Pak. J. Agri. Sci., Vol. 44(2), 2007

GOVERNMENT INTERVATION AND MARKET INTEGRATION IN PROMINENT WHEAT MARKETS OF PAKISTAN

Khalid Mushtaq*, Faisal Abbas** and Abedullah***
*Department of Agricultural Economics, University of Agriculture, Faisalabad, Pakistan
**Centre for Development Research (ZEF), University of Bonn, Germany
***Dept. of Environmental & Resource Economics, University of Agriculture, Faisalabad, Pakistan.
Corresponding author's E-mail: khalidmushtaq69@yahoo.ComT

Regional market integration in many agricultural commodities has been extensively studied for the insight it provides into the functioning of such markets; such studies provide valuable information about the dynamics of market adjustments, and whether there exist market imperfections, which may justify government intervention. In the case of widely spatially dispersed regional food markets in developing countries, the nature and extent of market integration is of particular importance. Periodic localized supply shortages are common and have the potential to create major food security problems. Further, various market imperfections, such as entrenched monopolies/monopsonies and inadequate and costly information transmission, hinder the attainment of market efficiency, and may constrain sustainable agricultural development and aggravate inequitable pattern of income distribution. This study empirically estimated the degree of integration in wheat markets using the law of one price (LOP) framework and cointegration analysis. Results show that wheat markets are perfectly integrated and Lahore is the dominating market. This high degree of market integration provides little justification for extensive and costly government intervention designed to improve the market efficiency.
Keywords: Pakistan, wheat markets, market integration, cointegration.

INTRODUCTION

Wheat has great significance in Pakistan's economy and contributes 3.1 percent to Agriculture GDP of the country. Nearly 10 percent of total population is involved in production, distribution and processing activities of wheat (Govt. of Pakistan, 2000-01). The Government of Pakistan has adopted different policy instruments overtime to ensure reasonable wheat supply. During last three decades, there has been substantial effort by Government to develop wheat sector in Pakistan. Beside subsidy program and non-price measures, support price policy was considered an important tool to increase wheat production. The purpose of price support policy was to encourage production so that the consumption needs are met from local supply at a higher level than equilibrium.

In the current wheat marketing system, the public and private sectors co-exist in Pakistan. The government procuress wheat from producers directly; it releases wheat to flour mills directly and wheat flour consumers through Public owned utility stores. Federal government fixes the support price of wheat and the provincial food departments and PASSCO procure wheat in harvest months at this price. The provincial food departments release wheat in lean months at the "issue price". Until recently issue price was the same throughout the year and now government has introduced cascading price mechanism to smooth out seasonal variation and cover the transaction cost. In addition, private sector is allowed to market wheat with free prices. Instead of bringing wheat directly to public procurement centers, most farmers sell to middlemen. Such as village shopkeepers and "beoparis" (middlemen). These traders sell wheat to the public procurement center or to the other private traders. Primary wholesale markets (mandis) are well developed in Pakistan, especially in the Punjab. Farmers and middlemen bring wheat to these markets and sell through commission agents who are registered in the market committees. The "arthis" (commission agents) buy wheat from growers and primary middlemen and sell to miller and wholesalers.

The public sector procures nearly 30 percent of total production. Thus, approximately 2/3rd of the total marketed wheat does not enter the public marketing chain at all. A substantial portion of the remaining two-third also enters the private marketing chain because the government releases the wheat stock to wholesale markets to stabilize price in lean months. The government of Pakistan is designing and implementing wheat production programes aimed to protect low-income consumers and to attain food self-sufficiency. This was mainly done by control of trading, price supports, costs of production and macro economic distortions (over valuation of exchange rate). However, support price policy has played a limited role in increasing wheat output, rather unprecedented increase in wheat support price have caused huge welfare efficiency losses and worsened income distribution (Mushtaq and Javed, 2001). The government procurement of marketed surplus at

support price have caused financial burden on the public exchequer. The support price policy to accelerate wheat production has created serious problems for Pakistan's wheat economy.

An alternative approach, which can stabilize prices, is market integration. It refers to the inter-relations between prices in separate markets and shows that price changes in one market leads to changes in the price of other markets. The present study aims empirically estimating the degree of integration in wheat markets using the law of one price (LOP) framework and is there any justification for government intervention in wheat markets in Pakistan. The structure of the paper is as follows: Section 2 discusses the LOP, Section 3 discusses the empirical approach, Section 4 discusses the data and results, while Section 5 concludes.

THE LAW OF ONE PRICE AND MARKET INTEGRATION

Richardson (1978) notes that the LOP is a test of market integration in period t and involves the regression:

$$\Delta P_{1t} = \beta_l + \beta_2 \Delta P_{2t} + u_t \qquad t = 1,\ldots,n \qquad (1)$$

where $\beta_l$and β_2 are parameters, Δ represents first differences where for example $\Delta P_{1t}=P_{1t}-P_{1t-1}$, and u_t is an error term with the usual properties. If the joint hypothesis that $\beta_l=0$ and $\beta_2=1$ is not rejected, the two prices are statistically identical and the LOP holds. Equation (1) can be estimated using the original price series or the series in logarithms. The former implies an absolute price difference as the maintained hypothesis while the latter implies a proportional price difference. Ravallion (1986) extends (1) by assuming that price adjustment between markets takes time, and using an error correction model, a nested test for short-run market integration is shown to be equivalent to a test of the LOP. The Granger-causality approach (Alexander and Wyeth, 1994) extends the Ravallion model and uses a single-equation error correction model to test causality between prices. The cointegration approach (Palaskas and Harriss-White, 1993, and Alexander and Wyeth, 1994) is based on the first step of the Engle and Granger (1987) two-step method. Estimating:

$$P_{1t} = \beta_l + \beta_1 P_{2t} + u_t \qquad t = 1,\ldots,n \qquad (2)$$

a test of long-run spatial market integration is equivalent to testing the stationarity of the residuals, u_t.

EMPIRICAL METHODOLOGY

The approach adopted here is based on the LOP in (2) but follows the Sims' (1980) vector autoregressive (VAR) methodology, unlike single-equation methods, the exogeneity of one price is not imposed *ex ante*; long-run market integration is examined using Johanson's (1988) cointegration procedure. This approach incorporates important features of previous models. First, both prices are determined by their current and past values. Second, the null hypothesis of no cointegration between two prices is a test of the LOP which holds if the null is rejected. Given cointegration, the null of perfect market integration is tested where a price change in one market leads to an equivalent price change in the other; imperfect market integration occurs if the relationship is not strictly proportional.

A price series is often trended and can be made stationary by first-differencing, that is it is integrated of order one, or I(1). In general, the OLS regression in (2) is spurious since it is based on the assumption that both series are stationary (Harris, 1995, p.14). The exception is when (2) is cointegrated where the prices move together so that a stable relationship between them is maintained. Any short-run disturbance away from this relationship induces changes in the prices so that the relationship is maintained in the long run. In this sense, cointegration implies that a meaningful long-run equilibrium exists (Granger, 1988). Since a cointegrating relationship cannot exist between two prices which are integrated of a different order, it is necessary to test for their order of integration. The subsequent test for cointegration is a formal test of the long-run equilibrium relationship between pair-wise prices.

We begin by testing for the presence of unit roots in the individual time series of each model using the augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981), both with and without a deterministic trend. The number of lags in the ADF-equation is chosen to ensure that serial correlation is absent using the Breusch-Godfrey statistic (Greene, 2000, p.541). If two prices are integrated of the same order, Johansen's (1988) procedure can then be used to test for the LOP between them. The procedure is based on maximum likelihood estimation of the vector error correction model (VECM):

$$\Delta z_t = \delta + \Gamma_1 \Delta z_{t-1} + \Gamma_2 \Delta z_{t-2} + \Lambda + \Gamma_{p-1} \Delta z_{t-p+1} + \pi z_{t-p} + \Psi x_t + u_t \qquad (3)$$

where z_t is a vector of I(1) endogenous variables, $\Delta z_t = z_t - z_{t-1}$, x_t is vector of I(0) exogenous variables, and π and Γ_i are $(n \times n)$ matrices of parameters with $\Gamma_i = -(I - A_1 - A_2 - \ldots - A_i)$, $(i=1,\ldots,k-1)$, and $\pi = I - \pi_1 - \pi_2 - \ldots - \pi_k$. This specification provides information about the short-run and long-run adjustments to the changes in z_t through the estimates of $\hat{\Gamma}_i$ and $\hat{\pi}$ respectively. The term πz_{t-k} provides information about the long-run equilibrium relationship between the variables in z_t. Information about the number of cointegrating relationships among the variables in z_t is given by the rank of the π-matrix: if π is of reduced rank, the model is subject to a unit root; and if $0<r<n$, where r is the rank of π, π can be decomposed into two $(n \times r)$ matrices α and β, such that $\pi = \alpha\beta'$ where $\beta' z_t$ is stationary. Here, α is the error correction term and measures the speed of adjustment in Δz_t and β contains r distinct cointegrating vectors, that is the cointegrating relationships between the non-stationary variables. Johansen (1988) uses the reduced rank regression procedure to estimate the α- and β-matrices and the trace test statistic is used to test the null hypothesis of at most r cointegrating vectors against the alternative that it is greater than r.

RESULTS AND DISCUSSION

Five wheat regional markets including Lahore, Peshawar, Hyderabad, Rawalpindi and Multan were selected for this study. As these cities are the primary major distributing centers of wheat in the country. The data used in this analysis are the monthly nominal wholesale prices (Rs./40 kg) from January 1980 to December 2001 (264 observations). All price series are considered in logarithmic form. Table 1 reports the results of tests of the series for unit roots using ADF tests both with and without linear trend. Both models indicate that Null of unit root cannot be rejected for all price series except for Peshawar, where stationarity is shown in the trended model. The trend is significant so we prefer the trended model and conclude that Peshawar series is stationary i.e. I(0). Thus we seek cointegrating relationships between the price in Lahore and each regional price.

The first step of the Johansen procedure is to select the order of the VAR for each price relationship. We use the LR-statistic, adjusted for small samples (Sims, 1980), to test the null hypothesis that the order of the VAR is k against the alternative that it is seven where k=0,1,2,…,5 and for all cases, k=2. Johansen's cointegration results are presented in Table 2. The trace test results suggested that these four price series are strongly cointegrated and converge to long run equilibrium in the sense that Pakistan wheat market system is stationary in three directions and non-stationary in one direction. In other words, three prices can be expressed in terms of the other one-price means that prices in four markets are fully cointegrated as law of one price (LOP) holds. It suggests that even though the regional markets are geographically dispersed, and therefore, spatially segmented, spatial pricing relationships reveal that the prices are linked together indicating that all the wheat exchange locations are in the same economic market.

Table 3 reports the pair wise relationship between the markets. The trace test results for the Lahore-Rawalpindi markets suggest that these two price series are strongly cointegrated and coverage to long run equilibrium. Results of trace test for the Lahore and Multan show that these two markets show one co-integrating vector and one common trend. Presence of co-integrated vector shows markets converge towards long run equilibrium but presence of common trend shows that the degree of integration is less. The result of Lahore-Hyderabad test showed that two price series are strongly cointegrated and converge to long run equilibrium. The results showed that Lahore wheat market is completely integrated with Rawalpindi,

Table 1. The Unit Root Results

Price	Test statistics for Non-trended Model	Test statistics for Trended Model	Trend
Peshawar	- .52	-4.20*	10.81*
Lahore	-.68	-2.66	2.55
Rawalpindi	-.54	-2.74	2.39
Multan	-.52	-3.42	2.60
Hyderabad	-.39	-2.86	2.50
Critical Value (95%confidence level)	-2.88	-3.43	2.79

Note: * significant at 95% confidence level.

Table 2. Co integration Results–Trace Statistics

Equation Tested	Null	Alternative	Statistics
Lahore, Rawalpindi, Multan, Hyderabad	r=0	r≥1	166.91(53.48)
	r≤1	r≥2	70.08(34.87)
	r≤2	r≥3	25.42(20.18)
	r≤3	r≥4	3.19(9.16)

Note: Critical values (95% confidence level) in parentheses.

Table 3. Pair-wise Co integration Results–Trace Statistics

Equation Tested	Null	Alternative	Statistics
Lahore-Rawalpindi	r=0	r≥1	34.3714 (20.18)
	r≤1	r≥2	10.6871 (9.16)
Lahore-Multan	r=0	r≥1	43.72 (20.18)
	r≤1	r≥2	8.55 (9.16)
Lahore-Hyderabad	r=0	r≥1	89.42 (20.18)
	r≤1	r≥2	9.18 (9.16)
Rawalpindi-Multan	r=0	r≥1	27.20 (20.18)
	r≤1	r≥2	5.84 (9.16)
Rawalpindi- Hyderabad	r=0	r≥1	89.42 (20.18)
	r≤1	r≥2	9.18 (9.16)
Multan-Hyderabad	r=0	r≥1	88.17 (20.18)
	r≤1	r≥2	5.96 (9.16)

Note: Critical values (95% confidence level) in parentheses.

Hyderabad and Multan wheat markets, because there exist cointegrating vectors. Trace test results for Rawalpindi-Multan show that these two markets show one co-integrating vector and one common trend. The results for Rawalpindi-Hyderabad markets indicate that price series are strongly cointegrated and converge to long run equilibrium. The wheat markets of Multan and Hyderabad possess one cointegrating vector and one common trend, so degree of integration is less in these two markets.

SUMMARY AND CONCLUSIONS

In this study, Johansen's co-integration approach has been used to check the degree of spatial market integration in the regional wheat markets of Pakistan. Using this approach, a number of co-integrating relationships have been tested and integration between Lahore, Hyderabad, Rawalpindi and Multan, wheat markets were found. The results showed that the regional markets are well integrated, except, Peshawar, with Lahore being the dominant Market.

From a policy-making perspective the high degree of market integration observed in this case leaves little justification for government intervention in wheat markets of Pakistan. In fact, most of the parastatal organizations suffer from gross inefficiencies, with immense costs to producers, consumers, environment and the government exchequer. In order to save these costs and to promote the cause of privatization, the government would be well advised to desist from active and direct engagement in procurement, storage, distribution, and for external trade on a massive scale and leave these tasks to the private sector. The government in its new role must be watchful of private sector activities, ensure healthy competition in agricultural commodity markets, and buy and sell in the major commodity markets to safeguard against monopolistic tendencies, excessive profiteering and rising stable commodity prices.

REFERENCES

Alexander, C. and J. Wyeth. 1994. Cointegration and Market Integration: An Application to the Indonesian Rice Market, Journal of Development Studies, 30, 303-328.

Dickey, D.A. and W.A. Fuller. 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, Econometrica, 49, 1057-1072.

Engle, R.F. and C.W.J. Granger. 1987. Co integration and error correlation. Representation. Estimation and Testing, Econometrica. 55:251-276.

Govt. of Pakistan. 2000-01. *Economic Survey of Pakistan.* Finance Division, Economic Advisor's Wing, Islamabad.

Granger, C.W.J. 1988. Some Recent Developments in a Concept of Causality, Journal of Econometrics, 39, 199-211.

Greene, W.H. 2000. *Econometric Analysis*. New Jersey: Prentice-Hall, Inc.

Harris, R. 1995. Using Cointegration Analysis in Econometric Modelling. London: Prentice Hall-Harvester Wheatsheaf.

Johansen, S. 1988. Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12, 231-254.

Mushtaq, K. and M.S. Javed. 2001. Agricultural price deregulation and food security. Paper Presented at a Seminar on Deregulation of Agriculture Prices, University of Agriculture, Faisalabad.

Palaskas, T.B. and B. Harriss-White. 1993. The Identification of Market Exogeneity and Market Dominance by Tests Instead of Assumption: An Application to Indian Material, Journal of International Development, 8, 111-123.

Ravallion, M. 1986. Testing Market integration, American Journal of Agricultural Economics. 68(1):45-52.

Richardson, J.D. 1978. Some Empirical Evidence of Commodity Arbitrage and the Law of One Price, Journal of International Economics, 8, 341-352.

Sims, C.A. 1980. Macroeconomics and Reality, Econometrica, 48, 1-49.