World Applied Sciences Journal 21 (4): 646-650, 2013
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2013.21.4.1725

Spatial Price Transmission: A Study of Rice Markets in Iran

[1]Forooz Jezghani, [1]Reza Moghaddasi,
[2]Saeed Yazdani and [1]Amir Mohamadinejad

[1]Department of Agricultural Economics,
Science and Research Branch, Islamic Azad University, Tehran, Iran
[2]Department of Agricultural Economics, University of Tehran, Karaj, Iran

Abstract: This paper investigates spatial market integration in Iranian rice market for the period from March 2000 to February, 2009 by using Vector Error Correction Model (VECM).The results showed market integration among Iran and Thailand, with Thailand leading the market. Additionally, the price of the Iranian rice was influenced by the Thailand prices.

Key words: Rice market · Spatial price transmission · Causality · Vector error correction model · Impulse response function

INTRODUCTION

As monetary policy in many countries aims to keep inflation (i.e. changes in prices) within the target band so as to ensure economic stability and sustainable growth, it is inevitable to know the likely inflation in advance for adopting appropriate policy measures. An analysis of spatial price relationship helps to understand how price shock in one region transmit to other regions and whether regional markets are integrated in the economy, which ultimately helps to forecast inflation in a more comprehensive way [1].

Market liberalization at the domestic level and at the boarder level has been a dominant feature of market reforms in most developing countries during the last two decades [2]. Iran has undertaken market reforms, its main food such as rice by both reducing public intervention for procurement and distribution since 1998.Rice accounts for a high caloric share in the Iranian diet, also high share in the farmers' agricultural income and the employment. The necessity of rice for household consumption, the reduction of real income and increasing rice prices imply that attending to the development of the rice industry is necessary.

According to Iran Customs Administration's statistics (2010) between 2000 to 2009. Iran imported the mostrice from Thailand. In this regard, changes in the Thai rice prices may affect Iranian import demand for rice and in turn Iranian rice prices directly or indirectly.

The aim of this study is to explore whether there exists any relationship between Thailand and Iran's rice prices by using a Vector Error Correction Model (VECM) and analyzing impulse response function and forecast error decomposition.

Data: In general, the export price is based on wholesale price in the exporting country. In this context, [3] and [4] argued that the domestic wholesale price could be understood as marginal cost of export price is also comparable whit wholesale price of importing country. Therefore, we compare the rice wholesale price of Iran and Thailand. Data of transportation costs and quality difference wasn't available, following [5] and [4]; we let constant term in the model to capture parts of these differences.

The monthly average of wholesale price of Iranian rice was taken from Ministry of Jihad-e Agriculture and the monthly average of wholesale price of Thai rice was taken from the FAO. The Thai prices are changed into Rial equivalent by using appropriate exchange rates. The exchange rates were taken from Central Bank of Iran. The data period covers March 2000 to February, 2009. Variables is used in logarithms and all prices are deflated by the consumer price index (CPI).

Corresponding Author: Forooz Jezghani, Department of Agricultural Economics, Science and Research Branch, Islamic Azad University, Tehran, Iran.

MATERIALS AND METHODS

The stationary of a series can be tested using a unit root test. Once it is established that the order of integration is the same for the variables of interest, the second stage of testing co-integration can be undertaken. The Engle and Granger [6] test and the Johansen test are the two most common approaches to testing for cointegration of data that are not stationary. Common problems of using the Engle and Granger test are those of arbitrary selection of dependent variables (as with stationary data) and failure to identify the number of cointegrating vectors for multivariate cases. Given a vector, P_t, containing variables of interest, the Johansen test was carried out using the following VAR representation.

$$Y_t = \mu + \prod_k Y_{t-k} + \sum_{i=1}^{k} \prod_i Y_{t-i} + \varepsilon_t \qquad (1)$$

where each of the Π_i is a $n\times n$ matrix of parameters, μ is a constant term and ε_t are identically and independently distributed residuals with zero mean and contemporaneous covariance matrix Ω. The VAR system in (1) written in error correction form (ECM) is;

$$\Delta Y_t = \mu + \Gamma_k Y_{t-k} + \sum_{i=1}^{k-1} \Gamma_i Y_{t-i} + \varepsilon t \qquad (2)$$

with $\Gamma_i = -I + \Pi_1 + +\Pi_i$, i = 1,…, k -1 and Γ_k is the long run solution to equation (3). If ΔY_t is a vector of I(1) stationary variables, then the left hand side and the first k-1 variables on the right hand side of the equation (3) are stationary I (0) and the error term, ε_t is by assumption, stationary. Hence, either Γ_k must be a matrix of zeros or Y_t contains a number of cointegrating vectors. The rank of Γ_k, defined by r, determines how many linear combinations of Y_t are stationary. If r > 0, then the variables are stationary in level, if r = 0, there exists no linear combinations that are stationary and if $0<r<n$, there are r stationary linear combinations of Y_t.

The Johansen approach tests for the number of cointegrating ranks were not co-integration directly. In this framework, there were two asymptotically equivalent tests for co-integration, a trace test and the maximum eigen value test. The calculated statistics for the trace test and the maximum eigen value tests were used to test the null hypothesis that there existed no co-integrating vector (r = 0) (the alternative hypotheses for the trace & maximum eigen value test being r > 0 and r = 1, respectively) and that there existed less than or equal to one cointegrating vector (r = 1) (the alternative hypotheses for the trace and maximum eigen value tests were r > 1 and r = 2, respectively). The Johansen framework can be applied to stationary and non- stationary data.

Analysis of relationships between prices is a common tool in market integration analysis. This is based on market definitions as old as modern economics [7]. The logarithms of prices in question are most commonly used in econometric analysis to measure market integration. The basic relationship to be investigated is then:

$$\text{Ln } Y_{1t} = \alpha + \beta \ln Y_{2t} \qquad (3)$$

where α is a constant term (the log of a proportionality coefficient) that captures transportation costs and quality differences and β gives the relationship between the prices.

A prior conditions specify that if $\beta = 0$, there are no relationships between the prices. $\beta = 1$, the law of one price holds and the relative price is constant. In this case the goods in question were perfect substitutes. This implied that the two markets were perfectly spatially integrated. Price changes in one market were fully reflected in alternative market. $0 \le \beta \le 1$, there is a relationship between the prices but the relative price is not constant and the goods will be imperfect substitutes. The degree of integration is evaluated by investigating how far the deviation of β is from unity.

RESULT

The Augmented Dickey-Fuller, Philips Perron unit root test and KPSS on each of the variables are reported in the Table 1. The results of all the tests indicate that all price series are non-stationary at their level but stationary at their first difference. Here the order of the integration is one. Therefore, the results allow to proceed for co-integration tests for the testing the long run equilibrium relationship.

The trace test (λ_{trace}) and maximum eigenvalue (λ_{max}) results are presented in Table 2. The test results in Table 2 indicate that Thailand and Iran prices were co-integrated with one cointegraing vector. That means this co-integrating rank gives the number of stationary

Table 1: Results of Unit Root Tests

	level			First-differences		
Variables	ADF	PP	KPSS	ADF	PP	KPSS
LTRWP	-0.90	-0.63	4.17	-8.59***	-8.34***	0.11***
LIRWP	0.10	0.79	4.13	-7.70***	-7.31***	0.25***

***indicates that unit root in the first differences are rejected at 1 percent.

Source: Authors findings

Table 2: Johansen–Juselius co-integration test

λ_{trace} test				λ_{max} test			
Null	Alternative	λ_{trace}	Prob.**	Null	Alternative	λ_{max}	Prob.**
r=0*	$r \geq 1$	39.14	<0.0001	r=0*	r=1	39.13	<0.0001
$r \leq 1$	$r \geq 2$	0.01	0.93	$r \leq 1$	r=2	0.01	0.93

Trace and Max-eigenvalue tests indicate 1 cointegration equation at 0.05 level. Source: Authors findings

*Denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-value [8]

Table 3: Causality test result

Null Hypothesis	F-statistic	Prob.
LIRWP does not Granger Cause LTRWP	0.98	0.42
LTRWP does not Granger Cause LIRWP	3.60	<0.0001

Source: Authors findings

linear combinations of the price series. So it is consistent with the identification of one linear combination of prices (as it is a bi-variate case) that exhibits stability over the time. The leg length was determined using LR, FPE, AIC, SC and LR criteria. The AIC, FPE and LR selected a 6-lag. The results of co-integration test confirm that the variables share a common trend and both the maximum eigenvalue test and the trace test statistics imply that there are at most one co-integrating vectors ($r \leq 1$).
The estimated long-run equilibrium relation is:

$$\underset{}{\text{LIRWP}} = 0.86 + 0.93\,\underset{(11.21)}{\text{LTRWP}} \quad (9)$$

where, LIRWP denotes Iran rice wholesale price and LTRWP is Thailand rice wholesale price. The coefficient on thai rice price is statistically significant at the 0.05 level.

Also we perform the stability analysis. The CUSUM test does not indicate any structural change in the rice wholesale prices regression coefficients. Figure 1 shows the CUSUM result.

The results of causality test confirm the existence of unidirectional causality from Thai prices to Iranian prices. We take into account that Thailand is a large exporter compared with Iran. This result seems to agree with the general notion.

Table 4: Estimation result of VECM

Error Correction	D(LTRP)	D(LIRP)
CoinEq1	0.07	0.10
	[1.30]	[-3.89]
D(LIRP(-1))	-0.25	0.29
	[-1.24]	[2.96] **
D(LIRP(-2))	0.39	-0.14
	[1.93]	[-1.48]
D(LIRP(-3))	-0.22	0.05
	[-1.12]	[0.47]
D(LIRP(-4))	0.06	-0.18
	[0.32]	[-1.86]
D(LIRP(-5))	-0.05	-0.21
	[-0.23]	[-2.24] **
D(LIRP(-6))	0.09	0.10
	[0.47]	[1.16]
D(LTRP(-1))	0.27	-0.02
	[2.34] **	[-3.86] **
D(LTRP(-2))	-0.24	-0.21
	[-2.11] **	[-3.86] **
D(LTRP(-3))	-0.30	-0.06
	[-2.38] **	[-0.98]
D(LTRP(-4))	0.09	0.03
	[0.80]	[0.54]
D(LTRP(-5))	0.24	0.00
	[2.03] **	[0.06]
D(LTRP(-6))	-0.01	-0.03
	[-0.09]	[-0.49]
C	0.00	0.02
	[0.32]	[3.28] **
R^2	0.54	0.56
Adj. R^2	0.40	0.51
F-statistic	8.93	9.79

Numbers in brackets are t statistics.

**indicates significant at 5 percent level

Source: Authors findings

Table 5: FEV of Thai and Iranian rice wholesale price Variance Decomposition of Thai prices

Period	S.E.	LIRWP	LTRWP
1	0.04	0.00	100.00
6	0.08	1.10	98.90
12	0.12	2.76	97.24
18	0.17	4.20	95.80
24	0.21	5.26	94.74
30	0.25	6.02	93.98
36	0.28	6.59	93.41
Variance Decomposition of Iranian prices			
Period	S.E.	LIRWP	LTRWP
1	0.08	92.87	7.13
6	0.22	90.03	9.97
12	0.29	50.53	49.47
18	0.33	30.11	69.89
24	0.36	23.13	76.87
30	0.38	19.93	80.07
36	0.41	18.10	81.90

Ordering LTRWP → LIRWP

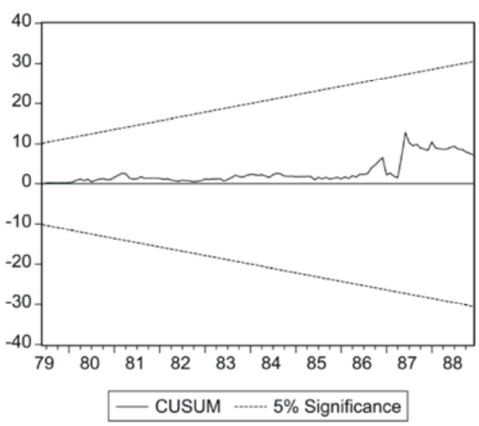

Fig. 1: The CUSUM Test

Finally we tests Vector Error Correction Model. The estimation result of VECM for Thailand and Iran rice wholesale prices are presented in table 4. According to F statistics the null hypothesis of insignificance of parameter estimation is rejecting. Thailand price is explained by four lagged value of own price whereas Iran rice price is explained by two lagged value of Thailand rice price and two lagged value of own price, which seems reasonable result.

Based on estimation results, impulse response functions and forecast error variance decomposition are derived.

One of the methods to solve contemporaneous correlations among error terms is the choleski decomposition. In this study, choleski decomposition is used. According to Granger Causality and

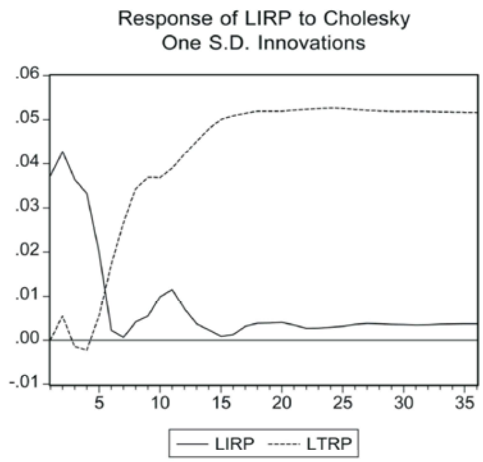

Fig. 2: Impulse response function for Iran rice wholesale price

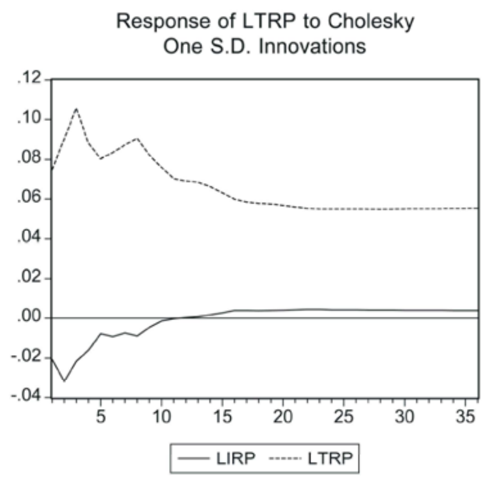

Fig. 3: Impulse response function for Thai rice wholesale price

because Thailand is a large exporter, the ordering of the Thailand rice wholesale price to Iran rice wholesale price is chosen. The significance of each impulse response will be investigated based on t statistic.

Figure 2 shows the impulse response of Iran price. Iranian price reacts to both shocks to own and Thailand price. In response to own price shock, Iran price increase in second month after shock. Positive change in Thai price leads to increase in Iran price two month after shock, which seems reasonable.

Figure 3 shows the impulse response of Thai rice price. In response to own price shock,Thai price increase in first three month, sixth and eight month. Indeed, Thai price increasein response to own positive price shock. In contrast, in this period, Thai price doesn’t change in response to change in Iranian price, which seems reasonable.

Table 5 shows FEV of Thai and Iranian rice wholesale price. As expected, the Thai rice wholesale price is exogenous and more than 93 percent of its FEV is accounted for by own price innovations.

Until the intermediate horizon (12 month) the Iranian rice wholesale price is exogenous, as over 50 percent of its FEVis accounted by its own innovations. However as the time horizons extended, it become endogenous with more than 18 percent of its FEV is accounted by its own innovations. After 12 month Thai rice price importance in explaining the Iranian rice wholesale price's FEV gradually increase and more than 81 percent of Iranian rice wholesale price's FEV is attributed to Thai rice price. Its shows that Thai rice price has influence on Iranian rice price.

CONCLUSION

This paper investigates spatial market integration in Iranian rice market by using monthly data from March 2000 to February, 2009 and vector error correction model (VECM). The Augmented Dickey-Fuller, Philip Perron unit root test and KPSS show that two countries prices are non-stationary at their level but stationary at their first difference. The co-integration test results show failure to reject the null of non co-integration which represented that all pairs of market prices are co-integrated. The CUSUM test for structural change does not indicate structural change in the rice wholesale prices. The Granger Causality test results indicate that price changes in Thai market have certain statistical influence on Iran market price changes. The Impulse response function indicates that Iranian wholesale prices responds to own and Thai rice price shock. FEV shows that until the intermediate horizon the Iranian rice wholesale price is exogenous. However as the time horizons extended, it becomes endogenous. After 12 month Thai rice price importance in explaining the Iranian rice wholesale price's FEV gradually increase and more than 81 percent of Iranian rice wholesale price's FEV is attributed to Thai rice price. Its shows that Thai rice price has influence on Iranian rice price.

The results shows that shocks originating from outside Iran could also be important factors influence Iranian rice prices. Thus, suggest that global market conditions continually monitor and internal policy accept with regard to market conditions of trade partners until sensitivity of domestic prices to fluctuations in trade partner prices would be decreased.

REFERENCES

1. Kharel, R.S .and T.P. Koirala, 2011. Spatial Price Integration in Nepal. Economic Review, 23: 21-36.
2. Alam, M., I.A. Begum, J. Buysse, A.M. McKenzie, M.M. Wailes and G.V. Huylenbroeck, 2010. Testing Asymmetric Price Transmission in the Vertical Supply Chain in De-regulated Rice Markets in Bangladesh. Present at the American Association of Agricultural and Applied Economics, Colorado, USA.
3. Saghaian, S.H. and M. Reed, 2000. Exchanges Rate Changes and Pricing-to-Market: The Case of U.S. Meat Exports. Paper presented at the Korea Rural Economic Institute seminar, September 2000.
4. Kwon, O.B., 2002. Do Changes in the Chicken Prices Affect Korean Chicken Prices?, Journal of Rural Development, 25: 15-39.
5. Yang, J., D.A. Bessler and D.J. Leatham, 2000. The Law of One Price: Developed and Developing Country Market Integration. Journal of Agricultural and Applied Economics, 32(3): 429-440.
6. Engle, R.F. and C.W. Granger, 1987. Cointegration and Error Correction: Representation, Estimation and Testing. Econometrica, 55(2): 251-276.
7. Cournot, A.A., 1971. Researches into the Mathematical Principles of the Theory of Wealth. A.M. Kelly, New York.
8. MacKinnon, J.G., A.A. Haug and L. Michelis, 1999. Numerical distribution functions of likelihood ratio tests for cointegration. J. Appl. Econom, 14(3): 563-577.