# Agricultural market integrations and accession to WTO: An application to the major crops in Iran

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## Abstract

Iran has observer status in the World Trade Organization (WTO) now and the Iranian Agriculture Ministry and the Commerce Ministry are making efforts to eliminate all non-technical problems in agricultural sector trade. However, the key questions with regard to Iran's accession to WTO are whether Iranian domestic agricultural markets are integrated; and if Iran's markets will integrate with world agricultural markets. To address these questions, integration of main crops' markets in Iran are analyzed in this article using the Engle-Granger cointegration technique and vector autoregressive (VAR) model applied to 1984-2002 price data.  The underlying hypothesis is that government intervention in the markets to support producers/consumers of agricultural products is the main determinants of market integration.

The typical results show that although long-run market integration exists among local markets of products such as rice and wheat, Iran's major agricultural product markets are not integrated with world markets in the long run. Government interventions were recognized to be as the major impediments to domestic and world market integrations. Finally some policy implications are discussed.

*Keywords: market integration, cointegration, agricultural products and Iran*

## Introduction

Iran applied to join the WTO first in 1996 and has got observer status by the member of the WTO in 2005. Despite existence of several domestic (e.g. input subsidies, credit programs, guaranteed price schemes, etc.) and trade supports (e.g. import and export controls, tariffs and/or non-tariff barriers), policy in Iran has been recently directed toward gradual abolition of government intervention in agriculture. Moreover, significant trade and foreign exchange reforms have been implemented in recent years. However, there are still markets such as wheat, rice and cotton where the government plays a significant role in pricing and in the supply and/or demand side of the markets.

Extending market integration regionally and globally is one of the requirements and what we expect from Joining the WTO. Whether Iran's domestic agricultural markets are spatially integrated and if these markets will integrate with world agricultural markets are amongst the key questions to evaluate the success of Iran's accession to the WTO.

Market integration reflects price transmission and the extent of how changes in one market are transmitted to another, and implicitly shows the extent to which markets function efficiently. Spatial market integration implies smooth transmission of price signals and information across distanced markets and its absence refers to incomplete price transmission resulting mainly from government intervenes and policies, trade handicaps, and/or transaction costs such as poor transport and communication infrastructure (Rapsomanikis *et. al.*, 2003). Studying market integration has important implications for economic welfare. As stated by Laping (2002), duplication of government intervention can be avoided by identifying groups of integrated markets, and security and balance of supply among food-deficit and food-surplus regions occurs through market integration. Furthermore, market integration provides better signals for production and consumption decisions (Giesbertz and Tonjes, 2004).

Agricultural market integration affects the overall level of agricultural output prices and input prices, the volume of foreign trade of agricultural products and, consequently, the volume of agricultural production. Indirectly, it affects the structure, size of farm population, farm income, production costs, the input

1

manufacturing and output processing industries and the overall national economy with its income and resource allocation effects (Niemi, *et. al.*, 2005).

Following Laping (2002), we are interested to find out answers to the key questions regarding Iran's accession to WTO: whether Iranian domestic agricultural markets are integrated; if so, is this a sign of competitiveness in the markets or is what may be so called planned market integration; and whether Iran's markets will integrate with world agricultural markets. To address these questions, markets integration of wheat, rice, and cotton in Iran are analyzed in this article using the Engle-Granger cointegration technique and vector autoregressive (VAR) model applied to 1984-2002 domestic and world prices of these products. The underlying hypothesis is that government intervention in the markets to support producers/consumers of agricultural products is the main determinants of market integration.

**Method**

Various measures of market integration including correlation coefficients and tests of integration have been used in the literature. The standard Granger (1969) test has been employed in the relevant literature to investigate the integration and influences of the domestic markets in short-run, which reflects the immediate response of a market to the price change in another market, and in long-run that shows the relationship between two markets and also reveals the stability of the prices in the long run (Laping, 2002). The methodology used in this paper is based on Engle-Granger (1987) cointegration technique and vector autoregressive (VAR) model that is well established in the literature and is widely used to study integration of agricultural products markets (see, Arshad**,** 1990**;** Asche, *et al.*, 1999; Debado and Marrero, 2002; Laping, 2002 and Rapsomanikis *et al.*, 2003). Recent developments in the time series analysis have suggested some improvements in the standard Granger test. The first step is to check for the stationary of the original variables and then to test cointegration between them. The Augmented Dickey Fuller (ADF) test in Microfit 4.0 was applied to the data to test the stationarity of the time series in this study. If the ADF statistics is less

than its critical values, then the null hypothesis is rejected and the series are stationary or integrated of order one i.e. I(1).

### *Cointegration*

After determining the order of integration of the variables, we estimated cointegration regression (1) using variables having the same order of integration and then, the stationarity of the residuals was tested using equation (2):

$$P_{it} = \alpha + \beta P_{jt} + \gamma t + e_t \qquad (1)$$

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

$P_{it}$ and $P_{jt}$ denote log form of prices at markets $i$ and $j$ at period $t$ and $\alpha$, $\beta$, $\gamma$, $\lambda$ and $\theta$ are parameters to be estimated. $\Delta$ is the difference operator and $e_t$ and $\mu_t$ are corresponding error terms of the two equations.

If the residuals $e_t$ are recognized to be stationary, we conclude that the two markets $i$ and $j$ are cointegrated that is based on the null hypothesis of ADF test.

### *Short-run integration*

We estimated equation (3) to check for the short term integration between the two markets.

$$\Delta P_{it} = \mu_{11} \Delta P_{it-1} + \cdots + \mu_{1n} \Delta P_{it-n} + \mu_{20} \Delta P_{jt} + \mu_{21} \Delta P_{jt-1} + \cdots$$

$$+ \mu_{2n} \Delta P_{jn-1} - \lambda (P_{it-1} - \alpha P_{jt-1} - \delta) + \varepsilon_t \qquad (3)$$

The markets are not cointegrated in shor run, if the null hypothesis (H0: $\mu_{11} = \ldots = \mu_{1n} = \mu_{21} = \ldots = \mu_{2n}$ and $\lambda = 1$) is rejected based on corresponding F-tests.

### *Granger causality*

The existence and direction of causal relationships between the time series involved in this study is tested by the Granger causality concept that is performed through the following VAR (k) model:

$$P'_t = \alpha_{10} + \sum_{j=1}^{k} \alpha_{1j} P_{t-j} + \sum_{j=1}^{k} \beta_{1j} P'_{t-j} + \varepsilon_{1t} \qquad (4)$$

$$P_t = \alpha_{20} + \sum_{j=1}^{k} \alpha_{2j} P_{t-j} + \sum_{j=1}^{k} \beta_{2j} P'_{t-j} + \varepsilon_{2t} \qquad (5)$$

Then, F test is used to check the direction of causaulity. If, for instance, $\{\alpha_{11}, \alpha_{12}, \ldots \alpha_{1k}\} \neq 0$, and $\{\beta_{21}, \beta_{22}, \ldots, \beta_{2k}\} \neq 0$, there is a bilateral causality between the two prices of P and P'in two markets, denoted as P↔P'. A unindirectional causality from P' to P is denoted as P'→ P (see more detail at: Seddighi, *et al*, 2000, p310).

Time series (1984-2002) on domestic prices of rice (for 47 months), wheat and cotton (for 12 years) and their world prices (for 18 years) were used in this study.

**Empirical Results**

The degree of integration of each variable involved determined by ADF test statistics are reported in Table 1.

Table 1. Degree of integration for prices of wheat, rice and cotton in Iran

| | Degree of integration | | Degree of integration |
|---|---|---|---|
| **Domestic price of wheat:** | | **Domestic price of rice:** | |
| West Azarbayjan | I(1) | Fars | I(0) |
| East Azarbayjan | I(1) | Gilan | I(0) |
| Kermansha | I(1) | Khuzestan | I(2) |
| Bushehr | I(1) | Mazandaran | I(2) |
| Charmahal | I(2) | **Domestic price of cotton:** | |
| Ilam | I(1) | Esfahan | I(1) |
| Esfahan | I(0) | Fars | I(0) |
| Fars | I(0) | Khorasan | I(1) |
| Gilan | I(2) | Mazandaran | I(1) |
| Hamadan | I(2) | **World price of wheat:** | |
| Hormozgan | I(1) | Asia | I(0) |
| Kerman | I(1) | Australia | I(0) |
| Khuzestan | I(0) | Canada | I(0) |
| Khorasan | I(0) | Argentina | I(2) |
| Kohgiluye | I(0) | Europe | I(0) |
| Kordestan | I(0) | **World price of cotton:** | |
| Lorestan | I(0) | Asia | I(0) |
| Markazi | I(0) | Europe | I(0) |
| Mazandaran | I(0) | **World price of rice:** | |
| Sistan | I(0) | Pakistan | I(1) |
| Tehran | I(0) | Thailand | I(2) |
| Yazd | I(0) | UAE | I(1) |
| Zanjan | I(0) | | |

As shown, domestic prices of wheat in provinces such as Esfahan, Fars, Khuzestan, Khorasan,…, Tehran, Yazd and Zanjan; of rice in Fars and Gilan and of cotton in Fars are stationary.  However, the ADF test rejects the null hypothesis for the rest of domestic prices that are found to be stationary either in the first or second differences, and so integrated of order I(1) or I(2).

World prices of imported wheat from Asia, Australia, Canada and Europe and of imported cotton from Asia and Europe are stationary but the other world prices are either I(1) or I(2).

In the following sections, the findings on integration of studied markets are discussed.


**Wheat market integration in Iran**

As a very common product and a staple food, wheat is produced almost everywhere in Iran. For reasons of food security, the Iranian government encourages the farmers to produce more wheat both by increasing their productivity and by increasing the area under cultivation. The guaranteed farm-level wheat price is almost the same as the world price evaluated at the official exchange rate but lower when black market exchange rate is used. Consumers are supported by subsidy so that the consumer price is highly lower than the world prices of wheat. The possible signs of domestic wheat market integration may not be real and could be categorized as planned market integration because both sides of wheat market in the country are intervened by the government.

Tables 2 and 3 report the results of ADF test applied to the residuals of the wheat cointegration equations[1]. The absolute values of the calculated test statistic for all the residuals were compared with their critical values. As can be seen, out of 266 pairs of wheat markets, a total of 249 in the long run (Table 2) and 77 in the short run (Table 3) are cointegrated.

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[1] The abbreviations in these two tables and later in table five stand for provinces in Iran: EAZ (East Azarbayjan, WAZ ( West Azarbayjan), KMS (Kermansha), BSH (Busher), CMB (Charmahal and Bakhtiari), ILM (Ilam), FRS (Fars), GLN (Gilan), HMD (Hamadan), HMZ (Hormozgan), KHZ (Khuzestan), KHR (Khorasan), KOH (Kohgiluye and Buyrahmad), KOR (Kordestan), LOR (Lorestan), MRK (Markazi), MZN (Mazandaran), SMN (Semnan), SIS (Sistan and Baluchestan), THR (Tehran), YZD (Yazd), ZNJ (Zanjan) and ESF (Esfahan).

Tables 2. The ADF results for local wheat markets integration in long run

| | WAZ | EAZ | KMS | BSH | CMB | ILM | FRS | GLN | HMD | HMZ | KMN | KHZ | KHR | KOH | KOR | LOR | MRK | MZN | SMN | SIS | THR | YZD | ZNJ | ESF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EAZ | -5.31 | | | | | | | | | | | | | | | | | | | | | | | |
| KMS | 2.56 | -5.10 | | | | | | | | | | | | | | | | | | | | | | |
| BSH | ns | -4.02 | -4.33 | | | | | | | | | | | | | | | | | | | | | |
| CMB | -2.46 | -3.10 | -3.63 | ns | | | | | | | | | | | | | | | | | | | | |
| ILM | -4.08 | -3.16 | -4.45 | -3.77 | -3.58 | | | | | | | | | | | | | | | | | | | |
| FRS | -2.68 | -2.45 | -5.75 | -3.65 | -3.26 | -2.61 | | | | | | | | | | | | | | | | | | |
| GLN | -3.47 | -3.65 | -3.32 | -3.81 | -3.92 | -2.45 | -3.69 | | | | | | | | | | | | | | | | | |
| HMD | -2.53 | -3.40 | -2.73 | -3.81 | -4.49 | -4.57 | -3.29 | -2.43 | | | | | | | | | | | | | | | | |
| HMZ | -2.19 | -2.17 | -2.86 | -3.09 | -2.68 | -2.19 | -4.58 | -2.43 | ns | | | | | | | | | | | | | | | |
| KMN | -4.27 | -4.46 | -3.53 | -5.37 | -3.47 | -3.73 | ns | -3.44 | -4.38 | -4.07 | | | | | | | | | | | | | | |
| KHZ | -5.77 | -5.11 | -3.52 | -4.77 | -3.78 | -3.41 | -3.11 | -4.54 | -2.64 | -3.71 | -3.92 | | | | | | | | | | | | | |
| KHR | -6.21 | -5.11 | -4.44 | ns | -2.73 | -2.76 | -1.89 | -4.37 | -9.23 | -1.93 | -2.11 | -3.00 | | | | | | | | | | | | |
| KOH | -3.07 | -4.69 | -3.19 | -4.67 | -3.83 | -2.86 | -3.01 | -2.51 | -1.76 | -2.86 | ns | -2.77 | -2.17 | | | | | | | | | | | |
| KOR | -3.10 | -2.89 | -3.29 | -2.69 | -4.67 | -3.74 | -2.82 | -2.91 | -1.94 | -1.88 | -3.62 | -3.48 | -2.44 | -2.41 | | | | | | | | | | |
| LOR | 2.81 | -3.42 | -3.07 | -4.31 | -3.19 | -3.61 | -2.42 | -4.09 | -1.61 | -2.07 | -3.25 | -3.12 | -6.78 | -3.09 | ns | | | | | | | | | |
| MRK | -3.65 | -5.66 | -4.22 | -3.55 | -2.63 | -3.32 | -4.12 | -5.16 | -2.81 | -3.01 | -4.18 | -2.21 | -3.78 | -3.13 | -3.49 | | | | | | | | | |
| MZN | -1.82 | -2.29 | -3.69 | -2.25 | -2.41 | -1.95 | ns | -3.13 | ns | -2.21 | -5.11 | -3.32 | -2.84 | -2.74 | -2.57 | -4.32 | -2.44 | | | | | | | |
| SMN | -3.22 | -2.63 | -2.46 | -4.28 | ns | -4.31 | -3.38 | -3.93 | -4.45 | -5.03 | -5.53 | -4.36 | -1.90 | -3.77 | -3.37 | -5.41 | -4.59 | ns | | | | | | |
| SIS | -2.26 | -4.50 | -2.35 | -3.29 | -2.99 | -4.09 | -4.91 | -3.89 | -2.98 | 4.01 | -5.21 | -4.65 | -5.70 | -4.22 | -4.01 | -3.64 | -4.09 | -3.85 | -4.70 | | | | | |
| THR | -3.13 | -3.49 | -3.48 | -3.99 | -2.71 | -3.36 | -3.28 | -3.34 | -6.26 | -2.18 | -3.52 | -4.70 | -2.76 | -3.82 | -3.53 | -5.29 | -3.12 | -4.74 | -3.62 | | | | | |
| YZD | -4.33 | -4.42 | -3.91 | -4.62 | ns | -3.66 | -4.68 | -3.13 | -2.63 | -5.14 | -4.16 | ns | ns | -2.32 | -2.79 | ns | ns | -3.82 | -3.53 | -4.94 | -3.56 | | | |
| ZNJ | -2.73 | -5.33 | -3.70 | -4.66 | -6.45 | -2.88 | -6.41 | -3.71 | -2.21 | -2.19 | -3.89 | -2.16 | -3.40 | -4.83 | -2.84 | -3.08 | -6.93 | -3.86 | -3.18 | -2.66 | -7.64 | ns | | |
| ESF | -4.29 | 11.45 | -4.11 | -5.23 | -3.57 | -5.34 | -4.32 | -3.31 | -2.15 | -3.11 | -3.31 | -2.60 | -5.38 | -3.09 | -3.62 | -2.27 | -3.49 | -3.48 | -4.12 | -3.50 | -2.06 | -2.14 | -3.44 | |

Tables 3. The F-test results for local wheat markets integration in short run

| | WAZ | EAZ | KMS | BSH | CMB | ILM | FRS | GLN | HMD | HMZ | KMN | KHZ | KHR | KOH | KOR | LOR | MRK | MZN | SMN | SIS | THR | YZD | ZNJ | ESF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EAZ | 4.85 | | | | | | | | | | | | | | | | | | | | | | | |
| KMS | ns | ns | | | | | | | | | | | | | | | | | | | | | | |
| BSH | 4.43 | 13.11 | 36.22 | | | | | | | | | | | | | | | | | | | | | |
| CMB | 15.25 | 3.89 | 23.11 | 4.34 | | | | | | | | | | | | | | | | | | | | |
| ILM | 10.34 | 3.24 | 9.41 | 35.45 | 16.05 | | | | | | | | | | | | | | | | | | | |
| FRS | 15.10 | ns | 22.2 | 8.79 | 5.6 | 40.24 | | | | | | | | | | | | | | | | | | |
| GLN | 4.32 | ns | ns | 13.92 | 9.19 | ns | 25.35 | | | | | | | | | | | | | | | | | |
| HMD | 5.26 | ns | 6.10 | 25.81 | 10.66 | .82 | 24.64 | ns | | | | | | | | | | | | | | | | |
| HMZ | 23.70 | 10.71 | 16.2 | ns | 15.42 | 26.5 | 6.44 | 20.37 | 14.52 | | | | | | | | | | | | | | | |
| KMN | 19.90 | 7.15 | 24.04 | 5.02 | ns | 52.31 | 6.09 | ns | 3.78 | ns | | | | | | | | | | | | | | |
| KHZ | ns | ns | ns | 10.51 | 3.53 | 14.24 | 9.17 | 3.34 | 3.27 | ns | 3.85 | | | | | | | | | | | | | |
| KHR | ns | ns | ns | 12.57 | 6.32 | 7.80 | 5.66 | 4.70 | 7.66 | 7.88 | 11.26 | 3.35 | | | | | | | | | | | | |
| KOH | ns | ns | 4.09 | 32.08 | 6.33 | ns | 67.11 | ns | ns | 15.22 | 29.62 | 12.57 | ns | | | | | | | | | | | |
| KOR | 18.67 | 6.87 | 11.94 | 34.08 | 12.36 | 3.35 | 24.59 | ns | 7.02 | 15.34 | 14.87 | 15.32 | 8.86 | 5.68 | | | | | | | | | | |
| LOR | ns | ns | ns | 29.13 | 32.47 | 17.44 | 9.17 | 4.46 | 5.16 | 8.64 | 1.79 | ns | ns | 5.34 | 16.70 | | | | | | | | | |
| MRK | ns | ns | 3.35 | 10.53 | 6.85 | 16.76 | 8.27 | 6.38 | 5.32 | 3.50 | 6.53 | ns | ns | ns | 10.80 | ns | | | | | | | | |
| MZN | 3.94 | ns | 6.18 | 8.50 | 3.27 | 8.72 | 3.67 | 4.41 | 11.03 | 3.24 | ns | ns | ns | ns | 4.45 | 10.92 | ns | | | | | | | |
| SMN | 45.37 | ns | 4.62 | ns | 2.97 | 7.49 | ns | 5.02 | 12.41 | ns | ns | ns | ns | 13.29 | 10.20 | ns | ns | 58.08 | | | | | | |
| SIS | 15.67 | ns | 8.82 | 5.03 | ns | 33.50 | ns | 14.51 | 10.68 | 4.13 | ns | 5.49 | 5.94 | 25.80 | 28.31 | 13.93 | 7.32 | 54.39 | ns | | | | | |
| THR | ns | ns | 14.50 | 7.47 | 9.45 | 5.19 | 4.19 | 3.56 | 7.24 | 12.49 | ns | ns | 4.33 | 13.89 | ns | 93.94 | ns | ns | | 4.60 | | | | |
| YZD | 23.37 | 4.50 | 28.70 | 4.80 | 5.27 | 38.58 | ns | 22.09 | 37.72 | ns | ns | 3.71 | 5.82 | 49.83 | 52.15 | 13.77 | 10.09 | 10.29 | ns | ns | 10.18 | | | |
| ZNJ | 6.55 | ns | 5.24 | 13.02 | 9.52 | ns | 21.23 | ns | ns | 11.92 | 12.26 | 9.1 | 5.17 | 6.29 | 4.41 | 6.67 | 6.66 | 9.49 | 4.55 | 5.79 | 7.15 | 17.42 | | |
| ESF | 9.52 | ns | 12.28 | 4.54 | 2.98 | 21.02 | 5.35 | 4.84 | 7.57 | ns | 2.96 | 8.49 | 5.62 | 23.94 | 34.10 | 10.17 | 6.40 | 3.03 | ns | ns | 9.63 | 7.34 | 7.56 | |

Cells with figures represent cointegration among the corresponding markets at a signification level of at least 10% and non-integrated markets are indicated with "ns".

Some pairs of markets gain strong cointegration. Based on the corresponding F values, the hypothesis of the lack of long run wheat markets equilibrium at West Azarbayjan-Busher, Busher-Charmahal, Busher-Khorasan, Charmahal-Semnan, Charmahal-Yazd, Fars-Mazandaran, Hamadan-Hormozgan, Hamadan-Mazandaran, Kerman-Kohgiluye, Khuzestan-Yazd, Khorasan-yazd, Kordestan-Lorestan, Lorestan-Yazd, Markazi-Yazd, Mazandaran-Semnan and Yazd-Zanjan are not rejected but this hypothesis cannot be accepted for the other pairs of markets at the 1 per cent level.

Among the 24 major provinces of wheat producers, market in West Azarbayjan is cointegrated in short run with those in Khuzestan, Khorasan, Kohgiluye, Lorestan, Markazi and Tehran. Furthermore, Mazandaran-Fars is another pair of cointegrated wheat market in Iran. In general, it seems that most local wheat markets in Iran are cointegrated due to the distortions made by the government namely by implementing guaranteed purchasing scheme as well as subsidized consumers price scheme and therefore there is no real cointegrations among the wheat markets. The main reasons for the lack of short term cointegration in the rest of wheat markets can be attributed to the inappropriate roads and insufficient rail nets in many parts of the country. Moreover, lack of a convenient information system prevent the acceleration of immediate price transmission throughout the country.

The results of long term and short term cointegration tests among the domestic wheat markets and the major world markets importing wheat to Iran are shown in Tabel 4.

Table 4. The results of cointegration for wheat market in world and Iran

| | Argentina | Asia | Australia | Canada | Europe |
|---|---|---|---|---|---|
| **Long term (the ADF results)** | | | | | |
| Asia | $-1.97^{**}$ | | | | |
| Australia | $-2.54^{**}$ | $-4.99^{***}$ | | | |
| Canada | $-2.39^{**}$ | $-3.09^{***}$ | $-1.61^{*}$ | | |
| Europe | $-2.42^{**}$ | $-3.16^{***}$ | $-2.71^{***}$ | $-3.48^{***}$ | |
| Iran | $-2.55^{**}$ | $-3.44^{***}$ | $-3.96^{***}$ | $-2.33^{**}$ | $-0.46$ |
| **Short term (F-tests results)** | | | | | |
| Asia | $64.08^{***}$ | | | | |
| Australia | $1.94^{**}$ | $96.64^{***}$ | | | |
| Canada | $0.19^{**}$ | $2.77^{***}$ | $0.12^{**}$ | | |
| Europe | $2.72^{**}$ | $47.72^{***}$ | $3.67^{***}$ | $0.84^{**}$ | |
| Iran | $3.56^{***}$ | $13.15^{***}$ | $12.94^{***}$ | $10.79^{***}$ | $3.29^{***}$ |

***,**,* sigfnificant respectively at 1%, 5% and 10% levels

As can be seen, Argentina, Canada, Asia, and Australia have cointegred wheat markets with Iran, however the involved price series in Iran and Europe are not cointegrated in long run. This may be attributed to almost low level of wheat trade volume between Iran and Europe. In the short run, cointegration does not exist between wheat market in Iran and wheat imoporting countries to Iran. The main reason behind this is the fact that Iran exclusively control the trade of this product to ensure domestic food security and therefore, domestic prices cannot queickly respond to the international prices.

*Test for Granger causality*

The results of Granger causality test for domestic wheat markets are reported in Table 5. As can be seen, Esfahan wheat market is recognized to dominantly influence the prices in other domestic markets. As the tenth producer of wheat in Iran, Esfahan is located in the centre of the country and comparing to the other provinces is ended to several highways and roads.

The results of Granger causality test for wheat markets in Iran and importing countries are shown in Table 6. The direction of price transmitiom from Australia market to those of other countries including Iran is significant and therefore the Australian wheat market is recognised to be the leader wheat market. Australia is the sixth importer of the world wheat importers and has the second position in this regard among the main wheat importing to Iran.

Table 5. The Granger causality tests for local wheat market in Iran

| | AZG | AZS | KMS | BSH | CMB | ILM | FRS | GLN | HMD | HMZ | KMN | KHZ | KHR | KOH | KOR | LOR | MRK | MZN | SMN | SIS | THR | YZD | ZNJ | ESF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AZG | | | | | ←* | | ← | ←* | ←* | | ← | | ←* | | | | | ← | | | ←* | | | ←* |
| AZS | ←* | | | ←* | | ←* | ←* | | ←* | ←* | ←* | ←* | ← | ←* | ←* | ←* | ←* | ←* | ←* | ← | ←* | ←* | ←* | ←* |
| KMS | | ←* | | ←* | | ← | ← | ← | | ←* | ← | | ←* | ← | | | ←* | ← | | | ←* | ← | | ←* |
| BSH | ←* | ←* | | | | | ←* | | | ←* | ←* | ←* | ←* | ←* | ←* | ← | ←* | ←* | ←* | ←* | ←* | ←* | ← | ←* |
| CMB | ←* | | ←* | ←* | | ← | ←* | | ←* | ←* | ←* | ←* | ←* | ← | ←* | ←* | ←* | ←* | ←* | ←* | ← | ←* | ←* | ←* |
| ILM | ←* | ←* | ←* | ← | ←* | | ←* | | ←* | ← | ←* | ←* | ←* | | ←* | ←* | ← | ←* | ←* | ←* | | ←* | ←* | ←* |
| FRS | | | | | ←* | | | | ← | | ←* | ← | ←* | | ← | | ← | ←* | ← | ←* | | | | ←* |
| GLN | ←* | ←* | ←* | ←* | ←* | ← | ←* | | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* |
| HMD | ←* | ← | ← | ←* | ←* | ←* | ← | ←* | | ←* | ←* | | ←* | ←* | ←* | ←* | ←* | ←* | | ←* | ←* | ←* | ←* | ←* |
| HMZ | ←* | | ←* | ←* | | ←* | ←* | ←* | ←* | | ←* | ←* | ←* | ←* | ←* | ← | ←* | ←* | ←* | ←* | ←* | ← | | ←* |
| KMN | | ←* | ← | ← | ←* | | ← | | ←* | ← | | ←* | ←* | ← | ←* | ← | ←* | ← | ←* | ←* | ← | ← | ←* | ←* |
| KHZ | | ←* | | ←* | | | | | ← | | ←* | | ← | | ← | | ←* | ← | ←* | | ← | | ←* | ←* |
| KHR | ←* | | | | | | ←* | ←* | ← | ← | ←* | ← | | ←* | ← | ← | ←* | ← | ←* | ← | ←* | ← | ←* | ←* |
| KOH | ← | ←* | | ← | ←* | ←* | | | ← | ← | ←* | ←* | ←* | | ←* | ←* | ← | ←* | ←* | ←* | ←* | ←* | ←* | ←* |
| KOR | ←* | | | | ←* | ←* | | ←* | ← | ←* | ←* | ← | ←* | ← | | ←* | ←* | ←* | ← | ←* | ←* | ← | ←* | ←* |
| LOR | ←* | ← | ← | | ← | ← | | ←* | ←* | ←* | ←* | | | | | | ←* | ←* | | | | | | ←* |
| MRK | | ← | ←* | | ← | ← | | ←* | | | | | | ← | ←* | ← | | | | | ← | ←* | ← | ←* |
| MZN | | ←* | | ←* | | ←* | ← | ←* | ←* | | | | | ←* | | | | | | | ←* | | | ←* |
| SMN | | ← | ←* | ←* | ←* | ←* | ←* | ←* | ← | | ←* | ← | ← | ←* | ← | ←* | ←* | ← | | | ← | ←* | ← | ←* |
| SIS | ←* | | ←* | | | | ← | | ← | | | | | | ←* | ← | | ← | ← | | | ←* | ← | ←* |
| THR | | ←* | | ←* | ←* | | | | ← | ← | | | | | | | ← | ← | | | | | | ←* |
| YZD | | | | | | ←* | | ←* | | | ←* | ←* | ←* | ←* | | | | ←* | ←* | ←* | ←* | | ←* | ←* |
| ZNJ | | | | | | | | | | | | | | | | | | | | | | | | ←* |
| ESF | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* | ←* |

←*significant at 1% and ← significant at 5%

Table 6. The Granger causality tests for world wheat market

| | Argentina | Asia | Australia | Canada | Europe | Iran |
|---|---|---|---|---|---|---|
| Argentina | | ← | ←* | ←* | ←* | ←* |
| Asia | | | ←* | ←* | | |
| Australia | | | | ←* | ←* | |
| Canada | ← | ←* | ←* | | ←* | ←* |
| Europe | ←* | ←* | ← | ← | | ←* |
| Iran | ←* | | ←* | | ←* | |

←*significant at 1% and ← significant at 5%

**Rice market integration in Iran**

Rice is an Iranian major agricultural product particularly in Northen areas, i.e. Mazandaran and Gilan, where the vast majority of rice is produced. The Iranian government intervenes in the rice market by controlling imports to prevent rises in the price of rice in the country. Among the factors affecting the increasing gap between production and consumption of rice are the direct and indirect policies of the government. These policies include input subsidies, credit programs, a guaranteed price, distribution of rice coupons and importing rice using foreign exchange evaluated at special cheap rate allocated for food.

Until recent years, almost 90% of total rice entering the country (mainly via Dubai from Thailand and Pakistan, through the ports of Bandar Abbas and Bushehr) was imported by the Ministry of Commerce and its Service Extension Company, and the rest by other state trading agencies (STA) including post revolution enterprises and cooperatives. The Iranian government imports shortages of rice by spending the official exchange rate by which the imported rice is apparently cheaper than the domestic rice. However, the imported rice is more expensive than the domestic rice when the prices are evaluated at the exchange rate in the black market (Bakhshoodeh and Thomson, 2006).

The Johannsen Cointegration test cointegration results (Table 7) revealed that despite the long distances, domestic rice market in Gilan (Northern areas) is cointegrated with those in Fars and Khuzestan (in Soutern areas) as it is between markets in Mazandaran and Khuzestan. However, the null hypothesis of coingration was not rejected for contiguous provinces of Gilan and Mazandaran and the two series proved non-cointegrated.

Tables 7. The ADFresults for local  and world rice markets cointegration in long run

| | Local | | | | World | | |
|---|---|---|---|---|---|---|---|
| | Fars | Gilan | Khuzestan | | UAE | Pakistan | Thailand |
| Gilan | -5.42*** | | | Pakistan | 1.18 | | |
| Khuzestan | -3.37*** | -2.2** | | Thailand | -0.15 | 0.12 | |
| Mazandaran | -0.17 | -1.47 | -3.82*** | Iran | 1.40 | 0.17 | -0.83 |

***,** sigfnificant respectively at 1% and 5% levels

Based on the results, there are no cointegration among the markets in Iran and the importing countries. This may be due to high fluctuations of rice price, exclusive control of government or the STAs on rice market and trade, and low level of total traded rice compare with its production in the globe.

Tests for short run cointegration (Table 8) revealed that there are no cointegration among the domestic as well as world markets. Apart from the reasons above, lack of appropriate transportation facilities causes delay on rice transaction domestically implying that traders cannot respond easily to the price changes.

Tables 8. The F-test results for local and world rice markets integration in short run

| | Local | | | | World | | |
|---|---|---|---|---|---|---|---|
| | Fars | Gilan | Khuzestan | | UAE | Pakistan | Thailand |
| Gilan | 28.21** | | | Pakistan | 3.07* | | |
| Khuzestan | 54.83** | 18.44 ** | | Thailand | 4.55** | 11.66** | |
| Mazandaran | 10.09** | 10.06 | 16.84** | Iran | 10.38** | 11.75** | 5.50** |

*significant at 1% and **significant at 5%

Various preferences in different countries and government policies are amongst the lack of short term cointegration of rice market in the world.

The Granger causality tests for domestic and world rice markets are reported in Table 9. As shown, prices in any of the considered domestic rice markets were found to be Granger cause of the prices in the rest of the remainig three markets and therefore there is not a uniqe leader rice market in the country. Existence of several regional markets may be the case in many developing countries.

Table 9. The Granger causality tests for local and world rice market

| | Local | | | | | World | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Fars | Gilan | Khuz-estan | Maza-ndaran | | UAE | Pakis-tan | Thai-land | Iran |
| Fars | | ←* | ←* | ←* | UAE | | | ←* | ←* |
| Gilan | ←* | | ←* | ←* | Pakistan | ←* | | | |
| Khuzestan | ←* | ←* | | ←* | Thailand | ←* | ← | | |
| Mazandaran | ←* | ←* | ←* | | Iran | ←* | ←* | ← | |

←*significant at 1% and ← significant at 5%

Change in price of rice in UAE market was recognised to affect those in Iran, Thiland and Pakistan markets. Therfeore, despite the UAE is not producer of rice but because of existence of high quality marketing facilities in this free trade rgion, it is the leader market.


**Cotton market integration in Iran**

In terms of annual cultivated land, cotton is the third after wheat and rice in the country. As an input for textile and oils factories, it is a strategic product used in feeding animals. The normal excess supply of cotton has led to foreign exchange earnings each year. From a policy point of view, and comparing the domestic and world price, cotton is in a similar category to rice. As stated by Bakhshoodeh and Najafi (2003), the Iranian government controls the cotton market through both pricing and trade policies. Despite the existence of a guaranteed price, farmers do not gain all the time from the policy, mainly due to the out-of-harvesting timing of the price announcement. The quantity of export is determined by several organizations such as the Iranian Ministries of Agriculture, Industry and Trade as well as the Management and Planning Organization of Iran, and is controlled by the Cotton and Oilseeds Organization of Iran. The aim of government is to assure that exported cotton is over domestic demand for this product. Therefore, the government imposes export quotas of raw cotton to support domestic production of textiles and oils.

The results of cointegration tests are shown in Table 10.


Tables 10. The results for local and world cotton markets cointegration in long run

| | Local | | | | World | |
|---|---|---|---|---|---|---|
| | Esfahan | Fars | Mazandaran | | Asia | Iran |
| Fars | -4.17*** | | | Iran | 1.18 | |
| Mazandaran | -4.09*** | -3.75*** | | Europe | -0.15 | 0.12 |
| Khorasan | -1.88* | -4.43*** | -2.66** | | | |

*significant at 10%, ** significant at 5% and *** significant at 1%

As indicated, there are long run equilibrum among the price of cotton in Esfahan market and those in Khorasan, Fars, and Mazandaran as well as among that in Khuzestan and those in Gilan and Mazandaran markets. This is highly because of the existence of cotton guaranteed price policy in the country.

Cotton market in Iran is cointegrated with that of Asia but the results proved non-cointegration between any other series of cotton prices including those of Europe and Iran. It should be noted that apart from the government policy, share of export to total production of cotton in the country is nearly close to zero that is mainly due to high production costs and low quality of domestic cotton.

As shown in Table 11, there were not relationships among the prices in the local as well as the world cotton markets in short run. Despite existence of guaranteed price scheme, cotton producers always do not gain from the policy. Furthermore, many textile factories in Iran were closed during the last few years and therefore there are not enough incentives for producers to retain their competitiveness power resulting not to follow price signals in other domestic markets rapidly.

Tables 11. The results for local and world cotton markets integration in short run

| | Local | | | | World | |
|---|---|---|---|---|---|---|
| | Esfahan | Fars | Mazandaran | | Asia | Iran |
| Fars | $11.98^{***}$ | | | Iran | $87.50^{***}$ | |
| Mazandaran | $10.84^{***}$ | $14.75^{***}$ | | Europe | $4.14^{**}$ | $23.72^{***}$ |
| Khorasan | $2.91^{**}$ | $76.14^{***}$ | $8.32^{***}$ | | | |

*significant at 10%, ** significant at 5% and *** significant at 1%

Moreover, lack of short term cointegration of Iran and the world cotton markets may be attributed to their low trade levels.

The Granger causality tests for local and world markets of cotton are shown in Table 12.

Table 12. The Granger causality tests for local and world markets of cotton

| | Local | | | | | World | | |
|---|---|---|---|---|---|---|---|---|
| | Esf-ahan | Fars | Maza-ndaran | Khora-san | | Asia | Iran | Europe |
| Esfahan | | ←* | | ←* | Asia | | ←* | ←* |
| Fars | | | ←* | | Iran | ←* | | ← |
| Mazandaran | ← | ←* | | ←* | Europe | ←* | ←* | |
| Khorasan | | | | | | | | |

←*significant at 1% and ← significant at 5%

Based on the Granger causality tests for domestic and world cotton markets the cotton prices in Khorasan, Fars and Mzandaran mutually cause each other, still there are no lead market in the country. We cannot conclude that any of the world markets are a lead cotton market as well.


**Conclusions and policy implications**

This study was performed to investigate whethet the domestic and world markets of the major agricultural products in Iran (wheat, rice and cotton) are integrated. The finding revealed that most of the related markets are not. Lack of sufficient transportation facilities and roads throught Iran and therefore unnecessary long time of transporting goods among the provinces causes unability of traders to respond to price signals and changes on time. Apart from this, government intervention in the markets and trades of the studied products as well as lack of marketing information systems are to be basic sources of non-cointagration.

Distortions introduced by the Iranian government weaken the link between the international and domestic markets. Agricultural policy instruments at the border (e.g. multiplicity of exchange rates, import and export controls, tariffs and/or non-tariff barriers), or at domestic level (e.g. input subsidies, credit programs, guaranteed price schemes, etc.) insulate the domestic markets and hinder the full transmission of international price signals by affecting the excess demand or supply schedules of domestic commodity markets (see also Abdulai, 2000 and Sharma, 2002).

In accordance with accession to the WTO, significant trade and foreign exchange reforms have been implemented recently in Iran and general policy has been directed

towards more market-oriented and gradual abolition of government intervention in agriculture. Although such improvements are required to enter the WTO, Iran has not met all the requirement yet and needs to release any type of supports for producers and consumers of agricultural products and to foster domestic competition power in the world markets through improving marketing instruments and quality. Of course such redirections can strengthen the domestic market integrations, but yet regarding the domestic and international price differences of studied products, several welfare issues are expected to occur after accessing the WTO. As is discussed by Bakhshoodeh and Najafi (2003) and Bakhshoodeh and Thomson (2006), whilst the absolute loss in rice producers' surplus may be relatively higher than the gain of rice consumers, wheat producers may gain from market liberalization and a loss in consumers' surplus is expected to occur. As far as foreign exchange is concerned, the policy causes an increase in rice imports but a decrease in wheat imports resulting from the changes in domestic supply and demand of these products. Since the decrease in government revenue from the taxes imposed on rice producers is much less than the reduction in subsidy costs, rice and wheat market liberalization also causes a notable reduction in treasury costs. One may think of comparative advantages in producing crops in the country and within this context Iran may no longer produce rice for instance. Instead, by lowering production costs of cotton and by improving its quality for export purposes, Iran can gain from joining to the WTO. In general, providing paths to foster competition have to be considered alongside with attempts to entering the WTO.

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