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THE EFFECT OF RICE PRICE-PLEDGING SCHEME ON PRICE TRANSMISSION OF RICE MARKETS IN THAILAND

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ABSTRACT

The rice price-pledging scheme is a price support program that aims to provide a loan at low interest rate to farmers. The government lends the farmer money equivalent to the value of the pledged rice. This policy has been criticized that it may distort the market mechanism. Therefore, this paper analyses the effect of the rice-price pledging policy on price transmission of rice markets in Thailand over the period of 2001-2009 using time series techniques. A co-integration analysis reveals existence of a long-run equilibrium relationship among farm gate, wholesale, retail, and export prices. Based on Granger causality test, a unidirectional causality was detected, running from farm gate to export prices, and from wholesale to export prices. In addition, there was bidirectional causality in other three price relationships: between retail and export prices; between wholesale and retail; between farm gate and retail. The results from Granger causality test together with the Wald (χ^2) coefficient test confirm that changes in predetermined farm gate price by government provided the largest effect to export prices. Consequently, exports are at a disadvantage when the rice-price pledging policy is launched.

Key Words: Thai rice market, causality, price transmission, time series analysis, rice-price

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INTRODUCTION

Rice is a major agricultural commodity in Thailand. Rice production is a major source of farmers' income. From 2001 to 2009, approximately 70 % of rice production was consumed in Thailand (OAE, 2010). In addition, rice is the most important staple food in Thailand. On average, per capita rice consumption per year was around 118 kg as a Thai person consumed about 335 kgfood per year in 2011. In addition, rice is a major export commodity in Thailand. In 2011, rice export value reached US$ 5,600 million (Thai rice export association, 2012).

The Thai government has launched the rice price-pledging scheme since 1982. The essence of rice price-pledging scheme is similar to the US loan rate program. The initial objective of rice price-pledging scheme was to provide a loan at low interest rate for farmers who needed cash in the early harvesting season so that the farmers can keep their products from selling at low price and delay sales until prices rise later. The government assigns the Bank of Agriculture and Agricultural Cooperative (BAAC) to lend the farmer money equivalent to the value of the pledged rice. The value is calculated at a price predetermined by the government. The farmers receive the loan for their pledged rice at the net interest cost of 3% per annum and are given 5 months to redeem their pledged rice. Otherwise the pledged rice goes to the government.

A big change in the scheme occurred in 2001 when the organization in charge of directing the pledging rice changed from BAAC to the rice millers. There was a dramatic increase in the price pledging of rice by 120% to 130% of the market price in 2001. As a result, the budget expenditure for the program rose from US$ 0.24 billion in 2001 to US$ 1.31 billion in 2005. The amount of pledged rice also sharply increased from 6 million tons in 2001 to the peak of 10 million tons in 2008. During the 2008 the price pledging of rice was reduced down to 12, 000 baht (US$ 348). However, the price pledging of rice was still 20% higher than the market price, causing the government's rice stock to increase markedly. Consequently, the government has become the largest domestic rice trader (Isvilanonda and Kao-ent, 2009).

Forssell, (2009); Lindblom, (2001); Ponnarong, (2008) indicated that the rice price-pledging scheme may distort market mechanism because this policy not only increases the farm price in the harvesting period but depresses the market price later in the season when the government releases the rice in the market. In addition, this policy also caused structural changes to the market. According to the Center of Applied Economics Research in Thailand (2004), around 65.73% of total rice was pledged with government while only 31.17% was sold to other suppliers in the market. The increase in the share of pledged rice hold by the government reduced the number of local rice buyers, related farmers' organizations, and central rice markets. Meanwhile, the millers have increased their roles as a representative of government in order to buy pledged rice from farmers.

Although the effects of the pledging policy on price relationship are still in doubt, Thailand government decided to reemploy the policy on October 2011. The process of price transmission through the different markets levels plays an important role in determining the size and distribution effects of price changes from one market level to others. Therefore, the aim of this paper is to analyses the effect of the rice-price pledging policy on price transmission over the period of 2001-2009. Conclusions drawn from this study will enable us to understand the price mechanism in Thai rice market during the rice price-pledging scheme implementation.

DATA AND METHODS

Data

The data used for this study include farm gate (FM), wholesale (WH), retail (RT) and export (EX) monthly prices of Thai Jasmine rice 100%. Wholesale (WH) prices refer to wholesale prices at Bangkok market. Retail prices refer to buying price of consumers at Bangkok market. Export prices refer to free on board (FOB) prices. The monthly price data on FM, WH, RT, and EX were obtained from the Office of Agricultural Economics (OAE), Bank of Thailand (BOT), Ministry of Commerce Thailand, and Osiriz /InfoArroz, respectively. The data has covered the period from January 2001 to December 2009. All price data were measured in US dollars.

Methods

The methodology employed in this paper entailed four steps. The first step was the unit root test. This step confirms that all variables integrated in the same order; if not, long-run equilibrium relationships between variables cannot be identified (Engle and Granger, 1987). The unit root test was conducted by the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1981) and Phillips-Perron (PP) (Phillips and Perron, 1988) test statistics under the null hypothesis that the time series in question is non-stationary around a fixed time trend. If the hypothesis cannot be rejected then a single difference will be performed to ensure that all variables are stationary.

The second step, using Johansen cointegration procedure (Johansen, 1988; Johansen and Juselius, 1990) presented in equation (1) to detect long-run equilibrium relationship among variables. In addition, maximum eigenvalue and trace tests were employed to identify cointegration relationship and the Schwarz Bayesian information criterion (SBC) was applied to select the number of lags required in each price series.

$$\Delta Y_t = \mu_1 + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \Pi Y_{t-1} + \varepsilon_{1t} \qquad (1)$$

where Δ is the difference operator, Y_t is the metrics of variables, μ_1 is a constant term, Γ and Π are coefficients for estimation, k is a lag length of the model, and ε is an error term. The third step, causal directions among variables was defined by using Granger causality test (Granger, 1969). The F-statistic test was employed to test causal relationships based on bi-variate autoregressive model (2) and (3). The hypothesis that X (Y)does not Granger cause Y (X)was performed.

$$\Delta Y_t = \mu_2 + \sum_{i=1}^{k} \beta_1 \Delta Y_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta X_{t-i} + \varepsilon_{2t} \qquad (2)$$

$$\Delta X_t = \mu_3 + \sum_{i=1}^{k} \beta_3 \Delta X_{t-i} + \sum_{i=1}^{k} \beta_4 \Delta Y_{t-i} + \varepsilon_{3t} \qquad (3)$$

where Δ is the difference operator, Y and X are variables, μ_2 and μ_3 are constant term, $\beta_2$and $\beta_4$are the estimate coefficients, and k is the lag length of the model. The final step, the Wald (χ^2) coefficient test was applied to examine the size of impact transmission among variables.

Empirical Results

Table-1 shows that the unit root tests from ADF and PP cannot be rejected in levels at the 5% significance. However, when the first order difference was tested, The ADF and PP tests indicated that unit root can be rejected at the 5 % significant level, which allows us to further analyze the co-integration.

Table-1: Results of unit root tests

Variable	Levels		First differences	
	ADF	PP	ADF	PP
FM	-3.253	-2.601	-7.071*	-6.642*
WH	-3.378	-2.788	-7.503*	-7.132*
RT	-2.648	-1.898	-6.158*	-5.606*
EX	-3.074	-2.761	-8.229*	-4.777*

Note: The asterisk indicates significance at the 5% level.

We applied Johansen, (1988) and latter on Johansen and Juselius, (1990) procedures to investigate long-run equilibrium relationship among the series FM, WH, RT and EX by employing optimal lag length of two which was the smallest number of the Schwarz Bayesian information criterion (SBC). The results of the long-run equilibrium relationship between the market levels were displayed in Table-2. Application of trace and maximum eigenvalue statistics indicated that there was one cointegration relationship among the market levels at the 5% significance level. In other words, farm gate, wholesale, retail and export prices move together in the long-run. Therefore, at least one causal directional either unidirectional or bidirectional should be found in the Granger causality test (Engle and Granger, 1987).

Table-2. Results of the cointegration tests

Null hypothesis	Test Statistic		Critical Value (95%)	
	Trace	Maximum eigenvalue	Trace	Maximum eigenvalue
$r = 0$	62.907*	39.074*	47.856*	27.584*
$r \leq 1$	23.833	12.018	29.797	21.132
$r \leq 2$	11.815	11.711	15.495	14.265

Note: The asterisk denotes rejection of the null hypothesis of cointegration at the 5% significance level.

The results from Granger causality test by *F*-statistic are displayed in Table-3. A unidirectional causality was detected, running from FM to EX, and from WH to EX. In other words, farm gate and wholesale prices cause export prices in the long-run. In addition, there was bidirectional causality in other four price relationships: between RT and EX; between WH and RT; between FM and RT; and in accordance with Wiboonpongse et al. (2001) between WH and FM.

Table-3. Results of Granger causality tests

Independent variable (X)	Dependent variable (Y)			
	ΔFM	ΔWH	ΔRT	ΔEX
ΔFM	-	5.394*	3.919*	2.851
ΔWH	5.241*	-	6.864*	1.286
ΔRT	17.504	19.827*	-	12.573*
ΔEX	8.317*	23.052*	7.090*	-

Note: The symbol (Δ) denotes the different operators. The asterisk denotes rejection of the null hypothesis at 5% significance level.

After the causal relationship was found (Table-3), the Wald (χ^2) coefficient test was employed to measure the size impact transmission among FM, WH, RT, and EX by using VAR model through equation (4) to (7).

$$\Delta \mathrm{FM_t} = \mu_4 + \sum_{i=1}^{k} \beta_5 \Delta \mathrm{FM_{t-i}} + \sum_{i=1}^{k} \beta_6 \Delta \mathrm{WH_{t-i}} + \sum_{i=1}^{k} \beta_7 \Delta \mathrm{RT_{t-i}} + \sum_{i=1}^{k} \beta_8 \Delta \mathrm{EX_{t-i}} + \varepsilon_{4t} (4)$$

$$\Delta \mathrm{WH_t} = \mu_5 + \sum_{i=1}^{k} \beta_9 \Delta \mathrm{WH_{t-i}} + \sum_{i=1}^{k} \beta_{10} \Delta \mathrm{FM_{t-i}} + \sum_{i=1}^{k} \beta_{11} \Delta \mathrm{RT_{t-i}} + \sum_{i=1}^{k} \beta_{12} \Delta \mathrm{EX_{t-i}} + \varepsilon_{5t} (5)$$

$$\Delta \mathrm{RT_t} = \mu_6 + \sum_{i=1}^{k} \beta_{13} \Delta \mathrm{RT_{t-i}} + \sum_{i=1}^{k} \beta_{14} \Delta \mathrm{FM_{t-i}} + \sum_{i=1}^{k} \beta_{15} \Delta \mathrm{WH_{t-i}} + \sum_{i=1}^{k} \beta_{16} \Delta \mathrm{EX_{t-i}} + \varepsilon_{6t} (6)$$

$$\Delta \mathrm{EX_t} = \mu_7 + \sum_{i=1}^{k} \beta_{17} \Delta \mathrm{EX_{t-i}} + \sum_{i=1}^{k} \beta_{18} \Delta \mathrm{FM_{t-i}} + \sum_{i=1}^{k} \beta_{19} \Delta \mathrm{WH_{t-i}} + \sum_{i=1}^{k} \beta_{20} \Delta \mathrm{RT_{t-i}} + \varepsilon_{7t} (7)$$

where Δ is the difference operator, FM, WH, RT, and EX are farm gate, wholesale, retail and export prices, respectively, μ_4, μ_5, μ_6, μ_7 are constant term, β_5, $\beta_6, \dots, \beta_{20}$ are the estimate coefficients, k is the lag length, and ε_4, ε_5, $\varepsilon_6, \varepsilon_7$ are error terms.

The findings in Table-4 revealed that the impact transmission from retail and wholesale prices towards farm gate level had the smallest magnitude. In other words, if retail price increases (decreases) by 1 USD will cause farm gate price decrease (increase) 0.541 USD. On the other hand, farm gate price will increase (decrease) 0.356 USD when wholesale price increase (decrease) 1 USD.

Table-4. Results of the Wald (χ^2) coefficient test

	Estimated impact (Standard error)	Wald statistic (ρ-value)	
Farm gate level			
Price transmission from RT to FM	-0.541		
	(0.127)	$\chi^2(2) = 18.921$	(0.000)
Price transmission from WH to FM	0.356		
	(0.120)		
Wholesale level			
Price transmission from FM to WH	1.341		
	(0.322)	$\chi^2(2) = 25.575$	(0.000)
Price transmission from RT to WH	-0.943		
	(0.230)		
Retail level			
Price transmission from WH to RT	-0.602		
	(0.445)	$\chi^2(2) = 21.564$	(0.000)
Price transmission from EX to RT	0.948		
	(0.334)		
Export level			
Price transmission from FM to EX	1.578		
	(0.316)		
Price transmission from WH to EX	1.031		
	(0.627)	$\chi^2(3) = 30.471$	(0.000)
Price transmission from RT to EX	-0.820		
	(0.234)		

Turning to retail level, two market levels caused the change of retail prices. Firstly, change from export prices.If export price rises (falls) by 1 USD then retail price will increase (decrease) by 0.948 USD. Secondly, the change of wholesale price (1 USD rises [falls] in wholesale price will cause 0.602 USD fall [rise] of retail price). It is important to note that the impact of price transmission from domestic prices including farm gate, wholesale and retail to export price were the largest size impact transmission. If farm gate and wholesale prices rise (fall) by 1 USD then the price of export price will increase (decrease) by 1.578 and 1.031USD, respectively. In contrast, if the retail price increases (decrease) by 1 USD then export price will decrease (increase) 0.820 USD. As a result, changing domestic rice price in every level obviously affected export price.

Apparently, export and wholesale prices were the only market levels that received an impact from changes in the farm gate price. However, these impacts were the largest observe in this study.

CONCLUSION

The intention of this study was to investigate the effect of the rice-price pledging policy on price relationship and price transmission of Thai Jasmine rice 100% among the different markets: farm gate, wholesale, retail, and export prices. By using a cointegration analysis, we concluded that farm gate, wholesale, retail, and export prices found to be in a long-run equilibrium relationship. Furthermore, the results from Granger causality confirmed three unidirectional and three bidirectional causal relationships of Thai jasmine rice 100% prices in four different market levels. Applying the Wald (χ^2) coefficient test we explored the size of impact transmission and found that rice price-pledging policy had a major influence over export prices,implying that the increase of farm gate price was transmitted the largest magnitude of changes through the price mechanism to export price. Furthermore, the effect of farm gate prices on retail prices was all filtered through wholesale prices.

During the rice-price pledging policy, rice markets were integrated; however, the transmission was imperfect among prices at the farm gate, wholesale, retail and export level. The stakeholders in each market level do not receive the same effects when prices of rice change. The results from this study provide vital evidence that the rice-price pledging policy have a direct impact over export prices. Thus implement this policy might lower the competitive advantage of Thai rice exports. Therefore, whenever policy makers decide to launch a producer-oriented policy, they should take special consideration of the effects price transmissions have over the benefit and welfare of different market levels. Hence, further studies should assess the impact of rice price-pledging policy over the different stakeholder's benefit and welfare at each market level.

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