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# **Market Integration and Price Transmission in the World Rice**

## **Export Markets**

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## Introduction

- Rice is an important staple food and rice trade has particular significance to rice consumers and producers, especially those in developing countries.
- Global rice export is concentrated in Thailand, Vietnam, India, Pakistan, China and United States; these six countries have contributed to more than 80% of total export since 2000.
- Global rice market is also a typical thin market with only seven percent of rice traded across borders. As a result, rice price is particularly volatile.
- Policies have strong impacts on rice trade despite increasing trade liberalization. Many exporting countries restricted export to ensure sufficient domestic supply and stable pricing.
- Various price support programs have been the main rice policy in Thailand since 2000. In 2011, the Thai government attempted to drive world rice price by stockpiling large quantity of rice, which proved to be disastrous later.
- Vietnamese rice export is tightly managed by Vietnam Food Association (VFA) and half of the rice export is carried out by VINAFOOD, the state trading enterprise in Vietnam.

## Objectives

- The first objective is to investigate whether the world rice market is integrated (Thailand, Vietnam and the U.S. are chosen for analysis due to data availability and comparability).
- The second objective is to model possible asymmetric price transmission in the world rice market, given rice market integration. Positive asymmetric price transmission suggests competition among rice exporters while negative asymmetric price transmission is indicative of collusion among exporters.

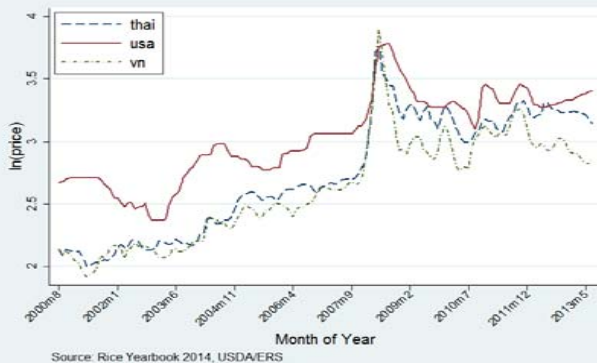


Figure 1: Log Price of Rice in Thailand, Vietnam and U.S.

## Data and Methodology

- Monthly rice price from August 2000 to July 2013 in Thailand, Vietnam and U.S. are used. Most comparable prices are chosen to minimize the impacts of product differentiation on the following analysis.
- Stationarity of the price series are first tested with ADF and KPSS tests.
- Johansen trace test is then performed in pairs to determine whether the prices are cointegrated. If cointegration is found, a vector error correction model (VECM) is estimated to model the price transmission process.
- Following Hansen and Seo (2002), the null hypothesis of linear adjustment vs. the alternative threshold adjustment is further tested with a supreme Lagrange Multiplier (*SupLM*) test:

$$SupLM = SupLM(\tilde{\beta}, v)_{V_U \leq V \leq V_L}$$

where  $\tilde{\beta}$  is the estimated cointegration vector from VECM,  $v_U$  and  $v_L$  are the  $\pi$  and  $1 - \pi$  percentile of error correction term from VECM. A grid search is performed to find  $v$  that maximize *SupLM*. Critical value of the distribution are derived via bootstrapping.

- Rejection of above null suggest threshold (asymmetric) adjustment and a threshold vector error correction model (TVECM) is further estimated:

$$\Delta P_t = \begin{cases} \mu_1 + \alpha_1 ECT_{t-1} + \sum_{n=1}^k \Gamma_{t-n}^1 \Delta P_{t-n} + \varepsilon_t^1, & ECT_{t-1} \leq v \\ \mu_2 + \alpha_2 ECT_{t-1} + \sum_{n=1}^k \Gamma_{t-n}^2 \Delta P_{t-n} + \varepsilon_t^2, & ECT_{t-1} > v \end{cases}$$

- where  $ECT_{t-1}$  is error correction term and  $\alpha_1$  and  $\alpha_2$  are adjustment speeds.
- In contrast to the conventional VECM where adjustment speed stays constant, the study period in TEVCM is divided into two regimes, depending on the relative prices for the countries under study.

## Results

### Thailand and U.S.

- Cointegration is found between Thailand and U.S. rice price and Thai price leads the U.S. price: 1.354% price change in Thailand would lead to 1% price change in the U.S.
- Asymmetric price transmission is not found.

	$\Delta p_{thai,t}$	$\Delta p_{us,t}$
$ECT_{t-1}$	-0.034 (0.022)	0.051*** (0.018)
Intercept	0.004 (0.004)	0.002 (0.003)
$\Delta p_{thai,t-1}$	0.492 (0.190)	0.156* (0.081)
$\Delta p_{us,t-1}$	-0.095*** (0.153)	0.452*** (0.113)

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### Thailand and Vietnam

- Cointegration and threshold adjustment is found for Thai and Vietnamese prices. Both VECM and TVECM are estimated.
- Thai price leads the Vietnamese price in both models; 0.847% Thai price change leads to 1% Vietnamese price change in equilibrium.
- In Regime 1 when Thai price is higher than Vietnam price in the long run, estimation is comparable to the linear VECM. In regime 2, the Vietnamese price adjusts to equilibrium faster than in regime 1, indicating asymmetric price transmission.

	Linear VECM		Threshold VECM			
			Regime 1		Regime 2	
	$\Delta p_{thai,t}$	$\Delta p_{vn,t}$	$\Delta p_{thai,t}$	$\Delta p_{vn,t}$	$\Delta p_{thai,t}$	$\Delta p_{vn,t}$
$ECT_{t-1}$	0.085 (0.056)	-0.160** (0.068)	0.093* (0.052)	-0.161** (0.072)	-0.174 (0.194)	-0.500** (0.201)
$\Delta p_{thai,t-1}$	0.354* (0.206)	0.384** (0.151)	0.239** (0.096)	0.069 (0.126)	0.343 (0.402)	0.500** (0.224)
$\Delta p_{vn,t-1}$	0.251*** (0.085)	0.512*** (0.103)	0.232*** (0.077)	0.438*** (0.104)	0.308 (0.232)	0.513*** (0.196)

### Vietnam and U.S.

- Cointegration is found between Vietnamese and U.S. price, 1% price change in U.S. leads to 1.139% price change in Vietnam.
- Asymmetric price transmission is also found. In regime 2 when Vietnamese price is higher than its long-run equilibrium level, it adjusts at a faster rate to equilibrium than in regime 1 when Vietnamese price is relatively lower comparing with equilibrium.

	Linear VECM		Threshold VECM			
			Regime 1		Regime 2	
	$\Delta p_{vn,t}$	$\Delta p_{us,t}$	$\Delta p_{vn,t}$	$\Delta p_{us,t}$	$\Delta p_{vn,t}$	$\Delta p_{us,t}$
$ECT_{t-1}$	-0.090** (0.037)	0.060*** (0.023)	-0.072** (0.037)	0.001 (0.019)	-0.753* (0.448)	-0.070 (0.265)
$\Delta p_{vn,t-1}$	0.549*** (0.122)	0.178*** (0.063)	0.552 (0.103)	0.114** (0.051)	0.900*** (0.154)	0.057 (0.120)
$\Delta p_{us,t-1}$	0.061 (0.612)	0.360*** (0.099)	-0.022 (0.110)	0.363*** (0.087)	0.028 (0.246)	0.587*** (0.225)

## Conclusion

- The world rice market is well integrated among the three major exporting countries: Thailand, Vietnam and United States.
- Thailand and United States lead Vietnamese price; Vietnamese price adjusts faster to equilibrium when it is relatively higher. This positive asymmetric price transmission imply that competition rather than collusion in the world rice market.
- For the rice importing countries, the international market is still a reliable source of rice supply while for the rice exporting countries, policies aiming to increase the rice price by limiting supply, such as the Thai rice pledging program in 2013, is ineffective since other exporters can always undercut the price.