Reliability of Pakistani Agricultural Price Data

by

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Prices have important allocational and distributional implications in a market economy. This is equally true for the prices of agricultural commodities in developing countries. In their decision to allocate land among different crops, farmers in developing countries have been found to be quite sensitive to changes in relative prices [1]. Also relative prices between the agricultural and non-agricultural sectors are considered to be important determining factors in the sectoral distribution of income and the development of the modern sector [2].

In Pakistan, a number of empirical studies have been carried out to explain the pattern of growth in the agricultural and non-agricultural sectors with the help of changes in relative price movements among different agricultural crops, or among manufactured consumption and capital goods, or between agricultural and manufactured goods [3,4,5,6]. The validity of the results derived from these studies would depend greatly on the reliability of the basic price data. Thus it is important that an attempt be made to judge the reliability of the agricultural price data.

This paper is divided into six sections. The first section details the complex system of agricultural marketing in Pakistan. The second section describes the institutional system adopted to collect the price information and publish such prices as different series. The third section briefly reviews the previous attempts in Pakistan to judge the quality of agricultural price data. The fourth section describes the methodology of the sample surveys that reliability of generated a fairly reliable set of prices. These prices are used to judge the the official price data in section five. The last section presents some concluding comments and suggests lines of enquiry for further work in this area.

I

Our main purpose in the description of the agricultural marketing system in Pakistan is to assess the difficulty of gathering the relevant price data.

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The structure of agricultural markets in Pakistan is complex and shows considerable variety for different commodities [7, 8]. This variety implies that the difficulty of price estimation would vary from commodity to commodity. For this reason the reliability of different prices may differ from commodity to commodity.

There are direct and indirect methods of agricultural marketing. Direct marketing implies that the farmer sells directly to the consumer or the retailer in rural or urban areas. Indirect marketing involves one or more intermediaries between the producer and the consumer.

The system of direct marketing in Pakistan is mainly prevalent in the distribution of perishable agricultural products and of those farm goods which need little or no processing. Milk, eggs, some fruits and vegetables comprise this group. The markets for this group of commodities are of a generally localized nature. Prices in some of the markets may significantly diverge from others but not attract competing supplies from other markets. No simple geographical consistency test for prices in different markets can be devised. Buyers and sellers of these products do not generally keep records of prices. Consequently the only method to ascertain the prices of these commodities in each local market is to design sample surveys based on the memory of sellers, and conduct them periodically.

The system of indirect marketing is more complex but does not cause such serious difficulties in the process of collection of price data as in the case of direct marketing. Due to the limitations of the direct marketing system, a major portion of trade in agricultural commodities in Pakistan involves the use of a number of intermediaries between the producer and the consumer. Trading is generally carried out where buyers and sellers come into close contact through their agents. Business practices in the market place are governed by the rules of behaviour laid down in various legislative acts by the government. Records of the prices are kept for each transaction.

Generally more than one intermediary exists between the farmer and the consumer. Since our interest is mainly with prices received by the farmer, we shall only describe the status and role of the intermediaries that come into contact with the farmer.

The grower sells his produce mostly to the village shopkeeper and/or to the itinerant dealer (*beopari*) who collects the produce from his farm or village home. An estimate of the produce sold in this manner is presented in Appendix Table I.

The rich farmer normally transports his produce to the market towns and sells it through the selling agents (*kacha arhtia*) to the buying agents (*pacca arhtiya*). The brokers (*dalals*) sell information on ruling prices in the market place both to buying and selling agents and help in finalising the deal. Buying and selling agents charge a certain percentage of the market price as remuneration for help in finalizing the transaction. The data on ruling prices can be obtained from the books of both the selling and buying agents and should match in theory. This is a good check on the reliability of the reported prices. Most of the grain crops and cash crops are disposed off in these primary markets called "*mandies*". Village shopkeepers and itinerant merchants who buy directly from farmers in the villages also sell their merchandise in these markets. Data collected from these markets can be quite reliable.

Wheat and rice are the only major crops the government buys from farmers in Pakistan. Farmers are price-takers and data on prices is easy to come by.

Some crops like sugarcane are sold directly to the processer. Sugar factories are price-makers and they are obligated to buy all that is offered. Data on prices is easy to come by and is quite reliable.

Marketing of livestock for slaughtering purposes in Pakistan is complicated because the grading of animals is a difficult task. Such price data is perhaps the most difficult to obtain.

This brief account of the marketing structure in Pakistan points out that the pirce data for grain and cash crops is the easiest to collect and that for perishable and livestock products the most difficult. The appraisal of the data for reliability is also easier for grains and cash crops as compared with the prices for perishable commodities and livestock. The markets for the first category of commodities are more integrated and the price differentials between different markets may not be substantial as competing supplies from other markets would drive the prices down. If glaring discrepancies between the prices of these goods are detected, one could start suspecting the quality of such data. No such consistency test can be applied to the prices of goods in segmented markets. This is due to the inherent nature of the commodities or monopoly or monoposony conditions or high transport costs.

II

Official Data on Agricultural Prices

There are two different sets of agricultural prices collected and published by the government of Pakistan. The first set of figures is defined as "harvest prices" and is published by the Director of Land Records, Northern Zone West Pakistan in the "Report on the Season and Crop" each year [9]. The second set is published in "Market and Prices" each month by the Agricultural Marketing Adviser [10].

The harvest price of a commodity is defined as the price received by the producer at the village market during the harvesting period. The data are collected from a variety of village markets during the specified period of six to eight weeks. A median price is computed for various districts [11]. The data at the village level is collected by the office of Field Kanungo (a revenue official). These prices cover 12 major crops only and 27 districts in West Pakistan. The crops are rice unhusked, wheat, barley, jowar, bajra, maize, gram, rape seeds, toria, raw sugar, cotton, and tobacco. Consequently coverage is quite limited regarding both commodities and areas in West Pakistan.

The prices published by the Agricultural Marketing Adviser are wholesale prices of agricultural and livestock products in important markets of Pakistan. The commodity and area coverage is quite extensive. The prices of different varieties of each commodity are generally listed as well. Prices of new products or new varieties as they appear in the production plan of the farmer are also included. Mexipak wheat and Irripak rice are listed separately from the older varieties of wheat and rice—albeit with a gap of about three years.

III

Several questions can be asked about the two sets of data. What is the real meaning of each definition of prices? Could one or both be used as an index of prices received by farmers? How good a measure is each set of prices? No attempt will be made to argue that this data is accurate in an absolute sense. All that is being attempted is to see whether the data is "sufficiently" accurate to be used in the analysis. By the word "sufficiently" we mean a maximum allowable percentage error. This specified allowable percentage error would depend on the question asked.

There are at least three methods to judge accuracy of the data being tested. One method is to examine the adequacy of the institutional arrangements for data collection. This can be supplemented with an analysis of the practical working of the administrative machinery. Another method is to compare the collected data with regularities that the series is supposed to have. Widespread divergences would cast doubt on the accuracy of the data. The last method is to collect alternative series of data with comparable concepts and a known level of accuracy. This series can then be compared with the data being tested for accuracy.

In Pakistan, the first method has generally been applied to test the quality of price data. It has been argued that the revenue officials responsible for the collection of harvest prices are preoccupied with other work and do not take this task seriously [12]. In connection with wholesale prices, it has been argued that the staff reporting prices is inadequately trained and inefficient [13]. Their task is complicated by the lack of standard grades for different commodities, They depend on doubtful prices supplied to them by commission agents [14]. The nutshell of all these arguments is that the published harvest and wholesale prices in Pakistan are considered unreliable.

The second method has been applied by Professor Falcon who studied harvest price data for 10 major crops for a 30-year period [11]. He found a reasonably good geographic consistency in prices between districts in the Punjab, contrary to the major conclusions reached by a priori reasoning of the first method.

No attempt to apply the third method has been made in Pakistan. We present results of this new approach for two reasons. First, the results of the other two methods are contradictory. We present new evidence on this issue. Second, it is an attempt to evolve a suitable methodology to appraise price data in developing countries.

IV

The alternative data on harvest and wholesale (i.e. ex-mandi) prices was provided by two sample surveys conducted by two students of Agricultural Economics at the Lyallpur Agricultural University [15, 16], under the close supervision of a professor of economics.

West Pakistan is divided into northern and southern zones. The northern zone comprises the administrative divisions of Sargodha, Lahore, Rawalpindi, Dera Ismail Khan and Peshawar. The southern zone comprises the administrative divisions of Multan, Bahawalpur, Khairpur, and Hyderabad. The Quetta and Karachi region are ignored in this survey.

One district was selected from each division. Within each district, several wholesale markets (i.e. mandies) were selected. From each market five percent of the commission agents (selling or buying agents) were selected at random. One village from the orbit of each selected market was selected. From each selected village, 40 farmers were selected at random. Three types of tenures (owner, owner-cum-tenant, tenant) and three size of farms (small, medium, large) were distinguished for the collection of data and were represented in the sample. In all 26 markets and 1170 farmers were covered by the survey.

Seven commodities were selected: wheat, gur, American cotton, toria, sarson, paddy, and desi-sugar. The recorded prices are unit values of the commodities sold in the village or in the mandies. The data presented is on a monthly basis over a two year period of study. For the southern zone, the data pertains to the year ending 30th June, 1966 and for the northern zone to the year ending 30th June, 1967.

The design and execution of the survey was carried out by skilled people. Thus the prices collected should be quite accurate.

V

This section presents the results of the comparison between the survey and the official price data. Survey data provides monthly information on harvest prices and ex-mandi wholesale prices for wheat, American cotton, gram, gur, desi-sugar, paddy, and toria for some of the districts of Multan, Sukkur, Rahimyarkhan, Hyderabad, Lyallpur, Gujrat, Sheikhupura, Dera Ismail Khan and Peshawar. All these crops belong to the category for which the collection of data is relatively easy.

Harvest price data published by the government is for the same category of crops as the survey data. Twelve crops and 27 districts were covered. But the official harvest price data is more limited than the survey data, in that official data pertains to the prices ruling during 6 to 8 weeks after the crop harvested starts coming into the market. Consequently the comparison between the survey and the official prices should be made only for similar periods. For this study, the data on harvest prices for the years of 1965-66 and 1966-67 was not available. Therefore, we can only judge the reliability of the wholesale prices.

The published data on wholesale prices is more extensive in terms of commodities and district markets than the survey data regarding the "mandi" prices. Consequently our appraisal of those prices would be limited only to the subset of commodities for which data is easier to collect. Furthermore our analysis was confined to the crops and districts for which official data was made available to us.

There are some differences in the definitions of the survey and official wholesale prices that must be clarified. The official wholesale prices pertain to the prices prevailing in "important" wholesale markets. Usually these markets are in big towns or in district headquarters. The survey selected 4 or 5 markets from each district. Thus the survey data mostly belongs to the smaller markets. For this reason, we may expect a price differential between the two set of price data, caused by the cost of transporting commodities between markets.

The data on wholesale prices is presented in the Appendix Table II. The similarity of the series can be tested by three different statistical methods.

The first relationship tested is the degree of correlation between the two series. Correlation co-efficients are computed between the two sets of data for the absolute prices in each month and also between the first differences of the monthly prices. Results are presented in Table I.

The correlation co-efficients are all positive and in most cases quite large. For absolute prices, in four out of seven cases, the co-efficients are significantly different from zero at the one per cent probability level. In the remaining three cases the co-efficients are significantly different from zero at the 5 per cent probability level. The degree of correlation between the first differences is also positive and quite large. In three cases, the co-efficients are significantly different from zero at the 1 per cent probability level. In another three cases, the co-efficients are significant at the 5 per cent probability level. For cotton, we get a positive correlation co-efficient but it is insignificant at the 5 per cent level.

We also test whether the correlation co-efficients are different from one. We would expect, if the official price data is collected with a high degree of accuracy, the two sets of data to have a high positive correlation approaching unity. In the case of both the absolute and the first differences, in six out of seven cases the correlation co-efficients are not significantly different from 1 at the 5 per cent level of significance.

We also test the relationship between the two series by means of a linear regression. Two models are employed in this connection. The first relationship tested was:—

$$P_{ot} = a + b\,P_{st} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where P_{ot} is the price for the month t from the official source and P_{st} the price for the month t from the survey source. The results are presented in Table II.

In all seven cases the 'b' co-efficients are of the right sign; an increase in the price from the survey sources is associated with an increase in the price from the official source. In five cases the 'b' co-efficients are significantly different from zero at the 7 per cent significant level. In the two remaining cases, the co-efficients are significantly different from zero at the 5 per cent significance level. The proportion of variance explained varies from 37 per cent in Multan wheat to 98 per cent in Sheikhupura wheat. In most cases, the proportion of variance explained is quite high. We have also presented the elasticity co-efficients calculated at the means in Table 2. These co-efficients range from .71 to 1.11, and most are clustered around the level of one. This is interpreted as implying that 1 per cent change in the price recorded in survey is roughly associated with 1 per cent change in official prices.

We also tested the hypothesis that the 'b' co-efficients are equal to 1. In six out of seven cases, the co-efficient was not significant at the 1 percent significance level. In the remaining case, it was not significant at the five percent level. Thus official prices are not significantly different from the survey prices.

We also test the linear relationship between the first differences in prices from the two sources. The regression lines were:

$$\triangle P_{ot} = a + b \triangle P_{st} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where $\triangle P_{ot} = P_{ot} - P_o (_{t-1})$, and $\triangle P_{st} = P_{st} - P_s(_{t-1})$. The results are shown in Table III. It must be noted that this test is relatively stricter than the one given by equation (1).

All the co-efficients are of the right sign. Two co-efficients are significantly different from zero at the 1 per cent level, three are significant at the 5 per cent level and two are significant at the 10 per cent level. The proportion of variance explained varies from 20 per cent to 83 per cent.

We also test these co-efficients to be different from 1. In all seven cases the co-efficients are not significantly different from one at the 1 per cent significance level. This evidence strengthens our early findings that official prices are not significantly different from survey prices.

We test the hypothesis that population means and variances of official and survey price data are not different at the 8 percent probability level. Thus if the t and F values calculated are smaller than those at the 1 per cent significance level in the relevant t or F tables, we shall accept the hypothesis. In doing so, we accept the risk of our judgement being incorrect once out of 100 samples in case large number of samples of such series are selected.

Table IV presents the details of means, variances and t and F values. In all seven cases t values are less than those in the tables for t—distribution at 1 per cent level. We accept the hypothesis that the means of the two series are not significantly different from each other. Similarly F values are also less than the table values. We also accept the hypothesis that the variances of the two series are not significantly different from each other.

The overall conclusion is that there is a basic similarity between the two series of prices. This is indicated by correlation analysis, regression analysis and by the t and F tests concerning means and variances.

To recapitulate, we found that the nature of the agricultural marketing system in Pakistan varies from crop to crop. We indicated, because of this variation, that the reliability of prices for each subset of commodities should be appraised separately. We argued that it was easier to collect prices for grains and cash crops, than those for milk, eggs, poultry, vegetables, fruits, livestocks and animal products.

The official harvest price data is limited only to major or minor grain and cash crops. We have not compared the survey data with such official prices as we had no access to official data. When this access is possible, we hope to extend analysis to such prices.

The official wholesale prices have more crop and area coverage than the survey data. Unfortunately survey data was limited only to the grain and cash crops. Therefore, we could not test the reliability of data for the commodities for which data is difficult to collect.

For the commodities and districts that we compared the 2 sets of data, we found a high degree of closeness and similarity between the two series. The implication is that official data collecting agencies are reliable.

Could we generalize from this and maintain that prices for other commodities would be as reliable as for those that we examined in our study? We have already hinted at some difficulties in the way of such a generalization. Since the reliability of data is a function of the ease with which such data can be collected and the amount of effort expended in such an endeavour, unless we know how determined the Pakistani authorities are to ensure a given level of accuracy in all prices, we can not conclude that prices for difficult cases would be more un-reliable. Only further empirical analysis can establish the quality of price data for the remaining agricultural commodities.

TABLE I

CORRELATION COEFFICIENT BETWEEN THE OFFICIAL PRICES AND SURVEY PRICES IN PAKISTAN

Crops / Districts	Wheat		Gur (Sugarcane product)		Cotton	
	Absolute Prices	First Differences	Absolute Prices	First Differences	Absolute Prices	First Differences
Lyallpur	.9690**	.9701**	.8531	.9279**	N.A.	N.A.
Multan	.6530*	.6461*	.8531**	.7875**	.7184*	.5624
Peshawar	N.A.	N.A.	.8264*	.8186*	N.A.	N.A.
Shiekhupura	.9919**	.7658*	N.A.	N.A.	N.A.	N.A.

Notes : *Means significant at 5 per cent level.
**Means significant at 1 per cent level.

TABLE II

A. LINEAR REGRESSIONS BETWEEN OFFICIAL AND SURVEY PRICES FOR THE MODEL ($P_{ot} = a + b\ Pst$) IN PAKISTAN

Crop	District	Regression equations [a] $P_{ot}=a+bP_{st}$	Number of observations	$\bar{r}^2$
Wheat	Multan	$P_{ot}=4.3903+.6972P_{st}$ (3.9520) (.2556)*	12	.3693
	Lyallpur	$P_{ot}=.9011+.9420\ P_{st}$ (2.0776) (.1075)**	7	.9267
	Sheikhupura	$P_{ot}=.3019+.9280\ P_{st}$ (.9741) (.4862)	8	.9811

Table II—*contd.*

Gur	Peshawar	$P_{ot} = 5.5815 + .8453\ P_{st}$ (4.4884) (.2333)**	8	.6340
	Multan	$P_{ot} = 1.5625 + .9622\ P_{st}$ (3.1496) (.1861)**	12	.7005
	Lyallpur	$P_{ot} = -.9094 + 1.0574\ P_{st}$ (2.3857) (.1390)**	8	.8905
Cotton	Multan	$P_{ot} = -6.0767 + 1.1904\ P_{st}$ (16.7086) (.4357)**	9	.4469

B. ESTIMATED ELASTICITY BETWEEN OFFICIAL AND SURVEY PRICES AT THE MEAN

Crop	District	Elasticity at Mean $= b\frac{s}{o}$
Wheat	Multan	.71
	Lyallpur	.95
	Sheikhupura	.98
Gur	Peshawar	.73
	Multan	.91
	Lyallpur	1.06
Cotton	Multan	1.11

(a) Figures in parenthesis are standard errors of coefficient
*Significant at 5%
**Significant at 1% level.
(b) $\bar{r}^2$ is adjusted for degrees of freedom.

TABLE III

LINEAR REGRESSIONS BETWEEN FIRST DIFFERENCES IN OFFICIAL AND SURVEY PRICES IN PAKISTAN

Crop	District	Regression equations (a) $\triangle P_{ot} = a + b\triangle P_{st}$	Number of observation	$\bar{r}^2$
Wheat	Multan	$\triangle P_{ot} = .7477 + 1.1112\triangle Pst$ (.2391) .3094*	11	.3527
	Lyallpur	$\triangle P_{ot} = .5491 + .5691\ \triangle P_{st}$ (.4664) (.4376)x	6	.3228
	Sheikhupura	$\triangle P_{ot} = .6769 + .4543\triangle P_{st}$ (.2896) (.1766)*	7	.5037

Table III—*contd.*

Gur	Peshawar	$\triangle P_{ot} = -.5013 + .9199 \triangle P_{st}$ (1.7552) (.2886)*	7	.6041
	Multan	$\triangle P_{ot} = -.3096 + .9745 \triangle P_{st}$ (.7352) (.2342)**	11	.5780
	Lyallpur	$\triangle P_{ot} = .3103 + 1.1060 \triangle P_{st}$ (.6499) (.1988)**	7	.8331
Cotton	Multan	$\triangle P_{ot} = .4082 + .5332 \triangle Pst$ (.6680) (.3200)x	8	.2023

Notes: xSignificant at 10% level
*Significant at 5% level
**Significant at 1% level
(a) The figures in parenthesis are standard errors of coefficients.

TABLE IV

MEANS, VARIANCES, t AND F VALUES FOR PRICES 1965/66 AND 1966/67

Crops	District	Means		Variances		t-value	F-value
		Official	Survey	Official	Survey		
		Rs/M	Rs/M	Rs/M	Rs/M		
Wheat	Multan	15.16	15.45	0.40	0.35	.3351	1.1428
	Lyallpur	18.96	19.17	18.91	19.17	.0557	1.070
	Sheikhupura	18.66	19.78	13.98	11.89	.0220	1.1758
Gur	Peshawar	21.33	18.61	28.03	26.92	.3688	1.0412
	Multan	17.53	16.64	13.46	10.58	.0222	1.2722
	Lyallpur	16.95	16.89	22.60	10.36	.0627	2.1818
Cotton	Multan	39.52	38.30	10.59	3.95	.3213	2.7529

Notes: (1) All t-values and F-values are significantly not different from zero at 1 per cent probability level.
(2) Source is Appendix Table—II.
(3) Prices are in rupees per maund.

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APPENDIX

TABLE I

PROPORTIONS OF AGRICULTURAL PRODUCE SOLD IN VILLAGE OR TOWN MARKETS IN PAKISTAN DURING 1965/1966 AND 1966/1967

District		Wheat	Cotton	Gram	Gur	Desi sugar	Paddy	Toria
Multan	V	61.61	93.00	N.A.	74.07	N.A.	N.A.	98.38
	M	38.39	7.00		25.93			1.62
Sukkur	V	98.75	N.A.	100	N.A.	N.A.	70.20	99.34
	M	1.25		0			29.80	.66
R.Y. Khan	V	66.32	73.20	N.A.	65.84	N.A.	N.A.	86.80
	M	33.68	26.80		34.16			13.20
Hyderabad	V	98.44	100	N.A.	91.33	N.A.	66.44	N. 4.
	M	1.56	0		8.67		33.56	
Lyallpur	V	25.81	37.45	N.A.	28.26	33.76	N.A.	28.70
	M	74.19	62.55		71.74	66.24		71.30
Sheikhupura	V	44.52	N.A.	N.A.	47.47	N.A.	42.78	N.A.
	M	55.48			52.53		57.22	
Gujrat	V	62.98	46.20	N.A.		N.A.	42.33	78.83
	M	37.02	53.80				57.67	21.17
D.I. Khan	V	N.A.	N.A.	N.A.	8.63	N.A.	N.A.	N.A.
	M				91.37			
Peshawar	V	N.A.	N.A.	N.A.	7.03	N.A.	N.A.	N.A.
	M				92.73			

Notes: V = sold in village markets.
M = sold in town markets.

Source: [13,14]

APPENDIX

TABLE II

WHOLESALE PRICE DATA FOR WHEAT, COTTON, GUR IN WEST PAKISTAN (Rs. per maund)

		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Wheat													
Lyallpur	S	—	—	—	—	16.44	17.30	17.02	18.48	19.66	21.39	23.90	—
	O	—	—	—	—	15.62	16.65	17.28	19.28	20.03	20.69	23.16	—
Sheikhupura	S	—	—	—	—	16.29	16.46	17.00	18.65	20.00	20.37	23.77	25.67
	O	—	—	—	—	14.87	15.75	16.12	17.75	18.50	20.00	22.37	23.87
Multan	S	16.25	16.49	15.22	14.82	14.90	14.63	15.08	15.43	15.85	15.48	15.23	16.05
	O	15.26	16.82	14.37	14.50	14.75	15.37	14.94	15.46	15.50	14.94	14.94	15.12
Gur													
Multan	S	14.63	14.60	13.64	12.95	14.11	13.43	22.30	20.45	20.78	18.81	17.36	16.57
	O	16.12	15.00	14.50	14.50	13.75	12.50	22.00	19.67	20.62	21.00	23.50	17.67
Lyallpur	S	14.77	16.05	15.27	17.07	21.49	22.06	—	—	—	—	15.50	12.96
	O	13.33	16.87	16.50	17.25	22.62	21.75	—	—	—	—	13.83	13.51
Peshawar	S	14.00	14.50	16.90	19.00	23.58	28.95	—	—	—	—	15.00	17.00
	O	17.00	24.00	18.67	22.00	26.87	30.00	—	—	—	—	15.75	16.25
Cotton													
Multan	S	39.22	38.41	38.17	39.91	40.35	—	—	—	37.19	35.27	35.59	40.61
	O	39.44	42.69	42.75	43.00	41.80	—	—	—	36.85	35.67	34.59	38.87

Notes: (1) S means survey data.
(2) O means official data.
(3) Data for district Multan is for 1965/66 while for other districts it is for 1966/67.