Testing the law of one price in gram markets of 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-integrations 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.

Keywords: Market Integration, Co-Integration, Gram Markets, Pakistan.

INTRODUCTION

In a decentralized economic system resources allocation take 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 include inefficient transportation infrastructure, difficulties in accessing market information, government imposed restriction 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 result in depressed farm prices and diminishing income (Tahir and Riaz, 1997). Overall market performance may be evaluated in terms of price relationship. 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 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, *et al*., 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 location 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 been used as a gauge of the success of market efficiency and structural 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 stabilize the prices in one key market and rely on arbitrage to produce the similar outcome in other markets. This reduces the cost 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 when a stable price relationship is established. This means that spatial prices can temporarily deviate from each other in the short-run and still be consistent with the idea of an integrated market. The concept of spatial 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 (Kohls and Uhl, 1998). Pulses are the dried edible seeds of cultivated legumes. Pulses contain more protein than any other plant .They have, therefore, been justifiably described as, the poor man's meat, In general, pulses contain 20 to 28 per cent protein per 100gm.c. Different pulses grown in Pakistan are mainly, gram or chickpea, mung, mash and masoor. The production of gram, during the year 2008-2009 was 760 thousand tones from an area of 1094 thousand hectares, which is 60 percent higher than the previous year (GOP, 2009). Chickpea is a major pulse crops which alone contributes 76% of the total area under pulses grown in Punjab (GOP, 2008).

Much emphasis is given to area and production of gram in Pakistan, while relatively little is known about how prices 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 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. The structure of paper is as follow: Section 2 discusses the empirical methodology; Section 3 discusses the data and results, while Section 4 concludes.

MATERIALS AND METHODS

(*Testing For Unit Root)*

We begin by 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 without a deterministic trend. 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 OLS is the following:

$$\Delta Y_T = \alpha 1 + \beta 1_t + (\phi 1\text{-}1)\, Y_{t}\text{-}1 + \sum 0_t \Delta Y_{t}\text{-}1 + \mu_t$$

Where Yt is the series under investigation, *t is* a time trend and *ut* 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 and 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 variable; 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:

$$Yt = \alpha + \beta X_t + \mu t$$

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 devotion from the long-run equilibrium path.

The economic interpretation for co-integration is that if in the long-run two or more series Y t and Xt are linked together to form an equilibrium relationship, then even though Yt and Xt 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 ut may thus be interpreted as the disequilibrium error i.e. the extent to which the relation 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:

$$Zt = A1\ Zt\text{-}1 + \ldots\ldots + At\ Zt\text{-}k + \mu t$$

Where Zt is vector of I (1) variable (containing both endogenous and exogenous variable), A1 is an (nx1) matrix of parameter, μt is (nx1) vector of while 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.

(RESULT AND DISCUSSIONS)

Monthly wholesale price (Rs. /40 kgs) 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 I Pakistan. The markets included in this study were Quetta, Peshawar, Lahore, Rawalpindi, Multan, Sukkhar 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 I) 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 price series, as absolute values of ADF statistics were well below the 95 percent 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 procedure 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 are maximum at first order i.e. 1132.3 and 1056.4, respectively. So VAR with order one was select (Table II).

The second step in Johansen's procedure was to test the presence of number of co-integration vectors among the series in each model**.** **(**Table III) presents Johansen's co-integration results. According to trace test there are four co-integrating vectors and three common trends at 95 % critical values because first four statistical values of trace test(247.77,156.07,104.30 and58.30) are greater then their respective 95% values (132.45,102.56, 75.98 and53.48).Whereas the remaining three statistical values of trace test (26.38,11.40 and4.41) are less then their respective 95 % value (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 direction 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 (LOP) holds. The results are in accordance with (Mushtaq *at al*.2007) who studied the rice market integration.

CONCLUSION AND RECOMMENDATION

This paper has examined the degree of spatial market integration in the regional gram markets of Pakistan using co-integration analysis and monthly whole sale price data from January, 1991 to December, 2006. The results indicated that theses 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 law of one price (LOOP) holds. The study conformed 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 order 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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Tables

Tabel I. Augmented Dickey – Fuller unit root test results for gram market 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
Sukkhar	-3.21	-2.85
Hayder abad	-3.24	-1.08
Quetta	-2.69	-2.13
CV 5 at Percent	-3.43	-2.87

Results are at 95 percent confidence level

Table II 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

Table III 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
Sukkhar	r < = 6	r =7	4.41	9.16