

LAW OF ONE PRICE: AN INVESTIGATION INTO MARKET INTEGRATION FOR SELECTED FRUITS AND VEGETABLES

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ABSTRACT

A study was conducted at Vegetable and Fruits markets of Rawalpindi, Mansehra and Muzaffarabad Pakistan, during the year 2012-13. The objective was aimed to examine the market integration for selected fruits and vegetables markets among Muzaffarabad, Mansehra, and Rawalpindi markets for observing price changes. Five vegetables (onions, tomato, potato, cauliflower, and garlic) and three fruits apple-kalakulu apple-golden, and banana) were selected. The variation of prices in Rawalpindi market was higher (Rs.25-40/ kg) than other two markets for potato and was lower in Mansehra market than other two markets, However, mean prices of tomato among the three markets was almost same. Similarly mean price of onion at Mansehra market was the lowest (Rs.33.5/kg) of all three markets, while there were greater fluctuations in garlic prices in these markets. The mean price of cauliflower in Mansehra market was lower (Rs. 20/kg) than Muzaffarabad (Rs. 25/kg) and Rawalpindi(Rs.26/kg) markets. The mean prices of apple (Kalakulu) among three markets were found different. The price fluctuation of apple (Kalakulu) in all markets showed that price at Rawalpindi market went on its maximum level. The results further indicated that tomato prices were partially transmitted from Muzaffarabad to Rawalpindi market and there was no difference in the transshipment cost between these two markets. Like Muzaffarabad-Rawalpindi markets, the price transmission from Rawalpindi to Muzaffarabad market was also partial. It was also observed that Rawalpindi-Muzaffarabad markets were not fully integrated for potato. The flow of price information from Rawalpindi, Mansehra and Muzaffarabad markets was partial i.e., these markets were partially integrated with each other for fruits and vegetables and not fully integrated, However, for banana and apple (golden) the markets of Muzaffarabad and Rawalpindi were fully integrated. It was suggested that government functionaries should disseminate market information especially prices on daily basis to improve marketing efficiency and competitiveness.

KEYWORDS: Law of One Price; Market Integration; Fruits and Vegetables; Price Transmission; Transshipment cost, Pakistan.

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INTRODUCTION

Market integration occurs when prices among poles apart locations or interrelated freight follow analogous patterns in an extensive period. Assemblages of prices frequently shift proportionally to each other and when this relation is very comprehensible among different markets is assumed that markets are integrated. Thus market integration is a gauge that explains how much different markets are interrelated. For triumphant farming, both production and marketing activities need to be performed efficiently. Efficient marketing system fetches to producers and consumers a good deal of income (8).

The expansion of agricultural sector call for the agricultural products ought to be competitive in domestic as well as in international markets. The extent of competitiveness may be the measure of market integration (9). Market integration is an imperative part of agribusiness activities and instrument of surviving in concerning sectors, which is most dynamic and hard-hitting in the world (3). Market integration has held on to importance in developing countries where it has potential application to policy questions regarding government interventions in markets. Market integration also provides substantiation of competitiveness and efficiency of pricing (15).

The marketing of fruits and vegetables has turned out to be more significant because quantity of these commodities is mounting and intensifying as the urban population is growing up. Private organizations and individuals in AJ&K carry out the marketing of fruits and vegetables. These items are highly perishable in nature. The quality of these commodities set in motion to deteriorate from the moment of harvest and continues throughout the marketing process and the entire distribution process is geared towards rapid marketing. The grower's share in consumers' rupee is not only small, but also fluctuates according to perish ability of produce and degree of collusion among marketing intermediaries. In addition, there are popular outlook among the economists of the country that there are some other dilemmas, which may reduce the efficiency of the marketing systems. These problems comprises are long chain of market intermediaries' results in high marketing cost, inefficient information system, Inadequate physical facilities and monopolistic power of a few traders (10).

Despite recognition of vital role of efficient agricultural marketing systems in the economy of Pakistan, research base in the sector is not upto the level. Pervious research on agricultural marketing in Pakistan, particularly in

horticulture sector, has comprised review articles containing descriptive analysis and secondary data. However, few attempts have recently been made to analyze the efficiency and performance of vegetable and fruit sector in Pakistan. No remarkable research has been noticed so far that addresses sufficiently the issues faced by this important economic sub-sector. Previous research studies divulged the prospects and constraints of fruit and vegetables marketing. Kumar (11) described that in Fiji growers and middlemen sell all commodities in municipal markets in town and cities. The middlemen have permanent stalls and sell produce throughout the week while grower come to market on Friday only. The size of bundles and heaps depends on the supply of produce. However he observed significant changes in the last ten years in economy of Fiji. Agriculture has large contribution to the Fiji's GDP, with major employment and export earnings. Harsianto (5) identified that marketing problem of vegetables in Indonesia could be attributed to unpredictable arrival of vegetables in the local market from scattered growers, price then move in response to those arrivals. Even higher quality vegetables may not be earning a higher price, because of variations of levels of perishability. Vegetables price are often below production costs and price fluctuate very widely on a day to day basic. Khair et al (7) compared the marketing margins of various intermediaries in the marketing of two apple varieties (Red and Golden Delicious) in Pashin district of Baluchistan. They found that in case of Red Delicious apple the share of farmers, contractors, wholesalers, retailers, and other costs were distributed as 30.86, 12.45, 6.6, 13.37 and 36.66 percent respectively while in case of golden delicious Apple the distribution falls as 23.96, 8.22, 4.54, 13.9 and 49.37 percent respectively. In this way the marketing margin for red and golden delicious were 69 and 76% respectively. Mukhtar (14) highlighted market imperfections and deficiencies in performance of agricultural marketing system. He suggested to evolve new harvesting and marketing technologies for improvement in market functioning. He further suggested improvements in market infrastructure, transportation, storage, grading, packing and processing facilities. Lohano and Mari (12) in a study on onion market integration in Pakistan used error correction model in presence of stationarity. They observed strong market integration in regional markets of Pakistan. Burhan (1) finds the agricultural crops production including tomato, chillies and onion is stochastic, and its growth over time is subject to various shocks including heavy rains, floods, water shortages, diseases and on lag year prices. Forecasts provide accurate and advance information to the governments and policy makers before the availability of final estimates. Further, this information would indicate whether the shocks have permanent or temporary effect on future production, and thus may also be useful for

policy makers in choosing the appropriate support services for the agriculture sector. Forecasts can be made by various methods including judgmental approaches, structured economic models, uni-variate time series models, multivariate time series methods and economic models used for forecasting. Flynn and Clark (2) estimated the level of market integration for fruits and vegetables within NAFTA region using panel data analysis. This approach provides more robust estimates than standard time series approach. These results show that fruit and vegetable markets within NAFTA region are integrated with moderate to high degrees in level, which empirically support what the trade economists believe. The results also show that market integration for fruits and vegetables experienced deeper integration in the last few years. This implies that price signals were more reflective of market conditions, and therefore, resulted in more efficient resource allocation and investment decisions.

The literature provided little information about aspects of vegetables and fruits marketing system in Pakistan. There is a need for further work, because an information gap exists and no systematic study has been carried out to provide detailed scientific information about the sector's performance. Also there are no empirical studies to support or disprove criticisms about the inefficiencies of vegetable production and marketing system. In fact, there is a deficiency of information about various aspects of vegetables production and marketing system. Almost nothing is known about marketing conditions, the extent of market integration, share of vegetables producers and other market traders in consumer's price. The process of price formation, market information, barriers to entry and exit and source of trading capital are unknown. Under these conditions, questions about the degree of competitiveness of the marketing system with which prices respond to the market forces of demand and supply cannot be answered.

In AJK, due to suitable climate conditions and availability of nearest big market of Mansehra and Rawalpindi, vegetable cultivation has increased significantly. Farmers in multi-cropping areas of AJK have devoted a considerable acreage to vegetable cultivation but still not self-sufficient in vegetable and depends on Mansehra and Rawalpindi markets.

This study aimed to examine the efficiency of the marketing system and to check the market integration for fruits and vegetables among Muzaffarabad, Mansehra, and Rawalpindi. Keeping in view competitiveness of fruits and vegetables markets, the study was conducted with the following specific objectives.

- To analyze market integration for preferred fruits and vegetables among Muzaffarabad, Mansehra and Rawalpindi markets.
- To observe the price changes in integrating markets
- To examine direction of flow of information from one market to other market.
- To make recommendations based on the finding of the study.

MATERIALS AND METHODS

The study is based on two hypothesis

Hypothesis No.1

H₀: Mansehra Rawalpindi and Muzaffarabad markets have no integration among each other with respect to potato, tomato, onion, garlic, cauliflower apple and banana.

H₁: Mansehra, Rawalpindi and Muzaffarabad markets have integration among each other with respect to potato, tomato, onion, garlic, cauliflower Apple and banana

Hypothesis No.2

H₀: The prices fluctuation for all these commodities among three markets is not fully transmitted.

H₁: The prices fluctuation for all these commodities among all three markets is fully transmitted.

This study was conducted at at Vegetable and Fruits markets of Rawalpindi, Mansehra and Muzaffarabad Pakistan, during the year 2012-13 using secondary data. The purposive data were collected from price control committees of selected markets. Vegetables and fruits markets located at Rawalpindi, Mansehra, and Muzaffarabad were selected. The data were obtained from the office of Commissioner Muzaffarabad, offices of price control committees at Rawalpindi and Mansehra. Data pertaining to retailer prices for nine months was extracted and analyzed to evaluate market integration. five vegetables (onions, tomato, potato, cauliflower, and garlic) and three fruits (apple-Kalakulu, apple-Golden and banana) were selected.

The bivariate econometric model was used to find out the market integration. The model was also applied as recommended by Loy *et al.* (13) for analyzing the market integration, located at five distinct locations.

$$P_i = \beta_0 + \beta_1 P_b + e \quad (2.1)$$

P_b = Price of fruits and vegetables in base market.

P_i = Price of fruits and vegetables in i th market.

β_0 = Intercept (Transshipment Cost)

β_1 = Coefficient of Integration

e = Error Term

The above model (2.1) suggests that prices at market P_i would change as prices at base market P_b changes. The coefficient (β_1) measures the degree of integration between the two markets. β_1 would be equal to 1 if the two markets were fully integrated (law of one price) and between 0 and 1 for partially integrated markets.

The law of one price stated as: "In an efficient market all identical goods must have only one price." The intuition for this law is that all sellers will flock to the highest prevailing price, and all buyers to the lowest current market price. In an efficient market the convergence on one price is instantaneous.

Fully integrated markets advocate that markets are performing well as the changes in the base market were fully transmitted to other markets, as required under perfect competition. A partially integrated market suggests that price change in the base market were not fully transmitted to the other markets because of some imperfection between the two markets. The intercept term β_0 representing the transshipment cost would be positive. The market integration can be more accurately measured if model 2.1 is estimated in the first difference form (6), that is:

$$\Delta P_i = \alpha_0 + \alpha_1 \Delta P_b + \mu \quad (2.2)$$

$$\Delta P_i = P_{it} - P_{it-1}$$

$$\Delta P_b = P_{bt} - P_{bt-1}$$

$$\mu = \text{Error Term.}$$

Again, α_1 would be equal to one for fully integrated markets and α_0 would be equal to zero for no change in the transshipment cost. To check whether the markets are fully integrated or not, following hypothesis would be analyzed for α_1 using the following t-test (4).

$$H_0: \alpha_1 = 1, t = \alpha_1 - 1 / S.E. \quad (2.3)$$

RESULTS AND DISCUSSION

The marketing channels involved growers, contractors, commission agents, wholesalers and retailers. The marketing issues of perishable commodities including fruits and vegetables are inadequate, infrastructure, transport facilities, congested and filthy market places, packaging with gunny bags and wooden crates, limited storage facilities and lack of price information add deterioration of the product quality, increase product spoilage ratio and enhanced transport cost. This situation implies that marketing functions are performed in a traditional way and markets for agricultural products are not functioning efficiently, such that there are great differences between prices paid by consumers and received by the producers.

Descriptive Statistics:

(a) Vegetables: The data (Table 1) indicated that mean price of three vegetables i.e. potato, tomato, and cauliflower was the highest at Rawalpindi market as compared to Muzaffarabad and Mansehra markets during the entire period of nine months, while highest mean price for onion was observed at Muzaffarabad market. The highest price range was recorded for Garlic at all three markets followed by tomato and onion, while lowest price range was witnessed for cauliflower in all the three markets for the entire period of nine months (Table1).

(b) Fruits: The data further (Table 2) depict that mean price of apple (Kalalulu) and apple (Golden) was the highest at Muzaffarabad market as compared to Rawalpindi and Mansehra markets during the entire period of nine months on per kg basis, while highest mean price for banana was observed at Mansehra market on per dozen basis. The highest price range was recorded for apple (Kalakulu) at these markets followed by apple (Golden) on per kg basis, while lowest price range was witnessed for banana in entire period of nine months on per dozen basis.

Table 1. Price spread for selected vegetables among Muzaffarabad, Rawalpindi and Mansehra Markets (Rs./Kg).

Vegetables	Muzaffarabad			Rawalpindi			Mansehra		
	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
Potato	25	35	30	25	40	32.5	20	30	25
Tomato	34	80	57	35	80	57.5	30	80	55
Onion	30	50	40	30	45	37.5	25	42	33.5
Garlic	180	240	210	160	200	180	170	190	180
Cauliflower	20	30	25	16	36	26	15	25	20

Source: Price control committees of the respective markets, 2012-13.

Table 2. Price spread for selected fruits among Muzaffarabad, Rawalpindi and Mansehra markets (Rs./Kg).

Fruits	Muzaffarabad			Rawalpindi			Mansehra		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Apple Kalakulu	100	150	125	90	140	115	100	145	122.5
Apple golden	90	130	110	80	120	100	85	125	105
Banana	80	180	130	70	140	105	80	190	135

Source: Price control committees of the respective market, 2012-13.

Econometrics Analysis

To investigate into the market integration, simple linear regression analysis was made on prices of first difference for selected fruits and vegetables in these markets. In this analysis only first difference was used, being sufficient to understand the behavior of price changes in the market.

Vegetables

Muzaffarabad-Rawalpindi markets

Potato

$$\Delta P_{mzpot} = \alpha_0 + \alpha_1 \Delta P_{rppot} + \mu$$

$$\Delta P_{mzpot} = 0.212 + 0.370 \Delta P_{rppot}$$

(0.50) (2.70)

$$H_0: \alpha_0 = 0 \quad t = 0.50$$

$$H_1: \alpha_1 = 1 \quad t = -8.077$$

The coefficient of variable change in prices for potato at Rawalpindi market is not equal to unity [$H_0: \alpha_1 = 1$; the value of t calculated (8.077) is greater than the t tabulated value 1.684] and falls between 0 and 1. It indicated that tomato prices were partially transmitted from Muzaffarabad to Rawalpindi market. The hypothesis, that intercept term is equal to zero is accepted ($H_0: \alpha_0 = 0$; $0.50 < 1.64$), indicating that there was no difference in the transshipment cost between these two markets.

Cross analysis: Like Muzaffarabad-Rawalpindi market, the price transmission from Rawalpindi to Muzaffarabad market was also partial.

$$\Delta P_{rppot} = \alpha_0 + \alpha_1 \Delta P_{mzpot}$$

$$\Delta P_{rppot} = 0.646 + 0.370 \Delta P_{mzpot}$$

$$\begin{matrix} & (-0.658) & (2.702) \end{matrix}$$

$$H_0: \alpha_0 = 0 \quad t = -0.658$$

$$H_1: \alpha_1 = 1 \quad t = -2.636$$

The coefficient of variable change in prices of potato at Muzaffarabad market is not equal to unity ($H_0: \alpha_1 = 1$; the value of t calculated is equal to 2.636 is greater than the t tabulated 1.684 value) and falls between 0 and 1. It indicated that tomato prices were partially transmitted from Rawalpindi to Muzaffarabad market. The markets were not fully integrated for potato.

Muzaffarabad-Mansehra markets

Potato

$$\Delta P_{mzpot} = \alpha_0 + \alpha_1 \Delta P_{mnpot}$$

$$\Delta P_{mzpot} = 1.036 + 0.774 \Delta P_{mnpot}$$

$$\begin{matrix} & (0.67) & (1.631) \end{matrix}$$

$$H_0: \alpha_0 = 0 \quad t = 0.67$$

$$H_1: \alpha_1 = 1 \quad t = -1.76$$

The coefficient of variable change in prices of potato at Manshera market is not equal to unity ($H_0: \alpha_1 = 1$; the value of t calculated is equal to 1.76 is greater than the t tabulated 1.684 value) and falls between 0 and 1. It indicated that tomato prices were partially transmitted for potato from Muzaffarabad to Manshera market. The hypothesis, that intercept term is equal to zero is accepted ($H_0: \alpha_0 = 0$; $0.67 < 1.64$), indicating that there was no difference in the transshipment cost between the two markets.

Cross analysis: Like Muzaffarabad to Mansehra market, the price from Mansehra to Muzaffarabad market was also partial, and not fully transmitted for the commodity.

$$\Delta P_{mnpot} = \alpha_0 + \alpha_1 \Delta P_{mzpot}$$

$$\Delta P_{mnpot} = 0.556 + 0.774 \Delta P_{mzpot}$$

$$\begin{matrix} & (0.14) & (0.16) \end{matrix}$$

$$H_0: \alpha_0 = 0 \quad t = 0.141$$

$$H_1: \alpha_1 = 1 \quad t = -3.324$$

The coefficient of variable change in prices of potato at Muzaffarabad market is not equal to unity ($H_0: \alpha_1 = 1$; the value of t calculated is equal to 3.324 is greater than the t-tabulated value) and falls between 0 and 1, indicating that potato prices were partially transmitted from Mansehra to Muzffarabad market. The markets were not fully integrated for potato.

Muzaffarabad-Rawalpindi Markets

Tomato

$$\Delta P_{mztom} = 0.382 + 0.417 \Delta P_{rptom}$$

(0.351) (4.625)

$$H_0: \alpha_0 = 0 \quad t = 0.351$$

$$H_1: \alpha_1 = 1 \quad t = -6.478$$

The coefficient of variable ΔP_{rptom} not equal to unity ($H_0: \alpha_1 = 1$; the value of t calculated 6.478 is greater than the value of t tabulated 1.684). It indicated that any change in tomato price at Rawalpindi market is not fully transmitted to Muzaffarabad market meaning that Rawalpindi and Muzaffarabad markets are partially integrated for tomato.

The hypothesis, that transshipment cost market is equal to zero is accepted $H_0: \alpha_0 = 0$; the value of t calculated is less than value of t tabulated, which indicated that there was no difference in the transshipment between the two markets.

Cross analysis: Following model the flow of price information Rawalpindi to Muzaffarabad markets.

$$\Delta P_{rptom} = 0.789 + 0.762 \Delta P_{mztom}$$

(0.536) (4.627)

$$H_0: \alpha_0 = 0 \quad t = 0.536$$

$$H_1: \alpha_1 = 1 \quad t = -1.442$$

The coefficient of variable change in price is equal to unity and the hypothesis that $H_0: \alpha_1 = 1$ is accepted because the t calculated is less than t tabulated 1.684. This show any change in tomato price at Muzaffarabad market was fully transmitted to Rawalpindi market.

Muzaffarabad-Mansehra markets

Tomato

The change in tomato price in Mansehra is not fully transmitted to Muzaffarabad as shown in following model.

$$\Delta P_{mztom} = 0.894 + 0.355 \Delta P_{mntom} \quad (2.436)$$

$H_0: \alpha_0 = 0$	$t = 0.725$
$H_1: \alpha_1 = 1$	$t = -4.418$

The coefficient of variable of price of tomato in Mansehra is not equal to unity (t calculated = 4.418 > t tabulated = 1.684) and falls between 0 and 1, denoting that any change in price in Mansehra market was partially transmitted to Muzaffarabad market. The hypothesis that transshipment cost between Mansehra and Muzaffarabad market is equal to zero is accepted ($H_0: \alpha_0 = 0$ t -calculated = 0.725 is less than the t tabulated value 1.684).

Cross analysis: Here again the flow of price information for tomato from Mansehra to Muzaffarabad market is not transmitted and partial; hence the markets are not fully integrated.

$$\Delta P_{mntom} = 0.082 + 0.322 \Delta P_{mztom} \quad (2.43)$$

$H_0: \alpha_0 = 0$	$t = 0.69$
$H_1: \alpha_1 = 1$	$t = -2.006$

Muzaffarabad-Rawalpindi Markets

Onion

For onion the market integration between these two markets is not fully integrated as indicated below:

$$\Delta P_{mzoni} = 0.102 + 0.861 \Delta P_{rponi}$$

	(0.184)	(11.495)
$H_0: \alpha_0 = 0$	$t = 0.184$	
$H_1: \alpha_1 = 1$	$t = -1.853$	

The change in onion price in Rawalpindi is not fully transmitted to Muzaffarabad. The coefficient of variable of price of onion in Rawalpindi

market is not equal to unity (t calculated = 1.853 > t tabulated = 1.684) and falls between 0 and 1. It shows that any change in price in Rawalpindi market was partially transmitted to Muzaffarabad market. The hypothesis that the transshipment cost between Rawalpindi and Muzaffarabad market is equal to zero is accepted, $H_0: \alpha_0 = 0$ t calculated = 0.185 is less than the t tabulated value 1.684.

Cross analysis: The flow of information between these two markets are also partial the value of t calculated is greater than t tabulated as shown in following model

$$\Delta P_{rponi} = 0.256 + 0.862 \Delta P_{mzoni} \quad (0.461) \quad (11.49)$$

$$\begin{array}{ll} H_0: \alpha_0 = 0 & t = 0.461 \\ H_1: \alpha_1 = 1 & t = -1.84 \end{array}$$

The coefficient of variable of price at Muzaffarabad market is not equal to unity and falls between 0 and 1, implying that change in price at Muzaffarabad market is partially transmitted to Rawalpindi market. The hypothesis, that transshipment cost between Rawalpindi and Muzaffarabad was equal to zero is accepted ($H_0: \alpha_0 = t$ calculated = 0.461 < t tabulated 1.684).

Muzaffarabad-Mansehra markets

Onion

$$\Delta P_{mzoni} = 0.175 + 0.832 \Delta P_{mnoni} \quad (9.520)$$

$$\begin{array}{ll} H_0: \alpha_0 = 0 & t = 0.275 \\ H_1: \alpha_1 = 1 & t = -1.931 \end{array}$$

The coefficient of variable of price at Mansehra (ΔP_{mnoni}) is not equal to unity ($H_0: \alpha_1 = 1$; t calculated = 1.93 > t tabulated = 1.684), indicating that both the markets were partially integrated. The transshipment cost between two markets is equal to zero ($H_0: \alpha_0 = 0$; t calculated = 0.275 < t tabulated = 1.684).

Cross analysis: Like Muzaffarabad Rawalpindi market, the price transmission from Mansehra to Muzaffarabad was also partial for onion. There is no price transmission between these two markets.

$$\Delta P_{mnonid} = 0.296 + 0.797 \Delta P_{mzonid} \quad (9.520)$$

$$\begin{array}{ll} H_0: \alpha_0 = 0 & t = 0.476 \\ H_1: \alpha_1 = 1 & t = -2.417 \end{array}$$

Muzaffarabad-Rawalpindi market

Garlic

$$\Delta P_{mzgar} = -0.070 + 0.725 \Delta P_{rpgar}$$

(-0.071) (5.499)

H₀: α₀ = 0 t = -0.071
H₁: α₁ = 1 t = -2.083

The change in Garlic price at Rawalpindi Δ P_{rpgar} was not fully transmitted to Muzaffarabad (H₀: α₁ = 1; t calculated = 2.083 > t tabulated = 1.684), denoting that markets were not integrated fully for the vegetable of garlic. It further suggests that transshipment cost between the two markets was equal to zero (H₀: α₁ = 1 ;t calculated 0.071 < t tabulated = 1.684).However , the flow of information i.e., price change from Rawalpindi to Muzaffarabad market was partial (H₀: α₁ = 1 ;t calculated 4.571 > t tabulated = 1.684).so that the markets are not fully integrated among each other for the commodity of garlic.

Cross analysis

$$\Delta P_{rpgar} = -0.389 + 0.547 \Delta P_{mzgar}$$

(-0.455) (5.499)

H₀: α₀ = 0 t = -0.455
H₁: α₁ = 1 t = -4.571

Muzaffarabad-Mansehra markets

Garlic

$$\Delta P_{mzgar} = -0.301 + 0.677 \Delta P_{mngar}$$

(-0.296) (5.027)

H₀: α₀ = 0 t = -0.296
H₁: α₁ = 1 t = -2.393

The above t value indicates that coefficient of variable Δ P_{mngar} is not equal to 1 (rejecting H₀: α₁ = 1) as t calculated = 2.393 > t tabulated = 1.684. This shows that Muzaffarabad and Mansehra markets were partially integrated i.e., the flow of information from Mansehra to Muzaffarabad was partial. The transshipment cost between the two markets was equal to zero (t calculated = 0.296 < t tabulated = 1.684).

Cross analysis

$$\Delta P_{mngar} = -0.111 + 0.524 \Delta P_{mzgar} \quad (-0.124) \quad (5.026)$$

$$H_0: \alpha_0 = 0 \quad t = -0.124$$

$$H_1: \alpha_1 = 1 \quad t = -4.577$$

The model indicates that coefficient of variable ΔP_{mzgar} is not equal to 1 (rejecting H_0 ; $\alpha_1 = 1$ as t calculated = 4.577 > t tabulated = 1.684.): specifying that α_1 falls between 0 and 1, that shows that the flow of price information that H_0 ; $\alpha_0 = 0$ is accepted (t calculated = 0.124 < t tabulated = 1.684) indicating that the transshipment cost between the two markets equal to zero.

Muzaffarabad-Rawalpindi markets**Cauliflower**

$$\Delta P_{mzcal} = 0.132 + 0.354 \Delta P_{rpcal}$$

$$(0.161) \quad (1.653)$$

$$H_0: \alpha_0 = 0 \quad t = 0.161$$

$$H_1: \alpha_1 = 1 \quad t = -3.01$$

The coefficient of variable change in prices of cauliflower at Rawalpindi market is not equal to unity (H_0 : $\alpha_1 = 1$; the value of t calculated is equal to 3.01 is greater than the t tabulated value 1.684 and falls between 0 and 1. It indicates that cauliflower prices were partially transmitted from Muzaffarabad to Rawalpindi market. The hypothesis, that intercept term is equal to zero is accepted (H_0 : $\alpha_0 = 0$; $0.16 < 1.684$), indicating that there was no difference in the transshipment cost between the two markets.

Cross analysis: Like Muzaffarabad and Rawalpindi market, the price transmission for cauliflower from Rawalpindi to Muzaffarabad market was also partial.

$$\Delta P_{rpcal} = 0.294 + 0.158 \Delta P_{mzcal} \quad (0.538) \quad (1.653)$$

$$H_0: \alpha_0 = 0 \quad t = 0.538$$

$$H_1: \alpha_1 = 1 \quad t = -3.019$$

The coefficient of variable change in prices of cauliflower at Muzaffarabad market is not equal to unity (H_0 : $\alpha_1 = 1$; the value of t calculated is equal to

3.019 is greater than the t tabulated value and falls between 0 and 1. It indicated that tomato prices were partially transmitted from Rawalpindi to at Muzaffarabad market. The markets were not fully integrated for cauliflower.

Muzaffarabad-Mansehra markets

Cauliflower

For the cauliflower the market integration between these two markets is not fully integrated as shown in following model

$$\Delta P_{mzcal} = 0.186 + 0.310,$$

$$\Delta P_{mncal} \quad (0.227) \quad (1.535)$$

$$H_0: \alpha_0 = 0 \quad t = 0.227$$

$$H1: \alpha_1 = 1 \quad t = -34.500$$

The change in cauliflower price in Mansehra market is not fully transmitted to Muzaffarabad market. The coefficient of variable of price of cauliflower in Rawalpindi market is not equal to unity t calculated = 34.50 > t tabulated = 1.684 and falls between 0 and 1. It denoting that any change in price in Mansehra market was partially transmitted to Muzaffarabad market. The hypothesis that the transshipment cost between Mansehra and Muzaffarabad market is equal to zero is accepted, $H_0: \alpha_0 = 0$ t calculated = 0.227 is less than the t tabulated value 1.684.

Cross analysis: Muzaffarabad Rawalpindi market and also in Mansehra and Muzaffarabad market, the price transmission from Mansehra to Muzaffarabad was also partial for the commodity of cauliflower. There was no price transmission between these two markets.

$$\Delta P_{mncal} = 0.169 + 0.157$$

$$\Delta P_{mzcal} \quad (0.289) \quad (1.535)$$

$$H_0: \alpha_0 = 0 \quad t = 0.289$$

$$H1: \alpha_1 = 1 \quad t = -8.184$$

FRUITS MARKETS**Muzaffarabad-Rawalpindi markets****Apple (Kalakulu)**

The flow of Apple price from Rawalpindi to Muzaffarabad is not fully transmitted as shown below:

$$\Delta P_{mzap1} = 0.514 + 0.505 \Delta P_{rppap1}$$

(0.355) (4.697)

$$H_0: \alpha_0 = 0 \quad t = 0.355$$

$$H_1: \alpha_1 = 1 \quad t = -4.626$$

This shows that both markets are not fully integrated for the fruit of Apple kalakulu. As we see the coefficient of change in prices of Apple kalakulu in Rawalpindi market is not equal to unity. Also the value of t calculated is greater than the value of t tabulated, and our null hypothesis is accepted that there is no integration for Apple in both markets. It indicates that any change in Apple prices of kalakulu in Rawalpindi is not fully transmitted to Muzaffarabad. The transshipment cost between these two markets is equal to zero is also accepted. There is no difference in transshipment cost between these two markets. Like Muzaffarabad and Rawalpindi market the flow of information from Rawalpindi to Muzaffarabad was partial.

Cross analysis

$$\Delta P_{rppap1} = 0.655 + 0.642 \Delta P_{mzap1} \quad (0.401) \quad (4.697)$$

$$H_0: \alpha_0 = 0 \quad t = 0.355$$

$$H_1: \alpha_1 = 1 \quad t = -2.613$$

Muzaffarabad-Mansehra markets**Apple (Kalakulu)**

$$\Delta P_{mzap1} = 0.146 + 0.757 \Delta P_{mnap1} \quad (0.113) \quad (6.318)$$

$$H_0: \alpha_0 = 0 \quad t = 0.113$$

$$H_1: \alpha_1 = 1 \quad t = -2.025$$

For Apple Kalakulu, above model shows that these two markets were not fully integrated; the change in Apple kalakulu price in Mansehra market is not fully transmitted to Muzaffarabad market. The coefficient of variable of price of Kalkulu in Rawalpindi market is not equal to unity t calculated = 2.025 > t tabulated = 1.684 and falls between 0 and 1, denoting that any change in price in Mansehra market was partially transmitted to Muzaffarabad market. The hypothesis that the transshipment cost between Mansehra and Muzaffarabad market is equal to zero is accepted, $H_0: \alpha_0 = 0$ t calculated = 0.113 is less than the t tabulated value 1.684.

Cross analysis

$$\Delta P_{mnap1} = 0.691 + 0.614$$

$$\Delta P_{mzap1} (0.595) (6.318)$$

$$H_0: \alpha_0 = 0 \quad t = 0.595$$

$$H_1: \alpha_1 = 1 \quad t = -3.979$$

Muzaffarabad Rawalpindi market and also the Mansehra and Muzaffarabad market, the price transmission from Mansehra to Muzaffarabad was also partial for the commodity of Apple (kalakulu). There is no price transmission between these two markets.

Muzaffarabad-Rawalpindi markets

Apple (Golden)

$$\Delta P_{mzap2} = 0.733 + 0.151$$

$$\Delta P_{rppap2} (0.546) (2.115)$$

$$H_0: \alpha_0 = 0 \quad t = 0.546$$

$$H_1: \alpha_1 = 1 \quad t = -11.792$$

The coefficient of variable change in prices of Apple golden at Rawalpindi market is not equal to unity ($H_0: \alpha_1 = 1$; the value of t calculated is equal to 11.792 is greater than the t tabulated value 1.684 and falls between 0 and 1. It indicated that apple Golden prices were partially transmitted from Rawalpindi to Muzaffarabad market. The hypothesis, that intercept term is equal to zero is accepted ($H_0: \alpha_0 = 0$; $0.546 < 1.684$), indicating that there was no difference in the transshipment cost between the two markets.

Cross analysis:

$$\begin{aligned} \Delta Prpap2 &= 0.805 + 0.586 \\ \Delta Pmzap2 &(0.304) \quad (2.115) \\ H_0: \alpha_0 &= 0 \quad t = 0.304 \\ H1: \alpha_1 &= 1 \quad t = -1.495 \end{aligned}$$

The change in Apple golden price at Muzaffarabad was fully transmitted to Rawalpindi ($H_0: \alpha_1 = 1$; t calculated = 1.495 < t tabulated = 1.684), denoting that the two market are integrated fully for the commodity of Apple golden, whereas the transshipment cost is partial between these two markets. This shows that any change in Apple golden price at Muzffarabad market was fully transmitted to Rawalpindi market.

Muzaffarabad-Mansehra markets**Apple (Golden)**

For apple Golden the market integration between these two markets does not exists as shown in following model:

$$\begin{aligned} \Delta Pmzap2 &= 0.513 + 0.679 \Delta mnap2 \\ &(0.431) \quad (4.284) \\ H_0: \alpha_0 &= 0 \quad t = 0.421 \\ H1: \alpha_1 &= 1 \quad t = -2.019 \end{aligned}$$

the change in Apple golden price in Mansehra market is not fully transmitted to Muzaffarabad market. The coefficient of variable of price of Apple golden in Mansehra market is not equal to unity t calculated = 2.019 > t tabulated = 1.684 and falls between 0 and 1, denoting that any change in price in Mansehra market was partially transmitted to Muzaffarabad market. The hypothesis that the transshipment cost between Mansehra and Muzaffarabad market is equal to zero is accepted, $H_0: \alpha_0 = 0$ t calculated = 0.421 is less than the t tabulated value 1.684. The price transmission from Mansehra to Muzaffarabad was also partial for the commodity of Apple (golden). There is no price transmission between these two markets.

Cross analysis:

$$\Delta P_{mnap2} = 0.232 + 0.420 \Delta P_{mzap2}$$

$$(0.247) \quad (4.284)$$

H₀: α₀ = 0 t = 0.247
H₁: α₁ = 1 t = -5.918

Muzaffarabad-Rawalpindi markets

Banana

$$\Delta P_{mzban} = 0.518 + 0.780 \Delta P_{rpban}$$

$$(0.453) \quad (5.144)$$

H₀: α₀ = 0 t = 0.453
H₁: α₁ = 1 t = -1.447

The coefficient of variable change in prices of banana at Rawalpindi market is equal to unity (H₀: α₁ = 1; the value of t calculated is equal to 1.447 is less than the t tabulated value 1.684. it indicates that banana prices were fully transmitted from Muzaffarabad to Rawalpindi market.

The hypothesis, that intercept term is equal to zero is accepted (H₀: α₀ = 0; 0.453 < 1.64), indicating that there was no difference in the transshipment cost between the two markets. The price transmission from Rawalpindi to Muzaffarabad was partial for banana.

Cross analysis:

$$\Delta P_{rpban} = 0.356 + 0.468 \Delta P_{mzban}$$

$$(0.398) \quad (5.144)$$

H₀: α₀ = 0 t = 0.398
H₁: α₁ = 1 t = -5.846

Muzaffarabad-Mansehra markets

Banana

$$\Delta P_{mzban} = 0.802 + 0.717 \Delta P_{mnban}$$

$$(0.692) \quad (4.895)$$

H₀: α₀ = 0 t = 0.692
H₁: α₁ = 1 t = -1.938

For the banana these two markets were not fully integrated. The change in banana price in Mansehra market is not fully transmitted to Muzaffarabad market. The coefficient of variable of price of banana in Mansehra market is not equal to unity t calculated = 1.938 > t tabulated = 1.684 and falls between 0 and 1, denoting that any change in price in Mansehra market was partially transmitted to Muzaffarabad market. The hypothesis that the transshipment cost between Mansehra and Muzaffarabad market is equal to zero is accepted, $H_0: \alpha_0 = 0$ t calculated = 0.692 is less than the t tabulated value 1.684. The price transmission from Mansehra to Muzaffarabad was also partial for banana.

Cross analysis

$$\Delta P_{mnban} = 0.028 + 0.478 \Delta P_{mzban}$$

(0.029) (4.895)

$H_0: \alpha_0 = 0$ $t = 0.029$
 $H_1: \alpha_1 = 1$ $t = -5.327$

CONCLUSIONS

Adverse climate conditions in AJK provide edge over other areas for producing quality of fruits and vegetables, but still the domestic production of these products is far beyond the domestic demand. The demand for fruits and vegetables is met mostly through supply from Mansehra and Rawalpindi markets.

The flow of price information from Rawalpindi, Mansehra and Muzaffarabad markets is partial i.e., these markets are partially integrated with each other markets for fruits and vegetables and these are not fully integrated.

Change in fruits and vegetables price at Muzaffarabad market is not fully transmitted to markets while partially transmitted to Rawalpindi, and Mansehra markets. However, change in fruits and vegetables prices at Mansehra and Rawalpindi market is not fully transmitted to Muzaffarabad. While the flow of information only for tomato from Rawalpindi to Muzaffarabad was fully transmitted, but for the commodities like banana and apple (Golden) the markets of Muzaffarabad and Rawalpindi were fully integrated.

RECOMMENDATIONS

- ⇒ Unsatisfactory flow of information between producing and consuming areas and assemblers of the produce, primary wholesalers, and transporters restrict efficient marketing of produce. There is need for the governments to examine and disseminate market information especially prices on daily basis to improve marketing efficiency and consequently the production.
- ⇒ The poor market integration reveals that markets are not quite competitive. This necessitates extensive government interventions to improve competitiveness and enhance market efficiency.
- ⇒ Good access roads play an important role for markets to be integrated and the distance between markets weakens the harmony. Therefore, investment can be made in the regional marketing structure, focusing on transportation and communication linkages to enhance integration.
- ⇒ No single regular fruit and vegetable market exists in AJK. Therefore, government should take initiative to establish public sector fruit and vegetable markets at district level throughout AJK.
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