International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.com
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Investigating Market Integration and Price Transmission of Different Rice Qualities in Iran

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Received: 1 February 2013,
Accepted: 10 October 2013

Abstract

Rice production in most of Asian countries has been increased more rapidly than population and this has been led to increase in supply and proportionately decrease in the real price of rice in world and domestic markets. Furthermore, together with growth in production and national gross income of the country per-capita income has been increased and also demand for rice at national and international level quality has been increased. In this case studying the market conditions of different qualities of rice including marketing margins, causative relations among the prices, market integrations in long term and finally price transferring and market integration in short term is the important consequence that can help policymakers and planners in their decision makings on research, production, distribution and marketing of rice strategic product. So, using the statistics from Jihad Agriculture Organization of Guilan Province in case of the price of rice qualities (items) including Sadri momtaz (S1), Sadri darge yek (S2), Sadri mamooli (S3) and Khazar (K1) during 1999-2009 market conditions of different qualities of rice was studied. Results show that impulses in wholesale prices in Khazar rice rapidly influence on-farm prices, however, in case of other rice qualities the rate and speed of this influence is low. But in wholesale-retail market for Sadri quality rice impulses influence strongly in wholesale price and this shows intense integration of these two rice markets in Iran. It is suggested that according to the different quality of rice verities, support policy design and decision making process assigned separately.

Keywords:
Market integration, Rice quality, Wholesale price, Retail price, On-farm price

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INTRODUCTION

Rice is from millet family and it is one the main seeds to be used by human beings and is the staple food in Iran, with the quality of cooked rice outweighing all other considerations for Iranian consumers. This product needs more water under cultivation level of rice has been centered in northern provinces of the country. More than 615 thousand hectares of irrigated lands in Iran have been dedicated to rice cultivation the total area under rice is more than 615000 ha and rice is grown in 15 provinces and considering the yield of 2400 kg white rice, more than 1.4 million tons of white rice is produced in Iran every year. The remainder domestic need is compensated by importing. Under cultivation level of Iran's paddy rice during 1986-2005 had been changing from 471000 to 628100 hectares. The most central reasons for fluctuations in under cultivation level during the mentioned years are drought and shortage of water resources needed for rice cultivation. Average yearly production of paddy rice during the first development program (1990-1994) and the second development program (1995-1999) had been 2.25 and 2.35 million tons, respectively, that has had 3.93% growth compared to the first program. Average yearly paddy rice production during the third development program (2000-2004) had been 2.54 million tons that compared to the end of the second program has had 8.26% growth (rice self-sufficiency plan, 2006). However, more than 80 percent of rice area is distributed in two Northern provinces of Guilan and Mazandaran. It is estimated that 265000 ha those in Mazandaran (including areas in Gorgan province) and 230000 ha in Guilan are under rice cultivation. The monthly temperatures and rainfall of Guilan – which are similar to those Mazandaran – during the rice growing season vary from 19° to 25°C and 25 to 125 mm, respectively. From 1.8 million tons in the late1980s, rice production in Iran increased to 2.36 million tons 1993, with the average yield being 3780 kg/ha (rough rice). The per caput consumption of rice is around 28 kg per caput/year. As the demand and supply of rice in Iran are still not evenly balanced, the country imports around 400000 to 500000 tons of rice for domestic consumption. (Agronomic report of different rice varieties cultivation in Gulan province, (1996-2006))

Rice production in most of Asian countries (consequence of using different modern varieties, new irrigation systems, using fertilizer and so on) has been increased more rapidly than population and this has been led to increase in supply and proportionately decrease in the real price of rice in world and domestic markets. Furthermore, together with growth in production and national gross income of the countries per capita income has been increased and also demand for quality rice at national and international level has been increased. Studying the market conditions which include marketing margins, causative relations, and market integrations in short term, is the important consequence that can guide and help policymakers and planners in their research, production, distribution and marketing. Almost all rice is grown under irrigated conditions in normal soils (pH 7.0 – 7.5) and yields are high, at 3 to 3.5 tones/ha for local and 5 to 7 tones / ha for improved varieties. Normally one crop of rice is taken from April/ May to August/September with 100- to 130- day varieties, with the appropriate duration being 110 to 125 days. Present study examines the rice marketing systems that facilitate the market integration at farm-wholesale-retail level for different rice qualities in Guilan province.

Varietal status

Despite the low yields of local varieties (averaging 2.5 to 3.5 tones/ha), because of their excellent quality traits, more than 80 percent of the total rice area in Iran is still under these varieties, which are similar to basmati types and are characterized by tall stature (125 to 135 cm), a weak Culm and droopy leaves. They have a long slender grain and a head rice recovery (HRR) of 60 to 63 percent, intermediate Amylase Content (AC), aroma and elongation qualities. They are prone to lodging and are also susceptible to blast and stem borer. The most popularly grown local varieties are *Sadri Momtaz* (S1), *Sadri Darge* Yek (S2), *Sadri Mamooli* (S3) and Khazar (K1).

Market integration

Spatial price behavior in regional rice markets is an important indicator of overall market per-

formance. Markets that are not integrated may convey inaccurate price information distorting the marketing decisions of rice producers and contributing to inefficient product movements. Therefore, an important part of market performance analysis focuses on regional price analysis and rice market integration between different market places.

Analysis of market integration has been the concerned affair of most researchers during the recent years. According to Barrette and Lee (2002) market integration is often defined as commerce capability among different markets. This definition includes (place equivalence process) transparency in market and depending on the state of demand, supply and cost transfer in different markets it determines prices and commercial flow and also impulse transfers in prices from one market to other ones.

Barrette (2008) defines that commerce capability shows the fact that goods is exchanged between two economies or two markets and one of the markets is exporter and the other is importer. Signals of commerce capability are transfer of demand surplus from one market to another one that may take place potentially or actually. Most of market integration techniques have been formed on the basis of One Price Low (OPL). These techniques assume that if markets are integrated, prices will differ only due to exchange costs in each one of the markets. One to one changes in prices in a market will simultaneously be transferred to another market (short term integration) and/or together with some pauses (long term integration). Of course some adjustments took place concerning long term integration.

Sanogo *et al.* (2010) applying a threshold autoregressive model about Coarse rice market integration between Nepal and India analyzed. These results show that adjustments to negative price deviations from long-run stable equilibrium are faster than adjustments to the positive ones given a null threshold

MATERIALS AND METHODS

Engle - Granger's Co-integration method

One of co-integration tests is Engle-Granger's (1987) test. If a time series variable becomes stationary ^{a} times differencing, this integrated variable will be of ^{a} order or $^{I(a)}$. If both time series variables of $^{P_{1t}}$ and $^{P_{2t}}$ are , then any linear combination of them will also be $^{I(a)}$. And now, if there are fixed numbers of $^{\alpha}$ and $^{\beta}$, then residual related to $^{P_{1t}}$ and $^{P_{2t}}$ or mentioned linear combination of the two time series will be as follows:

$$Ut=P_{1t}-\alpha-\beta P_{2t} \quad (1)$$

Steps of this test are as follows:

At first the stationary state of the two variables are studied and if the two stationary variables are of the first order, regression 2 is estimated:

$$P_{it}=\varphi+\omega P_{jt}+e_t \quad (2)$$

where $^{P_{it}}$ and $^{P_{jt}}$ are price in market i and price in market j within the time t, respectively. $^{\varphi}$ and $^{\omega}$ are parameters of the equation and $^{\omega}$ is the error item. At the next step stationary state of residuals is studied with the help of the following equation.

$$\Delta e_t = \lambda e_{t-1} + \sum_{k=2}^{n} \theta_k \Delta e_{t-1} + \mu_t \quad (3)$$

If residual items are stationary, then the two integrated market will be of the same order that is they contain long-term integration.(Engle *et al.*, 1987).

Engle-Granger causality

According to this test, two variables will be causes for each other if they can be predicted using the past amounts. Following equations are estimated for this test:

$$y_t = \sum_{i=1}^{p} \beta_i y_{t-i} + \sum_{j=1}^{q} \delta_j x_{t-j} + \varepsilon_t \quad (4)$$

$$x_t = \sum_{j=1}^{r} \alpha_j x_{t-j} + \sum_{i=1}^{s} \gamma_i y_{t-i} + e_t \quad (5)$$

In above equations, p, q, r and s are the length of lags in the model. In order for reliable estimation and preventing from error in the numbers of optimal lags, has offered a systematic method for determining the lengths of lags (granger, 1969). This method combines causality of Granger and final prediction of error (FPE) for determining optimized length of the lag for each variable of the combination. To do so, at first, any variable is fitted to their lags and FPE amounts are calculated according to the following formula:

$$FPE_{(m)} = \frac{T+m+1}{T-m-1} ESS_{(m)} / T \quad (6)$$

Where, T is the sample size and m is lag length. Now, the regression with the least amount for FPE, will determine the length of optimized lag. Then lags of other variable are entered in the regressions that, at first step, had the least amount for FPE. The model with the least amount for FPE, will show the length of optimized lag that is obtained for the following relation:

$$FPE_{(m^*,n)} = \frac{T+m^*+n+1}{T-m^*-n-1} \quad (7)$$

m* is the length of optimized variable that has been fitted on its lags and n is the lag length of the second variable.

Price transferring between farm, wholesale and retail levels

If markets are efficient and policies are not an obstacle to their operation, changes in the one market price of rice should be similarly reflected in changes in often market prices know as price transmission (Rafeek, 2003). Model developed by Ravallion (1985) was used to study the price transfer and short term integration of farm, retail and wholesale rice market considering different qualities of rice. This model that formulates relations among the prices at different levels as simultaneous equations system is as follows:

$$P_{fit} = \phi_{i0} + \phi_{i1} P_{fi,t-1} + \phi_{i2} P_{wit} + \phi_{i3} P_{wi,t-1} + \varepsilon_{ti} \quad (8)$$

$$P_{wit} = \psi_{i0} + \psi_{i1} P_{wi,t-1} + \psi_{i2} P_{rit} + \psi_{i3} P_{ri,t-1} + \varepsilon_{ti} \quad (9)$$

$$P_{rit} = \gamma_{i0} + \gamma_{i1} P_{ri,t-1} + \gamma_{i2} P_{wit} + \gamma_{i3} P_{wi,t-1} + \gamma_{i4} P_{fit} + \gamma_{i5} P_{fi,t-1} + \nu_{ti} \quad (10)$$

Where we have the followings:

P_{fit}: Farm price of rice product with *i* quality

$P_{fi,t-1}$: Farm price of rice product with *i* quality and a yearly pause

P_{wit}: Wholesale price of rice product with *i* quality

$P_{wi,t-1}$: wholesale price of rice product with *i* quality and a yearly pause

P_{rit} : Retail price of rice product with *i* quality

$P_{ri,t-1}$: Retail price of rice product with *i* quality and a yearly pause

e_{ti}, ε_{ti} and ν_{ti}: residual items of equations

ϕ_{ij}, ψ_{ij} and γ_{ij}: parameters of regression equations

ϕ_{i2} and ψ_{i2} coefficients show the price transfer condition from the levels of farm to wholesale and retail and vice versa in different qualities of rice. In analyzing these coefficients it can be said that which quality of rice has operated more efficiently in transferring the price among retail and wholesale markets and farmers and in which case the short term integration has occurred (Rapsomanikis *et al.*, 2003).

DISCUSSION

Figures 1 to 4, present farm, wholesale and retail prices of selected rice qualities during 1999-2009. In all prices, the year 2008 has dedicated the highest price to itself during the investigated period. Wholesale and retail prices have taken the highest places in each year compared to other qualities as well as to farm price. And this has taken place more intensely in three final years of the investigated period. Among the qualities of S2, S3 and K1 the differences between prices have been small until 2007, however, they have been increased in 2008 and 2009.

Figures 5 to 8 show an overview of marketing

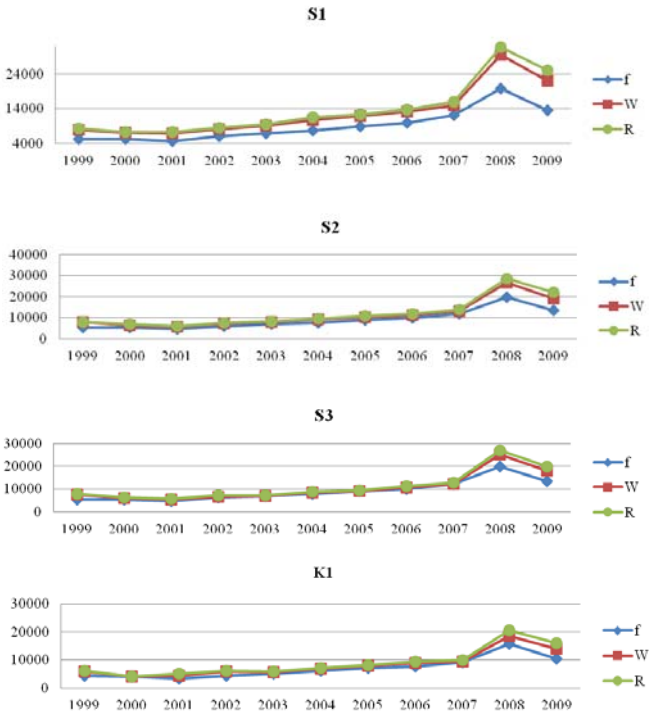

Figure: 1-4- Farm, Wholesale and Retail price of different rice qualities 1999-2009.

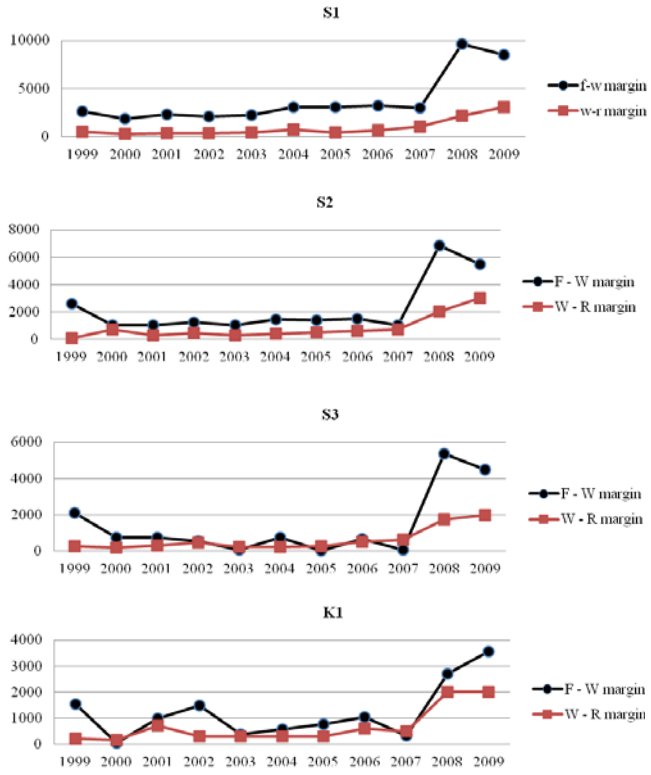

Figure: 5-8- Farm-Wholesale and Wholesale-Retail margins for different rice qualities.

margins in 2 levels of farm-wholesale and wholesale-retail for different qualities. For all qualities, until 2007 these margins have had fixed pattern. It is clear that in all figures fluctuations have occurred around an average and in other words, during 1999-2007 farm-wholesale and wholesale-retail margins have had stationary trend for all rice qualities. However, this has been changed in 2008 and 2009, and compared to wholesale-retail, price diffrences between farm–wholesale has intensely been increased.

ADF[1] stationary test results showed that all time series were I(1) and they become stationary after a differencing. Table 1 shows the results for cointegration tests of farm, wholesale and retail prices for different rice qualities. Except for K1 (wholesale-retail price) in other cases integration exist between different prices. In fact, it can be said that in all qualities of rice, market integration is present in long term and, markets have joined together so that created impulses in a market in long term are transferred to other markets.

Table 2 shows the results of Engle- Granger causality test for farm, wholesale and retail prices. In K1 and S2 there is bilateral relation in case of all prices. Table 2 support cointegration tests results and shows market integration in farm, wholesale and retail level for all rice qualities. So, applying system equations for investigating price transfer relations among marketing elements of different rice qualities has been considered.

Table 3 shows results from simultaneous equations system of price transfer model in different rice qualities. ϕ_{i2} and ψ_{i2} coefficients show the way the price transfers from farm level to wholesale and retail levels and vice versa. Estimation of ϕ_{i2} in different qualities shows that price transfer of wholesale and farm prices in short term, in other words, market integration of these two short terms in K1 rice is more than those of other qualities. Estimation of ψ_{i2} also shows that price transfer of wholesale and retail prices in short term, in other words, market integration in short term in case of K1 rice is less than those of other qualities. These results show that farm prices in K1 rice are quickly affected by shocks in its prices and in case of other rice qualities this influence takes place with a slow rate. Also, compared to other qualities, decisions made by farmer concerning changes in prices

Table 1: Cointegration tests of farm, wholesale and retail price for different rice varieties.

Tests	Null hypothesis	ADF statistic	P-value
1	Farm price is not cointegrated with wholesale price in S1	-2.02	0.04
2	Wholesale price is not cointegrated with retail price in S1	-3.75	0.02
3	Farm price is not cointegrated with wholesale price in S2	-2.17	0.03
4	Wholesale price is not cointegrated with retail price in S2	-3.14	0.005
5	Farm price is not cointegrated with wholesale price in S3	-2.04	0.04
6	Wholesale price is not cointegrated with retail price in S3	-2.2	0.03
7	Farm price is not cointegrated with wholesale price in K1	-2.56	0.01
8	Wholesale price is not cointegrated with retail price in K1	-1.88	0.06

Source: Research findings.

[1] *Augmented Dickey–Fuller*

Table 2: Engle-Granger causality test results for different rice qualities.

Tests	Null hypothesis	ADF statistic	P-value
1	For S1 retail price is not the causality of farm price	5.58	0.06
2	For S1 farm price is not the causality of retail price	3.13	0.15
3	For S1 wholesale price is not the causality of retail price	2.25	0.22
4	For S1 retail price is not the causality of wholesale price	2.08	0.23
5	For S1 wholesale price is not the causality of farm price	9.32	0.03
6	For S1 farm price is not the causality of wholesale price	5.32	0.07
7	For S2 retail price is not the causality of farm price	6.83	0.05
8	For S2 farm price is not the causality of retail price	3.53	0.13
9	For S2 wholesale price is not the causality of retail price	0.48	0.64
10	For S2 retail price is not the causality of wholesale price	0.85	0.45
11	For S2 wholesale price is not the causality of farm price	9.54	0.03
12	For S2 farm price is not the causality of wholesale price	5.4	0.07
13	For S3 retail price is not the causality of farm price	1.6	0.3
14	For S3 farm price is not the causality of retail price	0.85	0.85
15	For S3 wholesale price is not the causality of retail price	0.64	0.57
16	For S3 retail price is not the causality of wholesale price	0.86	0.48
17	For S3 wholesale price is not the causality of farm price	2.28	0.22
18	For S3 farm price is not the causality of wholesale price	1.61	0.3
19	For K1 retail price is not the causality of farm price	0.57	0.6
20	For K1 farm price is not the causality of retail price	0.14	0.86
21	For K1 wholesale price is not the causality of retail price	0.56	0.6
22	For K1 retail price is not the causality of wholesale price	0.83	0.49
23	For K1 wholesale price is not the causality of farm price	0.79	0.82
24	For K1 farm price is not the causality of wholesale price	0.38	0.7

Source: Research findings.

Table 3: Price transmission simultaneous equations system for different rice qualities.

Coefficients	S1	S2	S3	K1
ϕ_{i0}	1088.5 (0.97)	1096.9 (1.33)	1159.5 (0.96)	396.2 (0.7)
ϕ_{i1}	1.58 (0.012)	-0.49 (0.009)	0.56 (0.003)	0.19 (0.0007)
ϕ_{i2}	0.53 (0.001)	0.71 (0.0012)	0.65 (0.0005)	0.81 (0.00014)
ϕ_{i3}	-1.04 (0.008)	0.38 (0.0069)	-0.36 (0.0026)	-0.18 (0.00059)
ψ_{i0}	320.56 (0.69)	593.18 (0.45)	278.19 (0.65)	403.7 (0.64)
ψ_{i1}	1.61 (0.011)	-0.2 (0.0096)	0.77 (0.005)	0.58 (0.0069)
ψ_{i2}	0.96 (0.00002)	0.95 (0.00004)	0.93 (0.000005)	0.86 (0.00001)
ψ_{i3}	-1.59 (0.011)	0.11 (0.009)	-0.74 (0.005)	-0.53 (0.0063)
γ_{i0}	-601.16 (0.71)	-516.83 (0.47)	-222.49 (0.7)	-433.8 (0.71)
γ_{i1}	1.65 (0.011)	-0.12 (0.009)	0.79 (0.005)	0.61 (0.0073)
γ_{i2}	0.9 (0.0002)	1.12 (0.0001)	1.12 (0.00003)	1.2 (0.00003)
γ_{i3}	-1.41 (0.012)	0.25 (0.01)	-0.85 (0.005)	-0.68 (0.008)
γ_{i4}	0.25 (0.00001)	-0.99 (0.00001)	-0.066 (0.000002)	-0.08 (0.00002)
γ_{i5}	-0.39 (0.003)	-0.49 (0.001)	0.037 (0.00023)	0.015 (0.00005)
R^2	0.98	0.94	0.97	0.96

Source: Research findings.

are more affected by shakings on wholesale price of K1 high yielding rice. And in wholesale-retail market for Sadri quality rice, wholesale price is intensely affected by shocks on retail price and this shows intense integration of these two markets in rice product of Iran.

Since price transfer from wholesale to farm in high quality rice takes place rarely, price in wholesale level in case of such qualities is exclusive. In fact, increase in price at retail level rapidly transfers to wholesale level and consequently, this transfer takes place more from retail level to farm level in case of high yielding rice (lower qualities) compared to high quality rice transfer. It seems that, bargaining power of union of rice farmers concerning rich product

quality that is also supported by executive authorities is considerable.

The point to be considered is that according to above said contents in introduction part of the present research, being careful about the quality for the purpose of attending international markets is an inevitable reality and that, supporting the high yielding qualities and paying less attention to the quality and more attention to supply rice market with large quantities will cause reduction in production of good quality rice in future and irreparable harm to rice economy of the country. So, it is proposed that union of rice farmers prioritize bargaining about price determination for rice with high qualities and concerned executive powers also change their directions towards the policymaking and planning for high qualities. It is suggested that according to the different quality of rice verities, support policy design and decision making process assigned separately.

REFERENCES

1- Agronomic report of different rice varieties cultivation in Gulan province (1996-2006). Iran's Rice research center.

2- Barrett, C.B. (2008). Spatial Market Integration. The New Palgrave Dictionary of Economics, second ed. London: Palgrave Macmillan.

3- Barrett, C.B., Li, J. (2002). Distinguishing between equilibrium and integration in spatial price analysis. American Journal of Agricultural Economics 84, 292–307.

4- Engle, R. & Granger, C.W.J. (1987), Co-integration and error correction: representation, estimation and testing, Econometrica, (2)55, 251-276.

5- Granger, C. (1969). Investigating causal relations by econometric models and cross-spectral methods, Econometrica, 37, 424-438.

6- Rafeek, M. (2003). Rice Marketing System: Implication For Rice Quality Improvement And Issue Of Affordability, socio economics and planning center. Peradeniya.

7- Rapsomanikis, G. & Hallam, D. (2003). Market integration and price transmission in selected food and cash crop markets of developing countries: review and applications, online: http://www.fao.org/DOCREP/006/Y5117E/y5117e06.htm.

8- Ravallion, M. (1986). Testing market integration, American Journal of Agricultural Economics, 68(1), 102-109.

9- Sanogo, I., & Maliki, M. (2010). Rice market integration and food security in Nepal: The role of cross-border trade with India, Food Policy, 35, 312–322.