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Dairy Farmers' Welfare Losses from Farm-To-Retail Milk Price Adjustments: Highlight on Market Integration and Price Transmission

Mazhir Nadeem Ishaq[1]

[1] Northeast Agriculture University

Received: 14 December 2015 Accepted: 31 December 2015 Published: 15 January 2016

Abstract

This study was carried out in four districts of Punjab province of Pakistan with a focus to examine milk market integration, price adjustments and price spreads in short-run and long-run equilibrium for fluid milk. Price transmission describes how a price change at one level of market chain corresponds to another level. Vector Error Correction Model (VECM) was applied to estimate the symmetry of price transmission. Monthly average prices of milk producer and consumer covering the period from 2010 to 2016 were used in the empirical analysis. Seasonality was an important factor in milk production and was kept in account. Stationarity between farm and retail prices was examined through Augmented-Dicky Fuller (ADF) test whereas, the nature of long-term co-integration among price series was estimated by Johansen co-integration test.

Index terms— milk supply chain, price transmission, seasonality, price elasticity, co-integration, dairy prices, error correction model, punjab

1 Introduction a) Background of Study

olatility of price in agribusiness markets not only affects farm revenue and farmer's ability to maintain their operations but it also validates the market structure and it performance. Price is an essential economic tool which linked the different levels and/or intermediaries of a particular product market, such as dairy enterprise (Serra and Goodwin 2003). The efficiency of agricultural markets depends on a high degree of perfect and fair price mechanism based on efficient integration among various marketing stakeholders. Agriculture development may be achieved if changes in price at one level (e.g. consumer) are efficiently transmitted to next level of Market structure (Producer). In Pakistan, milk producers are deprived from the welfare effects of positive price changes due to inefficient transmission from retailers to dairy farmers. This price disparity resulted the rural economy with losses and under-development. This market inefficiency dilemma has led to the unfair redistribution of economic resources form agriculture sector to other enterprises.

In Pakistan's agriculture, the dairy farming is an important income generating activity. Milk produce contributes a major share to gross national income (GNP). Milk is very important livestock product which can provide a consistent source of income to smallscale dairy farmers (Shinoj et al. 2008). Livestock farming in agriculture sector is recognized as a potential source of employment generation for rural small, marginal and landless laborers. Livestock supplements human food in form of milk, meat, eggs, and skins along with farmyard manure for agriculture production. According to official statists of Economic survey of Pakistan, the contribution of livestock towards agriculture value addition and in the national GDP is 58.3% and 11.6 % respectively. Livestock's gross value addition represents an increasing trend of 2.7 percent to the corresponding previous period of 2014-15 and overall value had increased from 756.6 billion PKR to 776.5 PKR. The current estimated population milk producing animals (cow, buffaloes, goats, sheep and camel) was around 176.6 million.

1 INTRODUCTION A) BACKGROUND OF STUDY

In Pakistan, the total milk production for the year 2015-16 was recorded as 54.328 million tons and is presumed to be 6th in global milk producers. Buffaloes and cows are two major dairy animals which are primarily reared for milk production in Pakistan and their share in total milk production is 61 % and 32.8% respectively (GOP2015, and **??**OP 16).

The milk marketing system generally engaged various marketing agents which add some kind of utility at each specific marketing node. A marketing node in any marketing chain is referred to as a stage/level where exchange or transformation of a product takes place (Zia 2007). In Pakistan, milk marketing chain is usually composed of five different marketing nodes; milk producers, local milk collectors (Dhodi), processors/dairy plants, wholesalers/distributors, and retailers or milk shops. The overall milk marketing system is broadly segmented into two marketing channels; informal milk marketing channels and formal milk marketing channels. The traditional or informal milk marketing system deals with collection and distribution of raw fresh milk without any legal license issued from a regulatory department. Formal milk marketing system undertakes milk collection, processing and distribution under a lawful mechanism of dairy and food regulatory department to ensure food safety regulations. Milk marketing in Pakistan is dominated by informal sector as it occupies more than 94% share and rest is of milk is marketed by formal milk processing sector. Due to huge investment in reconstruction and new capacity building in formal dairy sector, the scenario is altering with rapid pace. However, the milk producers are free to sell their milk production according to price and services provided by existing available marketing system; either informal or formal channels.

Vertical price transmission analysis in milk marketing channels and spatial markets is a subject of considerable attention to examine price relationship among milk producers, wholesalers and final consumers. The price transmission is a complex economic relationship between the producers and the consumers and it explains how a price change atone marketing level react towards the next level in the marketing system of product. The prices of milk producers on farm gate is a sensitive issue as the marketing agents/middlemen often offered low prices as compare to their fair share from retail market prices. The price spread in milk marketing chain of Pakistan is wider as many small scale intermediaries are engaged. Retail prices do not absorb any negative change in prices which can lowers the retailers' profit margin and the price change is immediately shifted to consumer price (Azzam 1999).The market power exercised by processors or retailers tend to increase the difference between producer and consumer prices and resultantly reduce producer's share in consumer expenditure. This could be possibly explained in presences of adjustment costs, noncompetitive market structure, profit maximizing motives and non-linearities in supply & demand (Falkowski 2010).

According to the Peltzman (2000) majority of producer and consumer markets are often characterized by asymmetrical price transmission. The distribution of welfare effects e.g. farmers' benefit due to rise in retail price or consumer advantage due to fall in farm prices could not be materialized due the asymmetric price movements (Tekguc 2013).In developing countries to examine the functioning of vertical food markets, it is important to evaluate how marketing agents are delivering for the farmers and the consumers' welfare. The conditions of agribusiness market play a vital role in determining the retail prices and marketing middlemen (processors, distributors, retailers) often have enough market power to have upper hand over farm prices.

The potential causes of asymmetric price transmission could be the abuse of marketing power (Von Cramon-Taubadel and Meyer 2004); intensity of competition in market (Bailey and Brorsen, 1989); elasticity of product demand (Pletzam 2000); extent of product perishability (Reziti 2014); search costs in local markets (Chavas and Mehta2004); adjustment costs; menu and spatial costs (Goodwin and Harper 2000); government interventions to support farm gate prices (Lass et al. 2001).The distribution efficiency of a product can be examined through getting insight into the nature of relationship between producer and consumer prices. An asymmetric price relationship is considered as an economic disadvantageous for producers and consumers ((Stewart and Blayney 2011).

In agriculture marketing, the distribution of profits and issues of marketing margins within the marketing channels are important to be investigated. Analysis of demand and supply shocks assist to understand the direction of market adjustments and price movements in moving goods from one level of marketing chain to another. Globally the subject of price transmission has been widely studied for many commodities such as wheat and wheat flour **??** As regards dairy products, although various studies had already been conducted on price transmission mechanism and market cointegrations issues; however their conclusion and the evidences varies and mixed across the geographical locations and commodities. **??**havas and Metha (2004) carried out an empirical analysis for the butter market in the US and they found a strong evidence of asymmetry in the adjustment of retail prices. A study on whole milk price transmission elasticity was conducted by Capps and Sherwell (2007). The applied Houck error correction model (ECM) for analysis and their results proved that an asymmetric price transmission mechanism was present in farm-retail price relationship. Reziti (2014) found positive asymmetries during their study on milk and butter in the dairy industry of Austria. Stewart and Blayney (2011) conducted a study for the whole milk and cheddar cheese market in US and reported that asymmetric price movements between farm and retail level. They proved that the price shocks between two levels were transmitted with a delay as well as in an asymmetrical pattern. Recently, Reziti (2014) carried out a study in the Greek milk sector and threshold error correction autoregressive model was applied on monthly price data ranging from January 1989 to April 2009. This study results detect a nonlinear price adjustment between milk consumer and producers and abuse of market power by milk processor and retailers was observed.

2 b) Statement of the Problem

To analyze price adjustments in an unregulated milk marketing system and to evaluate the underlying symmetries is a complex phenomenon. The available information about Pakistani milk market evidenced that milk producers within prevailing milk supply chain are in a vulnerable position. Usually they sell milk to local milk collectors (Dodhi) at the prices which are almost half of retailers' prices. In Pakistan some studies had been conducted on rice and citrus markets; however so far no research is carried out to examine the vertical price transmission and cointegration issues for milk marketing in Punjab province. Therefore for Pakistan's dairy sector, a research gap exist to identify the behavior and the nature of relationship among milk marketing agents/ middlemen arising from milk price shocks. This study is an attempt to undertake the vertical price transmission analysis and to gain an insight into price adjustments among milk producers, wholesalers and retailers in four districts. The specific objectives of this study were; (i) to examine the short run milk price variation among intermarket and intra-marketing agents during flush and lean season of milk production; (ii) To analyze the nature of market integration and the long run vertical price transmission between the prices of milk producers and consumers. Hence, this study will deliver some valuable information on the directions of price adjustments and market integrations which is expected to be useful for the stakeholders involved in milk supply chain of Pakistan.

3 II.

4 Materials and Methods

5 a) Description of Study Area and Data Source

The study area for this research was the south region of Punjab province. Agriculture and rearing of livestock is the primary source of livelihood for rural residents of this geographical location in Pakistan. From south region of Punjab province four districts namely Vehari, Lodhran, Bahawalpur and Muzaffargrah were purposively selected. These districts have a rich population of livestock and milk production activities. Monthly average prices for milk producer and consumer were collected from four districts of the Punjab. The data used for this research was obtained from secondary sources. To acquire milk producer prices that match up with retail prices is a complex proposition. Agriculture statistics of Pakistan (2010) was chosen as first source of data. Second source of data was the essential food commodity price list which is monthly publicized from each of the District Coordination Office (DCO). A continuous reliable source of data on milk producers' prices could not found as such; however the data for one pair of milk consumer prices and milk producers' prices for four districts was estimated on averages after discussions with livestock, dairy development officials and dairy industry experts. Monthly milk price observations ranging from January 2010 to June 2016 were collected and undergone through data analysis. The nominal price data provided by the agriculture statistical office and the DCO office was deflated to January 2010 in terms of the Pakistan consumer price index to calculate the real price change in milk. Variables are transformed in logarithms.

6 b) Methodology for Price Spread over Different Markets

Efficiency analysis of marketing chain provides reliable information about price movements or spread within markets and over different marketing agents. In this paper for calculating price spread over selected district markets and for various marketing agents, we used Rudra's (1992) approach which is explained the price spread by symbol ?±?. The sign ? indicate the midpoint of milk price to various market middlemen in a given market. The symbol ?+? expressed the highest observed value and ?-? is for the lowest observed value. The intra-market price variation is denoted by the symbol ±?. After estimating and comparing the values of ? for different middlemen within the same market or for different regional markets for the same middlemen gives some idea about the inter-market and intra-market price variations. Rudra (1992) hypothesis for the calculation of price spread for different markets and over different marketing middlemen was applied. This hypothesis explained that a market of homogenous product becomes perfectly competitive as if the range of price variations for the homogenous product within different markets (excluding transactions cost) in any particular marketing middlemen as well as intermarketing agents for the same period is almost close to uniformity. In developing economies like Pakistan, the agricultural inputs and outputs data related to market analysis are usually short-term in nature. Hence, in determining the competitiveness of milk producers' and consumers' prices within districts markets, the Rudra's (1992) estimates seem to be more pertinent and applicable.

7 c) Selection of Price Series for Price Transmission Analysis

Due to various milk marketing agents (i.e. milk collectors, wholesalers, processors, distributors and retailers), there could be a number of possible combination of price series. However, we only emphasis on milk producer and consumer level in the vertical milk market linkages and selected farm and retail prices. According to study objectives, in this paper we applied different test for estimating the trend of price transmission. First of all, the descriptive statistics was applied in order to examine the relationship between milk producer and consumer as well as to describe the main features of a data collection. Certain other statistical tests were also applied to validate the results.

8 d) Unit root Test, Cointegration Test and Granger's Causality Test

It is very important to examine the price relationship over time; a) whether selected price series are stationary or not, b)if the price series are nonstationary with a unit root, what is the type of co integrated orders, c) if price series are co-integrated what is the direction of causality. If the price series are stationary at levels, then we can apply "ordinary least square" estimation method to examine the relationship between two price series. But if the series are nonstationary and have unit root then to determine the relationship, the series are taken at the first or second difference levels and the Error Correction Models (ECM) is applied for the purpose. We applied the commonly developed Augmented Dicky-Fuller test to assess whether the selected price series have unit root or not. The null hypothesis for milk producer and consumer price series was that; it is non-stationary having a unit root. Null hypothesis results, if fail to reject H o rather accept it, meaning that price series have unit root and are non-stationary. The required lag number for ADF test is determined by using Schwarz information criteria (SIC).

Pt=??+ ???? + ?????? ? 1 + ? ??????? ? 1 + ???? ?? ??=1**(1)**

Where Pt = denote prices natural logarithm C denote intercept t is a linear time trend If the selected time series price data is stationary on differencing, then the co-integrated order [I (1)] between price series is said to be present. We used Johansen (1988) test to find out the cointegration relationship between the price series.?? ???? ~= ?? + ???? ???? ~+ ????**(2)**

If Ppt and Pct price series are co-integrated and in the order of I(1), then the residuals V t would be I(0).

To examine the long run conintegration between two price series, we applied Granger causality test. The presence of long run relationship between two price series is detected if a significant information is statistically predicted by P1 about the future values of P2. The relationship is defined as P1 have Grangercausality for P2.In this study the estimation of Grangercausality test was very important; as no prior information on causal relationship between milk producer and consumer prices is established in literature for milk marketing system of Punjab. The null hypothesis was formulated in such a way that its rejection would provide Granger causality for P1 to the price series P2.

9 e) Empirical Models used for Price Transmission

Meyer and Von Cramon-Taubadel (VECM) model (**??**004) was used to examine the price dynamic relationship for non-stationary and co-integrated price series (Ppt and Pct). The Vector Error Correction model assumes the equation as follows:??????? = ?? + ?????? ???? ?1 ? ????? ???? ?1 ? + ????? ???? ? + ????? ???? ?1 + ?? ??**(3)** = =

Where Î?"Ppt and Î?"Ppt-1 stand for the changes in farm-gate and lagged changes in farm-gate prices. Î?"Pct and Î?"Pct-1 denotes the changes in retail and lagged changes in farm-gate prices. The speed of adjustment to long run equilibrium is denoted by an error correction term "?". While "?" and ? indicates price transmission elasticity in long-run and short-run between two prices respectively. ?t represent the white noise (residual). The white noise (?t) is expected to be zero at the long run equilibrium levels of both Pct and Ppt. However ?? ?? could be either positive or negative when both price series are away from their long run equilibrium. In other words; the whitenoise (?t) would be positive if Pct series is well above its long-run equilibrium and(?t) is negative in the opposite case of Ppt series. The error correction term (ECT) entered into Error Correction Model is a residual of equation (1) which is lagged by one period.??? ???? = ?? 0 + ? ?? 1?? ??? ???? ?1+1 ?? ??=1 + ? ?? 2?? ??? ???? ??? ?? ?? =1 + ?? * ?????? ???1 + ?? ??**(4)**

Where??CT t ?1 = ????t?1 ? ?? 0 ? ??1 * ????t?1

Granger and Lee (1989) in their study of US industry inventory proposed a modification in equation (2) which enables to estimate the two co-integrated prices variables asymmetric price transmission. They included additional dummy variables in the model and segmented the error correction term into ECT+ -and ECT-.??? ???? = ?? 0 + ? ?? 1?? ??? ???? ???+1 + ? ?? 2?? ??? ???? ??? + ?? 1 ?? 1?? + ?????? ???1 + ?? 2 ?? 1?? ? ?? ?? =1 ?? ??=1 ?????? ???1 + ?? ??**(5)**

with?? 1?? + = 1 if ??CTt?1 > 0 and 0 otherwise, ?? 1?? ? =1 if

ECTt?1 < 0 and 0 otherwise. The long -run asymmetry hypothesis in equation (3) is:?? 0 : ??1 = ??2 it will tested through F-test.

To assess both aspect of response variation, the contemptuous response term was segmented into positive and negative components through Von Cramon-Taubadel and Flahlbusch (1994) which follow the form with ?? 2?? + = 1 if ????pt???+1 > 0 and 0 otherwise, ?? 2?? ? =1 if ????pt-??+1 < 0 and 0otherwise.:??? ???? = ?? 0 + ? ?? 1?? + ?? ???? + ??? ???? ???+1 + ? ?? 1?? ? ?? 2?? ? ??? ???? ???+1 + ? ?? 2?? ?? ?? =1 ??? ???? ??? + ?? 1?? + ?????? ???1 + ?? 2 ?? 1?? ? ?? ??=1 ?? ??=1 ?????? ???1 + ?? ?? (6)

To test both symmetry hypothesis for short run and long run, the equation (4) can be used in conjunction with joint F-test as under:?? 0 = ? ?? 1?? + ?? ??=1 = ? ?? 1?? ? ?? ??=1 ?????? ?? 1 = ?? 2**(7)**

According to von Cramon-Taubadel, valid inferences with respect to the parameters of interest in (1) or (4) requires the Ppt to be weakly exogenous. On account of this, Boswijk and Urbain testing procedure was followed and in the first step "Ppt" was estimated through marginal model as follow:??? ???? = ?? 0 + ?? 1 (??)??? ???? ?1 + ?? 2 (??)??? ???? ?1 + ?? ??**(8)**

In the second step; we applied a variable addition test and fitted residual "?t" was estimated through marginal model (5); {in the structural model (2) insignificant results for fitted residual in the structural model, a slightly conditioned "Error Correction Model" is assumed on short-run weekly exogenous variables. To proceeds further and to test the significance of long run parameters with respect to weak exogeneity, the ECTt-1 is added from equation (1) to equation (5).

However, if the results of all tests revealed a non-cointegration between variables, the VAR model can be specified and estimated. In this situation, the two equation included in VAR model can be written as follows:?? ???? = ?? °+ ?? 1 ?? ???? ?1 + ? ? ? ? + ?? ?? ?? ???? ??? + ?? 1 ?? ???? ?1 + ? ? ? . +?? ?? ?? ???? ??? + ?? ??**(9)**?? ???? = ?? °+ ?? 1 ?? ???? ?1 + ? ? ? ? + ?? ?? ?? ???? ??? + ?? 1 ?? ???? ?1 + ? ? ? . +?? ?? ?? ???? ??? + ?? ??**(10)**

Where P pt and P ct are milk producer and consumers prices, and P pt-k and P ct-k are lagged milk producer and consumers prices respectively.

III.

10 Results and Discussion

11 a) Descriptive Statistics of Milk Prices at Dairy farmers and Milk Consumer level

In this section, we would discuss the price transmission and price adjustment analysis between the milk producer and consumer prices for selected four districts of Punjab province. The important descriptive statistics derived from the analysis of respective price series are mentioned in Table 1.Average price per liter of fresh raw milk for producers ranged from was 23 PKR to 48 PKR. Average retail milk price ranged 40PKR/L to 78PKR/L. The information reported in Table 1, demonstrates noteworthy difference between farm and retail level milk prices among four districts during the period 2010 to 2016. The relative variation in milk prices under investigation are likely due to unregulated marketing system and cost of transporting ,ilk from rural areas to urban center.

12 b) Seasonality and Milk Price Variations

In Pakistan, the seasonality is an important factor and the milk production cycle encompassed flush and lean seasons. Milk production from December 15 th to April15 th is considered as flush season whereas, from 16 th April to August 15 th is lean season. The rest of period also varies between mini flush (September to October) and mini lean (November and April). This variation in milk production is due to changing weather and availability of fodder production in hot summer and winter. The prices during flush and lean seasons remained fluctuated. In flush season, milk production is more but consumption is less. Therefore, milk collectors (Dodhi) decrease milk prices. On the other hand during the lean season, extreme hot summer / or in winter months, the consumers like to consume more milk in the and (4

13 (ii) Figures within parenthesis indicate percentage variation of price during milk peak and lean season

The estimation of fresh milk price variation was not far from uniformity when milk is sold directly from producers to consumers, as the percentage of price variation lies between 4.14 and 6.33. However, the percentage of price variation lies between 11.71 and 19.56 for inter-markets and/or intra-marketing agents which was far from uniformity. The possible explanation of this pattern may be as when milk collectors (Dhodi), small milk processors and retailers engaged in milk marketing chain; they added more transactions costs and absorb highest price margin. The highest percentage change in price was absorbed by milk collectors (Dhodi), followed by processors and retailers. The results in Table-2 explained the significant impact of seasonality on milk prices. The price for per liter was a little high during the lean season for all district markets and/or for all types of marketing middlemen. The graphical representation also explained that milk prices exhibit seasonal patterns for flush and lean season (Figure 2). The above Figure-2 demonstrates that milk producer and consumer prices increased and decreased with seasonal fluctuations and this trend suggest a price transmission symmetry. The price trend lines also indicate that large increases in consumer prices are followed by slightly increases in milk producer prices. This happened due to the existence of transactions costs or relatively high marketing margins at retail level.

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15 c) Stationarity of Price series

Figure 2 depicted that both price series i.e. milk producer and consumer prices contained a consistent time trend with a shift. Stationarity of price series was checked with unit root test to analyze the prescribed models for price transmission at milk producer and consumer level. Thus, a Unit root test at level and the first difference was estimated by applying Augmented Dickey -Fuller (ADF) procedure and the outcomes are reported below in Table 3. The null hypothesis about the stationarity of both price series were tested at levels and the first difference

through ADF-test. Appropriate lag length was determined by using Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC). The results showed that null hypothesis was rejected for all variables on first difference and the test statistics were significant at 5 % and 1% level. Both price series for has one serial unit root but not at the corresponding frequencies. Hence, all the price variables were of the order one I (1), and one cointegrating vector exist between each pair of milk producer and consumer prices at retail level (see Table 3).

16 d) Co-integration Outcomes

These results support to proceed for cointegration tests to check the long-run equilibrium relationship. Johannsen's co-integration procedure in a dynamic framework suggested that if a long-run relationship exist between both price series then; the movements among them will be bounded together and/or will be co-integrated. The outcome of Johansen test for both price series are presented under Table 4. The next important step in price transmission analysis of milk marketing was to determine the asymmetry of price movements between producer and consumer. Granger causality test was applied to find out the possible direction of price movements between marketing agents. To avoid from heteroscedasticity and Autocorrelation-consistent (HAC), seasonal dummies were added in the model. Granger causality test findings are presented in Table 5. milk producer ? milk collector/dodhi ? milk processors ? distributors ? retailers

The Granger causality analysis suggested two parallel effects of upward and downward price movement in a typical milk marketing chain :

The outcomes of Granger Causality test proved that in our marketing chain, there is a downward price mechanism. Hence, the direction of causality was from milk consumers to milk producer because the milk marketing middlemen have enough market power. This situation dragged the dairy farmers in a vulnerable position and deprived them from getting fair prices of their milk production. This problem stemmed from two major reasons; (i) milk is a perishable commodity and it cannot be retained or stock for a longer period of time (ii) the Pakistani's dairy farmers have not established and joined effective cooperative organizations. Hence, this poor structural arrangement of dairy sector compelled the dairy farmers in a price taker position.

17 f) Estimates of Vector Error Correction Model and Price Transmission

The findings presented in Table 3 & 4 explained that the trace and Maxi-eigen statistics were greater than critical values; price series were stationary at first determine appropriate lag lengths. The statistics values of both ? trace and ? max test suggested that the null hypothesis was rejected for the zero cointegrating vectors and long-run relationship for one cointegrating vector was present between each price series (see Table 4). The findings of VECM revealed that there exist positive relationship for outward price movements (milk producer ? milk consumer) and negative relationship is found for downward movement (milk consumer ? milk producer).

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The test of asymmetry for short-run suggested that the pattern of price movements for increase in prices was different than to decrease in prices (Table 6). The coefficients of ECT± showed that increase or decrease in consumer prices will affect the change in producer prices; however, greater price variations were observed for long to consumer price in order to retain its profit at fixed level (deviation equal to zero).The coefficient of VECM expressed price adjustments during a period of time. For one month (i.e. short-run period) one unit positive change in consumer's price would approximately adjust milk producer price 7.6% whereas in long-run equilibrium it is around 28% (Table 6). Hence, decrease in milk producer prices during flush season in long-run equilibrium did not transmitted to consumer welfare. This is attributable to marketing middlemen/retailers who absorb all the positive price deviation and did not shift this advantage to consumers. Consequently, coefficients of the segmented ECT revealed the asymmetric price transmission was obvious in milk marketing chain, Table 6. Our findings were also supported by a study conducted by Acosta and Valdes (2013) who analyzed the vertical milk market price transmission pre-consignation methods. Their study also suggested positive price transmission asymmetries and concluded that increase in farmer prices are passed on more quickly and more completely to retail prices than to decrease in farmer prices.

19 IV. Conclusions and Recommendations

This study was carried out to examine the price adjustments for short-run and long-run equilibrium. The symmetry of price adjustments between milk producer and consumer was studied through price transmission analysis. Time series data of milk prices ranged from January 2010 to June 2016 for producer and consumer were analyzed by applying VECM along with descriptive statistics. Both the price series were stationary at first difference; the Johansen cointegration test provided the evidence of long term cointegration in prices. The estimates of Vector Error Correction model (VECM) revealed that milk consumer price (Pct) was exogenous and the outcomes of Granger causality test validate the evidence of unidirectional price causality from farm to retail side and not vice versa. The analysis provide an indication that milk marketing system working in selected

districts is imperfect , market power is on the demand side and asymmetric price transmission is evident in milk supply chain. The possible justification for this could be that marketing middlemen earn large profit margins when milk price increases during hot summer or winter (lean season). The middlemen still make abnormal profit during flush seasons when milk supply is more but its demand declines. Thus, prices are transmitted from consumers to milk producers in an asymmetric mode and middlemen abuse their market power to absorb positive price shock or transmit with delay in long run equilibrium. The pattern of asymmetric price transmission towards the principal stakeholders i.e. milk producers and consumers during peak and lean seasons of milk production, not only lowers the dairy farmers' profitability but also abolish the consumer welfare effects.

The study suggest that the asymmetric flow of prices can be make smaller if milk producers are integrated into small or large milk cooperatives organizations. The milk collecting associations will help to reduce the transactions costs, offer reliable milk market with better returns and minimize the middlemen role/margins. The public or private interventions are also recommended to improve the milk marketing system of Pakistan. It could be achieved through better storage or low cost chilling units provided to milk producers at substantial rates for enhancing the perishable life of milk. These efforts would results to capture a larger share of milk producer in consumer price. Thus, study evidenced for market imperfections could be utilized for achieving a close collaboration of milk producers to restructure the milk supply system in Punjab province. Such collaboration would enable the farmers to strengthen their negotiation power in the vertical market linkages and having a better position for taking the price decision.

V. [1] [2]

1

Districts	Mean	Median	Standard Deviation	Minimum	Maximum
			Milk Prices at Farm Level		
Vehari	36	35	1.45	23	38
Lodhran	34	33.5	2.36	24	36
Bahawalpur	35	34	1.34	25	37
Muzaffargarh	38	36	1.36	25	38
			Milk Prices at Retail Level		
Vehari	45	44	2.35	35	77
Lodhran	46	45.6	3.56	36	75
Bahawalpur	45	44	2.35	35	74
Muzaffargarh	46	45	3.5	38	78

Source: Authors calculations from collected data, 2016.

Figure 1: Table 1 :

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[2]Dairy Farmers' Welfare Losses from Farm-To-Retail Milk Price Adjustments: Highlight on Market Integration and Price Transmission

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form of milk beverages and tea. Therefore, in summer and winter due to lean season and more consumption, milk prices rise up very high towards consumers' side but a slight increase is observed for milk producers. The market integration and price variation among districts

	Flush Season Milk Price Adjustments among Middlemen			
District	Milk Producers	Milk Collectors (Dhodi)	Small Processors	Retailers/ Milk Shops
Vehari	45.75+2.90 (6.33)	55.30+10.10 (18.3)	62.65+8.25 (13.16)	63.5+8.00 (12.6)
Lodhran	43.50+2.50 (5.74)	57.00+9.90 (17.5)	64.25+8.75 (13.61)	65.00+8.25 (12.61)
Bahawalpur	46.25+2.00 (4.32)	54.00+9.88 (18.3)	63.50+7.5 (11.8)	64.00+8.20 (12.8)
Muzaffargrah	45.00+2.25.00 (5)	56.50+9.75 (17.27)	61.25+7.7 (12.57)	63.50+7.75 (12.2)
	Lean Season Milk Price Adjustments among Middlemen			
Vehari	48.25+2.00 (4.14)	58.00+10.50 (18.1)	66.25+8.00 (12.07)	68.00+8.25 (12.13)
Lodhran	47.50+2.50 (5.26)	57.50+11.25 (19.56)	67.25+8.75 (13.01)	69.00+9.50 (13.76)
Bahawalpur	49.35+2.20 (4.45)	58.25+10.25 (17.6)	68.25+8.25 (12.08)	70.00+8.20 (11.71)
Muzaffargrah	48.55+2.50 (5.14)	60.20+10.25 (17.02)	65.25+8.00 (12.26)	68.50+8.50 (12.4)

[Note: Note: Price for standard milk (Fat 4.5%, SNF 8.5% and CLR 27.74) in lean season by Milk Producers was Rs.48 and flush season it was Rs.43 during 2015-16.]

Figure 2: Table 2 :

3

Variables	Levels		First Difference			Critical Value
	ADF	PP	ADF	PP	5%	1%
Producer Price	-2.39	-1.43	-7.16	-6.18	-2.83	-3.44
Consumer Price	-2.26	-1.56	-5.43	-5.7	-2.83	-3.44

Source: Authors calculation, 2016. Note: * =0.05 level (5%) ** = 0.01 level (1%) significance

Figure 3: Table 3 :

4

District	Hypnotized co-integration equations	Trace test statistics	p-value	Max-Eigen value statistics	p-value
Vehari	None	21.64	0.0013*	19.63	0.0103*
	At most 1	2.156	0.13	2.156	0.1302
Muzaffargrah	None	9.37	0.321	9.21	0.237
	At most 1	0.063	0.853	0.063	0.853
Lodhran	None	19.83	0.0011*	17.38	0.0113*
	At most 1	2.36	0.129	2.36	0.129
Bahawalpur	None	23.64	0.0023*	21.27	0.0023*
	At most 1	1.85	0.183	1.85	0.183

Source: Authors findings, 2016. ** MacKinnon-Haug-Michelis (1999) p-value and *indicate rejection of the l level. Trace and Max-eigen value tests indicate 1 co integration equation at 0.05 levels.

The coinegrating vector in Johansen (1998) test included a constant term with formulation of null and alternative hypotheisis [H o = the number of cointegrating vectors is zero (r=0); H 1 =one cointegrating vector is (r=1)]. AIC criteria were used to

e) Detection of Milk Price Symmetry

Figure 4: Table 4 :

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Figure 5: Table 5 :

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[Note:);Capps and Sherwell (2007); and, (Yong and Nie 2016) studies, where asymmetric price transmission was also evidenced for both long run and short run equilibrium. The estimates in Table6conclude that when milk producer price increases one unit, the milk retailers contemptuously shift this one unit increase]

Figure 6: Table 6 :

.1 Acknowledgement

This study was carried out under National Natural Science Foundation, China (7167031183) under a major project "Impact of infant powder milk safety trust index on product competitiveness-Index measurement, construction of related market model and market simulation" (G0300502).

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