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MARKET INTEGRATION OF GRAM IN PAKISTAN

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ABSTRACT: Regional market integration in many agricultural commodities has been extensively studied for the insight, it provides in to the functioning of such markets; such studies provide valuable information about the dynamics of market adjustment, and whether there exist market imperfection, which may justify government intervention. This study used the monthly wholesale price (Rs. / 40 kg) data from January 1991 to December 2006 of gram, in logarithmic form and empirically estimated the degree of integration in gram markets of Pakistan using co-integration analysis. Co-integration results show that all gram markets are highly co-integrated in the long run. The high degree of market integration observed in this case is consistent with the view that Pakistan's gram markets are quite competitive and provide little justification for extensive and costly government intervention designed to improve competitiveness to enhance market efficiency.

Key Words: Gram; Markets; Market Integration; Co-Integration; Pakistan.

INTRODUCTION

In a decentralized economic system, resource allocation takes place through price signals transmitted by the markets. In developing economies like Pakistan, there are several impediments to the efficient functioning of markets, particularly of agricultural commodity markets. These includes inefficient transportation infrastructure, difficulties in accessing market information, government imposed restrictions on the movements of goods between regions, government monopoly over the marketing and distribution system. If markets are not integrated then price signals could not be distorted which lead to inefficient allocation of resources and marketable surplus generated by the farmers, could results in depressed farm prices and diminishing income (Tahir and Raiz, 1997). Overall market performance may be evaluated in terms of price relationships. Co-integration test can be used to examine the stability of price relationship. Although the larger markets that are better connected with the transportation and communication network are expected to be well integrated; the same can not be said about the smaller, more remote markets.

Market integration refers to 'co-movement of price and more generally, to the smooth transmission of price signals and information across spatially separated markets (Golettie and Babu, 1995). Market integration provides important information on how the markets work. Such information helps the government to decide the extent to which it should promote market development. If, for example locations A, B, C, and D are well integrated, then the government may think of withdrawing from, or at least reduce, its efforts to influence the price setting process in those locations. Degree of market integration has often been used as a gauge of the success of market efficiency and structural adjustment policies in developing countries. Market integration leads to price stabilization because of detailed transmission of incentives across the marketing chain. Government of Pakistan tries to stabilize by adapting different policies. If the markets are well integrated the government will stabi-

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lize the prices in one key market and rely on arbitrage to produce the similar outcome in other markets. This reduces the cost of stabilization considerably. The level of integration of agricultural markets is a critical determinant of agricultural price policy in developing countries (Raghbendra et al., 2005).

Market integration is subjectively viewed as long-run phenomenon. It is present whenever a stable price relationship is established. This means that spatial prices can temporary deviate from each other in the short-run and still be consistent with the idea of an integrated market. The concept of spatial arbitrage is to visualize traders buying in price market, transferring the item to high price market, and reselling the purchased goods in different localities tend towards equality and move together with each other in integrated market. Markets that are not integrated tend to convey inaccurate price information that might distort production decision and contribute to inefficiencies in product market. In a market driven economy, the pricing mechanism is expected to transmit orders and direction to determine the flow of marketing activities. The pricing signal guide and regulate the production, consumption and marketing decision over time, form and place (Kohl and Uhl, 1998). Pulses are the dried edible seeds of cultivated legumes. Pulses contain more protein than any other plant. They serve as a low-cost protein to meet the needs of the people. They have, therefore, been justifiably described as 'the poor man's meat'. In general, pulses contain 20-28% protein per 100g. Different pulses grown in Pakistan are mainly, gram or chickpea, mung, mash and masoor. The production of gram, during 2008-2009 was 760000 t from 1094000 ha, which is 60% higher than the previous year (GoP, 2009). Chickpea is a major pulse crop which alone contributes 76% of the total area under pulses grown in Punjab (GoP,2007).

Much emphasis is given to area and production of gram in Pakistan, while relatively little is known about how price transmission takes place on the domestic pulses markets. Such information is important for gram producers and other gram value chain role players since it affects their marketing decision related to logistical matters and eventually profits realized. The main interest of studying price integration among local markets is to be able to identify sets of markets that lead other markets in price transmission process. This study aims at critically estimating the extent of market integration in gram markets of Pakistan.

MATERIALS AND METHODS

Testing for Unit Root

Testing 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 with out a deterministic trend was performed. The number of lags in the ADF-equation is chosen to ensure that serial correlation is absent using the Breusch-Godfery statistic. The ADF equation required for estimation by Ordinary Least Square (OLS) as follows:

$$\Delta Y_t = \alpha_1 + \beta_{1t} + (\phi_1 - 1)Y_{t-1} + \Sigma 0_t \Delta Y_{t-1} + \mu_t \quad (1)$$

Where Y_t is the series under investigation, *t* is a time trend and u_t are white noise residuals. We do not know how many lagged values of the dependent variable to include on the right-hand side of above equation. There are several approaches but here Lagrange Multiplier (LM) test was used.

Testing for Co-integration

The basic idea of co-integration was to identify an equilibrium or a long-run relationship (s) between variable, if there exist a long-run relationship between variables; then divergence from the long-run equilibrium path was bounded, and the variable were co-integrated. In this case, two conditions must be satisfied. First, the series for at least two of the individual variables were integrated of the same order and linear combination of the variables exists which was integrated to an order lower than the individual variables. For example, if the

variables become stationary after differencing once, i.e. are I(1), then the error term from the co-integrated regression is stationary, i.e. I(1) , consider the co-integration regression :

$$Y_t = \alpha + \beta X_t + \mu_t \quad (2)$$

If the series were both I (1) and the error term was I (0), then the series were co-integrated of order I (1,0). In the equation below, β measures the equilibrium relationship between the series Y and X, and μ is the deviation from the long-run equilibrium path.

The economic interpretation for cointegration is that if in the long-run two or more series Y_t and X_t are linked together to form an equilibrium relationship, then even though Y_t and X_t themselves are trended (i.e. non-stationary), they nevertheless move together closely over time and the difference between them is constant i.e. stationary. So the concept of co-integration implies the presence of long-run equilibrium to which an economic system move over time and μ_t may thus be interpreted as the disequilibrium error i.e. the extent to which the relationship deviate from equilibrium. Johansen's Full Information Maximum Likelihood (FIML) approach (Johansen, 1988; Johansen and Juselius, 1990) was used this study to test for co-integration. The Johansen maximum likelihood approach for multivariate co-integration is based on the following vector auto regression (VAR) model:

$$Zt = A_1 Z_{t-1} + \ldots + A_t Z_{t-k} + \mu_t \quad (3)$$

Where Zt is vector of I (1) variables (containing both endogenous and exogenous variables), A_1 is an (nxn) matrix of parameter, μ_t is (nx1) vector of white noise. Equation 4 could be estimated by OLS because each in Z regressed on the lagged values of its own and other variables in the system. Johansen (1988) used the rank regression procedure to estimate the α and β matrices and the trace test statistic was used to test the null hypothesis of most r co-integrating vectors against the alternative that it is greater than r.

RESULTS AND DISCUSSION

Monthly wholesale price (Rs. /40 kg) data from January, 1991 to December, 2006 of gram was used in the present study. The study analyzed price transmission in seven selected pulses markets in Pakistan. The markets included in this study were Quetta, Peshawar, Lahore, Rawalpindi, Multan Sukkhur and Hyderabad. The criterion for selecting these markets was based on net market position (surplus or deficit), geographical distribution, data availability and the volume of trade or the importance of market to the national pulses trade flow.

The first step in testing for market integration, is to check whether, each series was stationary or non stationary. Augmented Dickey Fuller (ADF) unit root tests were used to determine whether each time series was stationary or not. The null hypothesis was that the variable observed had unit root, against the alternative (Table 1) reported the results of test of series in logarithms for unit root using ADF tests both with and with out linear trend. Both model indicated that null of unit root could not be rejected for all the price series, as absolute values of ADF statistics were well below the 95 % critical value of test statistics. Thus it could be concluded that all the price series were non- stationary. The results are in accordance with (Mushtaq et al., 2008) who conducted work on market integration of apple in Pakistan using co-integration analysis.

After testing for unit root, the next step is to test for co-integration. Johansen pro-

Table 1. Augmented Dickey- Fuller Unit Root Tests results for gram markets in Pakistan

Variables	Trended Model	Non Trended Model
Peshawar	-2.75	-2.18
Rawalpindi	-2.31	-1.96
Lahore	-2.60	-2.49
Multan	-2.98	-2.63
Sukkhur	-3.21	-2.85
Hyderabad	-3.24	-1.08
Quetta	-2.69	-2.13
CV at 5 %	-3.43	-2.87

Table 2. Adjusted LR test on VAR with maximum of five lags

Order	AIC	SBC	Adjusted LR test
5	1042.8	663.82	---------
4	1064.1	760.96	43.43 (0.697)
3	1090.8	863.43	78.49 (0.926)
2	1115.5	963.85	116.77 (0.969)
1	1132.2	1056.40	167.49 (0.931)
0	-125.33	-125.33	2219.4 (0.000)

AIC= Akaike Information Criterion, SBC: Schwarz Bayesian Criterion

cedure had been applied to pulses prices. The first step in Johansen's procedure was the selection of the order of Vector Auto Regressive (VAR). We tried the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) to select the lag length. Both AIC and SBC select the lag length because values of both AIC and SBC are maximum at first order i.e. 1132.3 and 1056.4, respectively. So VAR with order one was selected (Table 2).

The second step in Johansen's procedure was to test the presence of number of co-integration vectors among the series in each model. According to trace test there are four co-integrating vectors (Table 3) and three common trends at 95 % critical values because first four statistical values of trace test (247.77, 156.07, 104.30 and 58.30) are greater than their respective 95% values (132.45, 102.56, 75.98 and 53.48). Whereas the remaining three statistical values of trace test (26.38, 11.40 and 4.41) are less than their respective 95 % values (34.87, 20.18 and 9.16).The results of the test suggests that these seven price are strongly co-integrated and converge to long run equilibrium in the sense that Pakistan gram market system is stationary in four directions and non- stationary in three directions. In other words, four prices can be expressed in terms of three prices means that prices in seven markets are fully co-integrated as law of one price (LOOP) holds. The results are in accordance with (Mushtaq et al., 2007; Fredoon and Esfahani, 2006) who studied the rice market integration.

It is therefore concluded that the gram markets are highly co-integrated and converge to long-run equilibrium in the sense that Pakistan gram, market system is stationary in four, directions and non- stationary in three. It means that prices in gram markets are fully co-integrated as LOOP holds. The study confirmed that market price linkages and the interrelationship among the spatial markets are important in economics analysis. Inter-market price linkages and speed of adjustment to shocks show that transportation costs have significant impact in determining the degree of market integration. Gram markets in Pakistan are quite competitive and provide little justification for the government intervention designed to improve competitiveness or to enhance market efficiency. The results of the study reveals that certain market are not well integrated with each other, and to achieve the goal of integration government should promote information and develop communication with in the markets. To enhance integration among the markets, infrastructure facilities should be provided by the government to targeted markets.

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Table 3. Co-integration results for gram -trace test

Equ. Tested	Null Hypothesis	Alternative Hypothesis	Statistics	95% CV
Quetta	r=0	r=1	247.77	132.45
Rawalpindi	r≤1	r=2	156.07	102.56
Lahore	r≤2	r=3	104.30	75.98
Peshawar	r≤3	r=4	58.30	53.48
Hyderabad	r≤4	r=5	26.38	34.87
Multan	r≤5	r=6	11.40	20.18
Sukkhur	r≤6	r=7	4.41	9.16

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