(0.0049)	(0.0051)	(0.0046)	(0.0027)
VAWorker	0.0616**	0.0704***	0.0433	0.0354	-0.0112	-0.0104	0.0121
	(0.0227)	(0.0190)	(0.0327)	(0.0273)	(0.0189)	(0.0170)	(0.0092)
CFCAgri	-2.1967	-2.8150	-5.9576	-5.2280	-0.0242	0.2777	-2.3388*
	(3.0902)	(2.5880)	(3.4743)	(2.9124)	(2.6627)	(2.2570)	(0.9763)
FCE	0.0009	-0.0010	-0.0001	0.0009	0.0149***	0.0149***	-0.0019
	(0.0064)	(0.0057)	(0.0081)	(0.0073)	(0.0037)	(0.0029)	(0.0012)
TaxesSubsidies	-0.0191	-0.0155	0.0287	0.0238	-0.0255	-0.0317**	0.0120*
	(0.0213)	(0.0194)	(0.0303)	(0.0271)	(0.0135)	(0.0103)	(0.0050)
Constant	70.9555	58.7389	-65.4513	-54.6891	262.1270***	252.3085***	-75.1185***
	(67.6453)	(60.5071)	(92.5921)	(84.6693)	(37.2487)	(27.8570)	(13.6150)
Observations	30	30	30	30	30	30	30
R-squared	0.8721	0.8105	0.9563	0.9713	0.9479	0.9630	0.9855
Hansen test	0.0408	0.0206	0.0088	0.0070	0.0028	0.0289	0.8812

Cattle meat/indigenous

Livestock Estimation Results

Variable	L01 (1)	L02 (2)	L03 (3)	L04 (4)	L05 (5)	L06 (6)	L07 (7)
LIndex	-30.5980	-26.8487	21.7303	19.8166	-140.2263***	-135.8415***	36.4574***
	(27.6738)	(25.2397)	(45.3714)	(40.1902)	(16.0302)	(11.3303)	(5.7823)
Employment	0.0015	0.0025	0.0171*	0.0127	0.0062	0.0036	0.0056***
	(0.0068)	(0.0058)	(0.0078)	(0.0069)	(0.0039)	(0.0032)	(0.0015)
Temperature	-0.4370	-0.6641	-2.4070	-2.8166*	-1.9736*	-1.9432***	-0.5797
	(1.0327)	(0.9222)	(1.6889)	(1.4006)	(0.8485)	(0.5692)	(0.4544)
NCSAgri	0.1278	0.1743	0.3648	0.3444	-0.0323	-0.0277	0.1555*
	(0.1998)	(0.1673)	(0.2261)	(0.1873)	(0.1694)	(0.1434)	(0.0637)
GFCFAgri	0.0149	-0.0103	-0.2124*	-0.2457**	-0.1729*	-0.1850**	-0.0816**
	(0.0806)	(0.0662)	(0.1064)	(0.0752)	(0.0754)	(0.0607)	(0.0257)
CreditAgri	-0.0097	-0.0094	-0.0030	-0.0147	0.0197**	0.0018	-0.0038
	(0.0061)	(0.0059)	(0.0107)	(0.0100)	(0.0076)	(0.0049)	(0.0032)
RDBFunds	-0.0476***	-0.0404***	0.0223	0.0416	0.0074	0.0128	-0.0010
	(0.0110)	(0.0106)	(0.0284)	(0.0223)	(0.0145)	(0.0080)	(0.0060)
TechnicalGrants	-0.0104	-0.0147**	-0.0022	-0.0011	0.0071	0.0046	-0.0025
	(0.0061)	(0.0054)	(0.0157)	(0.0113)	(0.0069)	(0.0053)	(0.0030)
ForeignAid	-0.0002	-0.0003	0.0012	0.0001	0.0021*	-0.0002	-0.0002
	(0.0009)	(0.0009)	(0.0017)	(0.0014)	(0.0011)	(0.0006)	(0.0004)
FDIAgri	0.0059	0.0095	-0.0036	-0.0054	-0.0071	-0.0115*	-0.0133***
	(0.0094)	(0.0092)	(0.0215)	(0.0194)	(0.0067)	(0.0048)	(0.0026)
VAAgri	-0.0069	-0.0076*	-0.0020	-0.0037	0.0025	0.0019	-0.0010
	(0.0038)	(0.0033)	(0.0048)	(0.0049)	(0.0051)	(0.0046)	(0.0027)
VAWorker	0.0616**	0.0704***	0.0433	0.0354	-0.0112	-0.0104	0.0121
	(0.0227)	(0.0190)	(0.0327)	(0.0273)	(0.0189)	(0.0170)	(0.0092)
CFCAgri	-2.1967	-2.8150	-5.9576	-5.2280	-0.0242	0.2777	-2.3388*
	(3.0902)	(2.5880)	(3.4743)	(2.9124)	(2.6627)	(2.2570)	(0.9763)
FCE	0.0009	-0.0010	-0.0001	0.0009	0.0149***	0.0149***	-0.0019
	(0.0064)	(0.0057)	(0.0081)	(0.0073)	(0.0037)	(0.0029)	(0.0012)
TaxesSubsidies	-0.0191	-0.0155	0.0287	0.0238	-0.0255	-0.0317**	0.0120*
	(0.0213)	(0.0194)	(0.0303)	(0.0271)	(0.0135)	(0.0103)	(0.0050)
Constant	70.9555	58.7389	-65.4513	-54.6891	262.1270***	252.3085***	-75.1185***
	(67.6453)	(60.5071)	(92.5921)	(84.6693)	(37.2487)	(27.8570)	(13.6150)
Observations	30	30	30	30	30	30	30
R-squared	0.8721	0.8105	0.9563	0.9713	0.9479	0.9630	0.9855
Hansen test	0.0408	0.0206	0.0088	0.0070	0.0028	0.0289	0.8812

Chicken meat/indigenous

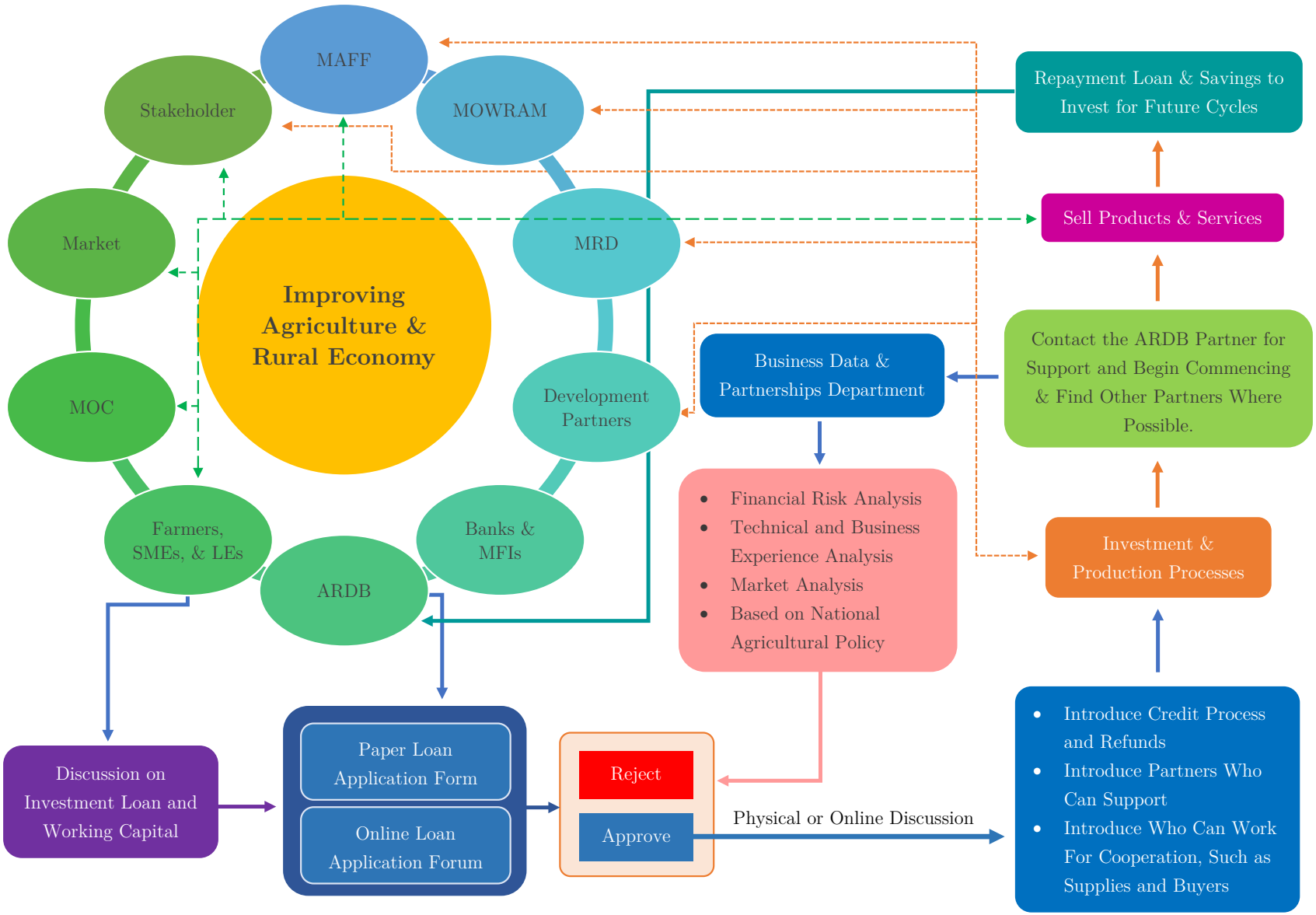
Summary Results

- Many agricultural inputs: water through irrigation, tractors, fertilizers, employment, and net capital stock in agriculture are not much efficient for crop production while many inputs are not correlated with liveshok's product estimators.
- Value added per capita in agriculture, consumption and taxes less subsidies are not a major driver of production growth for crops and livestock.
- Cassava, dry chilies and peppers, grapefruit and pomelos, green coffee, lemons and limes, mangoes, nuts, paddy rice, pineapples, roots and tubes, duck meat and other bird eggs in shells have increased income over the past 60 years.

Policy Discussion

- I wrote some op-eds to advocate with these below suggestion.
- It should to create a "***new system***" – *transfer grants with technical assistance.*
- Subsidies should dominate for those who are firmly committed to investing and **who cannot afford to obtain loans** from other financing and investment schemes related to potential products.
- Credit processes and administrative services must be timely, reasonable, reliable, good quality, and secures – *invest in new technological innovations.*
- Create **a central hub** that for accessing agricultural information, finding new markets, trading partners, and technical assistance – *community-supported agriculture.*

Policy and Investment Cycle



Conclusion

- This study provide an overview of the **current state** of Cambodian agricultural commodity and its subsidy bank to support agents in the sector. It also contributes to the growth of the literature on agriculture finance, diversification, public banks, subsidies and two-step GMM estimator in agriculture.
- It would be useful for further study on combine other econometric methods with theoretical and policy analysis on **micro dataset** in **specific products**, **market information** and the crop and livestock **value chain** at the regional or **provincial** level, as well as the **efficiency** of public banks.

Thank You!

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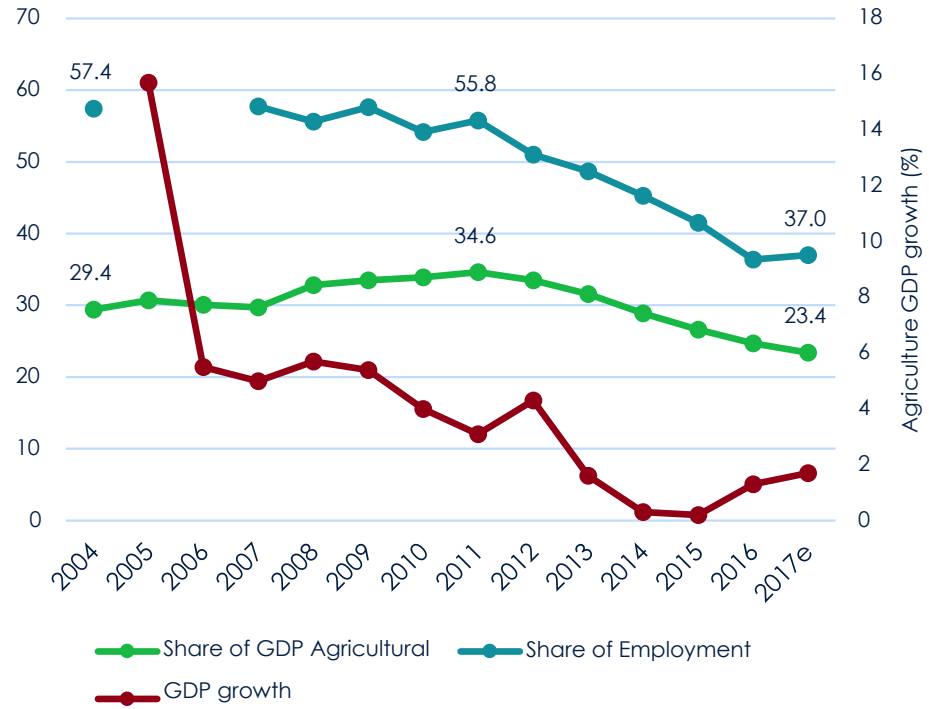
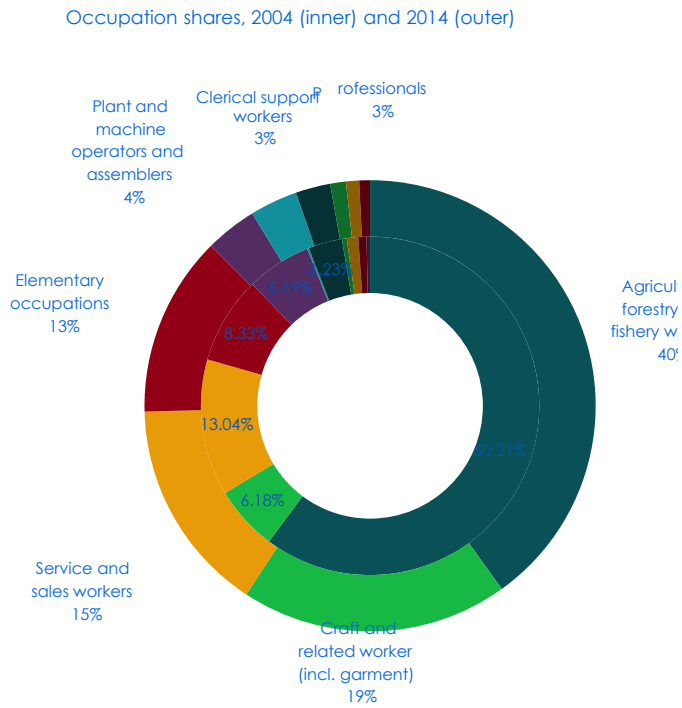
Appendix

Agricultural GDP and Employment



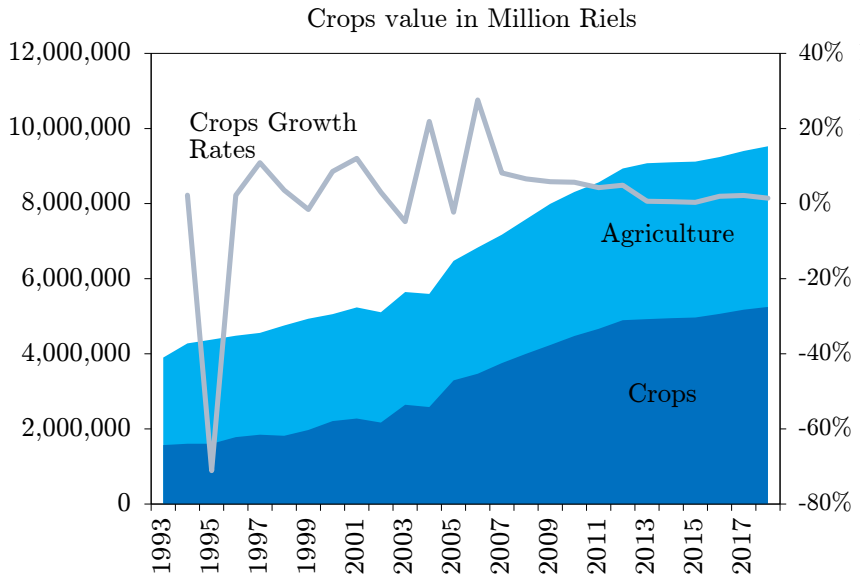


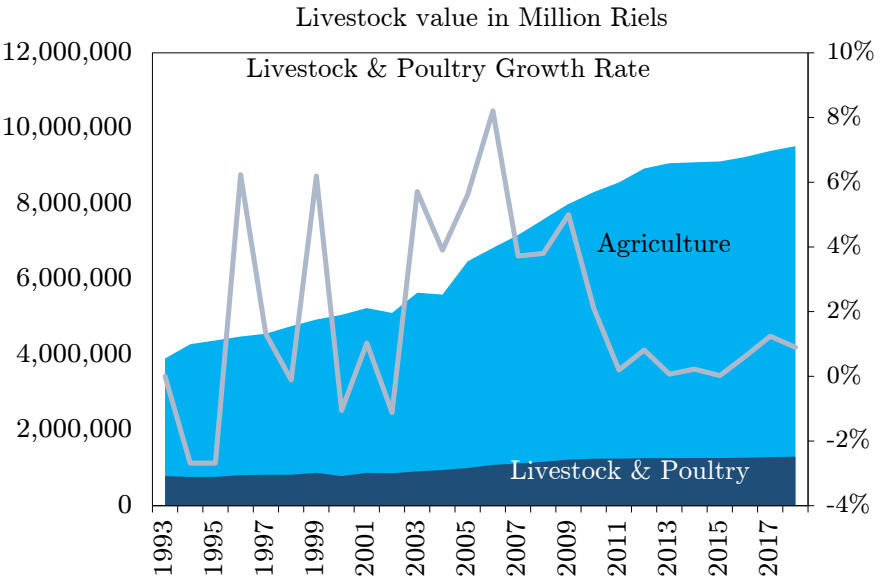
Source: **Cambodia Economic Diversification Study**
***Fostering diversification, value chain participation, and upgrading*, June, 2019.**

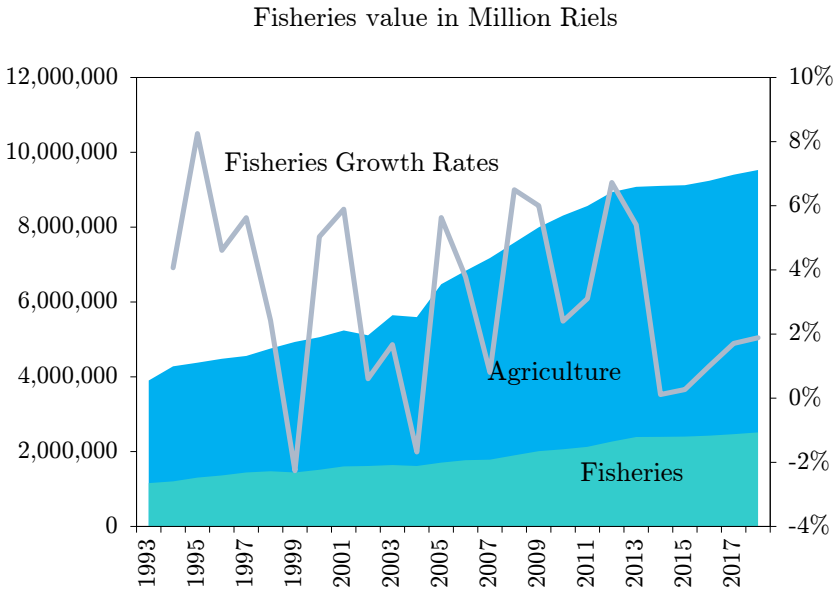
Agricultural GDP growth has slowed since 2012, and the share in employment and GDP has declined. While more than half of the workforce were still employed in poor quality jobs in 2014.

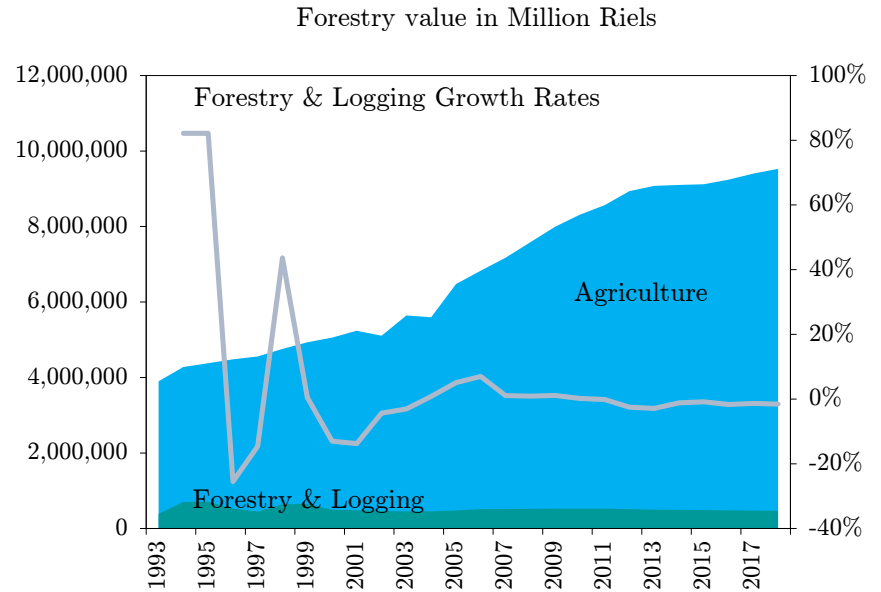
Crop, Livestock, Fisheries, and Forestry Outcome

Back









Source: Ministry of Economy and Finance 2018