Thresholds in rice markets

Nelissa Jamora[1], Friederike Greb, and
Stephan von Cramon-Taubadel

Department of Agricultural Economics and Rural Development
Georg-August-Universität Göttingen

[1]Email: njamora@gwdg.de

*Selected Poster prepared for presentation at the
Agricultural & Applied Economics Association's 2013
AAEA & CAES Joint Annual Meeting,
Washington DC, 4-6 August 2013*

THRESHOLDS IN RICE MARKETS

Nelissa Jamora, Friederike Greb, and Stephan von Cramon-Taubadel
Department of Agricultural Economics and Rural Development, Georg-August-Universität Göttingen, njamora@gwdg.de

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN
GRK 1666 GlobalFood
Transformation of Global Agri-Food Systems

BACKGROUND

Rice is one of the most important commodities in the world. It is grown in more than 100 countries and consumed by the bulk of the world's poor. The Asia Society and IRRI (2010) estimated about 566.6 million people living below the $1.25 poverty threshold depend on rice.

... changes in international rice prices have large impacts on the poor, but this will depend on how and to what extent price shocks are transmitted to the domestic markets in developing countries.

The objective of this study is to analyze rice price transmission (PT) through a **threshold vector error correction model (TVECM)** using an improved **regularized Bayesian estimator (RBE)**. To date, no one has attempted to estimate threshold PT processes with a consistent set of price data for a large number of countries using TVECM and the improved estimation technique. Moreover, our sample period allows us to examine the dynamics of price transmission in the pre- and post- 2008 food crisis regimes. We aim to improve our understanding of threshold effects in rice markets on world-to-domestic PT in developing countries.

DATA AND METHODS

The data used for the analysis includes 268 monthly domestic rice prices, from January 2000 to December 2012, extracted from the FAO GIEWS food price database. The domestic prices cover 27 countries in Africa, 15 in Asia, and 15 in Latin America.

First, we evaluate the time series properties of the data using standard Dickey–Fuller unit root tests and Johansen cointegration tests. Next, we follow Engle and Granger's two-step VECM approach and estimate cointegrating relationship between world and domestic rice prices. We evaluate the significance of threshold effects using sup-Wald test by Seo (2006).

We estimate the threshold values and the TVECMs as proposed in Greb et al. (2013) for the whole sample period. We extend the analysis by splitting the TVECMs, one for the period prior to December 2007 and another for the period thereafter. Finally, to generate further insights into the factors that may relate to the strength of PT from world to domestic markets, we look at the correlation between several policy variables and our adjustment parameters.

The empirical analysis is based upon logarithmic transformations of the prices. Standard unit-root tests confirmed the presence of unit roots in levels and stationarity in first differences.

THRESHOLD VECTOR ERROR CORRECTION MODEL

A TVECM captures the dynamics of the non-linear adjustment process. This non-linearity has important implications for policy analysis, because it changes the timing and magnitude of price responses estimated under linear assumptions (Meyer and von Cramon-Taubadel, 2004).

A two-regime one threshold TVECM can be represented as follows,

$$\Delta p_t = \begin{cases} \alpha_1 z_{t-1} + \sum_{j=1}^{k} \beta_{1,j} \Delta p_{t-j} + \varepsilon_{1,t} & if \ z_{t-1} \leq c \quad Regime \ 1 \\ \alpha_2 z_{t-1} + \sum_{j=1}^{k} \beta_{2,j} \Delta p_{t-j} + \varepsilon_{2,t} & if \ c < \ z_{t-1} \quad Regime \ 2 \end{cases}$$

where p_t is the vector of prices being analyzed, z_{t-1} is the error correction term (ECT), α_k is the adjustment parameter, and is the threshold parameter. The ECT contains the long-run cointegrating relationship between two prices and is estimated as $z_{t-1} = (p_{1,t} - \beta p_{2,t} - \theta)_{t-1}$.
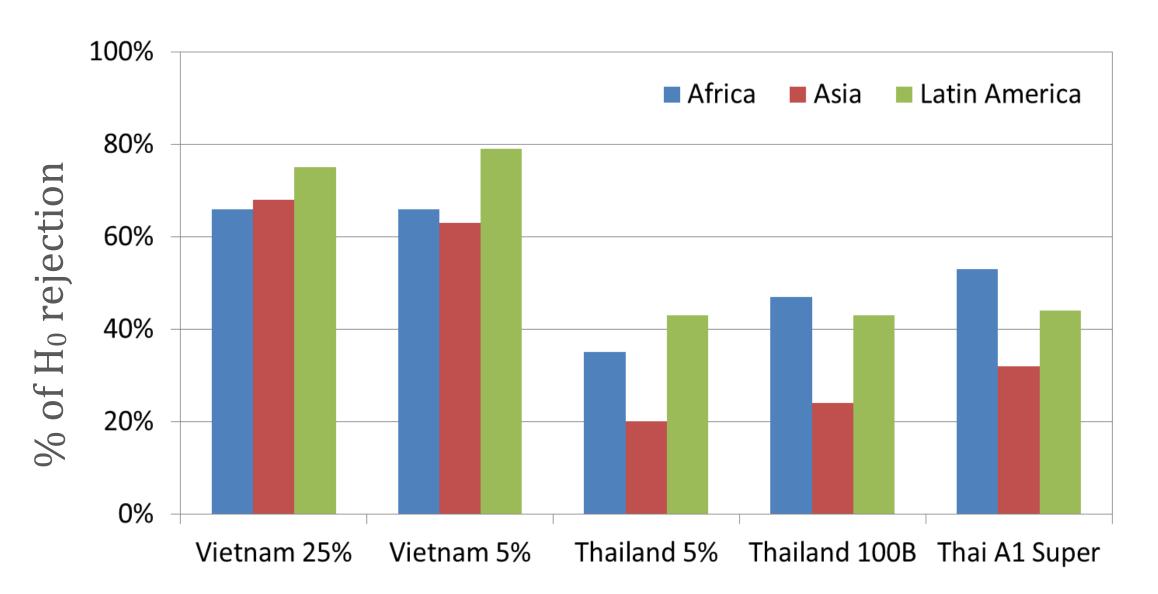
A two-regime one threshold model is estimated because trade movement usually goes in one direction, i.e. world to domestic for importers and domestic to world for exporters. Countries can either be classified as a traditional exporter or importer of rice based on historical volume of traded rice.

The estimation of threshold parameters is critical for two reasons:
(1) Thresholds serve as triggers for price adjustments to occur; and
(2) Improved threshold estimates lead to better PT estimates.

RESULTS

Prevalence of threshold cointegration

Seo's sup-Wald test at 5% significance level
H_0: no cointegration | H_1: threshold cointegration

- There is greater evidence for threshold cointegration than there is for linear/no cointegration.
- Higher prevalence of cointegration using Vietnam rice as the world price.
- Average threshold is estimated at -0.098, equivalent to about $311 ton⁻¹ price differential, calculated at the mean export price of Viet25%.
- Threshold values are much lower for countries in Asia and for rice-exporting countries. Thresholds do not appear to significantly differ by income level.
- Increase in thresholds from pre– to post– Dec 07 period.

Threshold

Region	n	All Estimate	All in $ value	Pre-Dec 07 Estimate	Pre-Dec 07 in $ value	Post-Dec 07 Estimate	Post-Dec 07 in $ value
Africa	125	-0.076	$396	-0.076	$391	-0.022	$454
Asia	82	-0.118	$107	0.013	$103	0.002	$189
Latin America	61	-0.117	$410	-0.117	$390	-0.043	$485
Trade status							
Exporter	39	-0.103	$105	-0.016	$116	-0.008	$131
Importer	299	-0.097	$346	-0.069	$344	-0.021	$422
Income group							
1	100	-0.083	$327	-0.081	$332	-0.024	$454
2	127	-0.086	$301	-0.010	$301	0.002	$189
3	41	-0.172	$302	-0.170	$295	-0.043	$485
All	**268**	**-0.098**	**$311**	**-0.062**	**$312**	**-0.019**	**$379**

DISCUSSION

Speed of adjustment, net alpha ($-\alpha_1 + \alpha_2$)

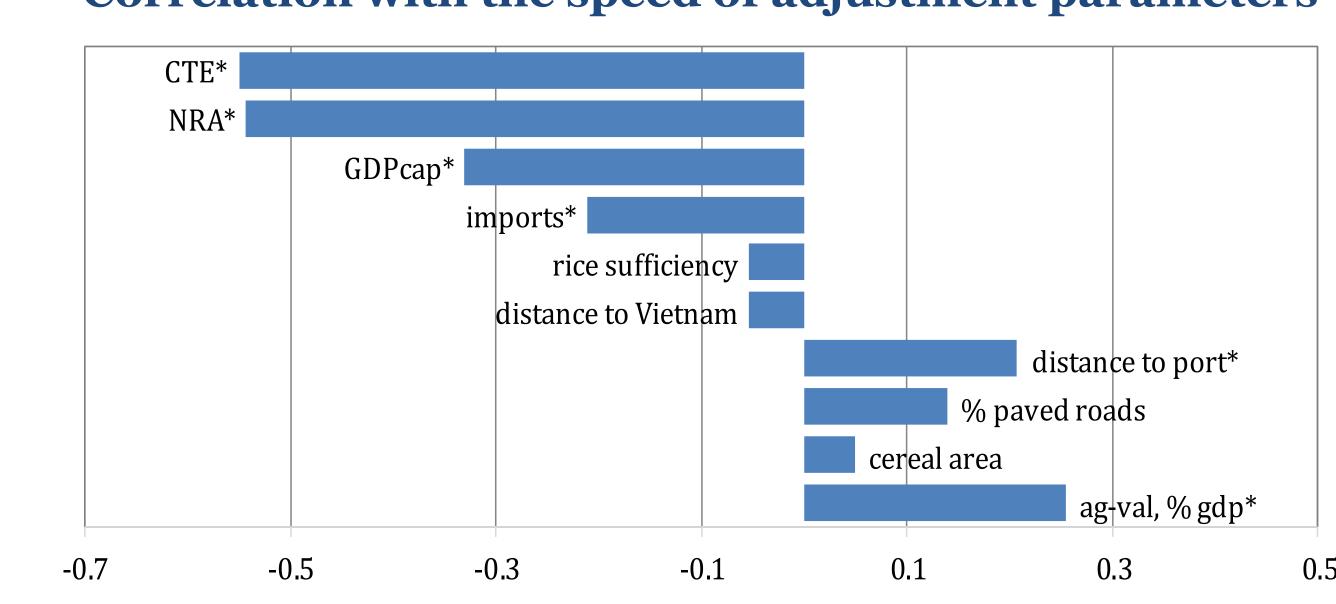| Region	VECM	All Regime 1	All Regime 2	Pre-Dec 07 Regime 1	Pre-Dec 07 Regime 2	Post-Dec 07 Regime 1	Post-Dec 07 Regime 2
Africa	0.269	0.419	0.288	0.463	0.510	0.409	0.363
Asia	0.146	0.235	0.210	0.308	0.322	0.266	0.269
Latin America	0.199	0.364	0.187	0.306	0.294	0.294	0.255
Trade status							
Exporter	0.215	0.230	0.341	0.391	0.280	0.239	0.334
Importer	0.215	0.371	0.224	0.365	0.408	0.355	0.304
Income group							
1	0.265	0.412	0.285	0.420	0.478	0.391	0.371
2	0.194	0.314	0.229	0.344	0.360	0.323	0.297
3	0.161	0.311	0.173	0.327	0.283	0.254	0.197
All	**0.215**	**0.350**	**0.241**	**0.369**	**0.390**	**0.338**	**0.309**

- Threshold models suggest much faster adjustments in response to price disequilibrium than is the case when threshold effects are ignored.
- There is a decline in the PT parameters after the food crisis.
- Higher income countries, perhaps because they have the capacity to implement policy interventions in rice trade, are related with slower price adjustment. The slowest price adjustment is observed in countries from income group 3.
- The PT behavior of exporters and importers differed in response to deviations in price disequilibrium. While exporters are able to quickly respond to deviations in equilibrium, the results indicate that in importing countries spatial arbitrage opportunities are restricted.
- The adjustment parameters are larger in magnitude in regime 1 than in regime 2 in many cases. However, this is not aligned with spatial equilibrium theory. The violation is even more evident after the food crisis.

POLICY AND PRICE TRANSMISSION

Aggressive policy interventions during and after the food crisis were observed to insulate the domestic markets and limit the impacts of high food prices to vulnerable groups in developing countries (Benson et al., 2008). These insulating policies, however, affected the export market for rice and could explain almost half of the increase in the world rice price during the food crisis (Martin and Anderson, 2012).

The results indicate that trade barriers are frequently used as a buffer against domestic or international shocks in rice prices, rather than using trade as a source of cheaper imports or an opportunity for export earnings (Anderson, 2009). In majority of cases, we observe that there is an effort, often successful, to restrict arbitrage and PT when the price difference expands. We find support for strong negative correlation between government intervention and the speed of adjustment.

Correlation with the speed of adjustment parameters

Notes: Speed of adjustment parameters from regime 2, all sample
* correlation coefficient significant at 5% level

Price distortion measures
(Anderson and Valenzuela, 2008)

nominal rate of assistance (NRA) percentage by which government policies have raised gross returns to farmers above what they would be without the government's intervention

consumer tax equivalent (CTE) measures the impact policies have on the buyer's price at the point on the value chain where the farm product is first traded internationally

Rice Science for a Better World