

International Price Shock and Impacts on Farmers in Rice Market

Trade Proseminar (Fall 2023)

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Nov 9, 2023

Motivation:

- Exchange rate policies in developing countries.
- Who benefit from exchange rate movement? Exporters or farmers?
- Firms' short-run adjustment mechanism when downstream firms have the power to adjust the intermediate input prices.

Research Question:

- How would terms of trade shock affect surplus of exporters and farmers?
- Would the exporters and intermediaries act as insurers for the farmers against income shock?

Today's Presentation

Methodology

- Empirical evidence of price pass-through in rice market using Thai Agricultural Survey Data.
- Mechanism: market power of rice mills (intermediate input buyers).

Preliminary Result

- Farmers that located in the area with high density of rice mill receive higher farm price.
- At the same time they experience higher price passthrough.

- **Volatility and Trade:** Allen and Atkin (2016); Helpman and Rainn (1978); Newbery and Stiglitz (1984)
- **Market power and intermediaries:** Atkin and Donaldson (2015); Chatterjee (2020); Zavalu (2022); Dhingra and Tenreyro (2020); Van Patten and Mendez-Chacon (2021); Barks, Brooks, Kabuki and Pelnik (2021); Bergquist and Dinerstein (2020); Casaburi and Reed (Forthcoming)
- **Agricultural and trade:** Costinot, Donaldson and Smith (2016); Sotelo (2020); Farrokhi and Pellegrina (2021); Bergquist, Faber, Fally, Hoelzlein, Miguel and Rodriguez-Clare (2019)
- **Insurance:** Burgess and Panda (2005); Jayachandran (2006); Rodrik (1998); Alesina and Warziarg (1997); Epifanni and Gancia (2006)

1. Background and Setting: Rice Market in Thailand
2. Data and Stylized Facts
3. Empirical Analysis
 - 3.1 Conceptual Framework and Empirical Strategies
 - 3.2 Empirical Results
 - 3.2.1 Empirical facts: Mark-ups across regions
 - 3.2.2 Empirical facts: Changes in prices
4. Model
5. Conclusion and next step

Recap: Background and Setting

Thai Rice Industry Overview

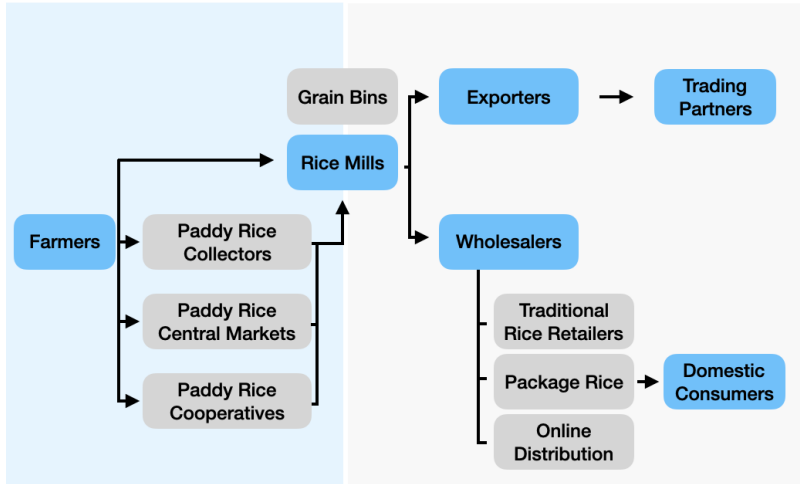
Rice and Thai Economy

- 46% of total harvest area in Thailand.
- 40% of household are in agricultural sector and 60.5% of agricultural household are rice farmers.
- The output is split half and half for domestic consumption and export.

International Rice Market

- 9.7% of total global rice production is for export
- Thailand is the 6th in terms of production (3.7% of total production), after China (29.3%), India (24.1%), Indonesia (7.0%) , Bangladesh (6.8%), and Vietnam (5.4%).
- Thailand is the 3rd in terms of export (11.9%); after India (38.9%) and Vietnam (12.9%)

Rice Industry in Thailand



Data

Data

1. Cross-sectional Thai Agricultural Household Survey (2006-2019)
 - 1.1 Price and Quantity
 - 1.2 Distribution Channels
2. Rice Business Registration Data and Google Maps Data
 - 2.1 Location (Village/District/Province)
 - 2.2 Distance

Data: Agricultural Survey Data

1. Geography and Location: Region, District, Subdistrict
2. Sources of Income: Rice Farming, Other Farm Income, Business, Wages, Government and Transfer
3. Rice Production: Quantities Sold, Price, Distribution Channel
4. Diversification: Land Area (Share), Income (Share), Farming Costs (Share)
5. Financial Constraints: Debt
6. Total Expenditure: Food Expenditure, Consumption Expenditure
 - Food Expenditure
 - Non-Food Expenditure

Rice Business Licensing

The following businesses are required to register in order to operate in Thailand.

1. Exporters

- 1.1 Package Rice Exporters

- 1.2 Border Exporter: Exporters that located near the border.

2. Importers

3. Rice Mill

- 3.1 Small: 5-60 tons/day

- 3.2 Medium: 60-300 tons/day

- 3.3 Large: >300 tons/day

4. Rice Market

5. Wholesaler: more than 40 tons per months

6. Rice Trader: middle man between rice mill and wholesalers/retailers

Assumptions

- International price shock and short terms adjustment of firms.
- Take production decision as given and quantities are predetermined.
- Export prices are exogenous.

Testable Hypothesis Whether intermediate buyers (rice mills) maintain their mark-ups (fully insured on their profits) and pass-through the price shock to upstream firms (farmers).

1. Relationship between farm price and rice mills' market power.
2. Ability for rice mills to pass-through price shock to the farmers.
3. Consumption adjustment and insurance of farmers.

Stylized Facts

Thai rice farmers are small

	Mean	s.d.	P25	P50	P75	Obs
Land for Rice Production						
- sqm	27,520	27,520	11,200	19,200	33,600	4,752
- share (%)	75.9	28.2	55.5	90.0	97.0	4,752
Quantities Produced						
- kg/year	10,122	13,702	2,000	4950	13,000	2,461
Price						
- Thai Baht/kg.	10.4	3.5	7	11	12.5	2,461

- Thai rice exports is approximately 8.2 mil tons

Distribution Channels

Channels	Household		Qunatities Sold		Price	
	No.	Share	No.	Share	Mean	S.D.
No intermediaries	93	3.7%	365,058	1.4%	13.7	6.6
Trader	637	25.3%	4,572,623	17.3%	10.82	3.06
Mill	1686	67.9%	20,643,227	78.3%	9.8	3.1
Market	37	1.5%	485,555	1.8	11.4	2.2
Co-op	58	2.3%	289,886	1.0%	13.3	4.7
Contracts	5	0%	20,000	0%	16.7	5.0

Empirical Results

Empirical Prediction 1: Surplus splitting and market power

How Surplus are splitting between exporters, rice mills and farmers

- Does surplus split between rice mills and farmers depend on the concentration of the rice mill?

Hypothesis 1: Farmers that located in the area with higher competition of rice mills receive higher prices.

$$Price_{hh,year} = \beta_0 + \beta_1 Mill_{province,year} + \beta_2 Quantities_{province,year} + \alpha_{year} + \varepsilon_{province,year}$$

Empirical Fact 1: Farmers located in area with higher number of rice mills receive higher prices

	Farm Price (Thai Baht per metric ton)			
	(1)	(2)	(3)	(4)
Number of Mill				
- Total	27.75 (20.04)			
- Large		19.73 (47.67)		
- Medium			62.32 (35.47)	
- Small				43.12 (37.06)
Quantities	-0.05 (0.008)	-0.06 (0.009)	-0.05 (0.007)	-0.05 (0.008)
Provincial Rice Production	0.04 (0.01)	0.03 (0.01)	0.05 (0.01)	0.04 (0.01)
Year FE	Yes	Yes	Yes	Yes
N	25,922	25,922	25,922	25,922
Adj R-sq	0.47	0.46	0.47	0.46
Clusters	Province	Province	Province	Province

Empirical Fact 1: Farmers located in area with higher number of rice mills get higher surplus share

	ln(Farm Price)		
	(1)	(2)	(3)
ln(Export Price)	0.842 (0.02840)	0.732 (0.0293)	0.593 (0.0909)
ln(Export Price)*No. of Mill		0.020 (0.0038)	
ln(Export Price)*1{ <i>LargeMill</i> }			0.261 (0.0957)
Province FE	Yes	Yes	Yes
Cluster	Province	Province	Province
Adj R-squared	0.49	0.49	0.49
obs	12,232	12,221	11,822

Table 1: Surplus Splitting

Empirical Fact 1: Farmers located in area with higher number of rice mills receive higher prices

Hypothesis 1:

Farmers that located in the area with high competition of rice mill receive higher prices.

Result

- Farmers that live in the provinces that have higher numbers of rice mills get relatively higher prices.
- Farmers that live in the provinces that have higher numbers of rice mills get higher surplus share.

Empirical Prediction 2: Pass-through and asymmetry

Testable Hypothesis: How rice mills adjust their mark-up when they are hit by international price shock?

- Does the rice mills maintain their mark-ups and completely pass-through the price shock to the farmers?
- Are there any asymmetry between positive and negative shocks?
- I use monthly country-level farm price and export price data from Jan 2005 to August 2022 to investigate the aggregate pass-through from export price to farm price.

$$\Delta \log P_t^{\text{farm}} = \beta \Delta \log P_t^{\text{ex}} + \alpha_{\text{month}} + \delta_{\text{year}} + \varepsilon_{\text{month}, \text{year}}$$

Empirical Fact 2: Pass-through from export price to farm price is incomplete

$$\Delta \log P_t^{farm} = \beta \Delta \log P_t^{ex} + \alpha_{month} + \delta_{year} + \varepsilon_{month,year}$$

	$\Delta \log P_{farm}$		
	(1)	(2)	(3)
		$\Delta P_{ex} > 0$	$\Delta P_{ex} < 0$
$\Delta \log P_{export}$	0.75 (0.02)	0.74 (0.04)	0.85 (0.07)
Month FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adj R-sq	0.94	0.94	0.78
N	200	85	114

Empirical Fact 2: Pass-through from export price to farm price is incomplete (Household Data)

	$\Delta \ln P^{farm}$
$\Delta \ln P^{ex}$	0.7587 (0.07712)
$\Delta \ln Q$	-0.170 (0.0062)
Cons	-.021 (0.0009)
Province FE	Yes
Cluster	Province
Adj R-squared	0.07
obs	3,080

Table 2: Export Price Passthrough: Household Data

Testable Hypothesis: How rice mills adjust their mark-up when they are hit by international price shock?

- Does higher competition among rice mills generate a result that is closer to a complete pass-through where exporters fully propagate the shock to local farmers?
- I use number of rice mills controlling total rice production in each province as a proxy for the market power.

Empirical Prediction 3: Pass-through and market power

	$\Delta \ln P^{farm}$	
	(1)	(2)
$\Delta \ln P^{ex}$	0.537 (0.1326)	0.596 (0.1008)
$\Delta \ln P^{ex} * \text{No. of Mills}$	0.012 (0.0062)	
$\Delta \ln P^{ex} * \text{Large Mills}$		0.031 (0.0103)
Cons	-.020 (0.0001)	-.020 (0.0001)
Province FE	Yes	Yes
Cluster	Province	Province
Adj R-squared	0.06	0.06
obs	3,080	3,080

Table 3: Export Price Passthrough & Competition: Household Data

Empirical Fact 5: Consumption Adjustment

- Farmers are financially constrained
- A positive income shock would lead to an increase in consumption and debt repayment.

Consumption Adjustment

	ln(variable)			
	Food	Non-food	Debt	Debt Repayment
	(1)	(2)	(3)	(4)
ln(rice farm income)	0.202 (0.0095)	0.290 (0.0113)	0.452 (0.0207)	0.405 (0.0227)
Cons	8.181 (0.1176)	7.652 (0.1385)	7.355 (0.2520)	6.697 (0.2767)
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Province	Province	Province	Province
Adj R-squared	0.47	0.583	0.31	0.36
obs	8,109	8,830	11,518	10,982

Table 4: Change in consumption given change in income

Farmers are borrowers

THB	Mean	10th Percentile	50th Percentile	90th Percentile
2011	236,103	30,000	150,000	510,000
2012	282,023	41,200	175,713	598,600
2013	303,407	40,000	178,350	646,100
2014	319,125	41,200	192,600	701,000
2015	330,087	40,000	196,860	725,600
2016	361,289	41,000	213,350	780,000
2017	365,064	40,000	208,830	740,000
2018	308,212	30,000	160,500	700,000
2019	319,450	30,000	175,850	713,000
2020	338,745	30,000	190,000	763,600

Table 5: Average loan size by household at the beginning of the year

Model

Taking stock

- Farmers that live in the area with high concentration of rice mills receive higher prices.
- At the same time, they also experience higher income shocks from price passthrough.
- Investigate the fluctuation in consumption given income shock.

Goal: Calculate the farmer surplus and conduct counterfactual analysis when there are rice mills as intermediaries and no rice mills.

Research Questions: Do small farmers get lower price but more insurance (less fluctuation in prices)?

- Would this lead to a better outcome when farmers are financially constrained?
- Calculate the surplus of the farmers and rice mills.

Key Mechanisms:

- Intermediaries (rice mills) act as insurers
- Farmers are financially constrained.

Conclusion and Next Step

- The paper studies the empirical facts about the pass-through from international price shock to upstream producer.
- This paper focus on short-run price adjustment, taking production decision as fixed.
- Higher the number of mills in the region, farmers got higher price but more fluctuation.

Next Step:

- Improve the measure of competition of intermediaries
- The next step, I plan to incorporate the empirical facts to the model to conduct the welfare and policy analysis.