

The Effect of Market Participation on Productivity: Evidence from Cambodian Rice Farmers

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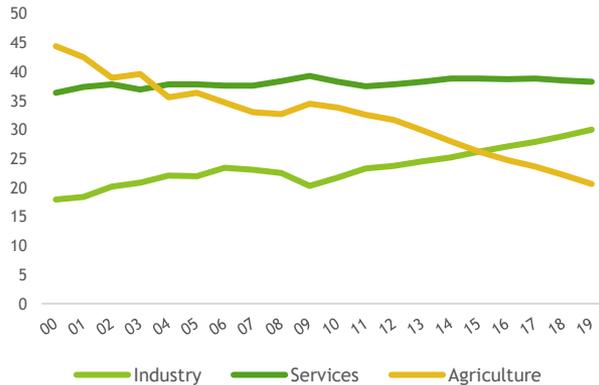
- I. Background
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Background

- Agriculture remains an important sector in developing countries. In 2018, agriculture value added constitutes about 1/4 of GDP and 2/3 of employment in low income economies.
- Poverty reduction in many of these countries remains heavily dependent upon the performance of the sector. That is because the livelihood of the poor population is based mainly on agriculture.
- In Cambodia, agriculture production is dominated by paddy rice and its cultivated area has steadily increased. In 2019, paddies occupied about 3/4 of the total cultivated area.
- Despite some progresses in the sector, Cambodia's rice yields remain relatively low compared to that of neighboring countries, indicating a potential role for productivity improvement.

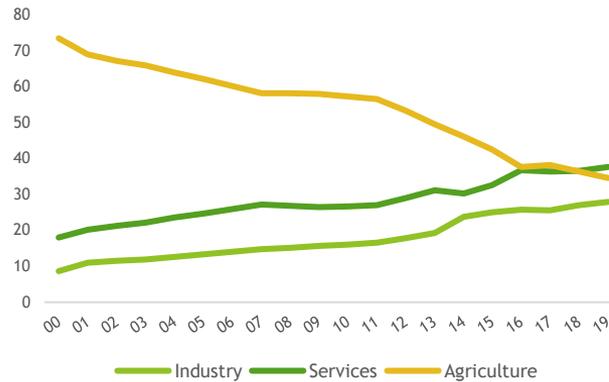
Background

Figure 1: Sectoral Composition of GDP
(percent of GDP, constant prices)



Source: World Development Indicators.

Figure 2: Employment Share
(percent of total employment)

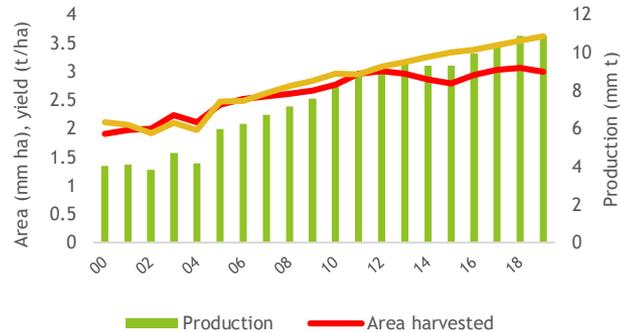


Source: World Development Indicators.

- Before the COVID-19 pandemic, Cambodia experienced an average real growth rate of 7.7 percent over the past two decades.
- A combination of accelerated growth in manufacturing, construction, and tourism means a diminishing role of agriculture in the economy albeit its expansion in absolute terms.

Background

Figure 3: Rice Paddy



Source: FAOSTAT

- Between 2000 and 2019, area harvested has broadened from 1.9 million ha to 3 million ha; meanwhile, improvement in yields have brought about a boost from 2.1 tons/ha to 3.6 tons/ha.
- A combination of land expansion and yield rise has boosted paddy gross production from about 4.03 million tons to 10.89 million tons with an average annual growth rate of 5.9 percent.
- This graph shows that while the increase in paddy production is due to increase in harvested area, the large part of it comes from the yield increase.

Background

Figure 4: Paddy Area & Production
(percent of cropland & crop production, constant prices)



Source: FAOSTAT.

- In 2000, paddy occupies about half of the total cultivated area. By 2019, its share reaches approximately 74%.
- However, the share of paddy production decreased from 76% to about 57%.
- Growth of other crops: Maze grew by 20%; cassava 51%; sugarcane 22%; vegetable 10% (between 2004 and 2012).

Background

- With steady increase in paddy production, Cambodia has achieved rice self-sufficiency since 1995.
- In 2008, Cambodia exports its first significant amount of milled rice and gradually recovers its status as a major rice exporter. By 2020, it exports about 700 thousand tons of milled rice, an 11 percent increase from the previous years.
- Of these exports, 42 percent is to China, 30 percent to Europe, 13 percent to Asian nations, and the rest to other countries. Aromatic rice makes up about 82 percent of the export.
- Although this export falls short of the government's target of one million tons by 2015, informal cross-border trade of paddy to neighboring countries is estimated to be over two million tons, three times that of the official exports.

Background

Studies on Cambodian rice sector differ depending on the data used:

- Yu and Fan (2011) estimate rice production response to prices using the Cambodia Socioeconomic Surveys conducted in 2004-2007.
- Chun (2014) employs a farm investment climate assessment survey to determine key factors contributing to rice production and commercialization of small farms in three provinces: Battambang, Kampong Thom, and Takeo.
- Applying the stochastic frontier model, Kea et al. (2016) measure technical efficiency and examine the determinants of rice production in 25 provinces between 2012 and 2015.
- Mishra et al. (2018) investigate the impact of flood and drought as well as access to capital on rice production in Kampong Thom, Pursat, Battambang, and Siem Reap by utilizing survey data from the International Rice Research Institute.
- Chhim et al. (2020) attempt to determine factors augmenting rice production and efficiency in Takeo Province.

Background

International studies on commercialization-productivity nexus:

- Govere and Jayne (2003), using data from Gokwe North District in Zimbabwe, find that households engaging intensively in commercialization scheme of cotton production have higher grain yields than non-cotton and marginal cotton producers.
- Strasberg et al. (1999), using data from Kenya, find similar productivity impact on food crop as a result of cultivating cash crops such as cotton and groundnuts.
- Rios et al. (2009), using data from Tanzania, Vietnam and Guatemala, find no consistent evidence of the impact of market participation on productivity.

Background

- Khun and Lim (2022): A one-ton increase in rice yields leads to about 20 percent rise in the probability of commercialization.
(Note: Commercialization is a binary.)
- What is different in this study?
 1. The impact of commercialization on productivity, rather than the other way around.
 2. Commercialization is calculated as a share of harvest sold.
- Why?
 - Because it should tell us if the government should put resources on commercialization or productivity-improving policies.

Background

Objective:

- To calculate the intensity of commercialization among rice farmers in various provinces in Cambodia
- To calculate the level of productivity among rice farmers in various provinces
- To examine factors that are correlated with productivity
- To estimate the impact of rice commercialization on productivity

Data and Variables

Data:

- Cambodia Inter-Censal Agriculture Survey in 2019 (CIAS19)
- Cambodia Agriculture Census in 2013 (CAC13)

Variables:

- Yields = annual amount of crop output in kilograms per hectare of land
- Commercialization: Household Crop Commercialization Index (HCCI)

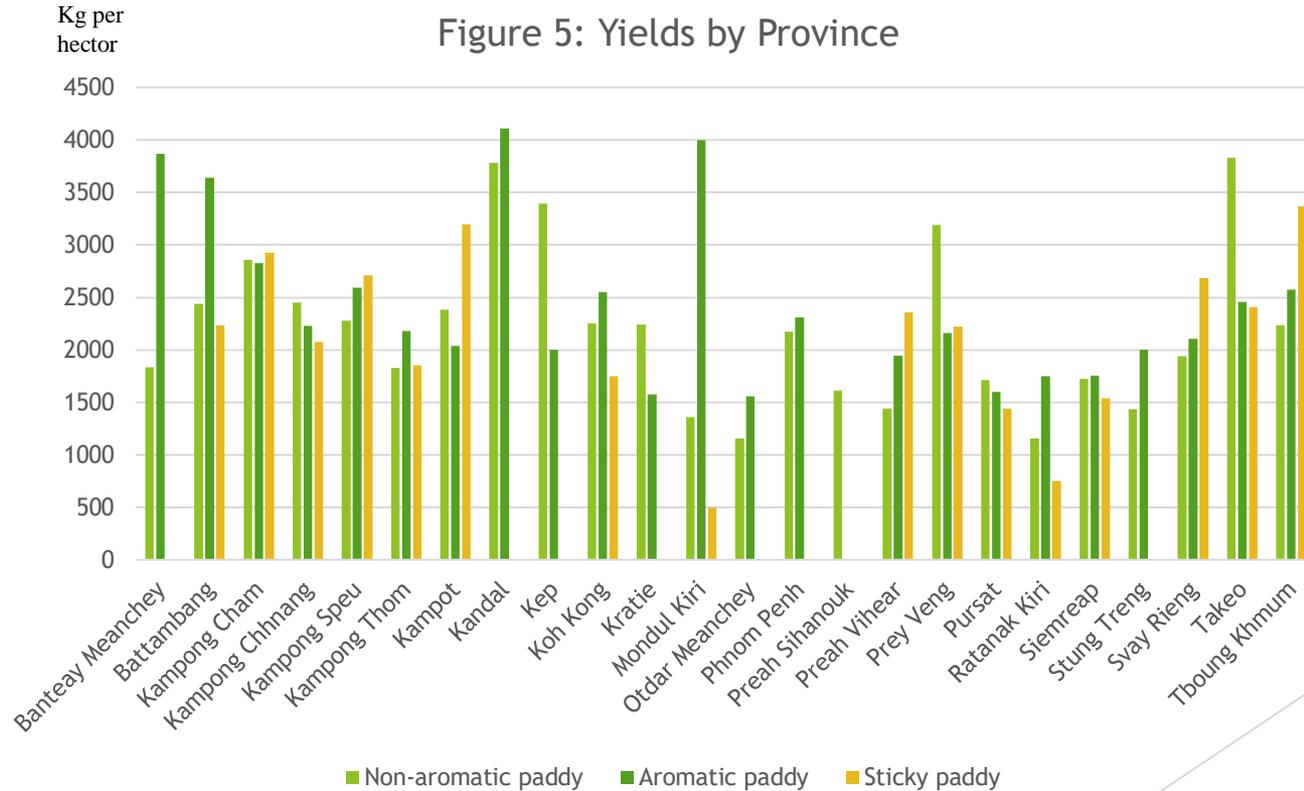
$$HCCI = \frac{\textit{Gross value of all crop sales}}{\textit{Gross value of all crop production}} \times 100$$

Data and Variables

- 24 Provinces: Banteay Meanchey, Battambang, Kampong Cham, Kampong Chhnang, Kampong Speu, Kampong Thom, Kampot, Kandal, Kep, Koh Kong, Kratie, Mondul Kiri, Otdar Meanchey, Phnom Penh, Preah Sihanouk, Preah Vihear, Prey Veng, Pursat, Ratanak Kiri, Siem Reap, Stung Treng, Svay Rieng, Takeo, Tboung Khmum.
- Rice: Aromatic, non-aromatic, and sticky
- Seasons: Both rainy and dry

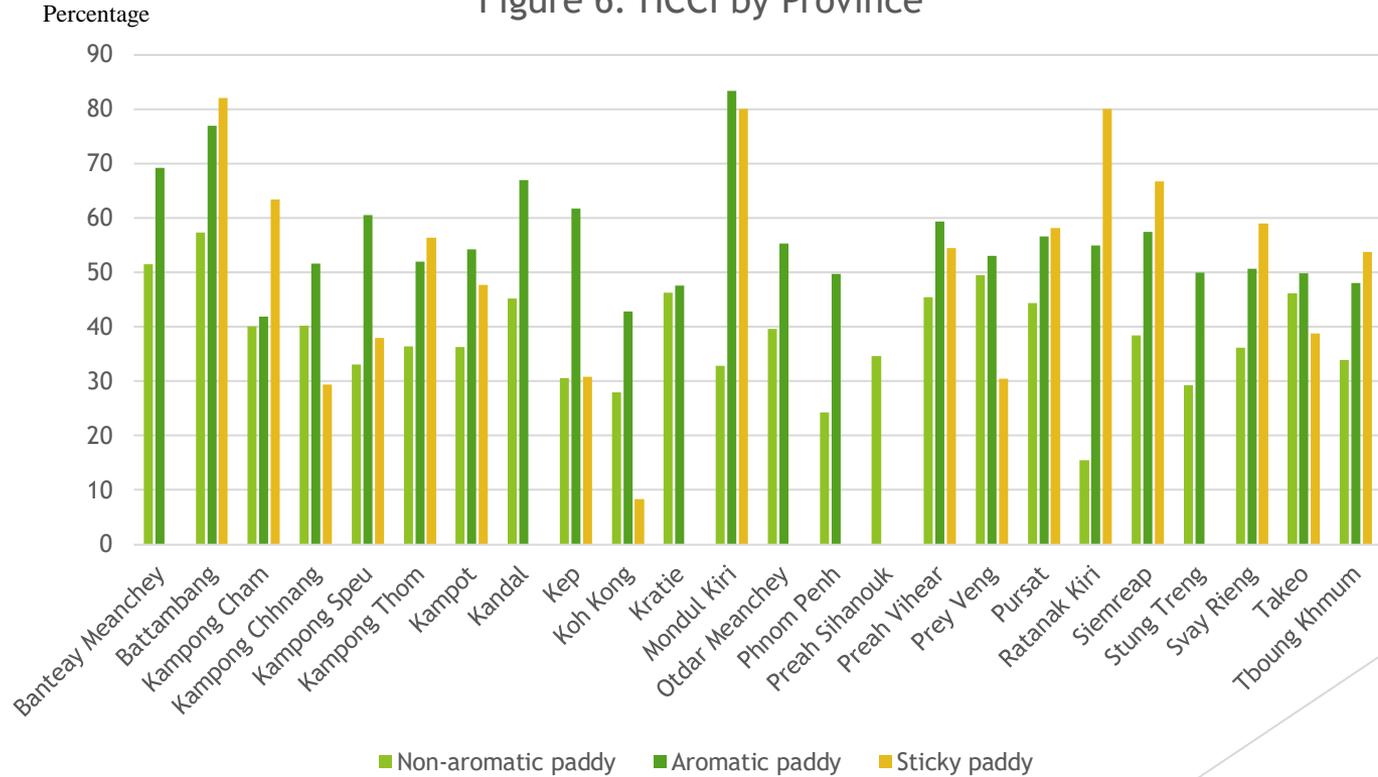
Data and Variables

Figure 5: Yields by Province

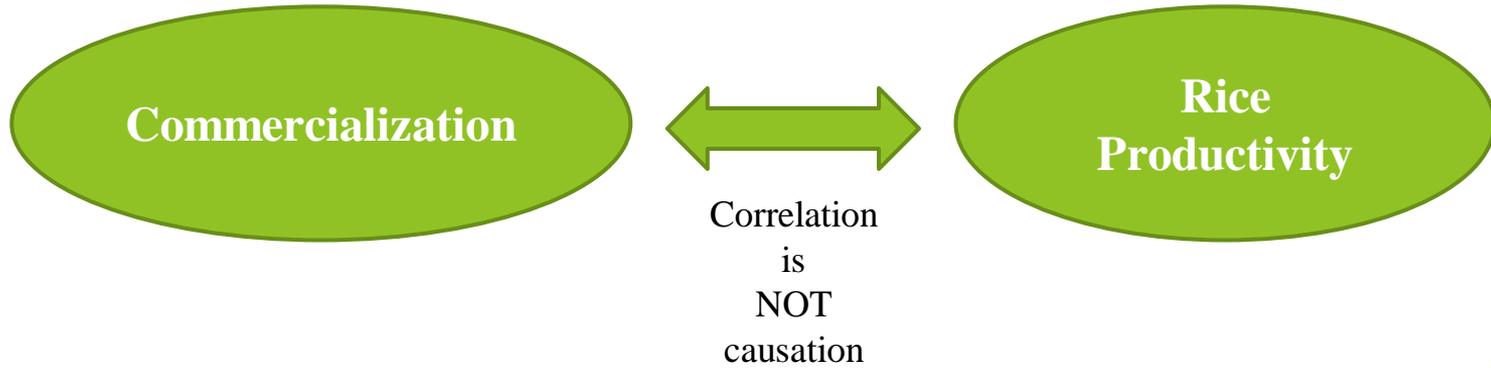


Data and Variables

Figure 6: HCCI by Province

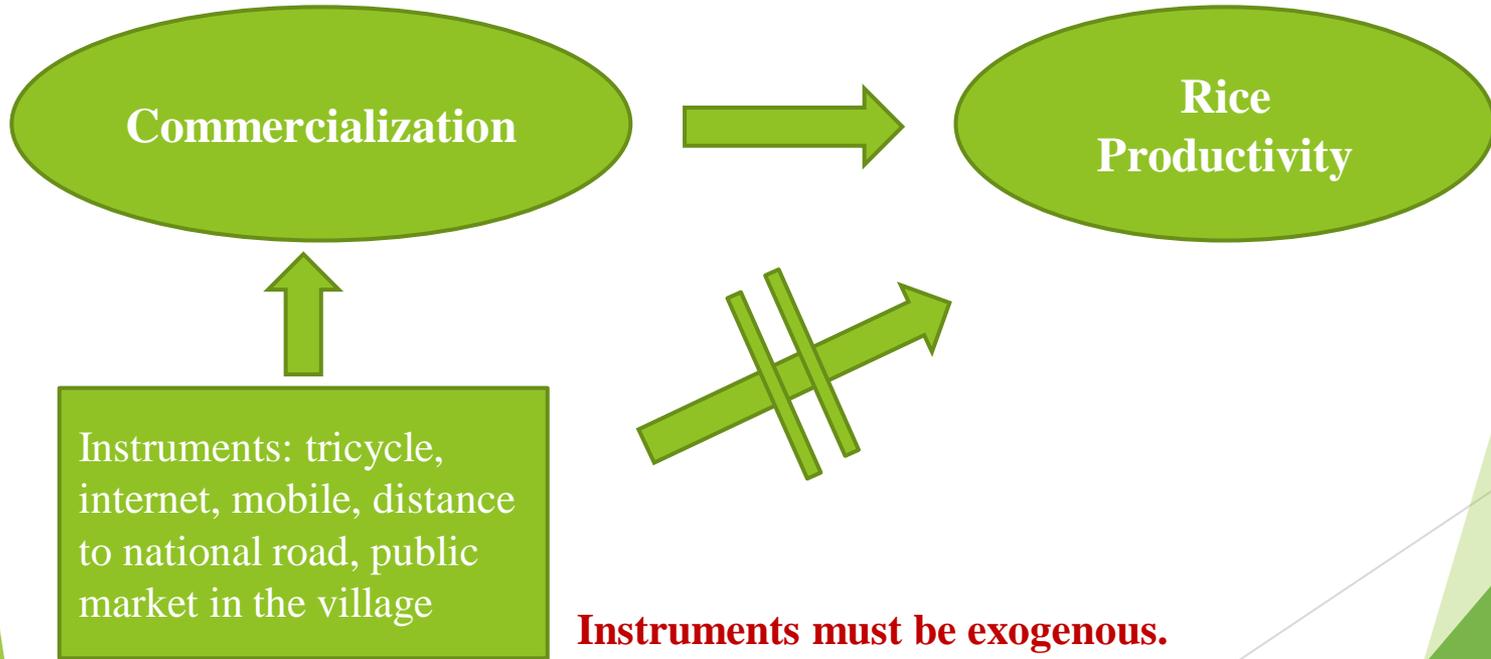


Methodology



Methodology

So, instrumental variable estimation:



Instruments must be exogenous.

Preliminary Results

Table 1: Two-Stage Least Square Estimation

Dependent Variable: Yields	Coefficient	S.E.
HCCI	22.95***	(8.957)
Shocks	-283.0***	(44.87)
Aromatic paddy	-122.8	(142.4)
Sticky paddy	107.1	(190.1)
Individual Characteristics		
Age	-0.894	(2.062)
Male	78.04	(80.04)
Married	-107.4	(68.65)
Primary edu.	191.4***	(55.66)
Secondary edu.	253.6***	(85.68)
High school+	189.2	(97.49)
No. children	-12.12	(27.36)
No. elderly	41.37	(41.98)
Constant	1393***	(434.5)
Province id.		yes
Number of obs.		9102
R-squared		0.218

Note: Robust standard errors are in parentheses.

The asterisk *** represents significant at the 99% confidence level.

Preliminary Results

Table 2: Two-Stage Least Square Estimation

Dependent Variable: Yields	Coefficient	S.E.
HCCI	9.717	(9.757)
Shocks	-217.2***	(49.65)
Aromatic paddy	102.5	(135.6)
Sticky paddy	283.8	(211.9)
Individual Characteristics		
Age	-0.870	(2.014)
Male	105.6	(70.81)
Married	-83.47	(68.38)
Primary edu.	223.3***	(48.37)
Secondary edu.	332.7***	(74.45)
High school+	306.3***	(92.01)
No. children	-42.57	(30.05)
No. elderly	27.58	(41.67)
Farm Characteristics		
Fertilizer	-68.94	(79.64)
Pesticide	331.7***	(81.56)
Irrigation	813.7***	(86.17)
Labor	0.046***	(0.012)
Loan	226.8***	(65.87)
Land	-103.7***	(24.44)
Farm size	-12.54	(18.79)
Constant	1755	(296.4)
Province id.		yes
Number of obs.		8969
R-squared		0.231

Conclusion

- Commercialization does not *directly* affect productivity.
- In fact, when farmers engage in crop sales, they spend more on pesticide and irrigation; hire more labor; and take out agricultural loans to improve productivity.
- Gov't policy should focus on improving productivity which will leads to commercialization.

- Other findings:
 - Education matters for productivity.
 - Fragmented land reduce productivity.

Thank you!

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the frame, creating a modern, layered effect against the white background.