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MARKETING EFFICIENCY FOR SELECTED CROPS IN SEMI-ARID TROPICAL INDIA

V.T. Raju and M. von Oppen

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics
ICRISAT Patancheru P.O.
Andhra Pradesh 502 324, India

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CONTENTS

		Page
1.	INTRODUCTION ..	1
2.	OBJECTIVES ..	2
3.	PAST STUDIES ON MARKETING EFFICIENCY	2
	3.1 Marketing margins	2
	3.2 Price correlations	4
4.	PRESENT STUDY OF MARKETING EFFICIENCY	4
	4.1 Marketing margins as a measure of marketing efficiency	4
	4.1.1 Methdology ..	4
	4.1.2 Results and discussion	8
	4.2 Correlation coefficients as a measure of marketing efficiency	11
	4.2.1 Methodology ..	11
	4.2.2 Results and discussion	11
	4.3 Comparison of two measures of marketing efficiency	16
5.	QUANTIFICATION OF MARKETING EFFICIENCY	23
	5.1 Methodology ..	23
	5.2 Results and discussion	25
6.	CONCLUSIONS ..	36
7.	REFERENCES ..	39
	Appendix Tables ..	41-50

Marketing Efficiency for Selected Crops in Semi-Arid Tropical India

V.T. Raju and M. von Oppen*

1. INTRODUCTION

An efficient farm marketing system is an important means for raising the income levels of farmers and for promoting the economic development of a country. The farmers allocate their resources according to their comparative advantage and invest in modern farm inputs to obtain enhanced productivity and production. This, in turn, contributes to increased market surplus of farm products and increased interregional trade, which increases demand for capacity increases in market facilities. Hence, policies to improve the efficiency of agricultural marketing would have a self-accelerating effect on productivity. However, before formulating any such policies, it is necessary to find out the degree to which the existing marketing system can be called "efficient" and also to identify and quantify the impact of relevant factors that determine efficiency of marketing system, so that improvements can be directed towards factors which are crucial in determining efficiency.

The objective of this report is to describe the marketing efficiency of ICRISAT crops (sorghum, pearl millet, pigeonpea, chickpea, and groundnut) in different regions of India. This report forms a part of a research project conducted at ICRISAT. The other part of the research project is reported separately (see Raju and von Oppen, 1980).

Generally, market efficiency is measured in two ways: (a) Operational efficiency and (b) pricing efficiency. Operational efficiency is measured in terms of marketing costs and marketing margins. These measures do not provide an absolute measure of overall market efficiency. Pricing efficiency is measured in terms of correlation of price movements of the same product in separate markets. While such correlations give

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* Economist and Principal Economist, respectively at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India. The authors are grateful to Drs. J.G. Ryan, H.P. Binswanger, J.R. Behrman, J.B. Hardaker, and D. Jha for their valuable comments and suggestions on earlier drafts of this paper and to S. Varma for editorial assistance.

indications of the degree of integration between markets, they too do not provide an absolute measure of market efficiency. Generally it is accepted that the higher the correlation of prices between pairs of markets for a particular product, the better integrated the markets are for that crop and hence, the more efficiently are they operating in terms of price.

2. OBJECTIVES

An attempt is made in this study to compare marketing margins and price correlation as measures of marketing efficiency. More specifically the objectives are:

(a) to examine some of the studies conducted on marketing margins and correlation coefficients as measures of marketing efficiency;

(b) to calculate marketing costs and marketing margins for the five important Indian SAT crops: sorghum, pearl millet, pigeonpea, chickpea, and groundnut for different agencies involved;

(c) to calculate correlation coefficients between markets for these five crops;

(d) to attempt a comparison between marketing margins and correlation coefficients as measures of marketing efficiency; and

(e) to identify the criteria determining marketing efficiency.

3. PAST STUDIES ON MARKETING EFFICIENCY

3.1 Marketing Margins

Studies in the past on price spreads and marketing margins in India were concerned primarily with rice and wheat. A few studies were conducted on pearl millet, chickpea, sorghum, and groundnut. Pigeonpea was not covered at all. The results of these studies on net marketing margins are summarized in Table 1. For comparison, the results reported were converted into percentages of consumer price. Wherever several markets or areas were studied, the results were averaged over markets or areas. Table 1 shows the large variability of the producers' share in the consumers' rupee as well as of marketing margins across crops and areas. Most of the studies measured only marketing margins and costs; the efficiency of marketing was

Table 1. Summary of studies on price spreads of foodgrains in India.

Crop	Year	Area	Producers' share in consumers' rupee	Net marketing margins as percentage of consumers' price			Ref. No.
				Wholesaler	Miller	Retailer	
Rice	1959-60	Madhya Pradesh - two pairs of markets	76	3.2		9.2	[18]
Rice	1976-77	Kurukshetra district of Haryana - two markets	56		22.7	7.0	[6]
Wheat	NR*	3 pairs of markets in Rajasthan	88	3		5	[10]
Wheat	NR	Gurdaspur district, Punjab	83	3.5	6.5	3.3	[15]
Wheat	1969-70	Rajasthan	88	3		3	[20]
Wheat	1971-72	2 markets of Gujarat	78	8.5		7.5	[21]
Wheat	1966-67	4 markets of Hissar district of Haryana	77	15		6	[9]
Sorghum	1971-72	2 markets of Gujarat	74	10		9	[21]
Pearl millet	1971-72	2 markets of Gujarat	72	12.5		9	[21]
Pearl millet	NR	2 markets of Jaipur district, Rajasthan (one regulated and other non-regulated): Reg.	89	5		6	[19]
		Non-Reg.	86	6		7	[19]
Chickpea	1966-67	4 markets of Hissar district of Haryana	81	10.5		4	[9]
Chickpea	1967	Ludhiana of Punjab	86	4		6.5	[5]
Groundnut	1964-66	Khanna Market of Ludhiana district, Punjab	65	1.5		12	[8]

* NR = Not reported.

not evaluated. In view of the limited number of markets that were included in these studies, it would indeed be difficult to draw conclusions as to overall market efficiency on the basis of any of these studies. A comparative evaluation of these results is not possible because the methodologies applied are not comparable, and therefore general conclusions can only be drawn subject to careful qualifications.

3.2 Price Correlations

Correlation analysis is another frequently employed approach to measure marketing efficiency. Most of the studies conducted in the past were on wheat and sorghum. Only one study was found on paddy, pearl millet, and groundnut. No study was conducted for the remaining foodgrains.

The past studies (Table 2) indicate that correlation coefficients of prices in foodgrain markets vary considerably across markets for all crops. Unlike the studies of marketing margins, the analyses of price correlation coefficients provide results which would seem to be comparable across markets and crops as long as comparable price series (weekly prices) for the same years are taken. Unfortunately, this is not always the case, and the past studies thus do not provide a basis for a general conclusion either.

4. PRESENT STUDY OF MARKETING EFFICIENCY

4.1 Marketing Margins as a Measure of Marketing Efficiency

4.1.1. Methodology

Three selected markets of Andhra Pradesh, namely Warangal, Khammam, and Tandur were studied in detail and marketing margins were calculated together with correlation coefficients for comparison. All the five ICRISAT crops are traded in these markets. In 1974-75, out of total market arrivals, ICRISAT crops amounted to about 40% in Warangal, 60% in Khammam, and 65% in Tandur [1].* The data were collected by survey method through questionnaires from market committees, traders, dhal and oil millers, retailers, and farmers in the year 1975-76 (Table 3).

Price spreads can be calculated on the basis of two methods: first, by following any specific lot or consignment through the marketing system and then assessing the costs involved at each of the different stages (time lag method [15]); secondly, by comparing prices at different levels of marketing at the same point in time (concurrent method [15]) and deriving gross and net margins.

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* Numbers in [ ] denote references. See pages 39-40 for complete reference.

Table 2. Summary of studies on correlation analysis of foodgrains in India.

Crop	Year	Area	Nature of prices	Range of correlation coefficients	Ref. No.
Paddy	1965-66 - 1970-71	Five markets in Gujarat	Weekly wholesale	-0.48 to 0.59	[21]
Wheat	1955-65	Five Punjab markets and Delhi market	"	0.90 to 0.97	[12]
Wheat	1961-64	Six markets of Punjab, two markets of Uttar Pradesh and Delhi market	Monthly market prices	0.86 to 0.98	[4]
Wheat	1965-66 - 1970-71	Eight markets in Gujarat	Weekly wholesale	0.41 to 0.96	[21]
Sorghum	1958-63	Seven markets of Maharashtra	"	0.84 to 0.94	[11]
Sorghum	1965-66 - 1970-71	Ten markets of Gujarat	"	-0.05 to 0.94	[21]
Pearl millet	1965-66 - 1970-71	Seven markets of Gujarat	"	-0.05 to 0.96	[21]
Groundnut	1962-63 & 1967-68	Nine markets of Punjab	"	0.27 to 0.99	[17]

Table 3. Number of market participants covered in the three selected markets of Andhra Pradesh, 1975-76.

Market	Participants			
	Commission agents and/or wholesale traders	Millers	Retailers	Farmers
Warangal	16	4	8	20
Khammam	10	5	6	16
Tandur	8	2	4	15
Total:	34	11	18	51

The first method (time lag method) provides a basis for the measurement of the marketing margin as marketing involves an element of time. However, because it is very difficult and time-consuming to pursue a particular lot through various stages of marketing, and because a single saleable lot at the final stage of marketing is divided into a series of purchases at different times, at different rates and sometimes of varying qualities, the time lag method is not practical.

The second method (concurrent method) commonly used is not always reliable as it does not take into account the time lag between purchase and sale of the produce and therefore it does not measure separately the profits earned by traders on account of their arbitrage operations over time.

For this study the concurrent method was used. The survey was conducted in regulated markets where the marketing channels for sorghum and pearl millet were found to run from producer to consumer, through commission agent, wholesale trader, and retailer. In cases of pigeonpea, chickpea, and groundnut the marketing channels included the miller between wholesaler and retailer.

The net price received by the farmer was calculated by deducting the marketing costs (excluding the transportation cost) from the original price paid to the farmer by the wholesale trader. Marketing

costs of the farmer included commission fee (charged as percentage of the value of the commodity), weighment, and labor charges (charged per unit of quantity). The price paid to the farmer is derived from the annual average price of the product calculated from the records of the market committee. This price is at the same time the purchase price for the primary wholesale traders. The sale price of the primary wholesale trader is calculated as the simple average of the sales prices reported on weekly basis by the selected traders for the same year. The difference between these two prices constitutes the gross margin for the wholesale traders.

At the level of wholesale traders, marketing costs were classified into the following four categories:

(a) Variable costs. These include costs of empty bags, thread, stitching, and cartage labor (hamali) for heaping, cleaning, and weighing. The total expenditure on all these items expressed per unit of quantity is considered as a variable cost and an average is computed for each commodity for all the traders surveyed in each market.

(b) Fixed costs. These represent annual and monthly costs incurred by the trader irrespective of the quantity and commodities traded. The items included are license fees (market license and other licenses, if any), telephone bills; electricity bills; rental value of office, godown, and drying platform; wastage; spoilage; salaries to employees; stationary; furniture; maintenance; and interest on capital, etc. Averages of the sums of these fixed costs per quintal of total turnover are computed for all the traders surveyed in each market.

(c) Market fee. The market fee is fixed by the government and is charged on an *ad valorem* basis on producers' sale price. The fee is converted into rupees per quintal of the particular commodity.

(d) Sales tax. Similar to market fee, sales tax is also fixed by the government. It is charged on an *ad valorem* basis on traders' sales price. This tax is also converted into rupees per quintal of the particular commodity.

By subtracting the sum of all marketing costs from wholesalers' gross margin, their net margins were derived. The sale prices of the retailers were calculated as averages of sale prices on a weekly basis reported by the surveyed retailers for the year. Retail margin were derived as the difference between retailers' purchase and selling prices; the net margins were computed as for wholesalers after deducting variable and fixed costs from the gross margin.[1]

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1. There are no fees or sales taxes for the retailers.

Taking the retailers' sale price as the consumers' purchase price, the producers' share in a consumer's rupee is calculated. In the case of pigeonpea, chickpea, and groundnut, that involve processing before reaching the consumer, millers' costs and margins are accounted for by following the same procedure; the values of by-products such as hulls (Chunni) or groundnut cake were not taken into consideration when calculating millers' net margins.

4.1.2. Results and discussion

The estimates of marketing margins computed for the selected crops in all three selected markets together are summarized in Table 4. The detailed estimates for the five crops are presented in Appendix Tables 1 through 5. Table 4 shows, as expected, that across crops the farmers' share in the consumers' rupee decreases with increase in the amount of services required for transformation of the raw product into a consumable commodity. These services imply gross margins for dhal milling in the case of chickpea (8.2%) and pigeonpea (8.8%), and oil milling in the case of groundnut (13.4%).

Wholesale traders' gross margins decrease across crops from 8 to 9% for sorghum and pearl millet, to about 7% for chickpea and pigeonpea, to less than 4% for groundnut. The decrease is explained by the fact that the customers of the sorghum and pearl millet traders are retailers or even consumers who buy relatively small quantities (minimum one bag) for which effort traders need to be remunerated with relatively higher margins; the customers of wholesalers dealing with higher valued chickpea, pigeonpea and groundnuts are generally millers who buy in bulk, thus allowing the wholesalers to operate at lower margins per quintal. Unfortunately, reliable data on turnover were not available to determine whether indeed income as the product of net margins multiplied by turnover would yield similar net returns across traders in the different crops.

In the case of retailers the opposite is true. The retailers' gross and net margins in percentage terms are about the same across crops but in absolute terms these margins increase with the increase in value of and services required for producing the final commodity.

The estimates of marketing margins in each of the three markets were computed as averages of the selected crops weighted by their respective prices. These are presented in Table 5, which shows differences (significant at 5%) between market at all trade levels, Tandur having the lowest and Warangal the highest margins; this difference is largely explained by the fact that marketyard and traders' shops in Tandur are more compactly located than in the other markets.

Table 4. Average estimates of marketing margins rupees per quintal in three markets[a] for five selected crops, 1975-76.

Item	CROPS				
	Sorghum	Pearl millet	Pigeon-pea	Chick-pea	Ground-nut
Wholesale Traders' Level:					
Gross margins	14.83 (8.77)[b]	13.23 (8.03)	17.59 (6.87)	17.71 (7.10)	11.36 (3.72)
Net margins	7.85 (4.64)	6.47 (3.93)	6.76 (2.64)	6.96 (2.79)	6.09 (1.99)
Millers' Level:					
Gross margins	n.a.[c]	n.a.	22.56 (8.81)	20.43 (8.19)	40.82 (13.35)
Net margins	n.a.	n.a.	11.54 (4.51)	11.55 (4.63)	16.81 (5.50)
Retailers' Level:					
Gross margins	7.08 (4.19)	6.18 (3.75)	12.27 (4.79)	10.92 (4.38)	23.50 (7.69)
Net margins	4.85 (2.87)	3.95 (2.40)	7.67 (3.00)	6.61 (2.65)	10.52 (3.44)
Farmer's Net Price	144.58 (85.49)[d]	142.66 (86.63)[d]	200.13 (78.16)[d]	196.84 (78.92)[d]	226.09 (73.97)[d]
Consumers' Price	169.11 (100)	164.67 (100)	256.04 (100)	249.41 (100)	305.66 (100)
	2.62	2.60	3.49	3.51	3.89

[a]Warangal, Khammam, and Tandur in Andhra Pradesh.

[b]Figures in parentheses are percentages of consumer price = 100.

[c]Not applicable.

[d]Farmer's share in consumer's rupee.

Table 5. Average estimates of market margins of five crops[a] in percent of consumer price in three selected markets in Andhra Pradesh, 1975-76.

Item	MARKETS		
	Warangal	Khammam	Tandur
Wholesale Traders' Level:			
Gross margins	7.04	7.00	6.68
Net margins	3.28	3.18	3.14
Millers' Level:			
Gross margins	10.83	10.23	9.30
Net margins	5.27	4.90	4.50
Retailers' Level:			
Gross margins	5.24	5.22	4.40
Net margins	3.18	2.76	2.64
Farmer's share in consumer's rupee	79.46	80.39	82.03

[a]Sorghum, pearl millet, pigeonpea, chickpea and groundnut.

4.2 Correlation Coefficients as a Measure of Marketing Efficiency

4.2.1. Methodology

For correlation analysis, weekly market prices of 1974-75 for the five selected crops collected from the price records of 29 markets included in the survey were used. For the markets of Warangal and Tandur daily prices were also available for correlation analysis. This allowed comparison of correlation coefficients of daily prices with weekly prices. To compare the correlation coefficients in different years, weekly prices of Warangal and Khammam markets of Andhra Pradesh for two calender years (1974 and 1975) were used for correlation analysis.

4.2.2. Results and discussion

It was found that in three out of four cases, daily prices produced slightly higher correlations than weekly prices (Table 6). This is probably due to the fact that simple averaging of six daily prices into one weekly price (as is normally done by the market authorities) does not take into account the weights of daily market arrivals, thus introducing random variation which is reflected in lower correlations of weekly prices as compared to daily prices. This is particularly true for sorghum where, in fact, the quantities as well as qualities arriving from day to day tend to vary more than for other crops included in this study, such as pearl millet where the averaging of daily prices into weekly prices increases correlation coefficients. Among ICRISAT crops pigeonpea showed the highest correlation of market prices, followed by chickpea, pearl millet, sorghum and groundnut. The coefficients of daily prices were all statistically significant at the 1% level.

Correlation coefficients between weekly prices of Warangal and Khammam markets of Andhra Pradesh in 1974 and 1975 are given in Table 7. The correlation coefficients were generally consistent in these two years. Also, these two markets were integrated relatively well in case of yellow sorghum, pigeonpea, and pearl millet compared to white sorghum and groundnut. It is clear from this table that coefficients are different for different qualities or varities of the same product. For example, when the weekly prices of white and yellow sorghum were correlated separately the coefficients were higher than for the weekly prices of sorghum (all varieties) put together (Table 6).

For four of the selected crops for which data were available, Table 8 shows the price correlation coefficients among the selected three markets as well as between each of these three and all of the 28 other markets surveyed for this purpose. The data in this table confirms the earlier observation that pigeonpea has the highest price

Table 6. Correlation coefficients of prices for ICRISAT crops in the markets of Warangal and Tandur in 1974-75.

Crops	Correlation coefficients based on	
	Daily price	Weekly price
Sorghum	0.62***	0.40**
Pearl millet	0.71***	0.91***
Pigeonpea	0.89***	0.85***
Chickpea	0.86***	--
Groundnut	0.60***	0.59**

*** Indicates significance level at 1%.
** Indicates significance level at 5%.

Table 7. Correlation coefficients of weekly prices for ICRISAT crops in Warangal and Khammam markets in 1974 and 1975.

Crops	Correlation coefficient for	
	1974	1975
White sorghum	0.40**	0.42**
Yellow sorghum	0.98***	0.89***
Pearl millet	0.86***	0.90***
Pigeonpea	0.96***	0.89***
Groundnut	0.50***	0.45***

*** Indicates significance level at 1%.
** Indicates significance level at 5%.

Table 8. Correlation coefficients of weekly market prices of selected crops among three selected markets and between each of these and 28 other markets in 1974-75.

Market	Sorghum			Pearl Millet			Pigeonpea			Groundnut			Average[a]
	WGL	KMM	TDR	WGL	KMM	TDR	WGL	KMM	TDR	WGL	KMM	TDR	
Warangal (WGL)	1.00	0.30**	0.40**	1.00	0.93***	0.91***	1.00	0.96***	0.85***	1.00	0.62***	0.59***	0.47
Khammam (KMM)		1.00	0.88***		1.00	0.90***		1.00	0.94***		1.00	0.72***	0.55
Tandur (TDR)			1.00			1.00			1.00			1.00	0.58
Agerage[b]	0.35**	0.58***	0.38**	0.56***	0.75***	0.59***	0.74***	0.71***	0.79***	0.25**	0.18	0.56***	

*** Indicates significance level at 1%
** Indicates significance level at 5%

[a]Average across four crops of average price correlation coefficients with 28 other markets.
[b]Average of price correlation coefficients between selected and 28 other markets.

correlations, followed by pearl millet. Sorghum prices are correlated at considerably lower levels and groundnut prices are significantly correlated only among the three markets, but not between these and the other 28 markets. The low correlation coefficient for sorghum as pointed out above my partly be explained by variability in quality of arrivals. The low correlation coefficient for groundnut prices is due to the fact that groundnuts as such are generally not trade over longer distances; the oil is traded, but due to restrictions in inter-regional trade of groundnuts and oil and differences in time lags and costs involved in processing the prices of groundnuts can hardly be expected to show significant price correlation coefficients.

If we compare the three markets on the basis of their average price correlations across crops with all other 28 markets, we find that Tandur and Khammam tend to have higher correlations than Warangal (Table 8).

Weekly market prices of one year (1974-75) of the five ICRISAT crops of every market surveyed were correlated pair-wise (Appendix Tables 6 to 10). Unweighted mean correlation coefficients between pairs of all selected markets for all the five crops are given in Table 9. Most of the correlation coefficients of prices for ICRISAT crops in different selected markets in 1974-75 were positive and significant at the 1% level.

Table 9. Mean correlation coefficients of 54 weekly market prices of ICRISAT crops, pairs of 29 markets in SAT India, 1974-75.[a]

Crops	Mean correlation coefficient
Sorghum	0.24
Pearl millet	0.37
Pigeonpea	0.62
Chickpea	0.72
Groundnut	0.31

[a]All coefficients were significant at 1% level.

Among ICRISAT crops, correlation coefficients were highest for chickpeas and pigeonpeas, the two crops which have more interstate trade. Sorghum, pearl millet, and groundnut prices correlated positively and significantly but considerably below the levels of correlations measured for the other crops. For groundnuts, the local processing and limited interregional trade might be responsible for low market price integration. In the case of sorghum and pearl millet, despite interregional trade, market prices were not well related, probably due to difficulties in price reporting, given the variability in quality of market arrivals, especially of sorghum.

Correlation coefficients of weekly market prices among the major markets of each state were summarized for each crop separately (Tables 10 to 14). Generally, market prices among these seven markets were significantly positively correlated. In the case of sorghum, the price correlations were lower for most of the market pairs, except between Warangal and Shahabad (0.9) and Warangal and Indore (0.7). For pearl millet, price correlations among markets were appreciably higher than for sorghum. Especially the markets of Indore, Patan, and Bagalkot showed high price correlations with most other markets. For pigeonpeas, market prices were higher and more consistently correlated among most markets than was the case for sorghum and pearl millet. Among the markets, Indore, Bagalkot, and Shahabad had the highest correlations with all other markets. In case of chickpea, all the six markets trading in this commodity were integrated well, except for the pair Patan-Bagalkot. For groundnut, all seven markets showed lower price correlations. The highest price correlation (0.8) was found between Poona and Nadbai, and Patan and Bagalkot.

The above discussion on correlation analysis indicates that most of the price correlations between major selected markets for all the five ICRISAT crops were high, positive, and statistically significant. Correlation coefficients between smaller markets are often very low and nonsignificant or sometimes negative. Hence, it is concluded that most of the selected major markets are integrated well for all the five crops and were efficient, while smaller markets were not.

4.3 Comparison of Two Measures of Marketing Efficiency

As stated above, both the analysis of marketing margins and price correlation analysis provide only relative measures of marketing efficiency. While it is generally agreed that higher correlation coefficients or lower margins (for given services) indicates better marketing efficiency it is obvious that this is not always true. Theoretically, cases can be conceived where prices correlate

Table 10. Correlation coefficients of weekly wholesale prices of sorghum in selected markets of different states in 1974-75.

Markets (Figures in parentheses indicate size in '000 tonnes)	Warangal	Indore	Poona	Nadbai	Patan	Bagalkot	Shahabad
Warangal (116) Andhra Pradesh	1	.73*** (38)[a]	.53*** (28)	.32 (6)	.35** (38)	.61*** (38)	.36** (10)
Indore (184) Madhya Pradesh		1	.07 (26)	.26 (10)	.38*** (52)	.52*** (52)	.65** (13)
Poona (136) Maharashtra			1	-.71** (10)	.32** (41)	.54*** (41)	.62** (13)
Nadbai (14) Rajasthan				1	-.36 (10)	.55 (10)	.10 (9)
Patan (52) Gujarat					1	.10 (52)	.69** (13)
Bagalkot (84) Karnataka						1	.16 (13)
Shahabad (33) Uttar Pradesh							1

[a]Figures in parentheses are number of non-zero paired observations.

*** Indicates the significance level at 1%
** Indicates the significance level at 5%

Table 11. Correlation coefficients of weekly wholesale prices of pearl millet in selected markets of different states in 1974-75.

Markets (Figures in parentheses indicate size in '000 tonnes)	Warangal	Indore	Poona	Nadbai	Patan	Bagalkot	Shahabad
Warangal (116) Andhra Pradesh	1	.93** (5)[a]	.54*** (24)	-.39 (6)	.84*** (30)	.61*** (28)	-.71 (5)
Indore (184) Madhya Pradesh		1	.77*** (15)	.78*** (18)	.63*** (16)	.73*** (14)	.85** (5)
Poona (136) Maharashtra			1	.72*** (14)	.65*** (41)	.68*** (36)	.89*** (12)
Nadbai (14) Rajasthan				1	.34 (15)	.57** (15)	-.26 (11)
Patan (52) Gujarat					1	.70*** (47)	.66** (12)
Bagalkot (84) Karnataka						1	.59** (12)
Shahabad (33) Uttar Pradesh							1

[a]Figures in parentheses are number of non-zero paired observations.

*** Indicates the significance level at 1%
** Indicates the significance level at 5%

Table 12. Correlation coefficients of weekly wholesale prices of pigeonpea in selected markets of different states in 1974-75.

Markets (Figures in parentheses indicate size in '000 tonnes)	Warangal	Indore	Poona	Nadbai	Patan	Bagalkot	Shahabad
Warangal (116) Andhra Pradesh	1	.96*** (41)[a]	.93*** (31)	.68*** (17)	.39** (31)	.79*** (41)	.92*** (32)
Indore (184) Madhya Pradesh		1	.91*** (42)	.60*** (18)	.54*** (38)	.91*** (52)	.91*** (43)
Poona (136) Maharashtra			1	.30 (9)	.72*** (30)	.85*** (42)	.87*** (34)
Nadbai (14) Rajasthan				1	.70*** (16)	.85*** (42)	.85*** (17)
Patan (52) Gujarat					1	.77*** (18)	.63*** (35)
Bagalkot (84) Karnataka						1	.89*** (43)
Shahabad (33) Uttar Pradesh							1

[a]Figures in parentheses are number of non-zero paired observations.

*** Indicates the significance level at 1%
** Indicates the significance level at 5%

Table 13. Correlation coefficients of weekly wholesale prices of chickpea in selected markets of different states in 1974-75.

Markets (Figures in parentheses indicate size in '000 tonnes)	Warangal	Indore	Poona	Nadbai	Patan	Bagalkot	Shahabad
Warangal (116) Andhra Pradesh	1	-	-	-	-	-	-
Indore (184) Madhya Pradesh		1	.87*** (42)[a]	.94*** (42)	.76*** (28)	.75*** (51)	.90*** (52)
Poona (136) Maharashtra			1	.85*** (33)	.74*** (26)	.64*** (41)	.78*** (42)
Nadbai (14) Rajasthan				1	.81*** (23)	.65*** (41)	.89*** (42)
Patan (52) Gujarat					1	.43** (27)	.74*** (28)
Bagalkot (84) Karnataka						1	.72*** (51)
Shahabad (33) Uttar Pradesh							1

[a]Figures in parentheses are number of non-zero paired observations.

*** Indicates the significance level at 1%.
** Indicates the significance level at 5%.

Table 14. Correlation coefficients of weekly wholesale prices of groundnut in selected markets of different states in 1974-75.

Markets (Figures in parentheses indicate size in '000 tonnes)	Warangal	Indore	Poona	Nadbai	Patan	Bagalkot	Shahabad
Warangal (116) Andhra Pradesh	1	.36** (41)[a]	.60*** (30)	.52** (20)	.58 (4)	.42*** (39)	-.3[illegible]** (40)
Indore (184) Madhya Pradesh		1	.52*** (41)	.49*** (34)	.39 (11)	.60*** (50)	.06 (48)
Poona (136) Maharashtra			1	.79*** (25)	.10 (11)	.60*** (39)	.11 (37
Nadbai (14) Rajasthan				1	.45 (8)	.46*** (34)	-.28 (32)
Patan (52) Gujarat					1	.76*** (11)	.60** (9)
Bagalkot (84) Karnataka						1	-.17 (47)
Shahabad (33) Uttar Pradesh							1

[a]Figures in parentheses are number of non-zero paired observations.

*** Indicates the significance level at 1%.
** Indicates the significance level at 5%.

well because traders collude between the two markets, thus reaping high margins. Similarly, it is quite possible and has been pointed out by others [7] that two markets with temporarily changing directions of commodity flows may show low price correlations despite the fact that traders may be efficiently operating at minimum margins in both markets. Finally, market margins may be higher in some markets — which are well integrated pricewise — only because the infrastructure (such as the distance from the marketyard to traders' shops in Khammam) requires additional movement and thereby higher costs.

These cases show that, ideally, the two measures of marketing efficiency should be employed jointly in order to give a complete picture of the efficiency levels at which different markets are operating. In the case of the tree markets studied the two measures tended to agree: Tandur had significantly lower price margins and on an average higher price correlation coefficients, while for Warangal the opposite was true, thus indicating that Tandur was probably a more efficient market than Khammam and Warangal.

The data compiled for these analyses allow measurement of the effect of a hypothetical case where traders double their net margins on the coefficients of correlation between producers' prices in two markets. This provides a test of the sensitivity of the price correlation coefficient to changes in traders' margins. It was arbitrarily assumed that in the cases of sorghum, pearl millet, pigeonpea, and groundnut, traders in the markets of Tandur and Warangal doubled their net margins during every second week in alternation (i.e., in the first week Tandur, in the second week Warangal, and so on). The effect on price correlation of this relatively large overall increase in traders' (not millers') net margins by 100% is shown in Table 15.

Table 15. Price correlation between Warangal and Tandur market: comparison of actual coefficients and coefficients obtained assuming higher marketing margins.[a]

Crops	Actual correlation coefficient	Coefficient obtained with higher marketing margins
Sorghum	0.40	0.32
Pearl millet	0.91	0.71
Pigeonpea	0.85	0.54
Groundnut	0.59	0.52

[a]Marketing margins assumed to be 100% higher than actually reported net margins of wholesale and retail traders during every second week; alternating between Warangal and Tandur.

The correlation coefficients drop by a few percentage points in the case of sorghum and groundnut crops with generally wider fluctuations in price and lower correlation coefficients as compared to pearl millet and pigeonpea, for example. In view of the general variability of price correlation coefficients across regions for sorghum and groundnuts the sensitivity of this measure to traders' increases in margins appears to be weak and insignificant. In the case of pearl millet and pigeonpeas, which are relatively stable in prices and generally show higher price correlations, an increase in traders' margins as assumed above does produce significantly lower correlation coefficients.

Experiments such as these show the relationship between price correlation coefficients and market margins and the sensitivity of correlations to changes in margins. As margins increase, correlation coefficients decrease; however, this effect is stronger for some commodities than for others. Both the analysis of margins and the analysis of correlation coefficients are relevant approaches and neither one can substitute for the other.

5. QUANTIFICATION OF MARKETING EFFICIENCY

5.1 Methodology

For quantification of marketing efficiency correlation coefficients are used. Pricing efficiency can be affected by several factors, and in this study an attempt was made to identify some such factors for which the following hypotheses were postulated:

$$CC_{ij} = f(DT_{ij}, SM_{ij}, SI_{ij}, MA_{ij}, NW_{ij}, HC_{ij}, TT_{ij}, NS_{ij}, MU_{ij}, PD_{ij}, DP_{ij})$$

Where

CC_{ij} - correlation coefficient between markets i and j.

DT_{ij} - distance between markets i and j measured in kilometers. It is hypothesized that if the markets i and j are far distant their prices will not be highly correlated. Hence a negative sign is expected.

SM_{ij} - average size of markets i and j measured in terms of total arrivals in thousand tonnes.

Larger markets are more efficient in pricing; a positive sign is expected.

SI_{ij} - average turnover of ICRISAT crops in percent of total turnover of the markets i and j, measured in terms of arrivals in tonnes. The hypothesis for this variable is that if the share of ICRISAT crops in total size is more between markets i and j then these markets are efficient for ICRISAT crops. A positive sign is expected for this variable.

MA_{ij} - age of markets i and j. This is measured in terms of number of years by deducting the year of regulation from the year 1975.

It is hypothesized that older markets are more efficient than new markets. A positive sign is expected for this variable.

NW_{ij} - number of wholesale traders in markets i and j.

If all other variables determining competition (such as traders turnover, market turnover, etc.) are kept constant, then the number of wholesale traders in a particular market measures the degree (not quality) of market access for farmers.[2] The more the traders concentrated in one market place, ceteris paribus the fewer are the market places and the longer is the distance that farmers have to travel for getting market access. Hence, the market efficiency is lower and the sign of this variable is expected to be negative.

NC_{ij} - number of commission agents in markets i and j.

The hypothesis and sign for this variable is similar to NW_{ij}.

TM_{ij} - number of telephones to market size in markets i and j.

It is hypothesized that the larger the number of telephone per market turnover, the higher is the market efficiency and a positive sign is expected for this variable.

TT_{ij} - number of telephones per trader in markets i and j.

The hypothesis and sign expected for this variable are similar to TM_{ij}.

NS_{ij} - number of market secretaries changed from 1967 to 1975 in markets i and j.

It is hypothesized that the larger the number of markets secretaries changed, the higher is the market efficiency. If a market secretary stays in a market for many years he is likely to be biased and tolerant towards collusion of traders resulting in inefficiency. A positive coefficien is expected for this variable.

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2. Note that there were only two markets in our sample with less than 20 traders; 23 markets had more than 50 traders.

MU_{ij} - utilization of marketyards in markets i and j.

This is measured in terms of market arrivals per unit size of the marketyard.

It is hypothesized that proper utilization of the marketyard results in market efficiency and hence a positive sign is expected for this variable, up to a maximum beyond which congestion leads to inefficiencies and a negative sign for the squared term is expected.

ST_{ij} - average turnover of the traders in markets i and j.

This is obtained by dividing market total turnover in thousand tonnes by number of wholesale traders in the market.

It is hypothesized that markets will be efficient if their turnover is shared by many small traders rather than few large traders sharing more. A negative sign is expected for this variable.

PD_{ij} - population density in the district where i and j markets are located.

It is hypothesized that markets are more efficient where more people exist. Hence a positive sign is expected for this variable.

DP_{ij} - density of crop production in the districts where i and j markets are located.

It is hypothesized that more production of a particular crop is a sign of specialization which implies more market participation by farmers and better market efficiency. A positive sign is expected for this variable.

Regressions were fitted for each crop and for all crops together with correlation coefficients as dependent variables and the above factors affecting pricing efficiency as independent variables. In addition, state dummies were also included for each crop regression. For the all-crops regression, in addition to state dummies, crop dummies were also included. As the dependent variable (i.e., correlation coefficient) was always between a pair of markets, independent variables were derived accordingly and the average value of pairs of markets was included in the regression except for the distance variable which was an absolute value. The original data used for calculating the independent variables are given in Table 16.

5.2. Results and Discussion

Regression results are summarized in Table 17. This table shows that most of the variables have the expected signs and the coefficients are statistically significant. Most of the hypotheses proposed can be accepted. In two cases the proposed hypotheses cannot be accepted as

Table 16. Original data used to develop some of the independent variables, 1974-75.

Name of the market	Year of regulation	Total market turnover ('000 tonnes)	Market turnover of ICRISAT crops (000 tonnes)					No. of				Size of market-yards (ha)	Total human population (000)[b]	Total geographical area (000 ha)[b]	Total cropped area (000 ha)	Production of ICRISAT crops (000 tonnes) in the district where the market is located				
			Sorghum	Millet	Pigeon-pea	Chick-pea	Groundnut	Commission agents	Wholesale traders	Telephones	Market Secretaries[a]					Sorghum	Millet	Pigeon-pea	Chick-pea	Groundnut
Warangal	1933	116	8.00	0.1	4.00	0.50	32.00	120	392	500	8	3.75	1,860	1,284	564	101.0	10.0	2.0	0.5	45.0
Khammam	1937	35	4.00	2.0	9.00	0.01	6.00	130	139	250	6	4.40	1,369	1,581	456	125.0	2.0	2.0	0.2	25.0
Tandur	1949	21	1.00	0.2	8.00	0.70	3.00	85	85	130	10	2.00	2,788	776	374	57.0	4.0	4.0	3.0	6.0
Indore	1953	184	9.00	0.1	13.00	17.00	44.00	160	504	680	6	20.00	1,035	383	277	36.0	0.2	11.0	26.0	2.0
Ujjain	1930	62	27.00	0.5	0.60	9.00	8.00	63	171	210	1	10.00	862	612	466	102.0	9.0	10.0	33.0	13.0
Khandwa	1964	34	0.90	-	3.00	0.40	4.00	77	135	200	2	5.25	879	1,071	450	95.0	2.0	15.0	4.0	17.0
N. Gunj	1966	7	0.04	-	2.00	0.60	-	-	14	-	1	1.50	513	658	410	50.0	0.0	10.0	26.0	1.0
Poona	1959	136	4.00	31.0	0.20	5.00	0.03	159	443	650	1	45.00	3,172	1,564	1,011	10.0	6.0	0.2	0.4	2.0
Latur	1931	84	2.00	2.0	2.00	1.00	7.00	127	326	400	2	25.00	1,893	1,412	1,105	12.0	1.0	2.0	2.0	5.0
Malkapur	1917	58	3.00	0.4	2.00	0.20	4.00	24	47	70	2	3.00	1,261	974	731	12.0	0.2	1.0	0.1	1.0
Malegaon	1949	24	0.03	2.0	0.02	0.10	2.00	19	86	100	1	10.00	2,367	1,558	844	1.0	11.0	0.3	0.6	3.0
Sondiacha	1939	20	0.30	3.0	0.03	0.05	4.00	52	76	50	3	10.00	1,661	1,314	722	5.0	7.0	0.4	0.3	6.0
Ganganagar	1964	79	-	-	-	5.00	-	152	253	450	6	30.00	1,394	2,063	1,440	2.0	46.0	0.0	252.0	0.1
Nadbai	1965	14	0.02	0.2	0.80	6.00	4.00	53	69	100	6	3.00	1,490	809	583	11.0	96.0	2.0	115.0	22.0
Hindone	1965	14	0.02	0.4	3.00	7.00	3.00	88	118	85	8	2.50	1,193	1,059	521	29.0	79.0	0.7	68.0	27.0
Begun	1970	6	0.06	-	-	0.05	2.00	37	60	26	5	1.25	945	1,086	364	24.0	0.0	0.4	13.0	27.0
Patan	1951	52	2.00	1.00	0.03	0.40	0.01	176	337	300	5	15.00	2,092	924	774	4.0	20.0	0.2	0.0	1.0
Santrampur	1952	7	0.09	0.09	1.00	0.06	0.04	8	91	30	1	1.60	1,846	885	527	0.7	3.0	0.6	2.0	4.0
Damnagar	1954	0	-	-	-	1.00	0.06	9	20	10	-	1.20	848	670	512	2.0	9.0	-	0.0	15.0
Bagalkot	1946	64	8.00	4.00	3.00	0.30	12.00	109	161	60	9	2.00	1,983	1,712	1,367	205.0	41.0	13.0	6.0	42.0
Gadag	1943	45	1.00	-	0.60	0.80	24.00	103	293	150	4	3.25	2,342	1,378	1,140	198.0	0.4	10.0	4.0	95.0
Chitradurga	1951	28	6.00	0.30	1.00	1.00	1.00	77	84	15	4	7.60	1,397	1,078	553	146.0	13.0	11.0	3.0	43.0
Shahabad	1972	33	0.04	1.00	11.00	5.00	104.00	22	82	15	4	2.00	1,850	604	501	18.0	5.0	10.0	34.0	54.0
Ujhani	1967	30	0.03	2.00	18.00	16.00	127.00	13	54	35	5	6.00	1,646	525	483	6.0	38.0	19.0	26.0	38.0
Jafargunj	1973	20	7.00	4.00	26.00	29.00	1.00	5	22	-	4	4.50	1,643	446	411	8.0	2.0	18.0	29.0	0.0
Orai	1967	16	2.00	-	6.00	25.00	-	102	82	5	5	23.00	8,135	459	371	26.0	10.0	14.0	80.0	0.0
Bendki	1965	13	1.00	4.00	5.00	37.00	-	10	53	20	7	3.00	1,278	432	349	36.0	7.0	28.0	58.0	0.1
Jarar	1969	6	0.02	2.00	20.00	0.70	-	26	32	16	2	2.00	2,309	486	414	3.0	49.0	26.0	83.0	0.3
Panwari	1971	0	0.20	-	0.02	0.30	-	-	5	-	4	1.00	988	720	497	59.0	2.0	14.0	96.0	0.2

[a]No. of Secretaries changed from 1965 to 1975.
[b]Of the district where market is located.

Table 17. Summary of regression results.[a]

Variables with positive signs	Expected signs	Variables with negative signs	Expected signs
Market size***	Yes	Distance***	Yes
Age of market***	Yes	Share of ICRISAT crops**	No
No. of commission agents	No	No. of wholesale traders***	Yes
No. of telephones per turnover***	Yes	No. of telephones per trader***	No
Change of market secretaries***	Yes	Average turnover by traders** (traders' size)	Yes
Utilization of marketyard***	Yes		
Density of population	Yes		
Density of crop production**	Yes		

[a]For complete regression results see Table 20.

*** Significant at 1% level.
** Significant at 5% level.

the variables have unexpected significantly negative signs. These are: (i) share of ICRISAT crops to total market turnover, and (ii) telephones per trader. Two variables were insignificant, i.e., number of commission agents with an unexpected positive sign, and density of population with an expected positive sign.

The negative sign for share of ICRISAT crops suggests that markets are inefficient if they are dominated by ICRISAT crops (or for that matter a group of crops). Thus markets may tend to be more efficient when larger variety of other crops arrive in. The negative effect of number of telephones per trader on pricing efficiency seems to imply that a few traders monopolize the telephones, and market efficiency is negatively affected.

The significance levels as computed for standard regression problems should probably be used only as an indicator of relative significance among variables, because of the nature of the data of this project. Except for distances between markets which represent actual observations, all independent variables defining market characteristics were generated by pairing markets, thus creating n(n-1)/2 data points from 'n' actual observations. It is not clear to which extent such data manipulation reduced the statistical significance of the results.

In other words, the appropriate number of degrees of freedom for this problem is unknown. On the one hand, the degrees of freedom derived from the generated data points appear to exceed what intuitively would seem appropriate; on the other hand taking just the actual n observations as the basis for computing the degrees of freedom would be too restrictive. In the absence of any known rule to determine the appropriate number of degrees of freedom for this case, it was decided to compute t-values of the estimation results by dividing the degrees of freedom into one half of the initial number. This decision can be interpreted as implying that each of the generated data points, which by definition reflects information from a pair of observations, contributes only half a degree of freedom (Table 18).

Even with this reduced number of degrees of freedom, only two more variables fall below the significance level of 5% (i.e., share of ICRISAT crops and average turnover by traders), while among the remaining, four variables maintain their significance level of 1% (i.e., age of market, market size, density of crop production, number of telephones per trader).

An alternative analysis was attempted by grouping markets by clustering the correlation coefficients (dependent variable). For this, correlation coefficients were arranged in descending order along with corresponding independent variables and made into three groups, the first group with correlation coefficients 0.5 and above, the second group with correlation coefficients up to 0.4 and the

Table 18. Calculated 't' values of the variables with initial and reduced degrees of freedom.

Variables \ Degree of freedom	1040[a]	520[b]
Age of market	5.58***	3.95***
Market size	5.06***	3.58***
Density of crop production	4.24***	3.00***
No. of telephones per trader	-4.19***	-2.96***
No. of telephones per turnover	3.56***	2.52**
No. of wholesale traders	-3.19***	-2.13**
Utilization of marketyard	2.98***	2.16**
Change of market secretaries	2.82***	2.00**
Distance	-2.76***	-1.96**
Share of ICRISAT crops	-2.49**	-1.76*
Average turnover by traders	-2.26**	-1.60
Density of population	0.18	0.21
No. of commission agents	0.10	0.07

[a]Initial number.

[b]One-half of initial number.

*** Significant at 1%.
** Significant at 5%.
* Significant at 10%.

third group with all negative coefficients. Regressions were run separately for each group and the results are given in Table 19. Group I, that is, correlation coefficients (dependent variable) from 0.5 and above, had a better fit than group II (correlation coefficients up to 0.4) and group III (negative coefficients). Thus the variables explained better for markets whose correlation coefficients were higher compared to those with lower coefficients. A homogeneity test was conducted for these groups by computing the F-statistic from the mean squared errors of the separate groups and the three groups combined. The significance of the F-value indicated that these three groups were statistically different and thus should be considered as independent of each other. However, because of the insignificance of most parameters nothing meaningful could be concluded from this analysis.

An attempt was also made to run regressions on individual markets. This allowed a comparison among different markets, that is, large and small, primary and secondary, and also with the original regression consisting of all markets and with generation of data. Regressions were carried out for ten different markets of different states: Indore, Poona (mostly secondary in nature) Warangal, Bagalkot, Ujjain, Patan (primary and large) Khammam, Chitradurga, Tandur, and Hindone (primary and comparatively small markets). Each of these markets was analyzed separately and correlations between that market with others formed the dependent variable and all the corresponding independent variables were regressed. In this way the duplication of data was also avoided.

The results of individual regressions for each market along with regressions for all markets are given in Table 20. The results confirm the earlier observation that factors like distance, market size, market age, number of secretaries changed, and production density are most reliable in explaining price correlations; they remain stable over the markets and all markets together. Whereas other characters like share of ICRISAT crops, wholesale traders, commission agents, telephones per turnover, telephones per trader, size of trader, marketyard use and population density are not so stable over the markets and all the markets combined.

In order to examine the impact of some of the variables when they are squared, a separate regression was carried out by introducing quadratic terms for some variables like telephones per turnover, telephones per trader, marketyard use, size of the trader, etc. The results are given in Table 21. Some variables like traders and turnover were included in the regression in more than once one way or the other while transforming the variables. This may lead to nonlinear dependence between these variables, which is not desirable. In order to examine that, separate regressions were run excluding these variables.

Table 19. Grouped regression results.[a]

Variables	Correlation coefficient (dependent variable)		
	0.5 and above	Up to 0.4	Negative
Intercept	.65	.36	-.02
Distance	-.00007 (-2.39)	-.00008 (-3.01)	-.00005 (-.56)
Market size	.0008 (1.70)	-.001 (-.19)	-.01 (-1.0)
Share of ICRISAT crops	-.17 (-.71)	-.29 (-1.05)	1.88 (1.64)
Market age	.004 (1.48)	-.002 (-.97)	-.004 (-.43)
No. of wholesale traders	.00002 (0.03)	.001 (1.56)	.002 (0.60)
No. of commission agents	-.001 (-.82)	-.002 (-1.35)	-.008 (-1.20)
Tel/turnover	.04 (1.10)	-.004 (-.15)	-.005 (-.80)
Tel/traders	-.23 (-1.11)	-.09 (-.57)	-.19 (-.48)
No. of secretaries changed	.008 (0.4)	.02 (1.10)	.13 (1.39)
Marketyard use	-.003 (-.05)	-.009 (-2.02)	-.002 (-.16)
Size of the trade	.38 (1.11)	.55 (1.16)	-.35 (-.47)
Population density	-.0001 (-.36)	-.0004 (-1.27)	.0003 (0.31)
Density of production	.34 (0.55)	1.33 (2.03)	-5.47 (-2.11)
State dummies			
Andhra Pradesh	-.00006 (-1.49)	-.0000008 (-.02)	.00014 (1.15)
Madhya Pradesh	-.00007 (-1.89)	-.0000009 (-.19)	.0002 (1.46)
Maharashtra	-.00009 (-2.21)	-.0000004 (-.009)	.0001 (1.37)
Rajasthan	-.0001 (-1.03)	-.00009 (-.92)	-.0001 (-.46)
Gujarat	-.00008 (-1.43)	.00002 (0.36)	.00002 (1.37)
Karnataka	-.00008 (-2.11)	-.00002 (-.35)	-.00003 (1.82)
Uttar Pradesh	--	--	--
Crop dummies			
Sorghum	-.02 (-.78)	-.05 (-1.71)	-.003 (-.05)
Pearl millet	.07 (3.92)	-.02 (-.81)	-.04 (-.63)
Pigeonpea	.16 (10.28)	.02 (0.69)	-.13 (-1.78)
Chickpea	.17 (11.09)	-.15 (-3.35)	.26 (3.25)
Groundnut	--	--	--
R^2	.36	.14	.27
$\bar{R}^2$	.33	.05	.16

[a]Figures in parentheses are 't' values.

Table 20. Regression results of all markets together along with some individual selected markets.[a]

Variables \ Types	All markets (Linear)	Regression for individual markets									
		Indore (MP)	Poona (MH)	Warangal (AP)	Bagalkot (KT)	Ujjain (MP)	Patan (GJ)	Khammam (AP)	Chitradurga (KT)	Tandur (AP)	Hindone (RN)
Intercept	.0686	-81.89	.70	19.51	2.13	-3.01	-7.80	1.29	.59	-.35	-1.19
Distance	-.0007 (-2.769)	-.0001 (-0.62)	-.0006 (-3.72)	.0003 (0.62)	.00008 (0.57)	.00008 (0.33)	-.001 (0.80)	-.0006 (-1.86)	-.00003 (-0.11)	.000008 (.03)	-.0002 (-1.19)
Market size	.0094 (5.06)	.02 (0.49)	.02 (0.56)	.14 (0.60)	.03 (1.27)	.02 (0.69)	.03 (0.84)	.09 (1.89)	.07 (2.18)	.09 (3.09)	-.006 (-.14)
Share of ICRISAT crops	-.1146 (-2.49)	-.56 (-.84)	-.80 (-1.67)	-.11 (-.16)	-.66 (-1.78)	-.38 (-1.15)	.18 (0.64)	.53 (1.73)	.02 (0.06)	-.17 (-.96)	-.07 (-.33)
Market age	.0103 (5.58)	.02 (3.01)	-.008 (-.82)	.04 (1.45)	-.007 (-.70)	.01 (1.34)	-.001 (-.10)	.02 (1.68)	.03 (1.62)	.02 (2.84)	.02 (1.17)
Wholesale traders	-.0019 (-3.05)	.07 (3.40)	-.002 (-.16)	-.05 (-.79)	-.02 (-1.72)	-.003 (0.25)	.07 (1.40)	-.01 (-1.02)	-.01 (-2.16)	-.004 (-.64)	.008 (.94)
Commission agents	.0001 (0.10)	-.22 (-4.53)	-.0004 (-.09)	.06 (0.77)	.02 (1.97)	-.02 (-.85)	-.01 (-1.38)	-.004 (-.37)	-.005 (-.47)	-.006 (-.98)	-.0005 (-.06)
Tel/turnover	.1028 (3.56)	23.77 (4.46)	.82 (2.33)	-3.18 (-.59)	-2.90 (-2.25)	1.14 (0.79)	.44 (1.0)	.21 (0.44)	-.04 (0.09)	.28 (1.29)	.23 (1.19)
$(Tel/turnover)^2$	--	--	--	--	--	--	--	--	--	--	--
Tel/traders	-.6245 (-4.19)	-90.48 (-4.33)	-4.75 (-2.71)	18.28 (0.69)	12.59 (2.33)	-4.67 (-.74)	-2.99 (-.94)	-1.87 (-.63)	-.38 (-.14)	-.69 (.58)	-1.98 (-1.35)
$(Tel/traders)^2$	--	--	--	--	--	--	--	--	--	--	--
Secretaries	.0356 (2.82)	.09 (1.47)	.04 (1.01)	.10 (1.12)	-.02 (-.29)	-.009 (-.13)	.10 (1.51)	.11 (1.32)	.14 (1.29)	.04 (0.63)	.02 (0.29)
Marketyard use	.0324 (2.98)	-.30 (-3.62)	.08 (0.67)	.04 (0.99)	.03 (2.47)	-.001 (-.14)	.13 (0.97)	-.002 (-.03)	.01 (0.08)	.03 (1.23)	.03 (0.51)
$Marketyard\ use^2$	--	--	--	--	--	--	--	--	--	--	--
Trader size	-.7472 (-2.26)	239.63 (4.12)	.68 (0.06)	-77.23 (-.73)	-10.74 (-3.73)	8.11 (0.53)	27.22 (1.54)	-5.51 (-.49)	-6.63 (-2.24)	-.58 (-.11)	4.00 (0.55)
$Trader\ size^2$	--	--	--	--	--	--	--	--	--	--	--
Population density	.0005 (0.18)	-.0009 (-.85)	.0000007 (0.0008)	-.002 (-1.27)	-.0009 (-.90)	.007 (0.55)	-.002 (-1.56)	-.002 (-1.12)	.000009 (0.005)	-.002 (-1.67)	-.001 (-.75)

Contd.

Table 20. Contd.

Variables \ Types	All markets (Linear)	Regression for individual markets									
		Indore (MP)	Poona (MH)	Warangal (AP)	Sagalkot (KT)	Ujjain (MP)	Patan (GJ)	Khammam (AP)	Chitradurga (KT)	Tandur (AP)	Hindone (RN)
Production density	1.5345 (4.24)	2.23 (2.29)	3.51 (2.09)	.78 (0.36)	3.56 (1.58)	2.34 (1.66)	.22 (0.13)	1.32 (0.80)	1.92 (0.95)	3.62 (3.18)	-1.26 (-.64)
State dummies											
Andhra Pradesh	-.0056 (-5.40)	-.0001 (-.82)	-.00003 (-.22)	-.0009 (-.84)	-.0002 (-1.12)	-.00004 (-.19)	-.00004 (-.21)	-.0005 (-1.23)	-.0002 (-1.01)	-.0005 (-2.57)	-.0002 (-.75)
Madhya Pradesh	-.0021 (-2.48)	-.0001 (-.61)	.0001 (0.84)	-.0004 (-.66)	-.0002 (-1.30)	-.00002 (-.11)	-.00006 (-.29)	-.0004 (-1.00)	-.0002 (-1.00)	-.0006 (-2.99)	-.0001 (-.38)
Maharashtra	-.0003 (-.36)	-.0005 (-2.76)	-.0001 (-.91)	-.0004 (-.72)	.00001 (.09)	-.00005 (-.24)	-.0001 (-.65)	-.0003 (-.71)	-.0001 (-.44)	-.0005 (-2.66)	-.0001 (-.50)
Rajasthan	-.0042 (-3.43)	-.0002 (-1.17)	-.00009 (-.63)	-.001 (-1.82)	-.0003 (-1.53)	-.00008 (-.36)	-.0002 (-.99)	-.0001 (-.24)	-.0006 (-.97)	-.0007 (-3.47)	-.00004 (-.13)
Gujarat	-.0023 (-2.06)	-.0005 (-2.32)	-.0001 (-1.00)	-.0003 (-.87)	.0005 (1.95)	.00002 (-.05)	.001 (1.67)	-.0001 (-.33)	.00006 (0.22)	-.0005 (-2.12)	-.0005 (-1.69)
Karnataka	-.0031 (-3.32)	-.0002 (-1.70)	-.0002 (-1.92)	-.0002 (-.49)	.0002 (0.77)	-.00007 (-.45)	-.0001 (-.74)	-.0004 (-1.22)	-.0001 (-.39)	-.0003 (-.207)	-.0002 (-.73)
Uttar Pradesh	--	--	--	--	--	--	--	--	--	--	--
Crop dummies											
Sorghum	-.1488 (-3.30)	-.29 (-1.54)	-.34 (-3.50)	-.03 (-.11)	-.49 (-1.98)	-.18 (-.99)	-.06 (-.54)	.68 (2.79)	.23 (0.87)	-.68 (-4.72)	-.29 (-1.62)
Pearl millet	.0141 (0.31)	.06 (0.30)	.14 (1.35)	.07 (0.31)	-.12 (-1.01)	-.03 (-.22)	.17 (1.45)	.85 (6.37)	.42 (2.84)	.02 (0.13)	.26 (1.45)
Pigeonpea	.3479 (9.09)	.33 (2.22)	.31 (3.45)	.51 (2.40)	.21 (1.82)	.43 (3.61)	.23 (2.13)	1.02 (8.23)	.79 (4.52)	.36 (2.70)	.21 (1.54)
Chickpea	.4041 (10.03)	.32 (2.10)	.32 (3.55)	--	.16 (1.41)	.37 (3.05)	.41 (3.76)	--	-.06 (-.14)	.24 (1.60)	.54 (3.24)
Groundnut	--	--	--	--	--	--	--	--	--	--	--
R^2	.36	.54	.59	.39	.38	.39	.37	.70	.51	.55	.44
$\bar{R}^2$	.37	.40	.48	.15	.20	.21	.18	.56	.28	.41	.26

MP = Madhya Pradesh; MH = Maharashtra; AP = Andhra Pradesh; GJ = Gujarat; KT = Karnataka; and RN = Rajasthan.
[a]Figures in parentheses are 't' values.

Table 21. Regression results of all markets together with different sets of variables.[a]

Variables \ Types	All markets (linear variables)	All markets (linear and some squared variables)	All markets with different sets of variables		
			1	2	3
Intercept	.0686	.7984	-.04	-.02	-.21
Distance	-.0007 (-2.769)	-.0007 (-2.80)	-.00009 (-3.64)	-.00009 (-3.62)	-.0001 (-4.23)
Market size	.0094 (5.06)	.0107 (5.25)	--	--	.002 (0.63)
(Market size)^2	--	--	--	--	.00004 (2.23)
Share of ICRISAT crops	-.1146 (-2.49)	-.1208 (-2.62)	-.06 (-1.24)	.05 (-1.20)	-.09 (-2.09)
Market age	.0103 (5.58)	.0107 (5.43)	.009 (5.28)	.009 (5.33)	.01 (6.01)
Wholesale traders	-.0019 (-3.05)	-.0029 (-3.80)	.0002 (0.31)	--	.003 (3.00)
(Wholesale traders)^2	--	--	--	--	-.000003 (-1.75)
Commission agents	.0001 (0.10)	.0016 (1.35)	.0003 (0.29)	--	.002 (1.03)
(Commission agents)^2	--	--	--	--	-.000008 (-.68)
No.of telephones	--	--	--	--	-.001 (-2.29)
(No.of telephones)^2	--	--	--	--	.000001 (1.23)
Tel/turnover	.1028 (3.56)	-.1184 (-1.09)	.02 (0.80)	.02 (0.85)	--
(Tel/turnover)^2	--	.0164 (1.88)	--	--	--
Tel/traders	-.6245 (-4.19)	.4269 (0.77)	-.27 (-1.85)	-.27 (-1.87)	--
(Tel/traders)^2	--	-.4078 (-1.52)	--	--	--
Turn/traders	-.7472 (-2.26)	-4.1171 (-3.17)	-.32 (-.99)	-.38 (-1.57)	--
(Turn/traders)^2	--	3.1916 (2.68)	--	--	--

Contd.

Table 21. Contd.

Variables \ Types	All markets (linear variables)	All markets (linear and some squared variables)	All markets with different sets of variables		
			1	2	3
Secretaries	.0356 (2.82)	.0381 (2.93)	.03 (2.48)	.03 (3.47)	.04 (2.64)
Marketyard use	.0324 (2.98)	.0292 (2.65)	.01 (2.66)	.01 (2.82)	.008 (1.97)
(Marketyard use)^2	--	-.0006 (-1.90)	--	--	--
Production density	1.5345 (4.24)	1.5442 (4.28)	1.09 (2.99)	1.11 (3.08)	1.21 (3.31)
Population density	.0005 (0.18)	.0009 (0.33)	.0002 (0.92)	.0002 (0.91)	.00006 (-.21)
State dummies					
Andhra Pradesh	-.0056 (-5.40)	-.0058 (-5.46)	-.00003 (-1.41)	-.00002 (-1.58)	-.0001 (-3.71)
Madhya Pradesh	-.0021 (-2.48)	-.0022 (-2.57)	.00002 (1.14)	.00003 (3.50)	-.00009 (-2.73)
Maharashtra	-.0003 (-.36)	-.0006 (-.66)	.00003 (1.61)	.00004 (5.71)	-.00008 (-2.43)
Rajasthan	-.0042 (-3.43)	-.0046 (-3.72)	.000008 (0.26)	.00002 (0.56)	-.00009 (-2.19)
Gujarat	-.0023 (-2.06)	-.0031 (-2.65)	-.00001 (-.28)	.000007 (0.37)	-.0001 (-2.58)
Karnataka	-.0031 (-3.32)	-.0034 (-3.56)	-.000006 (-.26)	.000003 (0.25)	-.0001 (-3.12)
Uttar Pradesh	--	--	--	--	--
Crop dummies					
Sorghum	-.1488 (-3.30)	-.1501 (-3.32)	-.12 (-2.71)	-.12 (-2.74)	-.13 (-2.98)
Pearl millet	.0141 (0.31)	.0124 (0.28)	.04 (0.80)	.04 (0.81)	.03 (0.58)
Pigeonpea	.3479 (9.09)	.3486 (9.11)	.34 (8.86)	.35 (8.94)	.34 (8.90)
Chickpea	.4041 (10.03)	.4048 (10.05)	.41 (10.05)	.41 (10.06)	.41 (10.01)
Groundnut	--	--	--	--	--
R^2	.38	.40	.26	.26	.27
$\bar{R}^2$	.37	.39	.24	.24	.25

[a]Figures in parentheses are 't' values.

Linear and quadratic terms of some of the variables presented in Table 21 are solved for their maximum or minimum by values taking the first derivative and equating with zero and compared with mean values of the corresponding variables. In the case of telephones the results indicate that 3 to 4 telephones per market whose turnover is 1000 tonnes was the minimum required for efficiency of the market. For more efficiency, the number of telephones must be more than that. The result of the analysis indicates that for efficiency there should not be more than one telephone per two traders and if it exceeds then it will result in inefficiency.

The results on marketyard utilization indicate that in general markets are not congested; in fact they are underused. The results indicate that about 24000 tonnes should be transacted in an acre of marketyard whereas the existing mean value was only 8000 tonnes per acre. Each trader should transact at least 600 tonnes of goods per year in the market, whereas the existing trader turnover is only 300 tonnes per year. For efficiency, the results indicate that market size should be at least 25000 tonnes per year, whereas the existing size is almost double than that. Regarding wholesale traders and commission agents, the existing number was very much less than the results indicate. A maximum of 500 wholesale traders and a maximum of 125 commission agents should operate in each market whereas at the time of this study there were an average of 161 wholesale traders and 78 commission agents. Similarly the existing number of telephones was only 160 whereas the results indicate that there should be a minimum of 500 telephones for efficiency. The results of different regressions using different variables indicate similar conclusions, except minor changes in the value of coefficients and 't' values in some variables. This indicates that transformation of some of the variables did not influence other variables much. This was also evident from the correlation matrix of independent variables given in Table 22. This table reveals that, except in the case of market size and number of traders, there may be no multicolinearity problem.

6. CONCLUSIONS

It can be concluded on the basis of estimates made on marketing costs and margins that the three selected markets in Andhra Pradesh were operationally efficient for all the five ICRISAT crops. The market margins obtained through different channels were reasonable. For all the crops the producers received the largest share of the consumers rupee. Whenever the market costs were high, they were due to higher taxes.

Table 22. Correlation matrix of independent variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Distance (1)	1												
Market size (2)	-.115	1											
% of SAT crops (3)	.033	-.179	1										
Market age (4)	-.184	.248	-.230	1									
No. of wholesale traders (5)	-.07	.891	-.203	.220	1								
No. of commission agents (6)	.041	.725	-.195	.142	.837	1							
Tel/turnover (7)	-.148	-.127	-.110	.073	.753	.196	1						
Tel/trader (8)	-.278	.396	-.161	.399	.343	.265	.643	1					
Changes of market secretaries (9)	.150	.031	.055	-.178	.069	.334	.332	.14[illegible]	1				
Marketyard utilization (10)	.169	.192	.011	.096	.051	.022	-.238	-.003	.311	1			
Size of trader (11)	-.025	.368	-.037	.277	-.009	-.037	-.530	.137	-.123	.396	1		
Population Density (12)	.116	-.066	.219	-.376	-.061	-.113	-.086	-.124	.187	.110	-.062	1	
Density of crop production (13)	.102	-.104	.192	-.247	-.132	-.051	.016	-.045	.259	-.027	-.028	.032	1

On the basis of correlation analysis, it can be concluded that most of the selected markets were integrated well for most of the ICRISAT crops. Among ICRISAT crops, sorghum prices were not well correlated. This may be due to greater quality variations in this crop as compared to other crops, and difficulties in quality assessment.

Both marketing margins and price correlation coefficients are in themselves incomplete measures of marketing efficiency; if applied together, they may complement each other in that one measure may suggest shortcomings that the other does not capture. In the case of the three markets studied, however, both measures tend to agree.

Analyses of the price correlation coefficients leads to the following conclusions: the fewer the traders the higher the pricing efficiency. In the existing markets; therefore, without reducing the total number of traders, more regulated markets with fewer traders in each would increase pricing efficiency. This would imply more markets in the vicinity of farmers providing better physical access. More telephones should be provided in these markets, but they should be distributed equally among traders. Market supervision is important and market secretaries should be exchanged at intervals so that they can properly oversee market activities without being influenced by vested (traders') interests. Marketyards should be established, large enough, yet not too large, to avoid congestion as well as too much empty space in the yard.

VTR,MvO:vsssm

7. REFERENCES

1. Anon. 1975. Annual administration report. Directorate of Marketing, Hyderabad, A.P., India.

2. Blyn, George. 1973. Price series correlation as a measure of market integration. Indian Journal of Agricultural Economics 28(2):56-59.

3. Cummings, R.W. (Jr.). 1967. Pricing efficiency in the Indian wheat market. New Delhi: Impex India.

4. Cummings, R.W. (Jr.). 1968. Effectiveness of pricing in an Indian wheat market: a case study of Khanna, Punjab. American Journal of Agricultural Economics 50(3):687-701.

5. Gill, K.S., and Johl, S.S. 1969. Price spreads in gram trade in Punjab. Agricultural Marketing XII(1):15-16.

6. Goel, R.C., and Gangwar, A.C. 1978. Marketing costs and margins of rice in Kurukshetra District. Agricultural Situation in India XXXIII(5):297-301.

7. Harriss, Barbara. 1979. State integration in dryland foodgrains markets and price inequality in Andhra Pradesh and Karnataka States. Paper presented at the Indo-British Geographical Seminar in South India, Madras, December 1979, India.

8. Kahlon, A.S., and Singh, B.. 1968. Marketing of groundnut in erstwhile Punjab. Department of Economics and Sociology, Punjab Agricultural University, Ludhiana, Punjab, India.

9. Kahlon, S.S., and Pandey, R.K. 1969. Marketing margins in the marketing of foodgrains in Hissar District. Journal of Research VI(2).

10. Krishnaswamy, L., Hari Harain, and Vijay Kumar. 1968. A study on price spread of wheat in Rajasthan. Agricultural Situation in India 23(4):317-324.

11. Lele, Uma J. 1967. Market integration — a study of sorghum prices in western India. Journal of Farm Economics 49(1) part I:147-159.

12. Lele, Uma J. 1973. Foodgrain marketing in India — private performance and public policy. Bombay: Popular Prakashan, India.

13. Raju, V.T., and von Oppen, M. 1980. Marketing margins and price correlations as measures of marketing efficiency for important crops in semi-arid tropical India. ICRISAT Journal Article No.109. ICRISAT Economics Program, Patancheru, A.P. 502 324, India.

14. Raju, V.T., and von Oppen, M. 1980. Marketing channels for selected crops in semi-arid tropical India. ICRISAT Economics Program progress report 16, Patancheru, A.P., India.

15. Randhawa, J.S., Joshi, H.L., and Singh, G.B. 1974. Marketing costs and margins of wheat in Gurdaspur District. Agricultural Marketing 16(4):16-20.

16. Shah, C.H. 1965. Marketing efficiency: concepts and measurement. Rapporteur's report, Seminar on Marketing of Agricultural Commodities. Seminar series V, Indian Society of Agricultural Economics, Bombay, India.

17. Singh, Balwinder, and Arora, B.S. 1975. An analytical study on spatial price differentials in groundnut in Punjab markets. Agricultural Marketing XVIII(3).

18. Singh, Lakshman. 1962. Marketing costs and producers' share in consumers' rupee — two case studies on rice in Madhya Pradesh. Agricultural Situation in India 16(10):1020-1024.

19. Singh, R.B. 1975. Price-spread and marketing margins of bajra in Jaipur District (Rajasthan). Indian Journal of Marketing 6(5&6):21-24.

20. Singh, R.V., Varma, R.C., and Agarwal, H.L. 1974. Marketing costs and margins of a cooperative marketing society and a private wholesale trader: a case study. Agricultural Marketing 17(1):14-18.

21. Thakur, D.S. 1974. Foodgrain in marketing efficiency: a case study of Gujarat. Indian Journal of Agricultural Economics XXIX(4):61-74.

22. von Oppen, M., Raju, V.T., and Bapna, S.L. 1979. Foodgrain marketing and agricultural development in India. Pages 173-192 In Proceedings of the International Workshop on Socioeconomic Constraints to Development of Semi-Arid Tropical Agriculture, 19-23 February 1979, Patancheru, A.P., India.

Appendix Table 1. Estimates of price spreads, marketing costs, and margins for sorghum in selected markets of Andhra Pradesh, 1975-76.[a]

Items	Warangal		Khammam		Tandur	
	Rs/q	%	Rs/q	%	Rs/q	%
Farmers' sale price	144.50	(85.4)	147.25	(86.8)	149.86	(88.9)
Farmers' market charges:						
Commission	2.89	(2.0)	2.20	1.50	2.25	1.50
Weighment	0.05		0.05		0.05	
Labor (Hamali)	0.18		0.07		0.07	
Total market charges	3.12	(1.8)	2.35	(1.4)	2.40	(1.4)
Farmers' net sale price	141.38	(83.6)	144.90	(85.4)	147.46	(87.5)
Primary wholesale traders'						
" purchase price	144.50	(85.4)	147.25	(86.8)	149.86	(88.9)
" sale price	160.39	(94.8)	162.15	(95.6)	163.55	(97.1)
" gross margin	15.89	(9.4)	14.90	(8.9)	13.69	(8.1)
" Market costs:						
variable costs	1.85		1.74		1.58	
fixed costs	0.86		0.99		0.75	
market fee	0.72	0.50	0.74	0.50	0.75	0.50
sales tax	3.61	2.25	3.65	2.25	3.68	2.25
" Total market costs	7.04	(4.2)	7.12	(4.2)	6.76	(4.0)
" Net margin	8.85	(5.2)	7.78	(4.6)	6.93	(4.1)
Retailers'						
" purchase price	160.39	(94.8)	162.15	(95.6)	163.55	
" sales price	169.19		169.65		168.50	
" gross margin	8.80	(5.2)	7.50	(4.4)	4.95	(2.9)
" Market costs:						
variable costs	1.76		2.45		1.50	
fixed costs	0.45		0.30		0.25	
total costs	2.21	(1.3)	2.75	(1.6)	1.75	(1.0)
" net margin	6.59	(3.9)	4.75	(2.8)	3.20	(1.9)
Consumers' purchase price	169.19	(100)	169.65	(100)	168.50	(100)
Farmer's share in consumer's rupee		(83.56)		(85.41)		(87.51)

[a]Figures in parentheses are percentages based on consumer purchase price = 100.

Appendix Table 2. Estimates of price spreads, marketing costs, and margins for pearl millet in selected markets of Andhra Pradesh, 1975-76.[a]

Items	Warangal		Khammam		Tandur	
	Rs/q	%	Rs/q	%	Rs/q	%
Farmers' sale price	140.90	(88.7)	146.20	(88.1)	148.67	(87.9)
Farmers' market charges:						
commission	2.82	2.00	2.19	1.50	2.23	1.50
weighment	0.05		0.05		0.05	
labor (Hamali)	0.18		0.12		0.10	
total market charges	3.05	(1.9)	2.36	(1.4)	2.38	(1.4)
Farmers' net sale price	137.85	(86.8)	143.84	(86.7)	146.29	(86.4)
Primary wholesale traders'						
" purchase price	140.90	(88.7)	146.20	(88.1)	148.67	(87.9)
" sales price	153.26	(96.5)	159.55	(96.1)	162.65	(96.1)
" gross margin	12.36	(7.8)	13.35	(8.0)	13.98	(8.3)
" Market costs:						
variable costs	1.85		1.74		1.25	
fixed costs	0.86		0.99		0.71	
market fee	0.70	0.50	0.73	0.50	0.74	0.50
sales tax	3.45	2.25	3.59	2.25	3.66	2.25
" total market costs	6.86	(4.3)	7.05	(4.2)	6.36	(3.8)
" net margin	5.50	(3.5)	6.30	(3.8)	7.62	(4.5)
Retailers'						
" purchase price	153.26	(96.5)	159.55	(96.1)	162.65	(96.1)
" sales price	158.81		165.98		169.22	
" gross margin	5.55	(3.5)	6.43	(3.9)	6.57	(3.9)
" Market costs:						
variable costs	1.76		2.45		1.50	
fixed costs	0.45		0.30		0.25	
total costs	2.21	(1.4)	2.75	(1.7)	1.75	(1.0)
" net margin	3.34	(2.1)	3.68	(2.2)	4.82	(2.8)
Consumers' purchase price	158.81	(100)	165.98	(100)	169.22	(100)
Farmer's share in consumer's r pee		(86.80)		(86.66)		(86.44)

[a]Figures in parentheses are percentages based on consumer purchase price = 100. Other figures under % column are fixed by the Government on ad valorem basis on farmers' sales price.

Appendix Table 3. Estimates of price spreads, marketing costs, and margins for pigeonpea in selected markets of Andhra Pradesh, 1975-76.[a]

Items	Warangal		Khammam		Tandur	
	Rs/q	%	Rs/q	%	Rs/q	%
Farmers' sale price	196.10	(78.2)	201.50	(79.2)	213.26	(81.1)
Farmers' market charges:						
commission	3.92	2.00	3.02	1.50	2.98	1.50
weighment	0.05		0.05		0.05	
labor (Hamali)	0.18		0.12		0.10	
total costs	4.15	1.7	3.19	(1.3)	3.13	(1.2)
net price	191.95	(76.5)	198.31	(78.0)	210.13	(79.9)
Primary wholesale traders'						
" purchase price	196.10	(78.2)	201.50	(79.2)	213.26	(81.1)
" sale price	214.13	(85.4)	218.82	(86.0)	230.67	(87.7)
" gross margin	18.03	(7.2)	17.32	(6.8)	17.41	(6.6)
" Market costs:						
variable costs	2.06		2.18		1.13	
fixed costs	0.73		0.85		0.99	
market fee	0.98	0.50	1.01	0.50	0.99	0.50
sales tax	6.96	3.25	7.11	3.25	7.50	3.25
total costs	10.73	(4.3)	11.15	(4.4)	10.61	(4.0)
" net margin	7.30	(2.9)	6.17	(2.4)	6.80	(2.6)
Millers'						
" purchase price	214.13	(85.4)	218.82	(86.0)	230.67	(87.7)
" sale price of dhal	238.46	(95.1)	242.02	(95.2)	250.82	(95.4)
" gross margin	24.33	(9.7)	23.20	(9.1)	20.15	(7.7)
" Market costs:						
variable costs	8.70		8.95		7.65	
fixed costs	2.90		2.55		2.30	
total costs	11.60	(4.6)	11.50	(4.5)	9.95	(3.8)
" net margin	12.73	(5.1)	11.70	(4.6)	10.20	(3.9)
Retailers'						
" purchase price of dhal	238.46	(95.1)	242.02	(95.2)	250.82	(95.4)
" sale price of dhal	250.82		254.32		262.98	
" gross margin	12.36	(4.9)	12.30	(4.8)	12.16	(4.6)
" Market costs:						
variable costs	3.90		4.05		2.76	
fixed costs	0.50		0.40		0.30	
total costs	4.40	(1.8)	4.45	(1.7)	3.06	(1.2)
" net margin	7.96	(3.2)	7.85	(3.1)	7.20	(2.7)
Consumers' purchase price of dhal	250.82	(100)	254.32	(100)	262.98	(100)
Farmer's share in consumer's rupee		(76.52)		(77.97)		(79.90)

[a]Figures in parentheses are percentages calculated considering consumer purchase price = 100. Other figures under % col. are fixed by the Government on *ad valorem* basis on farmer's sale price.

Appendix Table 4. Estimates of price spread marketing costs and margins for chickpea in selected markets of Andhra Pradesh, 1975-76.[a]

Item	Warangal		Khammam		Tandur	
	Rs/q	%	Rs/q	%	Rs/q	%
Farmers' sale price	194.80	(79.5)	198.66	(79.4)	207.59	(82.1)
Farmers' market charges:						
commission	3.90	2.00	2.98	1.50	3.11	1.50
weighment	0.05		0.05		0.05	
labor (Hamali)	0.18		0.12		0.10	
total costs	4.13	(1.7)	3.15	(1.3)	3.26	(1.3)
net price	190.67	(77.8)	195.51	(78.1)	204.33	(80.8)
Primary wholesale traders'						
" purchase price	194.80		198.66		207.59	
" sale price	212.23	(86.6)	216.99	(86.7)	224.96	(89.0)
" gross margin	17.43	(7.1)	18.33	(7.3)	17.37	(6.9)
" Market costs:						
variable costs	2.06		2.18		1.13	
fixed costs	0.73		0.85		0.99	
market fee	0.97	0.50	0.99	0.50	1.08	0.50
sales tax	6.90	3.25	7.05	3.25	7.31	3.25
total costs	10.66	(4.3)	11.07	(4.4)	10.51	(4.2)
" net margin	6.77	(2.8)	7.26	(2.9)	6.86	(2.7)
Millers'						
" purchase price	212.33	(86.6)	216.99	(86.7)	224.96	(89.0)
" sale price of dhal	233.33	(95.2)	238.79	(95.4)	243.36	(96.3)
" gross margin	21.10	(8.6)	21.80	(8.7)	18.40	(7.3)
" Market costs:						
variable costs	6.70		6.95		5.45	
fixed costs	2.90		2.55		2.10	
total costs	9.60	(3.9)	9.50	(3.8)	7.55	(3.0)
net margin	11.50	(4.7)	12.30	(4.9)	10.85	(4.3)
Retailers'						
" purchase price of dhal	233.33	(95.2)	238.79	(95.4)	243.36	(96.3)
" sale price of dhal	245.17		250.29		252.77	
" gross margin	11.84	(4.8)	11.50	(4.6)	9.41	(3.7)
" Market costs:						
variable costs	3.90		4.05		2.76	
fixed costs	0.50		0.40		0.30	
total costs	4.40	(1.8)	4.45	(1.8)	3.06	(1.2)
" net margin	7.44	(3.0)	6.05	(2.4)	6.35	(2.5)
Consumers' purchase price of dhal	245.17	(100)	250.29	(100)	252.77	(100)
Farmer's share in consumer's rupee		(77.77)		(78.11)		(80.83)

[a]Figures in parentheses are percentages worked out considering consumer purchase price = 100. Other figures under % column are fixed by the Government on ad valorem basis on farmer's sale price.

Appendix Table 5. Estimates of price spreads, marketing costs, and margins for groundnut in selected markets of Andhra Pradesh, 1975-76.[a]

Items	Warangal		Khammam		Tandur	
	Rs/q	%	Rs/q	%	Rs/q	%
Farmers' sale price	226.95	(74.4)	234.22	(75.0)	129.77	(76.7)
Farmers' market charges:						
commission	4.53	2.00	3.51	1.50	3.44	1.50
weighment	0.08		0.08		0.08	
labor (Hamali)	0.54		0.20		0.20	
total costs	5.15	(1.7)	3.79	(1.2)	3.72	(1.2)
net price	221.80	(72.7)	230.43	(73.8)	226.05	(75.5)
Primary wholesale traders'						
" purchase price	226.95	(74.4)	234.22	(75.0)	229.77	(76.7)
" sale price	238.15	(78.0)	246.67	(79.0)	240.17	(80.2)
" gross margin	11.20	(3.7)	12.47	(4.0)	10.40	(3.5)
" Market costs:						
variable costs	3.28		3.64		2.95	
fixed costs	0.75		0.88		0.85	
market fee	1.13	0.50	1.17	0.50	1.15	0.50
" total costs	5.16	(1.7)	5.69	(1.8)	4.95	(1.7)
" net margins	6.04	(2.0)	6.78	(2.2)	5.45	(1.8)
Millers'						
" purchase price	238.15	(78.0)	246.69	(79.0)	240.17	(80.2)
" sale price of g.nut oil	281.55	(92.2)	287.02	(91.9)	278.91	(93.1)
" gross margin	43.40	(14.2)	40.33	(12.9)	38.74	(12.9)
" Market costs:						
variable costs	10.32		9.50		8.70	
fixed costs	3.39		3.07		3.15	
sales tax	11.26	4.00	11.48	4.00	11.16	4.00
total costs	24.97	(8.2)	24.05	(7.7)	23.01	(7.7)
" net margin	18.43	(6.0)	16.28	(5.2)	15.73	(5.3)
Retailers'						
" purchase price of g.nut oil	281.55	(92.2)	287.02	(91.9)	278.91	(93.1)
" sale price of g.nut oil	305.23		312.28		299.47	
" gross margins	23.68	(7.8)	26.26	(8.4)	20.56	(6.9)
" Market costs:						
variable costs	13.90		15.53		12.26	
fixed costs	0.50		0.40		0.35	
total costs	14.40	(4.7)	15.93	(5.1)	12.61	(4.2)
" net margin	11.28	(3.7)	10.33	(3.3)	9.95	(3.3)
Consumers' purchase price of oil	305.23	(100)	312.28	(100)	299.47	(100)
Farmer's share in consumer's rupee		(72.66)		(73.78)		(75.48)

[a]Figures in parentheses are percentages worked out based on consumer purchase price = 100. Other figures under % column within brackets indicate the ad valorem rate at which the particular item is being charged.

Appendix Table 6. Correlation coefficients of weekly market prices of sorghum in selected markets in 1974-75.

	Andhra Pradesh			Madhya Pradesh			Maharashtra					Rajasthan			Gujarat		Karnataka			Uttar Pradesh			
	WGL	KMM	TDR	IND	UJJ	NGJ	PON	MLG	DOD	MKP	LTR	NDB	HND	BGN	PTN	SNT	GDG	BGK	CTD	SHB	BND	JRR	PNW
Warangal (WGL)	1.00	.30	.37	.73	.48	-.78	.53	.25	.63	.31	.65	.32	-.01	.35	.35	.16	.84	.61	.59	.86	63	.11	.74
Khammam (KMM)		1.00	.88	.74	.61	--	.54	.70	.82	.71	.90	--	--	--	.41	.19	.71	.71	.51	--	.95	--	.38
Tandur (TDR)			1.00	.31	.20	-.22	.20	.42	-.25	-.35	.32	.33	.76	.02	.17	.26	.40	.29	.41	-.26	.38	-.26	.42
Indore (IND)				1.00	.74	-.72	.07	.74	-.11	.10	.22	.26	-.46	.68	.38	.34	.54	.52	.51	.65	.52	-.11	.60
Ujjain (UJJ)					1.00	-.33	.27	.91	.01	.32	.10	-.25	-.53	.27	.64	.44	.33	.37	.45	.90	.23	.68	.53
N. Gunj (NGJ)						1.00	.79	-.90	.91	.90	-.53	-.09	.70	-.08	.21	.82	-.77	-.60	-.86	.45	-.77	.32	-.64
Poona (PON)							1.00	.74	-.22	.26	.41	-.71	-.29	.46	.32	.46	.39	.54	.52	.62	-.14	.28	-.21
Malegaon (MLG)								1.00	.80	.77	.52	--	-.10	.55	.36	.90	.21	.83	.92	--	.79	--	.79
Dondiacha (DOD)									1.00	.41	.29	.59	.44	-.32	.20	.06	.42	.06	.25	.88	-.33	--	-.36
Malkapur (MKP)										1.00	.24	.28	.32	.34	.33	.23	.35	.03	.15	.82	-.28	.74	-.28
Latur (LTR)											1.00	.10	.76	.19	.08	.11	.60	.47	.33	.63	.06	-.30	.27
Nadbal (NDB)												1.00	.84	.25	-.36	-.09	-.06	.55	.06	.10	.08	-.29	-.33
Hindone (HND)													1.00	.21	.27	.48	.33	-.10	.58	--	-.22	--	-.38
Begun (BGN)														1.00	.60	.63	.32	.48	.57	.78	.56	.82	.31
Patan (PTN)															1.00	.34	.13	.10	.26	.69	-.13	.56	.21
Santrampur (SNT)																1.00	.31	.63	.67	-.16	.18	.57	.31
Gadag (GDG)																	1.00	.75	.70	.56	.56	.12	.53
Bagalkot (BGK)																		1.00	.78	.16	.53	-.03	.33
Chitradurga (CTD)																			1.00	.41	.60	.45	.53
Shahabad (SHD)																				1.00	.42	.67	.65
Bendki (BND)																					1.00	.37	.71
Jarar (JRR)																						1.00	.71
Panwari (PNW)																							1.00

Appendix Table 7. Correlation coefficients of weekly market prices of pearl millet in selected markets in 1974-75.

	Andhra Pradesh			Madhya Pradesh		Maharashtra					Rajasthan		Gujarat		Karnataka		Uttar Pradesh		
	WGL	KMM	TDR	IND	UJJ	PON	MLG	DOD	MKP	LTR	NDB	HND	PTN	SNT	BGK	CTD	SHB	BND	JRR
Warangal (WGL)	1.00	.93	.91	.93	.91	.54	.44	.10	.86	.02	-.39	.79	.84	.52	.61	.51	-.71	-.23	-.68
Khammam (KMM)		1.00	.90	.71	--	.71	.28	.82	.65	.40	.40	.97	.88	.85	.74	.84	.11	-.23	-.93
Tandur (TDR)			1.00	.58	.14	.84	--	--	--	.47	.86	.94	.70	.66	.80	.92	.83	-.11	-.89
Indore (IND)				1.00	.81	.77	.10	.10	.01	.73	.78	.77	.63	.53	.73	.74	.85	-.48	-.50
Ujjain (UJJ)					1.00	.42	.11	.10	-.10	-.11	.45	.89	.69	.38	.73	.31	-.13	-.36	--
Poona (PON)						1.00	.52	.91	.61	.69	.72	.77	.65	.78	.68	.75	.89	-.22	-.66
Malegaon (MLG)							1.00	.37	.26	.54	--	.41	.25	.41	.07	.12	--	--	--
Dondiacha (DOD)								1.00	.27	.52	--	.69	.15	.29	-.14	-.42	--	--	--
Malkapur (MKP)									1.00	.77	--	.59	.69	.81	.55	.29	--	--	--
Latur (LTR)										1.00	.70	.27	.12	.58	.16	.23	-.21	-.35	-.41
Nadbai (NDB)											1.00	.89	.34	.38	.57	.66	-.26	.01	--
Hindone (HND)												1.00	.67	.63	.61	.46	.15	-.08	-.79
Patan (PTN)													1.00	.68	.70	.45	.66	-.16	-.66
Santrampur (SNT)														1.00	.78	.26	.75	-.23	-.34
Bagalkot (BGK)															1.00	.69	.59	-.33	-.58
Chitradurga (CTD)																1.00	.08	-.17	-.70
Shahabad (SHB)																	1.00	.56	--
Bendki (BND)																		1.00	--
Jarar (JRR)																			1.00

Appendix Table 8. Correlation coefficients of weekly market prices of pigeonpea in selected markets in 1974-75.

	Andhra Pradesh			Madhya Pradesh				Maharashtra					Rajasthan		Gujarat		Karnataka			Uttar Pradesh			
	WGL	KMM	TDR	KDW	IND	UJJ	NGJ	PON	MLG	DOD	MKP	LTR	NDB	HND	PTN	SNT	GDG	BGK	CTD	SHB	BND	JRR	PNW
Warangal (WGL)	1.00	.96	.85	.92	.96	.82	-.49	.93	.50	.88	.87	.83	.68	.57	.39	.87	.53	.79	.94	.92	.94	.85	.94
Khammam (KMM)		1.00	.94	.91	.95	.82	-.46	.94	.53	.79	.73	.80	.69	.44	.30	.79	.48	.76	.90	.82	.93	.74	.95
Tandur (TDR)			1.00	.83	.74	.89	-.21	.82	.68	.71	.86	.94	.65	.54	.61	.81	.32	.62	.94	.81	.90	.77	.58
Khandwa (KDW)				1.00	.93	.93	-.50	.87	.45	.89	.91	.80	.73	.77	.60	.92	.54	.84	.87	.91	.94	.90	.90
Indore (IND)					1.00	.90	-.51	.91	.29	.93	.90	.77	.60	.87	.54	.88	.66	.91	.81	.91	.95	.91	.96
Ujjain (UJJ)						1.00	-.34	.85	.51	.71	.92	.81	.81	.77	.63	.91	.50	.72	.92	.88	.93	.91	.91
N. Gunj (NGJ)							1.00	.38	-.58	-.60	-.57	-.49	-.76	-.67	.17	-.46	-.38	-.42	-.57	-.90	-.76	-.70	-.49
Poona (PON)								1.00	.44	.94	.91	.82	.30	.66	.72	.85	.62	.85	.93	.87	.91	.82	.93
Malegaon (MLG)									1.00	.80	.47	.62	.37	.33	.30	.52	.35	.19	.92	.39	.37	.35	-.40
Dondiacha (DOD)										1.00	.96	.90	.08	.21	.14	.93	.46	.61	.92	.90	.94	.90	.37
Malkapur (MKP)											1.00	.35	.77	.84	67	.95	.74	.83	.96	.93	.95	.94	.94
Latur (LTR)												1.00	.76	.72	.57	.85	.63	.70	.91	.82	.80	.74	.77
Nadbai (NDB)													1.00	.84	.70	.71	.81	.85	.68	.85	.80	.81	.76
Hindone (HND)														1.00	.67	.81	.32	.95	.74	.95	.93	.94	.96
Patan (PTN)															1.00	.69	.52	.77	.65	.63	.67	.60	.41
Santrampur (SNT)																1.00	.39	.78	.55	.95	.95	.92	.93
Gadag (GDG)																	1.00	.54	.62	.82	.80	.76	.72
Bagalkot (BGK)																		1.00	.88	.89	.93	.89	.98
Chitradurga (CTD)																			1.00	.82	.70	.74	.68
Shahabad (SHB)																				1.00	.99	.97	.98
Bendki (BND)																					1.00	.98	.97
Jarar (JRR)																						1.00	.98
Panwari (PNW)																							1.00

Appendix Table 9. Correlation coefficients of weekly market prices of chickpea in selected markets in 1974-75.

	AP	Madhya Pradesh				Maharashtra					Rajasthan				Gujarat		Karnataka		Uttar Pradesh			
	TDR	KDW	IND	UJJ	NGJ	PON	MLG	DOD	MKP	LTR	NDB	HND	GNG	BGN	PTN	SNT	GDG	BGK	SHB	BND	JRR	PNW
Tandur (TDR)	1.00	.67	.80	.75	-.25	.84	.88	.76	.82	.90	.88	.80	.55	.03	.96	.69	.70	.33	.58	.89	.79	.76
Khandwa (KDW)		1.00	.90	.85	-.08	.78	.86	.60	.86	.87	.89	.90	.90	.89	.60	.86	.85	.55	.85	.90	.89	.86
Indore (IND)			1.00	.91	.13	.87	.89	.73	.94	.94	.94	.97	.91	.84	.76	.91	.93	.75	.90	.96	.92	.94
Ujjain (UJJ)				1.00	.06	.81	.35	.48	.85	.96	.91	.91	.58	.95	.66	.85	.85	.64	.81	.90	.80	.88
N. Gunj (NGJ)					1.00	.09	.09	.03	-.05	-.01	-.35	-.26	-.06	.60	-.18	-.06	-.16	-.14	-.37	-.19	-.30	-.11
Poona (PON)						1.00	.84	.79	.89	.92	.85	.90	.68	.88	.74	.88	.88	.64	.78	.89	.82	.86
Malegaon (MLG)							1.00	.61	.85	.89	.86	.86	.65	.82	.70	.82	.83	.62	.73	.91	.81	.87
Dondiacha (DOD)								1.00	.76	.75	.73	.71	.66	.48	.47	.64	.78	.87	.68	.73	.77	.64
Malkapur (MKP)									1.00	.94	.89	.93	.83	.96	.85	.91	.95	.76	.87	.93	.89	.92
Latur (LTR)										1.00	.96	.96	.86	.92	.82	.92	.91	.67	.86	.97	.88	.92
Nadbai (NDB)											1.00	.96	.90	.91	.81	.88	.87	.65	.89	.95	.91	.89
Hindone (HND)												1.00	.94	.92	.74	.95	.92	.70	.89	.95	.90	.92
Ganganagar (GNG)													1.00	.67	.42	.84	.81	.87	.68	.84	.72	.64
Begun (BGN)														1.00	.87	.91	.90	.92	.74	.86	.87	.86
Patan (PTN)															1.00	.72	.71	.43	.74	.80	.82	.76
Santrampur (SNT)																1.00	.91	.70	.88	.91	.89	.92
Gadag (GDG)																	1.00	.78	.88	.91	.91	.90
Bagalkot (BGK)																		1.00	.72	.68	.91	.74
Shahabad (SHB)																			1.00	.88	.90	.88
Bendki (BND)																				1.00	.91	.94
Jarar (JRR)																					1.00	.91
Panwari (PNW)																						1.00

AP: Andhra Pradesh

Appendix Table 10. Correlation coefficients of weekly market prices of groundnut in selected markets in 1974-75.

	Andhra Pradesh			Madhya Pradesh			Maharashtra					Rajasthan			Gujarat			Karnataka			UP
	WGL	KMM	TDR	KDW	IND	UJJ	PON	MLG	DOD	MKP	LTR	NDB	HND	BGN	PTN	DNG	SNT	GDG	BGK	CTD	SHB
Warangal (WGL)	1.00	.62	.59	.45	.36	.63	.60	.19	.13	.41	-.27	.52	.30	.31	.58	.99	-.32	.49	.42	.52	-.33
Khammam (KMM)		1.00	.72	.60	-.36	-.45	-.10	-.59	-.57	-.45	.08	.09	.16	-.11	.10	.72	.10	-.14	-.31	.33	.35
Tandur (TDR)			1.00	.75	.66	.69	.74	.71	.40	.42	.34	.35	.69	.60	.29	.91	.53	.91	.67	.31	-.21
Khandwa (KDW)				1.00	.59	.72	.63	.80	.68	.84	.39	.39	.49	.60	.21	.92	.42	.73	.75	-.11	-.27
Indore (IND)					1.00	.41	.52	.62	.59	.30	.16	.49	.52	.66	.39	.48	.39	.60	.60	-.10	.06
Ujjain (UJJ)						1.00	.53	.68	.57	.70	.17	-.05	-.13	.32	.35	.84	-.21	.61	.22	-.34	-.20
Poona (PON)							1.00	.72	.67	.59	.70	.79	.79	.51	.10	.28	.59	.78	.60	.44	.11
Malegaon (MLG)								1.00	.72	.76	.57	.32	.52	.62	.74	.18	.43	.58	.69	.14	.18
Dondiacha (DOD)									1.00	.73	.58	.54	.57	.64	.84	.12	.41	.46	.68	-.08	.14
Malkapur (MKP)										1.00	.33	.23	.23	.52	.78	.64	.14	.54	.74	-.05	-.20
Latur (LTR)											1.00	.35	.36	.33	.53	-.79	.54	.38	.40	-.49	.53
Nadbai (NDB)												1.00	.87	.42	.45	-.53	.44	.49	.46	-.61	-.28
Hindone (HND)													1.00	.76	.84	-.06	.52	.78	.66	-.44	-.27
Begun (BGN)														1.00	.63	.12	.53	.67	.76	.03	.05
Patan (PTN)															1.00	-.35	.15	-.15	.76	.10	.60
Damnagar (DNG)																1.00	-.31	.90	.51	.10	-.90
Santrampur (SNT)																	1.00	.40	.42	-.29	.17
Gadag (GDG)																		1.00	.68	.47	-.16
Bagalkot (BGK)																			1.00	.25	-.17
Chitradurga (CTD)																				1.00	-.28
Shahabad (SHB)																					1.00

UP: Uttar Pradesh