Pakistan J. Agric. Soc. Sci. Vol. 1, No. 2, 1987

RECENT TRENDS AND VARIABILITY IN PRICES OF SELECTED CROP AND LIVESTOCK PRODUCTS IN PAKISTAN

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ABSTRACT: Recent trends (1971-85), year-to-year variability and seasonal variability in wholesale prices for wheat, maize, beef, mutton, milk, desi ghee, poultry meat, eggs, green fodder and dry fodder are analysed. Prices of livestock products are shown to have increased relative to grain while prices of fodders have fallen sharply. Livestock prices are the least variable from year to year while fodder prices are the most variable. Seasonality of prices of all products and especially of fodders has declined over time.

Knowledge of relative price relationships and variability over seasons and around trends is important for understanding patterns of change and resource allocation in the agricultural sector. In Pakistan, in particular, there have been no studies of changing relationships between crop and livestock prices. A recent report by Cheong and D'Silva (5) suggests that livestock prices may have increased more rapidly than grain prices but does not explore either annual or seasonal variability in prices. Given the close inter-linkages between crop and livestock activities in most Pakistan farming systems, especially through provision of fodder to animals, an analysis of relative price relationships and variability is important for understanding farmers' management (2, 7).

This paper examines price trends and variability for three groups of agricultural commodities; 1) grains, 2) livestock products and 3) fodders. Grains included were wheat to represent a basic food staple, and maize also a food grain but increasingly used for livestock feeding. Livestock products included were meat, poultry products, milk and desi ghee (locally made butter products from buffalo milk). Fodders included in the analysis were green fodder and the main dry fodder, wheat straw. The government has intervened strongly in wheat markets to control prices and has also unsuccessfully tried to enforce meat prices. Prices of some livestock products have been influenced by imports of substitutes (e.g. dry milk). No price policy interventions apply to maize or fodders nor are these products normally traded internationally by Pakistan.

The paper analyses prices for these commodities at two levels; 1) recent trends from 1971 to 1985 and variability around these trends, and 2) seasonality in prices, and trends in seasonality overtime.

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Data Sources and Methods of Analysis

Wholesale price data were taken from various published sources (8, 9, 10, 11, 13). These were supplemented by unpublished statistics, especially fodder prices collected by the Directorate of Economics and Marketing, Punjab. Grain and livestock prices were averages of several major markets (Karachi, Lahore, Peshawar, Faisalabad, Multan and Quetta). In the case of fodders, prices were analysed for Lahore and Faisalabad to represent an irrigated area, and Rawalpindi to represent a rainfed area. Data on fodder prices for rainfed areas were neither up-to-date nor complete and results should be treated with caution. Prices were deflated by the monthly Consumer Price Index series and trends estimated by simple time trend regressions. Year-to-year variability in prices around trends was computed by the Cuddy-Della Valle Index of Variability (4), $I = CV\sqrt{1 - R^2}$ where CV is the Coefficient of Variation of prices and R^2 the Coefficient of Determination of the linear time-trend regression. The lower the index the less the variability. Seasonal price indices were measured for deflated prices using the program, SEASON, in the MSTAT statistical package (14). Seasonal price data were, however, not available for livestock products.

Recent Trends and Annual Variability in Prices

Results of analysis of recent price trends are summarized in Table 1. The price of wheat, the major food staple, has declined significantly over time. Rapid technological change in wheat, setting of procurement prices below import prices (6) and recourse to wheat imports in most years underly this trend. Government price interventions in wheat markets have also apparently been reasonably successful in minimizing year-to-year variability in wheat prices, as measured by the Index of Variability. Maize prices, on the other hand, show no significant trend over time. Slower increases in productivity combined with rapid increases in demand for poultry and industrial uses have increased real prices of maize relative to wheat (1). Maize prices, determined by relatively free markets have also been more variable than wheat prices. However, with rapid increases in poultry production, maize and wheat have become close substitutes in poultry rations and this has stablized maize prices in recent years (1, 2).

Prices of livestock products show quite divergent trends. Prices of red meats (mutton and beef) have increased significantly. Relative stagnation in meat production and import controls on the supply side, combined with rapid increases in demand with rising incomes explain these trends. Other livestock products, milk and desi ghee, show no significant price trends. It is

Table 1. Changes in Real Prices and Indices of Variability in Prices of Crop and Livestock Products, 1971-1984

Item	Percent Change in Real Prices[a] (1971-1984)	Cuddy – Della Valle Index of Variability
Grains		
Wheat	–18**	7.1
Maize	NS	11.1
Livestock Products		
Mutton	+ 9*	3.8
Beef	+20**	5.5
Milk	NS	9.3
Ghee	0	5.4
Poultry	– 8*	3.8
Eggs	–52**	7.8
Fodders		
Irrigated		
Dry fodder	–46**	7.2
Green fodder	–23*	8.9
Rainfed		
Dry fodder	–50*	10.2
Green fodder	0	15.7

a Calculated from linear time trend regression, Y=a+bt.
NS non significant
** Significant at 1 percent level of probability
* Significant at 5 percent level of probability.

hypothesised that somewhat lower income elasticities of demand for these products together with imports of close substitutes (especially dry milk powder and vegetable ghee) have reduced upward pressures on these prices.[1] Finally, prices of poultry products have declined sharply in real terms, no doubt due to rapid technological change and high rates of growth in this industry. Per capita availability of poultry products increased by 400-500 percent from 1971-1984 while per capita availability of other livestock products was generally stagnant (12).

1. Over the same period real prices of vegetable ghee declined by 56% due to imports and a consumer subsidy.

Although government intervention in livestock markets has been much less than for grain markets, year-to-year price variability in livestock prices is generally less than for grains due to lower production variability. For example, the Index of Variability of wheat production from 1971 to 1985 was 6.4 compared to 1.4 and 2.7 for milk and beef production, respectively, over the same period.

Fodder prices are a crucial factor in the profitability of livestock production, particularly beef and milk. Fodder prices have declined sharply over the period, especially prices of dry fodder (The only exception is green fodder in rainfed areas for which we have noted the problems in data availability). Fodder prices are largely determined by domestic supply and demand and are not influenced by trade. On the demand side, there has been a rapid switch from bullock power to tractors in the Punjab over the period, decreasing the total number of animals. On the supply side, production of dry fodder is a perfect complement to wheat grain and hence the supply curve is almost perfectly inelastic with respect to fodder prices. Wheat production has expanded rapidly in both irrigated and rainfed areas and placed downward pressure on dry fodder prices. The decline in green fodder prices may relate to technological change (i.e. use of fertilizer on fodder crops) but may also reflect development of a better marketing infrastructure, including reduced transport costs which are a large component of fodder prices.

Year-to-year variation in fodder prices in irrigated areas is little different to variability in grain prices. However, variability in prices is much higher for both green and dry fodders in rainfed areas where production is subject to the vagaries of rainfall.

In sum, over recent years, relative to grain prices, livestock prices, especially meat, have increased and fodder prices have sharply decreased. Since fodder is the major component in the cost of producing beef and milk, these changing price relationship imply either increasing profitability of livestock relative to grain crops in Pakistan farms, or relative stagnation in technological change in livestock compared to grain crops. In fact, both processes appear to be in operation although there is a paucity of data on the economics of livestock production to further substantiate these conclusions. Changing relative prices of crop and livestock products have been in part supported by trade policy which has encouraged trade in grains (especially wheat imports) but has been relatively closed with respect to livestock products (especially meat).

Seasonal Price Variability

Analysis of seasonal price variability was completed for only grain and fodder prices. Monthly prices of livestock products were not available and in any event, are less likely to be subject to seasonal supply and demand fluctuations than crop products and by-products.

Three variables were computed to measure seasonal price variability:

1. The Grand Seasonal Index (GSI). This was calculated as the average monthly price (de-trended) divided by the twelve month moving average. [See (14) for details].

2. A Coefficient of Seasonality computed as the ratio of GSI for the three peak months divided by the GSI for the three slack months.

3. Trends in the Coefficient of Seasonality to measure how seasonality in prices has changed overtime. This was based on linear time-trend regressions on the Coefficient of Seasonality calculated for each year.

Seasonality Patterns

Results of the seasonality analysis are presented in Tables 2 and 3. The following general observations can be made.

1. Wheat grain prices in both irrigated and rainfed areas follow the expected seasonal patterns with prices gradually increasing from a minimum in the post-harvest period (June-July) to a maximum in the pre-harvest period (Feb-April). Maize prices also follow a similar pattern from the pre-harvest to the post-harvest period. However, because maize is a 'Kharif' crop, peak and slack months are the inverse of those for wheat, a 'Rabi' crop.

2. Green fodder prices closely reflect the supply pattern of green fodder, which in turn reflects temperature patterns in irrigated areas and rainfall patterns in rainfed areas. In irrigated areas, green fodder prices rise after the Kharif fodder crop is finished and remain high until berseem the Rabi fodder crop, is in full production in February. In rainfed areas, green fodder prices are also high in this period (due to both low rainfall and low temperatures) until the beginning of the harvest of mustard fodder (intercropped with

Table 2. Grand Seasonal Indices for Grains and Fodders, 1973-74

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Irrigated Areas												
Wheat grain	102.2	103.7	103.4	102.2	97.0	94.6	95.7	97.7	98.4	99.7	102.0	103.0
Maize grain	92.9	95.1	96.3	103.3	100.8	103.1	108.4	106.1	105.8	105.6	91.1	93.5
Wheat straw	111.9	110.0	104.1	103.4	89.9	83.6	86.4	92.9	99.2	103.0	106.1	108.7
Green fodder	109.0	100.4	93.0	80.7	87.5	83.9	95.0	95.2	99.7	110.3	119.8	125.0
Rainfed Areas												
Wheat grain	104.5	107.0	105.9	105.6	96.0	95.1	92.9	97.3	96.6	97.3	100.6	101.0
Maize grain	96.8	98.4	99.3	101.5	101.6	100.0	109.9	103.9	107.6	98.1	92.3	90.6
Wheat straw	106.4	104.9	104.1	108.6	102.8	97.2	92.9	81.8	92.4	98.6	105.2	105.0
Green fodder	105.6	94.9	96.2	86.5	102.6	97.7	89.6	87.2	91.1	107.8	112.1	128.8

Table 3. Coefficient of Seasonality and Trend in Seasonality of Grains and Fodders in Irrigated and Rainfed Areas, 1973-84

	Coefficient of Seasonality	Time Trend in Coefficient of Seasonality
Irrigated Areas[a]		
Wheat grain	114	−1.73**
Maize grain	132	−3.35*
Dry fodder	142	−4.42**
Green fodder	160	−5.68*
Rainfed Areas[b]		
Wheat grain	118	NS
Maize grain	133	NS
Dry fodder	148	−3.39*
Green fodder	161	NS

** Significant at 1 percent level of probability
* Significant at 5 percent level of probability
NS Non significant
a Data avilable 1973-84 only
b Data available 1973-1981 only

wheat). A secondary peak in green fodder prices in rainfed areas occurs during the dry period of May/June.

3. Dry fodder prices reflect both wheat prices (i.e. seasonal supply of wheat straw) and green fodder prices (green fodder is a close substitute to wheat straw fed with oil seed cake) (Figure 1). In rainfed areas, the lowest price of wheat straw occurs in August when wheat grain prices start to rise, but when ample green fodder is available due to monsoon rains. In irrigated areas, green fodder prices are lowest in April, while wheat straw prices are supported by low stocks of dry fodder in the pre-harvest period.

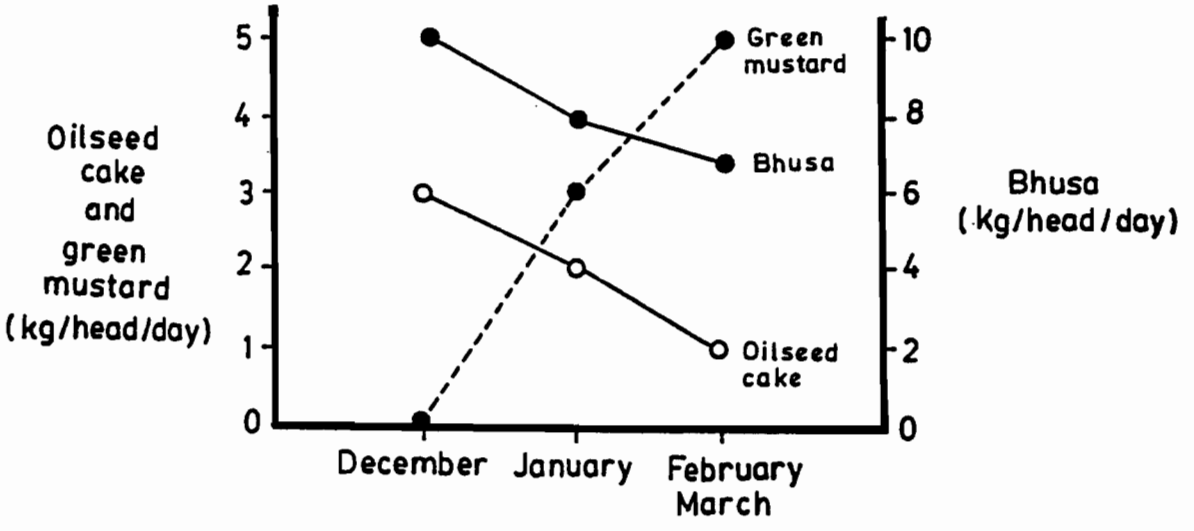
4. Maize prices, are substantially more seasonal than wheat prices. Seasonality of wheat prices is reduced by the government policy of maintaining a fixed procurement price throughout the year which discourages private stock holdings of wheat (3).

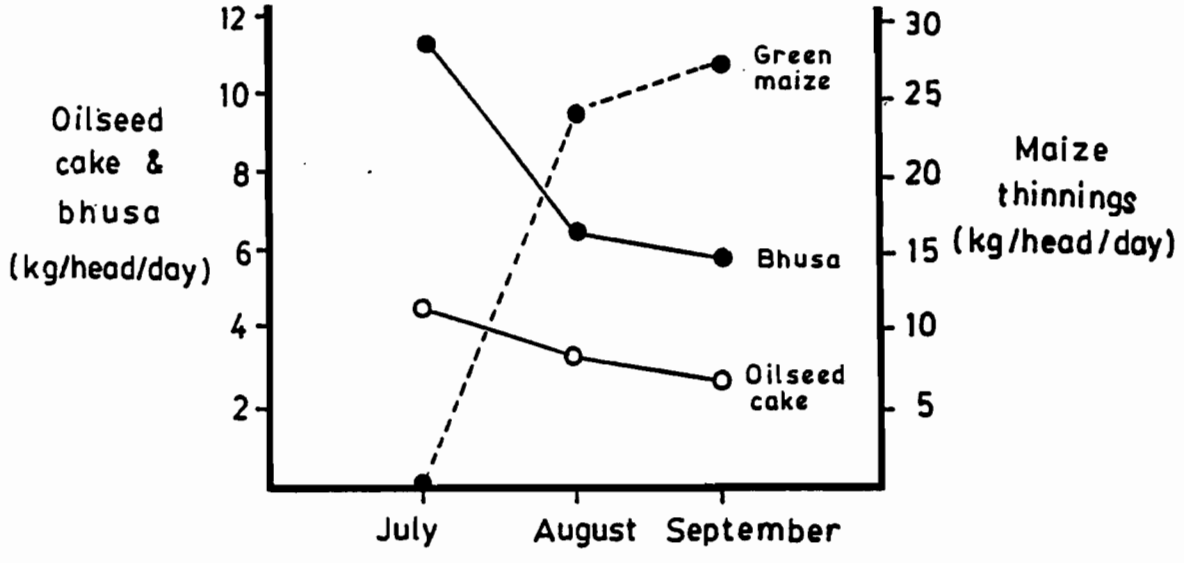
5. Fodder prices show significantly more seasonal variability than grain prices and within fodders, green fodder prices are somewhat more variable than dry fodder prices due to non-storability. However, there is little difference in degree of seasonality of fodder prices between rainfed and irrigated areas.

Trends in Seasonality

The time-trend of the Coefficient of Seasonality reveals interesting structural changes in grain and fodder markets. The degree of seasonality in grain prices has declined somewhat, especially for maize in irrigated areas. An increasing share of wheat being marketed under the procurement system and the increased demand for maize in industrial uses and feed rations, where there are close substitutes, have decreased seasonal price fluctuations for grains. In addition, seasonal price fluctuations in fodder prices, especially green fodder prices, have decreased dramatically in recent years (Table 3). Three factors may explain this. First, fodder markets have generally become more developed and more integrated. Improved roads and transport services enable fodder to be transported over a wider area and it is now common to see both green and dry fodder being transported from irrigated to rainfed areas. Second, improved supplies of irrigation water, especially tubewells, have enabled planting and harvesting of fodder crops to be staggerred over a longer period and reduced seasonality in fodder supplies. Finally, the use of oilseed cake as a substitute for green fodder has undoubtedly increased with increasing rural incomes. Since the price of oilseed cake shows little or

Figure 1. Inter-relationship between oilseed cake, wheat straw and green fodder used as fodder in Rabi and Kharif seasons Punjab rainfed areas, 1984.





Source: Supple et al (15)

no seasonal price fluctuation, increased use of oil seed cake should help smooth seasonal fluctuations in both green and dry fodder prices.

Conclusions

Recent trends in grain, livestock and fodder prices, both annual and seasonal, suggest a number of useful hypotheses for further research. Increasing livestock prices in the light of decreasing real fodder prices point to the need for greater efforts to increase productivity of traditional livestock enterprises, particularly buffaloes and cattle. At the same time, low year-to-year variability in fodder and livestock prices despite little direct government intervention in these markets, suggest that there is little price risk to farmers in using improved livestock production technology.

Seasonal variability in fodder prices is significantly higher than for grain prices and there is strong evidence of a decline in seasonality with the development of more effective markets for fodder. The results of this study support the need for more research on the changing relationship between crop and livestock prices and their implications for resource allocation at both the farm level and in government expenditures in the agricultural sector. They also point out deficiencies in recording of price data, particularly fodder prices, for undertaking the needed research in these areas.

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