CAUSAL IMPACT PRICE TRANSMISSION OF THE RICE MARKETS IN THAILAND

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ABSTRACT
This paper analyses the causal impact price transmission among four different market levels of Thai rice over the period of 2001 to 2009. A co-integration analysis reveals that a long-run equilibrium relationship exists among farm gate, wholesale, retail, and export prices. Furthermore, significant upstream and downstream causal relationships are identified based on Granger causality test. These results together with the Wald (χ^2) coefficient test confirm that changes in farm gate prices provided the largest effect to export and wholesale prices, respectively. Consequently, exports are at a disadvantage when producer-oriented policies are launched.

KEY WORDS: Thai rice market, causality, price transmission, time series analysis

1. INTRODUCTION

Rice in Thailand represents important roles in domestic consumption, international demand, and GDP contribution from exports. The rice market channel in Thailand starts at the farm level. The paddy produced from farmers are then traded to the millers through local traders (75% of paddy), farmer's organizations (6% of paddy) and directly by farmers themselves (19%) (The Agricultural Futures Trading Commission, 2007). Millers then process the rice and distribute the white rice to the wholesale and retail level (70% of milled rice) and the rest are of the rice is destined for export level (OAE, 2010).

Rice prices in Thailand are not only determined by market system but also by government intervention through implementation of rice price policy. The pledging policy was implemented by the government of Thailand from 1982 to 2009 and was used as means to support farmers' income. Basically, farmers were given access to government loans by pledging their rice production. The rice value they received depended on the quantities they produced and the price the government predetermines which usually was higher than the market price. As a result, the pledging policy has been criticized that it may distort market mechanism (Forssell, 2008; Lindblom, 2001; Ponnarong, 2008).

Although the effects of the pledging policy on price relationship are still in doubt, the 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, in this study the long-run equilibrium, causal relationship among different markets levels, and size impact transmission were examined in order to illustrate the price interaction and transmission during the implementation of the pledging policy in Thailand.

2. DATA AND METHODS

2.1 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 covered the period from January 2001 to December 2009. All price data were measured in US dollars.

2.2 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 information criterion was applied to select the number of lags required in each price series.

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.

where Δ is the difference operator, Y and X are variables, μ_2 and μ_3 are constant term, β_2 and β_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.

3. 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

	Levels		First differences	
Variable	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*

The asterisk (*) indicates significance at the 5% level.
Critical value at the 5% level of significance for the ADF and PP statistic are -3.452
Note: The critical values are obtained from the Mackinnon (1996) table

We applied Johansen (1988) and 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 Information Criterion. 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

	Test Statistic		Critical Value (95%)	
Null hypothesis	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

The symbol (r) denotes the number of cointegration vectors
The asterisk (*) denotes rejection of the null hypothesis of cointegration at the 5% significance level
Note: The critical values are obtained from the Mackinnon (1996) table

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

	Dependent variable (Y)			
Independent	ΔFM	ΔWH	ΔRT	ΔEX

variable (X)				
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*	-

The symbol (Δ) denotes the different operators
The asterisk (*) denotes rejection of the null hypothesis of X does not Granger cause Y at the 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).

where Δ is the difference operator, FM, WH, RT, and EX are farm gate, wholesale, retail and export prices, respectively, $\mu_4, \mu_5, \mu_6, \mu_7$ are constant term, $\beta_6, \cdots, \beta_{20}$

β_5, are the estimate coefficients, k is the lag length, and $\varepsilon_4, \varepsilon_5, \varepsilon_6, \varepsilon_7$ are error term

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.

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.

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)	$\chi^2(3)$ = 30.471 (0.000)
Price transmission from WH to EX	1.031 (0.627)	
Price transmission from RT to EX	-0.820 (0.234)	

4. CONCLUSION

The intention of this study was to investigate the causal impact price relationship and price transmission of Thai Jasmine rice 100% among the different markets namely, 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 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 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. Thailand is the largest rice exporter in the world market. However from the results presented in this study, producer-oriented policies like the pledging policy have a direct impact over export prices. Thus we can conclude that establishing 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, in order to illustrate the effect of producer-oriented policy it is necessary to assess the impact of the pledging policy over the different stakeholder's benefit and welfare at each market level.

REFERENCES

[1] A. Wiboonpongse & Y. Chaovanapoonphol, Rice marketing system in Thailand, *International symposium, agribusiness management towards strengthening agricultural development and trade*, Chiangmai, TH, 2001, 189-208.

[2] C.E. Lindblom, *Market system: what it is, how it works, and what to make of it* (Yale University Press, 2001).

[3] C.W.J. Granger, Investigating causal relations by econometric model and cross spectral methods, *Econometrica*, 1969, 37(3), 424 – 438.

[4] D. Dickey & W.A. Fuller, Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49(4), 1981, 1057 – 1072.

[5] Food and Agriculture Organization (FAO). Trade statistic. 2011. Available at www.faostat.fao.org. (Accessed data : November 1, 2011)

[6] J.G. Mackinnon, Numerical distribution functions for unit root and co-integration tests, *Journal of Applied Econometircs*, 1996, 71(3), 462 – 470.

[7] L.H. Chen, C. Jatuporn & O.M.C Narreto, Price analysis of domestic rice market in the Philippines, *Economics Letters*, 2011, 10(7), 639 – 646.

[8] Office of Agricultural Economics (OAE). 2010. Agricultural Economics Data. Available at www.oae.go.th (Accessed data : November 1, 2011)

[9] P.C.B. Phillips & P. Perron, Testing for a unit root in time series regression, *Biometrika*, 75(2), 335 – 346.

[10] P. Ponnarong, Thailand: grain and feed, *USDA Foreign Agricultural Service, Gain report. No. TH808*, 2008.

[11] R.F. Engle & C.W.J. Granger, Co-integration and error correction: Representation, estimation and testing. *Econometrica*, 55(2), 1987, 1057 – 1072.

[12] S. Forssell, *Rice price policy in Thailand - policy making and recent developments* (Nationallekonomiska Institutionen Vid Lunds University, 2008).

[13] S. Johansen, Statistical analysis of cointegration vectors, *Journal of Economic Dynamics and Control*, 1988, 12(2-3), 231 – 254.

[14] S. Johansen & K. Juselius, Maximum likelihood estimation and inference on cointegration with application to the demand for money, *Oxford Bulletin of Economics and Statistics*, 1990, 52(2), 169 – 209.

[15] The Agricultural Futures Trading Commission (AFET). Domestic rice market structure. Available at www.aftc.or.th (Accessed data : November 1, 2011).