AN ANALYSIS OF THE PRICE BEHAVIOUR OF SELECTED COMMODITIES

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(A Study for the Planning Commission)

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FOREWORD

Ensuring stability in the prices of essential commodities is an area of major concern for policy makers. Price instability affects both producers and consumers and has macroeconomic implications as well. A steep rise in the prices of primary commodities spills over to other sectors of the economy and leads to an increase in the overall rate of inflation.

Bearing this mind, the current study examines the price behaviour of a few selected agricultural commodities. The objectives of the study are to analyse: the behaviour of the procurement prices of wheat, rice and groundnut; the relationship between their procurement prices and cost of production, farm harvest prices and wholesale prices; the variability in the prices of these selected commodities; and, the structure of markets.

One of the many findings of the study is that one reason for the higher growth in the prices of cereals, particularly rice and wheat, is the significant increase in their procurement prices. On the structure of markets, the study finds that by and large, markets for cereals in the four metro cities of the country appear to be competitive. But, there are complex long-run relationships among the prices of cereals, oilseeds and edible oils, indicating that stabilising prices of any one particular commodity while ignoring relationships among the prices of substitute commodities will have no significant impact on the prices of the target commodity.

The results of this study would be of use to policy makers and academia having interest in price policy and structure of grain markets. The Council is grateful to the Planning Commission for sponsoring the study. We wish to express our sincere thanks to the staff members of the Planning Commission (Sh. M. D. Asthana, Sh. R. Srinivasan and Sh. Sharat Kumar) and the Ministry of Consumer Affairs (Sh. Kamal Kishore, Sh. A. K. Jha and Sh. Piyush Srivastava) for their wholehearted support and keen interest in the study. The cooperation from the traders and other individuals and Sh. T. K Krishnan, in particular who helped in data collection is thankfully acknowledged.

The study was conducted by Dr. Anil Sharma with support from Dr. Parmod Kumar.

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Suman Bery
Director General

Executive Summary

Stabilisation of prices of essential agricultural commodities continues to remain an area of major concern for policy makers. Price instability affects both producers and consumers and has macroeconomic implications as well. High growth in the prices of primary commodities spills over to other sectors of the economy leading to an increase in the overall rate of inflation.

There is thus a need to study the price behaviour of a few essential agricultural commodities and the reasons that underlie the large variations in their prices in order to devise improvements in the system. The current study analyses the behaviour of the procurement prices of wheat, rice and groundnut; the relationship between procurement prices and cost of production, farm harvest prices and wholesale prices; variability in the prices of these selected commodities (inter-year, intra-year, inter-market, intra-market); and the structure of markets. The main conclusions of the study are summarised below.

Behaviour of Procurement, Farm Harvest and Wholesale Prices

- The analysis clearly shows actual procurement prices to be far in excess of those recommended by the Commission for Agricultural Costs and Prices (CACP) during the 1990s as compared to the 1980s. The mean excess of procurement prices actually announced by the government over cost of cultivation (Cost A2 + family labour) also exhibits substantially higher incentives during the 1990s as compared to the 1980s. The higher margins in the case of wheat and rice over the cost of cultivation point to the significant pressure exercised by the producers of cereals.
- Thus, one of the reasons for the higher growth in the prices of cereals, particularly rice and wheat, is the significant increase in their procurement prices, which sets the floor for both farm harvest prices and wholesale prices. As the objective of price policy is to provide incentives to producers to produce more, it is important to bear in mind that price support policy is one among a host of other non-price instruments for promoting growth of agricultural commodities.
- The analysis shows that there has been acceleration in the rate of growth of the nominal as well as real prices of cereals. This is in sharp contrast to the trends observed during the 1980s, when the real prices of these crops exhibited a significant

decline. The results for groundnut seed and groundnut oil on the other hand exhibit trends contrary to those observed in the case of cereals. The rates of growth in both nominal as well as real prices clearly show deceleration in the 1990s as compared to the 1980s.

- Raising procurement prices of cereals by higher margins pushes up their procurement. As a consequence, government has to carry over huge stocks, which pushes up the economic cost of food grains. This is particularly true when international prices are low and exporters do not find it lucrative to buy, store and sell at a later date. This is exactly what happened with respect to the international prices of wheat during the last two to three years (1997-98, 1998-99 and 1999-2000) in particular.
- Increase in the economic cost compels the government to raise the central issue prices of cereals, which reduces off-takes from the PDS (Public Distribution System). If the issue prices are not raised the widening spread between the wholesale price and the central issue price also provides strong incentives for leakage, i.e., diversion of cereals from the PDS to the open market. As a result, stocks start depleting, which forces the government to resort to all kinds of instruments such as unduly higher incentives in the form of procurement prices, ban on exports, credit controls, controls on stocking and licensing requirements for building up the depleted stocks.
- The policy implication of these findings is that there is hardly any need for raising procurement prices to such high levels as has been done in the recent past.

Inter- and Intra-Year Variations in Prices

- A comparison of the variations in prices of the selected commodities shows that price fluctuations are generally higher in the case of coarse cereals, groundnut and groundnut oil as compared to rice and wheat. Among the selected commodities price variability is the lowest in case of rice.

- Decomposition of prices into seasonal, trend and random elements reveals that seasonal fluctuations exhibit a slight increase in the case of wheat and coarse cereals during the 1990s, while for other crops seasonal fluctuations have narrowed down during the 1990s in comparison to the 1980s.

- The occurrence and amplitudes of irregular factors exhibited a decline during the 1990s as compared to the 1980s for the three commodities - wheat, rice and groundnut oil. In the case of coarse cereals, however, there was a significant increase in the occurrence of irregular factors during the 1990s in comparison to the 1980s. The results also indicate that despite significant reduction in inter-year variability of wheat during the 1990s, intra-year variability has shot up during this period.
- Further analysis of factors affecting seasonal price changes shows that the price stabilisation measures (buying and selling) were not successful in reducing the seasonal rise in the wholesale prices of rice in particular. Unexpected changes in the supply of cereals on the other hand have a strong influence on seasonal price movements of cereals.
- Though, government interventions did have the desired effect on monthly changes in the prices of wheat, there has been no significant impact of the changes in stocks on monthly variations in the prices of rice. The results also suggest the strong influence of the changes in the prices of substitutes on the movements of monthly wholesale and retail prices of these two cereals.

Inter-and Intra-Market Variability in Prices

- High intra-year variations in prices were observed during 1990-91, 1991-92, and 1996-97 in the case of wheat; during 1990-91, 1991-92 and 1995-96 in the case of rice; and during 1992-93 and 1997-98 in the case of groundnut oil respectively. Generally, higher intra-year variations in prices were observed in those markets that were close to the main production areas.
- This implies that as the supply reaches its peak during the main marketing season, prices in surplus areas fall to their lowest levels, but prices in the deficit areas continue to remain high. When the supplies start dwindling prices start rising and as the prices peak, private traders anticipating an incipient fall in prices off load their stocks just before the start of the next marketing season. But in the deficit areas, traders hold on to their stocks expecting a price rise depending upon the time lag and perceived shortfall in the supply.

- In the majority of markets, differences in prices between markets were in general just enough to cover the costs of shipment between these markets. However, there were some markets where the differences in prices between markets were higher than the shipment costs between those markets.
- Thus, there is a need to monitor and keep a record of actual trade flows among different markets, which would help in explaining the issues related to inter- and intra-market variability in the prices of various commodities.

Structure of Markets in the Four Metropolitan Cities of India

- By and large, markets for cereals in the four metro cities of the country appear to be competitive. Market level information, though, indicated higher inequality in terms of the volume of trade handled by traders in Chennai and Delhi (Narela) markets in the case of wheat and in Kolkata, Chennai and Mumbai markets in the case of rice.
- For edible oils, the Chennai market for edible oils and Kolkata market for mustard seed and mustard oil exhibited higher inequality in terms of the volume of trade handled by the traders. The concentration was less pronounced in the Mumbai market.
- A comparison of vertical margins among selected metros revealed that the margins between the wholesale and the retail prices are excessive in Delhi, for rice in particular. But in other markets, the price spreads were in general low.
- It was also observed that there is asymmetry in the transmission of price signals from the wholesale to the retail level and vice versa which implies that shocks in the prices at the wholesale level are not transmitted in an identical manner to the prices at the retail level. These estimates show that the cumulative effect on retail prices of an increase in their wholesale prices exceeds the cumulative effect of their price decreases. The slower transmission of the downward movements in the wholesale prices to the retail price suggests that consumers do not benefit as much from the decreases in the wholesale price. The analysis also suggested the absence of causality between the wholesale to retail prices in the case of rice and wheat in selected markets.

- This asymmetry in the transmission of prices and higher spreads between the wholesale and retail prices could be due to several reasons such as relatively high concentration of trade, higher transaction costs, weak infrastructure and information systems. It is a fact that transaction costs in the northern states of the country are high due to higher procurement incidentals compared to the other states.
- Yet another reason could be the larger number of intermediaries in between the wholesalers and the retailers which raises the transaction costs. There are several other reasons, which have been cited in the literature such as adverse information.
- For better policy formulation, it is suggested that market barriers and structural rigidities in the system that lead to higher transaction costs should be removed.

Prices of Cereals and Edible Oils during 1998-99

- Apart from the increase in procurement prices of wheat and rice, the other reason for the increase in the prices of cereals during 1998-99 was the fall in net availability of total cereals.
- This occurred due to three main reasons: (i) decrease in the output of cereals during the previous year, (ii) higher procurement due to the increase in procurement prices, and (iii) increase in exports and smuggling along the border.
- In the case of edible oils, the increase in prices during 1998-99 was due to the events that created a shortage of edible oils in the market. The edible oil business during 1998-99 was severely hit by the deaths that occurred from dropsy that broke out as a result of the consumption of adulterated mustard oil. The majority of state governments banned the sale of loose mustard oil which severely shook the edible oil market.

Inter-Commodity Price Linkages

- The results suggest complex long run relationships among rice, wheat and coarse grains; groundnut seed, mustard seed, cottonseed and other oilseeds; groundnut oil, vanaspati oil, mustard oil and other edible oils. This indicates that stabilising prices of a particular commodity while ignoring the prices of substitutes will not have any significant impact on the prices of commodities.

- The prices of cereals are reflected (discovered) in the prices of wheat as its price affects all other grains after a lag of one month. Similarly, in the case of oilseeds, the prices of oilseeds are made known (discovered) by the prices of rapeseed-mustard.
- Short run price movements in the prices of oilseeds are stable but movements in the prices of edible oils, groundnut oil in particular, are highly volatile. The imported edible oils, however, stabilise the edible oil markets, which indicates that the import liberalisation policy in the case of edible oils has helped in reducing the impact of high shocks on the prices of edible oils.
- The differences in the behaviour of prices of oilseeds and edible oils are due to asymmetry in the transmission of prices from oilseeds to edible oils and from edible oils to oilseeds. This suggests that oilseeds and edible oil markets are not vertically integrated.
- The above findings clearly point to the fact that there is asymmetry in the transmission of price signals from raw materials to the final product, which basically occurs due to the structural rigidities in the policy framework and actions of intermediaries in the vertical chain. To integrate oilseeds and edible oil markets these structural bottlenecks need to be dealt with.

Chapter 1

Introduction

Despite significant expansion in irrigated area, the output of a majority of agricultural commodities in India continues to remain vulnerable to weather changes. Therefore, stabilisation of prices of those agricultural commodities on which average consumers spend a sizeable proportion of their per capita expenditure continues to remain an area of major concern for the policy makers. Price instability imposes costs on both the producers as well as the consumers. If the price of a particular commodity falls below a certain level, producers lose because the price may not be able to cover the actual cost of production of that commodity. However, consumers benefit from low prices because they can buy more of the same commodity. Alternatively, if the price a commodity goes up producers gain but consumers lose because they have to adjust their expenditure and budget in response to changes in relative prices.

Apart from these microeconomic considerations there are macroeconomic effects of changes in agricultural prices. While positive price incentives to farmers help the government to achieve self-sufficiency, fluctuations in agricultural prices spill over to other sectors of the economy, leading to increase in the overall rate of inflation. Sometimes, a steep increase in the prices of agricultural commodities creates serious problems as happened in the case of wheat during 1996 and onions and other vegetables during 1998. Large variations in prices have serious consequences. Firstly, they provide enough room for speculators to take advantage of the situation especially in cases where there are restrictions on the movement of commodities and external trade is not permitted. Secondly, they lead to the formulation of flawed policy measures, which can be very costly.

Therefore, the government has to balance the twin objectives of self-sufficiency through the provision of remunerative prices to producers and protection to consumers by providing them subsidised food through the Public Distribution System (PDS). To achieve these objectives, government has to keep a close watch on the prices of a few essential commodities, which form quite a large proportion of an average consumer's budget. Thus, it was felt that there is a need for studying the price behaviour of a few essential agricultural commodities. The current study proposes to analyse the price behaviour of two key cereals (rice and wheat) and groundnut oil.

1.1 Objectives of the Study

The basic issues that are relevant in the present context are as follows:

1. What are the behaviour patterns of procurement prices of the selected commodities and central issue prices of rice and wheat?
2. What is the relationship between procurement prices and cost of production, farm harvest prices and wholesale prices of these three crops?
3. Has the variability in prices of these commodities intensified over time? What are the possible explanations for these changes, particularly during the year 1998-99?
4. What is the structure of markets in the internal trade of these commodities in selected metro centres of the country?

1.2 The Data

The data for the current study was collected mainly from published sources. Recent unpublished data on the relevant variables was collected from the Ministry of Consumer Affairs, Ministry of Agriculture and Commission for Agricultural Costs and Prices.

1.3 Structure of the Report

The report has seven chapters. After a brief backdrop (Chapter 1), Chapter 2 goes onto analyse the growth in procurement prices of wheat, rice and groundnut over time during the period, 1980-81 to 1998-99. It also examines the relationship between procurement prices, farm harvest prices and wholesale prices of these three crops and the behaviour pattern of procurement prices in relation to the cost of production of these commodities. Chapter 3 investigates growth and variability in the wholesale prices of the selected crops and also their substitutes. In particular, the variability in annual nominal and real prices are examined as well as intra-year variations in the prices of selected crops and their substitutes. In Chapter 4, the variability in the prices of these commodities in selected markets of the country are analysed and inter-market price spreads and transit costs including marketing margins are compared. The structure of markets in selected metro centres of the country is analysed in Chapter 5.

Chapter 6 is devoted to explaining inter-commodity price linkages, i.e., how movements in the prices of one substitute are transmitted to another. The understanding of transmission of price signals from one commodity to another and their degree of association is essential to stabilising prices of commodities. Finally, Chapter 7 summarises the main conclusions of the study.

Chapter 2

Behaviour of Procurement, Farm Harvest and Wholesale Prices of Selected Commodities

The Commission for Agricultural Costs and Prices (CACP) recommends procurement prices for 23 agricultural commodities. In its recommendations the CACP takes into account not only a comprehensive overview of the entire structure of the economy of a particular commodity but also a number of other important factors. This is reflected in the list of factors that go into the determination of support prices - cost of production; changes in input-output prices, open market prices, demand and supply; inter-crop price parity; effect on industrial cost structure, general price level, cost of living; and the international price situation. Based on the recommendations made by the CACP the government announces support prices. The objectives of price policy are two-fold: (i) to assure the producer that the price of his produce will not be allowed to fall below a certain minimum level, and (ii) to protect the consumer against an excessive rise in prices.

To analyse the behaviour of prices, the first indicator is the procurement price, which sets the floor below which prices are not allowed to fall.[1] To examine the influence of producers or consumers on price policy formulation, we calculated three indicators.

(i) The first indicator is the mean excess of the prices actually fixed by the government over the prices recommended by the CACP. This would indicate the influence exercised by the producers, if there is an sharp increase in procurement prices actually announced by the government over the prices that are recommended by the Commission.

(ii) The second indicator is the average annual change in nominal and real procurement prices, i.e. nominal procurement prices deflated by an index of wholesale prices of all commodities. The changes in real prices would show the movement in the procurement prices *vis a vis* general price level in the economy.

(iii) The third indicator is the mean excess of prices actually recommended by the government over cost of cultivation (Cost A2 + family labour). It is argued that procurement price should cover at least the paid out expenses including the imputed

[1] However, there have been instances when the actual prices received by farmers have fallen below these floor levels for some commodities in some markets (Tyagi, 1990)

value of family labour. The paid out expenses include actual expenses paid either in cash or kind such as hired human labour and bullock labour, cost of seeds, manures, fertilisers, pesticides, interest paid on capital, depreciation and repair charges. The excess of actual procurement prices over the cost of cultivation would reveal the level of incentives given to the producers.

All the three indicators for the three selected crops - wheat, rice and groundnut - are presented in Table 2.1. The time period considered for this analysis is 19 years, i.e. from 1980-81 to 1998-99. The first three columns show the actual difference between the procurement prices fixed by the government and those recommended by the CACP. It is evident from the table that in the case of wheat there are three years during the 1990s, 1992-93, 1997-98 and 1998-99 when significantly higher margin is observed in the procurement prices fixed by the government over the recommended prices. As a result, averages for the 1980s (1981-82 to 1989-90) and 1990s (1990-91 to 1999-2000), show much higher incentives during the 1990s in comparison to the 1980s. A more or less similar trend is observed in the case of rice as well. There is one distinction, however. The level of the difference between the actual procurement prices announced by the government and those recommended by the commission is relatively small during the 1990s in comparison to the 1980s. In the case of groundnut, however, trends in procurement prices reveal exactly the opposite. The recommendations of the CACP were adhered to in most of the years. In fact, the actual prices were fixed below those recommended by the CACP during some years (Table 2.1).

Similar trends are noticeable in the average annual rates of growth in both nominal as well as real procurement prices during the 1980s and 1990s for both wheat and rice. However, the magnitude of the difference in trends during the 1980s and 1990s in the case of rice is much smaller than in the case of wheat. The average values of these variables show that a significantly higher increase is observed in the case of wheat as compared to rice. In sharp contrast to the changes observed in the case of wheat and rice, average annual changes in both nominal and real procurement prices of groundnut show lower values during the 1990s in comparison to the 1980s.

Table 2.1: Trends in Procurement Prices of Wheat

Year	Excess of Actual Procurement Price over Recommended Price (per cent)			Change in Procurement Price over previous year (per cent)			Change in Real Procurement Price over previous year (per cent)			Excess of Actual Procurement Price over cost of production (A2 + FL) (per cent)		
	Wheat	Rice	Groun-dnut	Wheat	Rice	Groun-dnut	Wheat	Rice	Groun-dnut	Wheat	Rice	Grou-ndnut
1980-81	0.00	5.00	0.00							50.37	58.82	6.10
1981-82	2.36	0.00	-1.10	11.11	9.52	31.07	1.20	2.14	25.06	44.58	55.38	12.59
1982-83	0.00	0.00	0.00	9.23	6.09	9.26	4.13	-0.15	2.19	63.00	52.88	0.02
1983-84	0.00	0.00	0.00	6.34	8.20	6.78	-1.11	1.14	-0.49	72.88	61.03	6.96
1984-85	-1.94	0.00	0.00	0.66	3.79	7.94	-5.46	-1.54	2.44	60.32	55.86	25.35
1985-86	0.00	1.43	0.00	3.29	3.65	2.94	-1.08	-1.41	-1.68	70.72	68.85	13.69
1986-87	0.00	0.00	0.00	3.18	2.82	5.71	-2.49	-3.92	-0.69	79.97	57.89	9.18
1987-88	0.61	0.00	0.00	2.47	2.74	5.41	-5.24	-4.68	-3.54	72.42	37.64	-0.07
1988-89	0.00	0.00	0.00	4.22	6.67	10.26	-3.01	-0.74	3.53	63.29	35.47	33.67
1989-90	0.00	7.56	-6.00	5.78	15.63	9.30	-1.56	6.17	0.87	52.02	49.33	21.42
1990-91	7.50	0.00	0.00	17.49	10.81	23.40	6.55	-1.14	9.53	76.76	52.06	130.79
1991-92	0.00	-2.13	0.78	4.65	12.20	12.07	-7.99	0.37	-0.69	70.73	37.10	165.45
1992-93	14.29	3.85	-6.67	24.44	17.39	7.69	13.07	7.54	-0.22	103.65	60.23	25.07
1993-94	8.20	0.00	-1.25	17.86	14.81	12.86	8.77	4.71	2.50	98.49	72.29	14.89
1994-95	0.00	0.00	0.00	6.06	9.68	8.86	-4.33	0.45	-0.97	92.03	63.87	26.06
1995-96	0.00	1.41	0.00	2.86	5.88	4.65	-4.48	-1.04	-1.15	92.80	59.20	19.33
1996-97	0.00	2.70	0.00	5.56	5.56	2.22	-0.75	-0.01	-3.59	77.70	62.59	20.23
1997-98	17.28	0.00	0.00	25.00	9.21	6.52	19.24	3.16	0.45	113.56	63.60	12.29
1998-99	12.09	0.00	0.00	7.37	6.02	6.12	0.48	1.12	1.33	108.51	64.08	16.26
Averages												
80-81 to 90-91	0.78	1.27	-0.65	6.38	6.99	11.21	-0.81	-0.41	3.72	64.21	53.20	23.61
91-92 to 98-99	6.48	0.73	-0.89	11.72	10.09	7.62	3.00	2.04	-0.29	94.68	60.37	37.45
Source: Computed.												

The mean excess of procurement prices actually announced by the government over the cost of cultivation (Cost A2 + family labour) also exhibit substantially higher incentives for wheat during the 1990s in comparison to the 1980s. The average excess of actual procurement prices over cost of production during the 1980s was 64 per cent, which increased to 95 per cent during the 1990s. In the case of rice the average margin of procurement prices over cost of production increased from 53 per cent during the 1980s to 60 per cent during the 1980s. The mean excess of the procurement prices actually announced by the government over cost of cultivation (Cost A2 + family labour) in the case of groundnut is similar to the trends witnessed in the case of cereals, but the margins are much lower.

This clearly shows that there has been an attempt to fix procurement prices of cereals higher than those recommended by the CACP, which points to the significant pressure exercised by the producers. However, one of the reasons for this could be the low procurement during some years when the procurement prices were unattractive to the farmers and maintaining parity with international prices due to large depreciation of the rupee in the early 1990s. But, even this is not true, specifically with respect to international prices of wheat during the last two years in particular (Figures 2.1 to 2.3). For example, international prices of wheat after having touched a new peak in 1996-97 declined steeply thereafter. But, domestic prices have witnessed an increase during the last two years.

There are two disadvantages of fixing higher support prices. Firstly, as mentioned before, support prices set the floor for both farm harvest prices and wholesale prices. The farm harvest prices are those which prevail during six to eight weeks immediately after the harvesting period and wholesale prices are those which prevail in the wholesale markets.[2] A comparison of procurement prices, farm harvest prices and wholesale prices of all the three crops wheat, rice and groundnut exhibited in Figures 2.4 to 2.6 clearly demonstrates this. Though, there are some years in between when the wholesale prices have fallen below farm harvest prices, on an average the kind of pattern observed is - support price < farm harvest price < wholesale price.

[2] The farm harvest prices and wholesale prices of wheat are the weighted averages for five states - Haryana, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh. In the case of rice, these prices are the weighted averages for Andhra Pradesh, Haryana, Madhya Pradesh, Punjab and Uttar Pradesh. For groundnut, these are weighted averages for Andhra Pradesh, Gujarat and Maharshtra.

Figure 2.1: Domestic and International Prices of Wheat (US $/qtl)

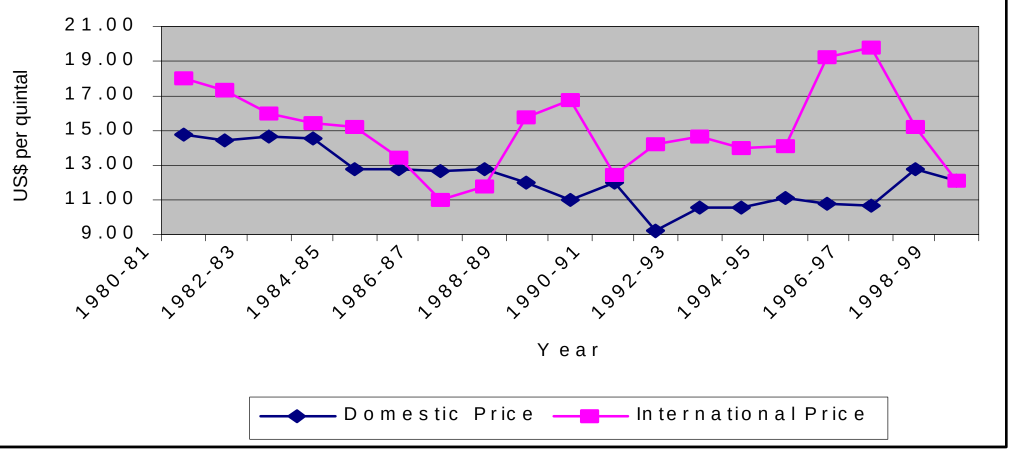


Figure 2.2: Domestic and International Prices of Rice (US$ per qtl)

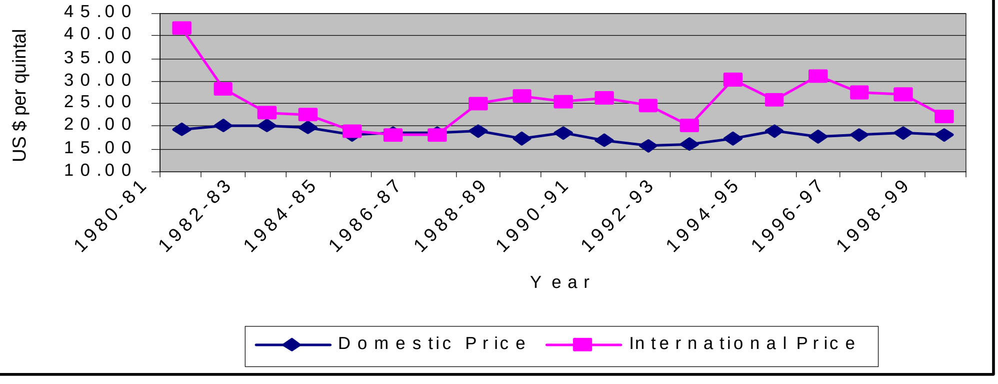


Figure 2.3: Trends in International and Domestic Prices of Groundnut.

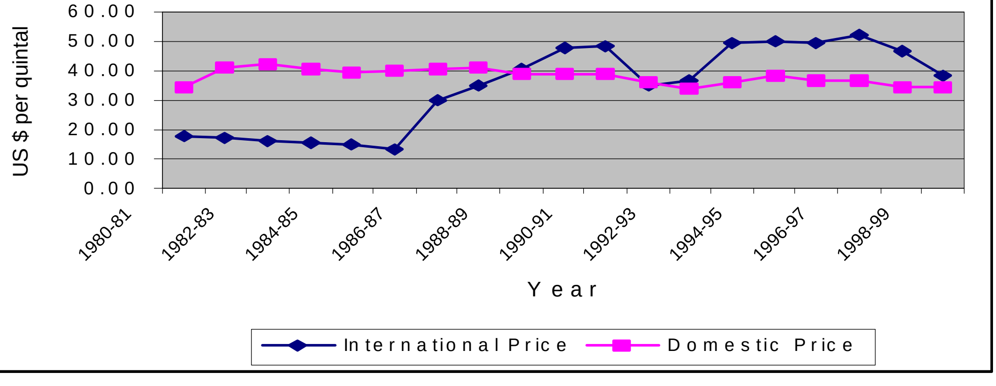


Figure 2.4: Trends in procurement, farm harvest and whole sale prices of wheat.

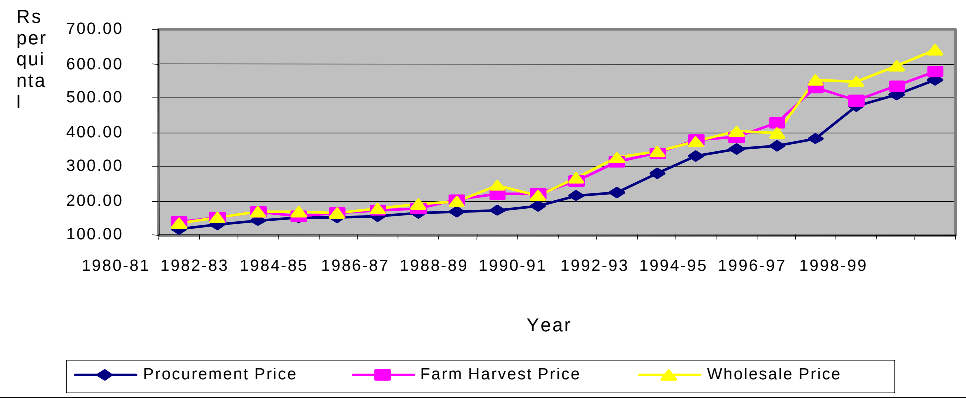


Figure 2.5: Trends in procurement, farm harvest and wholesale prices of rice.

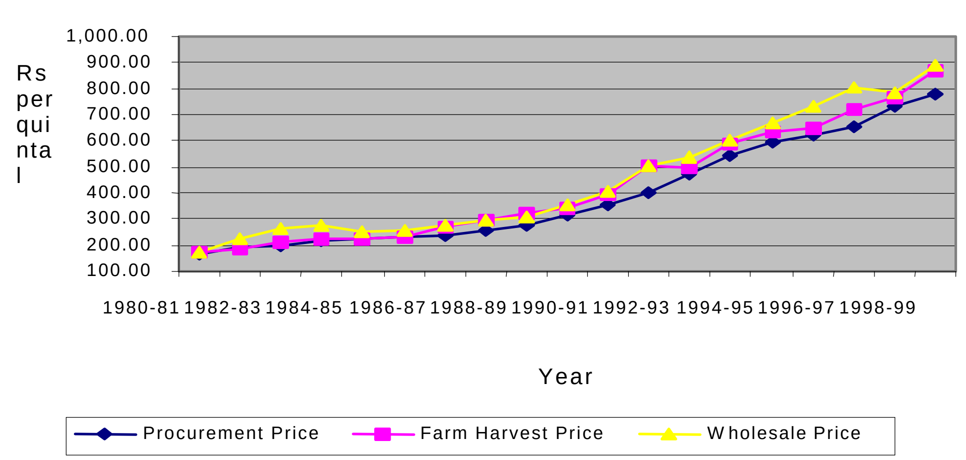
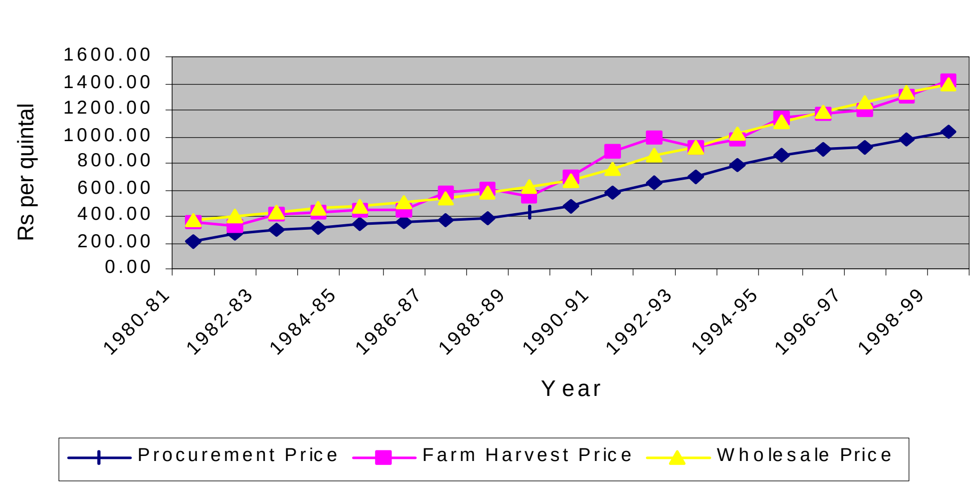


Figure 2.6: Trends in procurement, farm harvest and wholesale prices of groundnut.



The regression results presented in Table 2.2 illustrate the empirical relationship between wholesale and procurement prices of the three selected crops over the period 1980-81 to 1998-99. The regression coefficients of procurement prices are significant in all the three equations. The coefficient of procurement price in the case of wheat shows that a 10 per cent increase in the procurement price of wheat pushes up the wholesale price of wheat by 5.54 per cent. A similar increase in the procurement price of rice, however, raises the wholesale price by a much higher margin, i.e., 10.67 per cent. In the case of groundnut, a 10 per cent increase in the procurement price boosts its wholesale price by about 5 per cent, close to the level observed in the case of wheat.

Table 2.2: Relationship between Wholesale and Procurement Prices of Selected Crops

Crop	Constant	Procurement Price	Time	$\bar{R}^2$	DW
Wheat	2.2314	0.5538 (3.20)	0.0395 (2.79)	0.97	2.26
Rice	-0.1826	1.0675 (5.57)	-0.0073 (-0.42)	0.98	1.55
Groundnut	3.1219	0.4977 (7.95)	0.0373 (6.77)	0.99	1.83

Notes:
1. Figures in parentheses are respective "t" values.
2. Equations were estimated in logarithms.

Secondly, the procurement agency, Food Corporation of India (FCI), which is entrusted with the responsibility of running market intervention operations for wheat and rice ends up buying more than what the agency would have initially required. This is particularly true when prices are expected to remain low and traders do not find it lucrative to buy, store and sell at a later date. Procurement equations presented in Table 2.3 reveal that a 10 per cent increase in the real procurement price raises the procurement of wheat by a little more than 13.84 per cent. The elasticity of the real procurement price is more than the elasticity of output of wheat. In the case of rice also a 10 per cent increase in the real procurement price increases the level of procurement by close to 10 per cent, but a similar 10 per cent increase in output raises procurement by nearly 11 per cent.

The increased procurement of cereals pushes up both the cost of procurement as well as the level of stocks held by the government, which raises the cost of carrying a higher level of stocks. For example, the procurement incidentals of the FCI constitute about 24 per cent of the procurement price of wheat and 15 per cent of the procurement price of paddy. This implies that a 10 per cent increase in the procurement price of wheat and rice raises the procurement incidentals by about 2.4 per cent and 1.5 per cent, respectively. Likewise, the cost of carrying a much higher level of stocks also increases with the increase in the level of stocks held by the FCI. As a consequence, the economic cost of food grains bought by the FCI goes up, which necessitates increase in the central issue prices of food grains (Table 2.4).

Table 2.3: Procurement Functions for Wheat and Rice

Crop	Constant	Procurement Price	Output	$\bar{R}^2$	DW
Wheat	-6.8809	1.3837 (2.74)	0.6228 (3.29)	0.49	1.97
Rice	-7.4926	0.9855 (1.56)	1.0979 (3.97)	0.74	1.82

Figures in parentheses are respective "t" values.
Equations were estimated in logarithms.

Table 2.4: Changes In Procurement Prices, Economic Cost And Central Issue Prices Of Cereals

	Wheat			Rice			Ratio of actual level of stocks over minimum norm*
Year	Change in procurement price over previous year (per cent)	Change in economic cost over previous year (per cent)	Change in issue price over previous year (per cent	Change in procurement price over previous year (per cent)	Change in economic cost over previous year (per cent)	Change in issue price over previous year (per cent	
1992-93	24.44	29.00	19.14	16.58	17.75	21.69	0.87
1993-94	17.86	5.54	16.92	16.48	13.64	16.59	1.41
1994-95	6.06	3.60	17.54	8.81	4.45	0.00	1.85
1995-96	2.86	5.95	0.00	4.56	9.80	0.00	1.44
1996-97	5.56	9.63	-10.78	5.26	11.13	-5.76	1.13
1997-98	25.00	25.05	-2.42	11.80	10.94	-5.20	1.25
1998-99	7.37	0.93	4.76	6.02	4.25	11.11	1.49

Source: Computed.

- As on April 1, 1993 and so on for the other years.
- Changes in procurement and issue prices are for the marketing years.

If central issue prices are not raised the widening gap between wholesale price and central issue price increases off-take from the PDS. This happens, particularly when most of the surplus brought to the markets by the producers is picked up by the FCI and very little is left with the traders. To stabilise prices in the open market, the government has to release cereals in the open market. For this government has to maintain a higher level of stocks. As the off-take increases and when the stocks of food grains start depleting government resorts to all kinds of measures such as unduly higher incentives in the form of procurement prices, ban on exports, credit controls, controls on stocking and licensing requirements for beefing up the depleted stocks.[3]

Summing up, the analysis clearly shows that there has been an attempt to fix procurement prices of cereals higher than those recommended by the CACP, which points out the significant pressure exercised by the producers of these two crops. However, one of the reasons for this could be the low procurement during some years when the procurement prices were unattractive to the farmers and maintaining parity with international prices due to large depreciation of the rupee in the early 1990s. But, even this is not true, specifically with respect to international prices of wheat during the last two years in particular. Therefore, one of the reasons for the higher growth in the prices of two cereals, particularly rice and wheat is the significant increase in their procurement prices, which sets the floor for both farm harvest prices and wholesale prices.

[3] The events of 1996-97 clearly demonstrate such a phenomenon. During 1996-97, when international prices of wheat shot up, the exports of wheat became highly competitive. As a consequence, the procurement of wheat remained low and stocks of wheat started depleting. When the prices of wheat started increasing in the domestic market, the government first reduced the export quota of wheat and later on banned exports of both wheat as well as wheat products completely. The selective credit controls, which were abolished in 1995-96, were re-imposed again for a limited period. Similarly, stocking and licensing requirements were re-introduced and procurement prices of wheat were raised substantially (by 25 per cent) in 1997-98.

Chapter 3

Inter- and Intra-Year Variations in Prices

Price instability affects both producers and consumers. Apart from these micro influences, there are macroeconomic effects of changes in prices of various commodities. Extremely high growth in the prices of primary commodities spills over to other sectors of the economy, which leads to an increase in the overall rate of inflation. Therefore, the government has to balance the twin objectives of expanding output through the provision of remunerative prices to the producers and protecting the interests of consumers by making sure that prices remain within certain limits. In this chapter, we examine the fluctuations in annual and monthly prices of the selected crops. The objective is to know whether variability in the prices of selected commodities has intensified over time. If yes, then what are the factors that explain these variations in the prices of the selected commodities?

3.1 Variability in Annual Nominal and Real Prices

Growth and variability in prices can be estimated by using different methods. A yearly price variation, i.e. price change in a given year relative to the price in the previous year is the most common and easiest method. However, this method fails to separate the trend element and random factors in the price variation. The commonly used method of separating the trend element is the simple linear or log linear regression method. We have used log-linear regression to estimate trend and measure the fluctuations in prices around the log-linear trend. For this analysis, we have used price indices both nominal as well as real[1] of wheat, rice, coarse cereals, groundnut seeds, groundnut oil and other edible oils. The results are shown in Table 3.1.

The data reveal that over the period 1980-81 to 1989-90, nominal prices of wheat, rice and coarse cereals grew at an exponential rate of about 5 per cent (wheat and coarse cereals) and 6 per cent (rice) per annum, respectively. But in the 1990s (1990-91 to 1999-2000), the rates of growth in nominal prices accelerated to about 9 per cent per

[1] Nominal price index deflated by the wholesale price index for all commodities.

annum for these crops. Higher growth in their nominal prices during the 1990s resulted in a positive growth in their real prices.

Table 3.1 Growth Rates and Variability in Prices of Wheat, Rice, Groundnut Seed and Groundnut Oil

	Growth Rate (%)		Coefficient of Variation (%)	
	1980s	1990s	1980s	1990s
Nominal Prices				
Wheat	5.22 (11.6)	8.91 (17.7)	0.85	0.81
Rice	5.92 (10.3)	8.82 (18.9)	1.07	0.74
Coarse cereals	4.97 (7.80)	9.08 (6.22)	1.21	2.01
Groundnut seed	7.11 (8.2)	4.54 (5.4)	1.63	1.34
Groundnut oil	7.86 (8.7)	3.94 (4.1)	1.70	1.53
Other edible oils	8.46 (19.17)	3.50 (12.19)	0.82	0.40
Real Prices				
Wheat	-1.43 (-3.1)	1.37 (2.6)	0.92	1.02
Rice	-0.44 (-0.8)	1.79 (4.3)	1.09	0.80
Coarse cereals	-1.67 (2.42)	1.56 (1.17)	1.38	2.34
Groundnut seed	0.74 (0.9)	-2.4 (-3.6)	1.68	1.35
Groundnut oil	1.49 (1.7)	-3.0 (-3.1)	1.77	1.92
Other edible oils	1.84 (4.70)	-3.93 (8.11)	0.76	0.81

Notes:
1. Growth rates have been computed using semi-logarithmic trend and variability is measured by the coefficient of variation around the semi-logarithmic trend.
2. Figures in parentheses are respective t-values

This is in sharp contrast to the trends observed during the 1980s, when real prices of these crops exhibited a significant decline. Moreover, there is an increase in the inter-year variability in real prices of wheat and coarse cereals during the 1990s, which is reflected in their higher coefficients of variation around the log linear trend. Among cereals, rice is the only crop whose real prices displayed reduced variability during the 1990s in comparison with the 1980s.

The rates of growth in the prices of groundnut seed, groundnut oil and other edible oils on the other hand, exhibit trends contrary to those observed in the case of cereals. The rates of growth in both nominal as well as real prices clearly show deceleration in the 1990s as compared to the 1980s. Real prices of edible oils fell sharply during the 1990s. The trends in the variability of nominal and real prices of edible oils show diverse movements during the 1980s and 1990s. The nominal prices exhibit a slight decrease in the variability during the 1990s in comparison to the 1980s, but real prices indicate a slight increase in the variability during the 1990s.

To explore whether variations in the output of these crops have contributed to the increased variability in their prices, we have presented the rates of growth in area, production and yield of these crops in Table 3.2. The data reveal that barring the exception of coarse cereals the variability in the output of all other crops has declined during the 1990s in comparison to the 1980s. In the case of coarse cereals, there does not appear to be a significant change in the variability of output during the two decades.

The data exhibited in the table, however, show that there has been a decline in the rate of output growth during the 1990s as compared to the 1980s for all the selected crops. In the case of wheat, lower growth in yield during the 1990s is the main reason for reduction in the rate of output growth because there has been an increase in the growth in area under wheat during the 1990s. Similarly, in the case of rice a slightly higher fall in the productivity growth brought down rate of output growth significantly during the 1990s. In the case of coarse cereals and groundnut, however, there has been a decline in area during the 1990s. As a result, there is a decline in the output growth despite improvement in the productivity of these crops during the 1990s.

3.2 Variability in Monthly Prices

The examination of price behaviour based on monthly data could be more illuminating on account of a larger sample size, which brings to light intra-year variations also. One way of analysing variability in monthly prices is by examining the extent of divergences between the highest and the lowest price. An alternative may be decomposing prices into trend, pure seasonal and cyclical or irregular components. We

Table 3.2: Growth Rates and Variability in Area, Production and Yield of a Few Selected Crops

	Growth Rate (%)		Coefficient of Variation (%)	
	1980s	1990s	1980s	1990s
Area				
Wheat	0.45 (1.3)	1.55 (4.6)	1.00	0.65
Rice	0.41 (1.2)	0.35 (2.3)	0.81	0.32
Coarse cereals	-1.35 (4.75)	-2.15 (7.02)	0.70	0.68
Groundnut	1.63 (2.0)	-2.25 (-5.6)	3.75	1.59
Other oilseeds	2.89 (5.93)	2.06 (5.24)	1.78	1.06
Production				
Wheat	3.51 (5.5)	3.20 (5.5)	1.53	0.81
Rice	3.55 (3.9)	1.61 (3.2)	2.03	0.71
Coarse cereals	0.35 (0.29)	0.19 (0.14)	3.20	3.04
Groundnut	3.69 (1.7)	1.15 (1.1)	10.40	3.82
Other oilseeds	7.11 (6.19)	4.55 (6.11)	5.84	2.23
Yield				
Wheat	3.06 (7.5)	1.65 (3.0)	0.49	0.42
Rice	3.14 (5.1)	1.26 (2.8)	0.77	0.36
Coarse cereals	1.70 (1.57)	2.34 (2.10)	1.48	1.25
Groundnut	2.06 (1.4)	3.40 (3.1)	2.05	1.04
Other oilseeds	4.22 (4.48)	2.49 (3.63)	1.38	0.80

Notes:
1. Growth rates have been computed using semi-logarithmic trend and variability is measured by the coefficient of variation around the semi-logarithmic trend.
2. Figures in parentheses are respective t-values.
3. The period for the 1980s is from 1980-81 to 1989-90 and for the 1990s is from 1990-91 to 1998-99

have used both these methods on monthly indices of wholesale prices (base 1981-82) as reported in the Index Numbers of Wholesale Prices, Government of India.

3.2.1 Divergence of the Highest Price from the Lowest Price

The extent of divergence of the lowest price from the highest price of wheat, rice, groundnut seeds and groundnut oil is presented in Tables 3.3 to 3.6. It is discernible from Table 3.3 that on an average deviation of the lowest price from the highest price of wheat has increased during the 1990s as compared to the 1980s. The average deviation for the 1990s is 24 per cent as compared to the average deviation of 17.3 per cent during the 1980s. This is despite the fact that the 1990s witnessed normal monsoons, whereas in the 1980s there were at least three years of drought. This is also reflected in the coefficients of variation around mean presented in the same table. In fact, there were six years in the 1990s when the deviations of the lowest price from the highest price exceeded 21 percentage points (the average for the whole period). During the 1980s, however, there were only four years when the deviations of the lowest price from the highest price exceeded 21 percentage points.

These results clearly indicate that despite reductions in inter-year variability of wheat price during the 1990s, intra-year variability has shot up during this period. This in a way suggests that price stabilisation measures were rather unsuccessful in reducing the intra-year price variability during the 1990s despite normal monsoons.

Analysis of the lowest price month and the highest price month reveals that April to June is the period when wheat prices are the generally low because these months coincide with the peak marketing season. However, there was an exception, year 1997-98 when the lowest price occurred in the month of September. Similarly, the highest price months are also not distributed consistently. Generally, January to March is the period when prices are at the peak levels, but there have been a few exceptions to this rule as well. This is particularly true for the years 1989-90 and 1999-2000 (November) and 1992-93 (August). These variations could be due to abnormal price movements and the consequent adjustments that were carried out during these years.

Unlike wheat, intra-year variability in the case of rice has come down in the 1990s compared to the 1980s (Table 3.4). The average deviation of the lowest price from the highest price fell slightly in the 1990s (from 14.3 per cent to 12.7 per cent). This is also reflected in the decrease in the coefficient of variation. Further, there were only three years in the 1990s (1990-91, 1991-92 and 1992-93) when the deviation of the lowest price from the highest price exceeded the average value of 13.6 percentage points. In contrast, there were at least five years during the 1980s when these deviations exceeded the average value of 13.6 per cent.

Table 3.3 Variations in Monthly (Nominal) Price Index of Wheat

Year	Deviation of the Lowest Price from the Highest (%)	Coefficient of Variation (%)	Month (Lowest)	Month (Highest)
1980-81	24.65	8.04	Apr	Jan
1981-82	10.53	3.26	Jun	Mar
1982-83	30.38	9.12	May	Mar
1983-84	7.25	2.43	May	Jan
1984-85	6.19	2.32	May	Feb
1985-86	19.40	5.51	May	Mar
1986-87	12.24	4.11	May	Jan
1987-88	23.08	7.82	Jun	Feb
1988-89	29.99	9.54	May	Feb
1989-90	9.71	3.13	Mar	Nov
1990-91	48.31	12.85	Apr	Feb
1991-92	48.66	14.32	May	Feb
1992-93	8.96	2.70	May	Aug
1993-94	21.98	6.76	May	Feb
1994-95	6.05	2.15	May	Jan
1995-96	9.01	2.76	Jun	Mar
1996-97	38.71	12.44	May	Mar
1997-98	21.19	6.38	Sep	Jan
1998-99	24.82	7.42	Apr	Feb
1999-00	12.79	4.82	May	Nov
Averages				
1980s	17.3	5.5		
1990s	24.0	7.3		
Whole period	20.7	6.4		

The lowest price months in the case of rice generally occurred during the peak marketing season (October to January), though in some years the lowest price has occurred during the month of February (1992-93, 1995-96 and 1997-98). The highest price occurred mostly in the lean season months of August and September. There was only one exception, 1983-84, when it occurred in the month of October, which coincides with the onset of the procurement season.

Table 3.4 Variations in Monthly (Nominal) Price Index of Rice				
Year	Deviation of the Lowest Price from the Highest (%)	Coefficient of Variation (%)	Month (Lowest)	Month (Highest)
1980-81	16.8	5.3	Dec	Sep
1981-82	16.8	6.1	Dec	Aug
1982-83	22.7	7.6	Jan	Sep
1983-84	11.8	3.2	Dec	Oct
1984-85	14.8	4.6	Dec	Sep
1985-86	12.8	4.2	Dec	Aug-Sep
1986-87	13.2	4.0	Dec-Jan	Sep
1987-88	13.7	4.8	Dec	Aug
1988-89	10.8	3.7	Dec	Sep
1989-90	9.5	3.4	Jan	Sep
1990-91	22.5	6.5	Nov	Sep
1991-92	14.2	4.7	Oct	Aug
1992-93	14.8	4.2	Feb	Sep
1993-94	11.9	3.5	Jan	Aug
1994-95	8.1	2.7	Oct	Sep
1995-96	12.4	4.0	Feb	Sep
1996-97	5.3	1.8	Oct	Aug
1997-98	12.2	3.7	Feb	Sep
1998-99	13.2	3.8	Oct	Sep
Averages				
1980s	14.3	4.7		
1990s	12.7	3.9		
Whole period	13.6	4.3		

In case of groundnut seeds and groundnut oil also, the average deviation of the lowest price from the highest price was lower in the 1990s than in the 1980s (Tables 3.5 and 3.6). In both groundnut seed and groundnut oil, intra-year coefficient of variation in prices also fell in the 1990s in comparison to the 1980s. The price fluctuations were very high during the 1980s, which is reflected in the number of years of significantly large variations for both groundnut and groundnut oil – seven in the case of groundnut and five in the case of groundnut oil, respectively. The marketing season of groundnut is a little longer, because there are two crop seasons – kharif and rabi, The lowest price generally occurred between November and April and the highest price generally between

July and October. Similar to wheat and rice there are a few exceptions in the case of groundnut as well.

Table 3.5 Variations in Monthly (Nominal) Price Index of Groundnut Seed				
Year	Deviation of the Lowest Price from the Highest (%)	Coefficient of Variation (%)	Month (Lowest)	Month (Highest)
1980-81	33.94	9.20	Nov	Aug
1981-82	11.97	3.44	Apr	Jul
1982-83	30.40	8.12	Mar	Aug
1983-84	20.13	6.00	Feb	Jul
1984-85	10.86	3.52	Mar	Dec
1985-86	43.48	13.76	Nov	Aug
1986-87	36.87	11.81	Dec	Aug
1987-88	28.50	7.78	Sep	Jun
1988-89	25.08	6.60	Feb	Sep
1989-90	33.23	9.51	Nov	Oct
1990-91	16.38	4.45	Nov	Oct
1991-92	11.31	4.16	Apr	Dec
1992-93	28.08	8.57	Mar	Sep
1993-94	26.77	9.52	Feb	Aug
1994-95	18.54	5.35	Nov	May
1995-96	12.34	3.22	Feb	Sep
1996-97	12.65	3.03	Nov	Oct
1997-98	29.49	7.23	Dec	Sep
1998-99	10.74	3.10	Oct	Nov
Averages				
1980s	27.4	8.0		
1990s	18.5	5.4		
Whole period	23.2	6.8		

A comparison of these deviations in the prices of these four commodities exhibits that price fluctuations are generally higher in the case of groundnut and groundnut oil compared to rice and wheat. The price variability has been the least in the case of rice. The analysis also shows that wheat is the only crop that has exhibited higher intra-year fluctuations during the 1990s in comparison to the 1980s. To examine the components contributing to the variability, however, one needs to separate the changes in prices into random elements present in any price series and the systematic factors. This is attempted in the next section.

Table 3.6 Variations in Monthly (Nominal) Price Index of Groundnut Oil				
Year	Deviation of the Lowest Price from the Highest (%)	Coefficient of Variation (%)	Month (Lowest)	Month (Highest)
1980-81	45.16	11.91	Nov	Aug
1981-82	10.77	3.11	Apr	Aug
1982-83	24.50	8.21	Mar	Sep
1983-84	19.15	5.74	Dec	Jul
1984-85	8.01	2.26	Jun	Dec
1985-86	51.69	16.30	Feb	Sep
1986-87	35.06	10.87	Dec	Aug
1987-88	22.40	6.74	Sep	Nov
1988-89	34.01	9.89	Mar	Sep
1989-90	46.07	12.97	Dec	Oct
1990-91	22.44	6.18	Nov	Jan
1991-92	15.47	5.27	Jun	Nov
1992-93	41.76	12.45	May	Sep
1993-94	22.01	7.03	Feb	Sep
1994-95	24.23	7.30	Dec	Aug
1995-96	10.07	2.98	Mar	Sep
1996-97	3.91	1.10	Mar	Jun
1997-98	35.60	11.37	Nov	Sep
1998-99	14.48	4.47	Jul	Nov
Averages				
1980s	29.7	8.8		
1990s	21.1	6.5		
Whole period	25.6	7.7		

3.2.2 Decomposition of Prices

Any economic series is composed of two elements - pattern and an element of error or randomness. The error is assumed to be the difference between the combined effect of pattern and the actual series. In this section, we have tried to decompose the price data into three components – trend [T], seasonality [S] and cyclical and irregular elements [CI]. To decompose the series, we first separate the seasonal factor from the actual series and estimate a de-seasonalised series. In the next step we eliminate the trend factor from the de-seasonalised series. The remaining residual series contains only the cyclical and irregular factors.[2] The results are discussed below.

Seasonality

The estimates of pure seasonal factors in nominal and real prices for wheat, rice and groundnut for the 1980s and 1990s are shown in Table 3.7 and Figures 3.1 to 3.11. A comparison of the seasonal factors for the two sub-periods shows that the band of seasonality (the difference between the lowest and the highest seasonality factor) increased in the 1990s in comparison to 1980s for wheat and coarse cereals (Table 3.7). For other commodities, however, the band narrowed down in the 1990s. This is true not only in the case of nominal prices but also in the case of real prices of these commodities. This implies that the seasonal fluctuations have increased slightly in the case of wheat and coarse cereals during the 1990s, while these fluctuations have narrowed down in the case of the other two commodities. These results are similar to the ones discussed in the previous section.

The results also indicate that in the 1980s the band of seasonality was the highest in the case of groundnut seeds, while in 1990s the band of seasonality was the maximum in the case of wheat. In terms of real prices, however, wheat tops the list with the highest band both in the 1980s as well as in the 1990s.

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[2] To de-seasonalise the series, a seasonal index is generated which shows the typical intra-year movements in the wholesale prices of wheat. Firstly, a twelve-month moving average is calculated. The first figure for the twelve-month moving average of price series is the average of the April to March data. Because this figure is centred between September and October, it is necessary to adjust the moving average so that these are in step with the original data. This process is called centering and involves computing a two-month moving average of the twelve-month moving averages.

The next step is to express each original value as a percentage of the corresponding centred moving average. The twelve-month moving average is a rough estimate of a de-seasonalised series because the twelve-month average smoothes out seasonal movements. Thus, by dividing the original price data by the moving average series, we get an estimate of the seasonal movements - $(T * C * S * I)/(T * C * I) = S$

Time series is very likely to show a tendency to increase or decrease. This illustrates that the trend is usually predominant in time series. To separate out the trend factor, we fitted a straight line on the moving average data of the type: $Y = a + b$ time, which gives us the trend values [T].

To calculate cyclical and irregular movements the residual method is used. This method consists of eliminating seasonal variation and trend from the original series. Thus residual is the cyclical and irregular movement. Symbolically,

$$(T * S * C * I)/(S * T) = C * I$$

By dividing the de-seasonalised series by the above trend series gives us the estimates of cyclical and irregular factor estimates. For details see Kenney and Keeping (1962).

Table 3.7: Indices Of The Lowest And Highest Seasonality Factor In Wheat, Rice, Groundnut Seed And Groundnut Oil (Nominal And Real)					
	Lowest	Month	Highest	Month	Difference (%)
Nominal Prices					
1980s					
Wheat	95.25	May	105.46	Feb	10.71
Rice	96.73	Jan	104.77	Aug	8.31
Coarse cereals	95.80	April	103.35	Aug	7.88
Groundnut seed	94.47	Feb	107.47	July	13.76
Groundnut oil	95.73	Mar	107.71	Aug	12.52
1990s					
Wheat	95.15	May	107.33	Feb	12.80
Rice	98.55	April	101.95	Sep	3.45
Coarse cereals	95.79	Oct	102.29	Mar	6.78
Groundnut seed	96.40	Feb	104.30	Aug	8.20
Other oilseeds	96.46	Mar	103.67	Aug	7.47
Groundnut oil	95.92	Mar	106.04	Sep	10.55
Other oils	97.74	Mar	102.33	Sep	4.69
Real Prices					
1980s					
Wheat	94.90	June	106.60	Feb	12.33
Rice	97.56	Jan	103.70	Sep	6.30
Coarse cereals	96.27	Apr	101.70	Feb	5.64
Groundnut seed	95.81	Feb	105.70	July	10.33
Groundnut oil	96.79	April	105.94	Aug	9.45
1990s					
Wheat	95.52	May	107.77	Feb	12.82
Rice	99.17	April	101.04	Sep	1.89
Coarse cereals	95.17	Oct	103.22	Mar	8.46
Groundnut seed	97.27	Feb	103.42	July	6.33
Other oilseeds	97.31	Mar	102.75	Aug	5.58
Groundnut oil	96.79	Mar	105.08	Sep	8.57
Other oils	98.61	Mar	101.40	Aug	2.84
Note: Mean of Seasonal Index is 100					

Comparing the months in which the lowest and the highest seasonality factors occurred, the results show that there is no change in the months of the lowest and the highest seasonality factors as far as nominal prices of wheat are concerned. In terms of real prices, however, the lowest seasonality factor has shifted from the month of

June in the 1980s to the month of May in the 1990s. Likewise, in the case of rice also a shift has taken place in the lowest seasonality factor from the month of January in the 1980s to the month of April in the 1990s. There is a shift in the months of the lowest seasonal factor and the highest seasonal factor in the case of coarse cereals as well.

In the case of groundnut seed and groundnut oil, the lowest seasonal factors were noticed in the months of February and March, respectively. In terms of nominal prices, the highest seasonal factors for groundnut and groundnut oil shifted from July and August during the 1980s to August and September during the 1990s, respectively. The real prices, however, do not show any change in the highest seasonal factor in the case of groundnut.

Trend

An analysis of the trend components of these commodities using nominal and real monthly prices reveals that there was acceleration in the growth of nominal prices of all the four commodities during the 1990s in comparison to the 1980s (Table 3.8). However, trend components of real prices are somewhat different for the cereals compared to the oilseed crop, groundnut. There is a positive and significant growth in the real prices of cereals during the 1990s in comparison to the significant fall witnessed during the decade of 1980s (Figures 3.12 to 3.15). On the other hand, real prices of groundnut seed and groundnut oil exhibited a negative growth during the 1990s in comparison to a positive growth during the 1980s (Figures 3.16 to 3.19). These trends in monthly prices match the pattern observed in annual prices discussed in section 3.1.

Cyclical and Irregular Factors

Irregular factors show random effects on prices – effects that arise from variations in weather and unpredictable policy actions. A comparison of irregular factors[3] among these commodities highlights the fact that the fluctuations in prices due to irregular factors are more in the case of groundnut seeds, groundnut oil and coarse grains than in the case of wheat and rice (Tables 3.9 to 3.12). Considering both nominal as well as real prices, in the case of wheat negative and positive fluctuations

[3] The irregular factors mentioned here include possible cyclical elements also.

in irregular factors never exceeded 10 per cent mark, while in the case of rice they exceeded the 10 per cent mark just once (1982-83).

Quite the opposite, these fluctuations exceeded 10 percentage points four times in the case of groundnut seeds and five times in the case of groundnut oil, respectively (Tables 3.9 and 3.10). Further, the amplitude of irregular factors was much larger in the case of groundnut seeds and oil than that of wheat and rice.

A comparison of the occurrence of irregular factors during the 1980s and the 1990s shows that the frequency with which irregular factors occur has become smaller in the 1990s in comparison to 1980s for wheat and rice. During the 1980s, there were three years in the case of wheat and four years in the case of rice when these deviations exceeded the 5 per cent mark compared to just two years in the case of wheat and one year in the case of rice during the 1990s, respectively. In the case of groundnut no change was observed in the number of years when the extent of irregular disturbances exceeded 5 per cent ceiling. However, in the case of real prices of groundnut oil, there were only four years during the 1990s when such disturbances rose above the 5 per cent mark compared to 6 years during the 1980s. One of the reasons for the low occurrence of irregular factors for some of these crops during the 1990s compared to the 1980s is probably the poor performance monsoon during the 1980s. During the 1980s, 1982-83 and 1985-86 exhibited moderate drought conditions and 1986-87 and 1987-88 witnessed slight to severe drought conditions.

The above analysis shows that there has been acceleration in the rate of growth of the nominal as well as real prices of cereals. This is in sharp contrast to the trends observed during the 1980s, when the real prices of these crops exhibited a significant decline. The results for groundnut seed and groundnut oil on the other hand exhibit trends contrary to those observed in the case of cereals. The rates of growth in both nominal as well as real prices clearly show deceleration in the 1990s as compared to the 1980s.

The results also indicate that despite reductions in inter-year variability of wheat during the 1990s, intra-year variability shot up during this period. What could be the possible explanation for this increase in intra-year price variability? Does this imply that price stabilisation measures were not successful in reducing the intra-year price variability during the 1990s despite normal monsoons? Or are there other factors that have led to the increase in intra-year variability in the price of cereals. This is attempted in the next section.

Table 3.8 Trend Equations Fitted to Nominal and Real Monthly Price Indices				
Crop	Period	Constant	Trend	R^{-2}
Nominal Prices				
Wheat	1980s	88.47 (59.7)	0.541 (25.4)	0.84
	1990s	158.8 (41.4)	2.075 (36.5)	0.92
Rice	1980s	89.8 (65.7)	0.654 (33.4)	0.90
	1990s	170.3 (80.8)	2.263 (72.4)	0.98
Coarse cereals	1980s	80.67 (50.1)	0.521 (22.5)	0.81
	1990s	147.3 (27.7)	2.098 (26.6)	0.86
Groundnut Seed	1980s	79.3 (31.3)	0.735 (20.2)	0.77
	1990s	204.0 (52.8)	1.327 (23.2)	0.82
Other oilseeds	1990s	27.5 (32.)	1.349 (28.5)	0.88
Groundnut oil	1980s	75.3 (28.3)	0.811 (21.2)	0.79
	1990s	214.3 (43.0)	1.119 (15.1)	0.67
Other oils	1990s	117.1 (12.9)	0.939 (18.8)	0.75
Real Prices				
Wheat	1980s	1.02 (87.7)	-0.001 (-4.7)	0.15
	1990s	0.93 (66.9)	0.001 (5.8)	0.22
Rice	1980s	1.04 (99.0)	-0.0001 (-1.03)	0.0006
	1990s	1.00 (134.2)	0.001 (13.1)	0.60
Coarse cereals	1980s	0.94 (77.3)	-0.001 (-3.4)	0.08
	1990s	0.87 (42.4)	0.002 (5.5)	0.20
Groundnut seed	1980s	0.94 (51.9)	0.001 (3.1)	0.07
	1990s	1.13 (82.2)	-0.002 (-8.3)	0.37
Other oilseeds	1990s	1.23 (37.2)	-0.001 (-7.7)	0.33
Groundnut oil	1980s	0.90 (46.8)	0.001 (4.9)	0.16
	1990s	1.18 (58.9)	-0.003 (-8.8)	0.40
Other oils	1990s	1.64 (48.2)	-0.003 (-17.7)	0.73
Figures in Parentheses are respective ‘t’ values				

Table 3.9 Cyclical and Irregular Factors in the Prices of Wheat, Rice, Groundnut Seed and Groundnut Oil (Annual Averages)								
	Wheat	Wheat_R	Rice _N	Rice _R	G.Seed _N	G.Seed _R	G.Oil _N	G.Oil _R
1980-81	0.99	0.98	0.97	0.94	1.11	1.07	1.11	1.06
1981-82	1.01	0.99	1.01	1.01	0.97	0.97	1.00	1.00
1982-83	1.06	1.06	1.11	1.11	0.99	1.00	1.01	1.02
1983-84	1.02	1.02	1.03	1.03	1.01	1.02	0.99	1.01
1984-85	0.94	0.94	0.95	0.97	0.90	0.92	0.86	0.89
1985-86	0.97	0.99	0.95	0.98	0.96	1.00	0.94	0.97
1986-87	0.97	1.00	0.95	0.98	1.07	1.09	1.11	1.15
1987-88	0.98	0.99	1.02	1.01	1.13	1.11	1.09	1.07
1988-89	1.07	1.06	1.03	1.01	0.90	0.88	0.93	0.90
1989-90	0.99	0.97	0.99	0.97	0.96	0.97	0.97	0.97
1990-91	0.99	0.99	0.97	0.97	1.05	1.07	1.12	1.14
1991-92	1.03	1.02	1.07	1.06	1.06	1.05	1.04	1.02
1992-93	1.02	1.02	1.00	1.01	0.89	0.89	0.85	0.84
1993-94	1.02	1.04	1.00	1.01	0.95	0.93	0.93	0.91
1994-95	1.00	0.99	1.00	0.98	1.09	1.05	1.06	1.02
1995-96	0.91	0.90	0.98	0.98	1.04	1.02	1.04	1.02
1996-97	1.02	1.01	1.00	1.00	1.00	1.00	0.97	0.97
1997-98	0.96	0.97	0.96	0.96	1.00	1.01	1.04	1.06
1998-99	0.99	0.99	1.03	1.03	0.98	1.01	0.99	1.04
1999-00	1.08	1.09	1.05	1.06	0.89	0.93	0.92	0.98

Table 3.10 Per cent Variation Around the Mean of Cyclical and Irregular Factors								
	Wheat_N	Wheat_R	Rice _N	Rice _R	G.Seed _N	G.Seed _R	G.Oil _N	G.Oil _R
1980-81	-0.81	-1.82	-3.40	**-6.58**	**11.20**	**6.83**	**10.78**	**5.70**
1981-82	1.07	-1.15	0.52	0.38	-2.58	-2.54	0.28	0.10
1982-83	**5.33**	**5.65**	**10.45**	**11.03**	-0.56	0.20	1.32	2.18
1983-84	1.75	1.71	2.24	2.61	1.46	2.26	-0.39	0.62
1984-85	**-6.13**	**-5.81**	**-5.06**	-3.54	**-9.67**	**-7.66**	**-13.59**	**-11.46**
1985-86	-3.50	-1.25	**-5.57**	-2.60	-3.62	-0.43	**-6.25**	-2.95
1986-87	-2.95	-0.23	**-5.25**	-2.75	**6.87**	**9.44**	**11.59**	**14.39**
1987-88	-2.21	-1.46	1.63	0.81	**12.90**	**11.38**	**8.64**	**7.13**
1988-89	**7.04**	**6.22**	2.49	0.58	**-9.56**	**-12.16**	**-6.90**	**-9.83**
1989-90	-1.10	-3.43	-1.02	-2.98	-3.68	-3.34	-3.01	-2.79
1990-91	-0.69	-0.70	-3.66	-3.39	**5.28**	**7.20**	**12.53**	**14.05**
1991-92	2.50	1.63	**6.81**	**6.04**	**5.96**	4.63	4.12	2.03
1992-93	2.16	2.10	-0.37	0.95	**-10.42**	**-10.80**	**-15.15**	**-16.30**
1993-94	2.21	3.43	0.17	0.44	**-5.15**	**-7.11**	**-6.99**	**-9.69**
1994-95	0.13	-0.81	-0.48	-2.03	**9.10**	**5.01**	**6.12**	1.45
1995-96	**-8.75**	**-9.75**	-2.05	-2.45	4.16	2.16	4.59	2.21
1996-97	1.87	1.31	-0.27	-0.30	0.27	-0.15	-3.30	-3.62
1997-98	-4.16	-3.31	-4.34	-4.50	0.59	0.96	4.40	**5.52**
1998-99	-1.17	-1.44	2.27	2.73	-1.64	1.26	-0.83	3.57
1999-00	**7.40**	**9.11**	4.87	**5.58**	**-10.88**	**-7.18**	**-7.96**	-2.31
Note: The figures in bold are those which exceed 5% variation								

Table 3.11 Cyclical and Irregular Factors of Coarse Grains, Edible Oil and Oilseeds (Annual Averages)						
	C.Grain_ N	C.Grain_ R	EdibleOil_ N	EdibleOil_ R	Oilseeds_ N	Oilseeds_ R
1980-81	1.08	1.05	-	-	-	-
1981-82	1.03	1.03	-	-	-	-
1982-83	1.04	1.05				
1983-84	0.95	0.95	-	-	-	-
1984-85	0.89	0.90	-	-	-	-
1985-86	1.01	1.04	-	-	-	-
1986-87	0.95	0.98	-	-	-	-
1987-88	1.02	1.01	-	-	-	-
1988-89	1.07	1.06	-	-	-	-
1989-90	0.93	0.92	-	-	-	-
1990-91	0.95	0.96	1.05	1.07	1.05	1.07
1991-92	1.24	1.24	1.07	1.06	1.08	1.06
1992-93	0.90	0.92	0.96	0.95	0.93	0.92
1993-94	0.91	0.91	0.96	0.93	0.96	0.94
1994-95	1.05	1.04	1.04	0.99	1.04	1.00
1995-96	1.01	1.01	1.01	0.98	0.99	0.97
1996-97	1.05	1.05	0.97	0.96	0.94	0.95
1997-98	0.91	0.91	1.01	1.02	1.01	1.02
1998-99	1.02	1.02	1.02	1.07	1.04	1.07
1999-00	1.10	1.10	0.88	0.94	0.97	1.02

Table 3.12 Per cent Variation Around the Mean of Cyclical and Irregular Factors						
	C.Grain_ N	C.Grain_ R	EdibleOil_ N	EdibleOil_ R	Oilseeds_ N	Oilseeds_ R
1980-81	7.71	4.04	-	-	-	-
1981-82	2.84	2.39	-	-	-	-
1982-83	3.75	3.94	-	-	-	-
1983-84	**-5.76**	**-5.75**	-	-	-	-
1984-85	**-11.47**	**-10.27**	-	-	-	-
1985-86	-0.02	3.00	-	-	-	-
1986-87	**-5.48**	-2.89	-	-	-	-
1987-88	1.12	0.66	-	-	-	-
1988-89	**6.32**	**5.04**	-	-	-	-
1989-90	**-7.39**	**-8.97**	-	-	-	-
1990-91	**-5.37**	**-5.05**	**5.08**	**7.51**	**5.35**	**6.49**
1991-92	**23.66**	**23.18**	**7.79**	**6.09**	**7.89**	**6.16**
1992-93	**-10.37**	**-8.83**	-3.88	**-5.09**	**-7.57**	**-8.04**
1993-94	**-9.82**	**-9.20**	-3.76	**-6.74**	-4.12	**-6.00**
1994-95	4.82	3.52	4.25	-0.68	3.70	0.04
1995-96	0.24	0.04	1.09	-1.57	-1.53	-3.13
1996-97	4.32	4.31	-2.87	-3.46	**-5.62**	**-5.71**
1997-98	**-9.74**	**-10.01**	1.52	2.54	1.36	2.03
1998-99	1.09	1.19	2.26	**7.04**	3.52	**6.89**
1999-00	**9.53**	**9.67**	**-11.50**	**-5.63**	-2.98	1.27
Note: The figures in bold are those which exceed 5% variation						

3.3 Explaining Intra-Year Price Variability

The prices of commodities are determined by factors such as supply, demand, marketing cost, time and place of sale. In general, the prices of commodities whose supply is seasonal touch the lowest level immediately after the harvest when the marketing season reaches its peak. The maximum level is recorded during the off season. In a perfectly competitive market without any government intervention and with a perfect flow of information, seasonal price increase should be equal to storage cost only. In case there are market imperfections, storage decisions are based on expectations about annual supply and demand. In a particular season, if the output is less than the expected level, off season prices will rise by higher proportions. Alternatively, if the production is more than the expected level of output, prices in the off season will also remain subdued. Seasonal price changes, therefore vary from year to year, but are generally equal to the storage costs in the long run.

The government through procurement and distribution of cereals influences the impact of excessive short run uncertainties in prices. The impact of government actions on seasonal increase is twofold. By buying and selling within the same crop year government influences the range of the minimum and the maximum prices. The procurement prices fix the floor price and disbursement under the PDS is carried out at fixed issue prices which are much lower than the open market prices. These operations, therefore, affect the seasonal increase in the wholesale prices of wheat and rice. Secondly, by selling surplus stocks carried over from earlier years, government action can reduce unexpected shortages in supply, which also influences the seasonal price increases.

To capture the impact of government intervention and unexpected changes in the supply of wheat and rice on seasonal price changes, we propose the following model:

$$SI = a_0 + a_1 \, INT + a_2 \, NCUS + a_3 \, DQ\_CG$$

$$SI = a_0 + a_1 \, INT + a_2 \, DQ + a_3 \, DQ\_CG$$

The annual seasonal increase in the wholesale prices (SI) of wheat and rice is expressed as a function of government intervention (INT), net change in unexpected supply (NCUS) and variation in the output of coarse grains around trend. The government intervention variable measures the difference between the amount procured and distributed within a crop year[4] as a percentage of net production. The second variable, net change in unexpected supply is the sum of the difference between the actual output and the normal trend output (Q-Q*) and changes in government stocks. Since prices of wheat and rice are also influenced by variations in the output of coarse grains, we have also included deviations in the output of coarse grains around trend as one of the explanatory variables.

To examine factors that explain changes in government intervention, INT is expressed as a function of the procurement price, the issue price and variation in the net availability of cereals around trend. The procurement price variable is the ratio of the procurement price to the wholesale price (PP/WP) and the issue price is the ratio of the issue price to the wholesale price (IP/WP). The deviation in the net availability of cereals is the difference between the actual availability and the normal trend availability as a percentage of trend availability [(AV_C – AV_C*)/AV_C*].

$$INT = b_0 + b_1\, PPWP + b_2\, IPWP + b_3\, DAV\_C$$

In a similar fashion, to identify factors that explain unexpected changes in the output, we expressed changes in unexpected output as a function of wholesale price, yield and rainfall. The wholesale price is the variation in the wholesale price around the trend [(WP– WP*)/WP*]. The yield variable is also expressed as a variation in the actual yield around the trend [(YLD- YLD*)/YLD*] and rainfall is the actual rainfall index deflated by the normal rainfall index.

The time period for this analysis is 19 years, from 1980-81 to 1998-1999. It is discernible from the Table 3.13 that both government intervention and unexpected changes in the supply of wheat have a negative impact on the seasonal price increase of wheat. Between these two variables, the impact of unexpected changes in the supply of wheat has a much larger impact on the seasonal price of wheat. For example, doubling the amount of government intervention reduced the seasonal price increase by around 9 per cent, but similar changes in the unexpected supply of wheat lead to 37 per cent fall in the seasonal price variations of wheat.

To analyse the impact of unexpected changes in the output of wheat alone, we tried a regression, which indicates that there is no significant difference between the

[4] That is, opening stock + procurement - closing stock + import - export

elasticity of the NCUS variable and DQ variable. The only difference between these two variables is that in the NCUS variable changes in government stocks are also accounted for, whereas in the DQ variable changes in the output of wheat alone are considered. These results indicate that unexpected changes in the output of wheat and coarse grains influence seasonal price increases in wheat. However, government intervention is not a significant variable affecting such price movements.

The positive and significant sign of unexpected changes in the supply of coarse grains suggests that the volatility in the output of coarse grains influences the volatility in wheat prices, though the impact is small. The elasticity of seasonal price increase with respect to variations in the output of coarse grains is very low (only 0.01).

Like in the case of wheat, the government intervention variable (INT) was not found to be a significant variable that affects seasonal changes in the wholesale prices of rice as well. Unexpected changes in the supply of rice though have an affect on seasonal price movements of rice. But, there is no impact of the unexpected changes in the supply of coarse grains on intra-year price variations of rice. These results indicate that government actions in terms of intervention (buying and selling) were not successful in reducing the seasonal rise in the wholesale prices of wheat.

Table 3.13 Determinants of Seasonal Price Increase

Sr.No	CROP	DEP	C	INT	NCUS	DQ	DQ_CG	R^{-2}	D-W
1	Wheat	SI	26.9 (7.0)	-264.0 (-3.4) [0.09]	-192.0 (-2.4) [0.37]		68.8 (2.1) [0.01]	0.36	1.52
2	Wheat	SI	26.8 (7.0)	-74.1 (-1.2) [0.02]		-175.7 (-2.5) [0.32]	69.9 (2.2) [0.01]	0.37	1.51
3	Rice	SI^{Φ}	13.9 (9.1)	-35.2 (-1.1) [0.04]	-47.6 (-2.6) [0.05]		12.0 (1.2) [0.003]	0.22	2.37
4	Rice	SI^{Φ}	14.0 (8.9)	10.3 (0.3) [0.01]		-44.9 (-2.6) [0.11]	11.9 (1.2) [0.003]	0.21	2.40

Notes:
$^{\Phi}$ denotes regression corrected for auto-correlation
The figures in parentheses in the first row are ‘t’ values.
The figures in the second row are the elasticity estimates at mean levels.

As regards, government intervention, Table 3.14 shows that increase in the procurement price leads to higher intervention by the government in terms of higher procurement, and increase in the issue price results in lower intervention because of the fall in off-takes from the PDS. The availability of cereals is another important factor, which determines government intervention. The elasticity estimates shown in parentheses (in the second row) may seem to be very high and must be interpreted with due caution. The main reason for such high estimates is the way a dependent variable is defined in these equations. The dependent variable in these equations is the difference between the amount procured and distributed within a crop year expressed as a percentage of net production. These estimates clearly suggest that changes in the procurement and issue prices of cereals are more important determinants of government intervention compared to changes in the output of these crops.

Table 3.14 Determinants of Government Intervention

	CROP	DEP	C	PPWP	IPWP	DAV_C	DQ	R^{-2}	D-W
1	Wheat	INT^{Φ}	-0.27 (-2.8)	0.70 (4.1) [82.4]	-0.37 (-3.0) [48.4]	0.65 (3.3) [2.28]		0.54	1.92
2	Wheat	INT	-0.21 (-1.7)	0.53 (-2.8) [64.9]	-0.28 (-2.4) [37.3]		0.44 (1.6) [2.45]	0.36	2.13
3	Rice	INT	-0.42 (-5.1)	0.68 (6.5) [38.0]	-0.14 (-1.7) [7.4]	0.18 (1.7) [0.30]		0.69	1.77
4	Rice	INT	-0.40 (-5.3)	0.64 (6.7) [36.0]	-0.14 (-1.8) [7.0]		0.18 (2.5) [0.42]	0.74	1.48

Notes:
$^{\Phi}$ denotes regression corrected for auto-correlation
The figures in parentheses in the first row are ‘t’ values.
The figures in the second row are the elasticity estimates at mean levels.

Table 3.14 presents equations explaining deviations in the output of wheat and rice. It is clear from the results that rainfall is the most important and significant variable that causes fluctuations in the output of both these crops. A percentage change in the ratio actual rainfall to normal leads to 3 per cent change in the deviation of wheat output from the normal trend and 4 per cent change in the deviation of rice output from the trend, respectively. The high elasticity of rainfall points towards the vulnerability of output, especially on the south-west monsoon[5]. The deviation in yield (which is also the outcome of abnormal rainfall to a certain extent) is another factor, which lends instability to the output of these crops. The elasticity of deviations in yield is almost double in the case of rice (1.02) as compared to wheat (0.61), which also indicates higher dependence of rice output on monsoon rainfall than wheat output. Fluctuations in the wholesale prices were significant only in case of wheat, which indicates that variations in wheat output are also influenced by variations in wholesale prices.

Table 3.15 Determinants of Output Variations

	CROP	DEP	C	DWP	DYLD	RFI		R^{-2}	D-W
1	Wheat	DQ^{Φ}	-0.12 (-2.2)	0.26 (2.0) [0.63]	0.81 (5.2) [0.61]	0.001 (2.0) [2.86]		0.74	1.72
2	Rice	DQ^{Φ}	-0.13 (-2.6)	-0.002 (-0.03) [0.004]	1.24 (13.4) [1.02]	0.001 (2.6) [4.06]		0.96	2.06

Notes:
$^{\Phi}$ denotes regression corrected for auto-correlation
The figures in parentheses in the first row are ‘t’ values.
The figures in the second row are the elasticity estimates at mean levels.

The above analysis indicates that government actions in terms of intervention (buying and selling) were not successful in reducing the seasonal rise in the wholesale prices of cereals. Yet another way of investigating this issue is to analyse whether market intervention operations reduce average month to month price changes. To examine this we estimated regressions for changes in monthly wholesale and retail prices of wheat and rice and changes in government stocks based on the following equations;

Wheat
$\Delta WPw = a_0 + a_2 \Delta STw + \sum a_{3,4,5} Ds + \varepsilon_{1t}$
$\Delta RPw = a_0 + a_2 \Delta STw + \sum a_{3,4,5} Ds + \varepsilon_{1t}$

Rice
$\Delta WPr = a_0 + a_2 \Delta STr + \sum a_{3,4,5} Ds + \varepsilon_{1t}$
$\Delta RPr = a_0 + a_2 \Delta STr + \sum a_{3,4,5} Ds + \varepsilon_{1t}$

[5] The rainfall index we have used here is June-September rainfall both for wheat as well as rice.

Where ΔWPw and ΔRPw ΔWPr and ΔRPr are monthly changes in the wholesale and retail prices of wheat and rice respectively; ΔSTw and ΔSTr are monthly changes in government stocks of wheat and rice; and, Ds are the seasonal dummies (four quarters) which take into account seasonal changes in the prices of these two crops. A few alternative specifications of these regressions were also run, in which other variables such as changes in the stocks and prices of substitutes were also included as separate variables.

The results are reported in Tables 3.16 and 3.17. The results suggest that there is a significant impact of the changes in stocks of wheat on both wholesale and retail prices of wheat. The seasonal price changes in two alternative models with and without stock changes suggest that government interventions did have a desired affect on monthly changes in the prices of wheat. The effect of government interventions is more pronounced in the peak marketing season. The first dummy variable, which was found to be non-significant in first specification (with stock changes) turned out to be a significant variable in the second specification in which stock changes were not included. This implies that if government had not intervened the prices of wheat would have come down significantly in the peak marketing season.

For rice the results suggest that changes in stocks of rice do not have a significant impact on the changes in prices of rice as shown by the non-significance of the stock changes variable in rice equation (Table 3.17). This is also reflected in the alternative specifications when we compare models with and without stock changes. The parameter estimates of dummy variables in these two alternative specifications did not show significant variations. These results suggest that there is no significant impact of the changes in stocks on seasonal variations in the prices of rice.

The estimates for both wheat and rice, however, suggest strong influence of the changes in the prices of substitutes on the movements of monthly wholesale and retail prices of these two cereals. For example, monthly changes in the prices of rice and coarse cereals have a significant impact on monthly changes in the prices of wheat (both at the wholesale as well as retail level). In the case of rice, though, changes in monthly prices of coarse cereals do not have a significant impact. But, monthly changes in wheat prices do have a significant affect on monthly changes in the prices of rice.

Table 3.16 : Regressions of wholesale and retail prices of wheat						
	ΔLWP wheat	ΔLWP wheat	ΔLWP wheat	ΔLRP wheat	ΔLRP wheat	ΔLRP wheat
Constant	-0.003 (-0.5)	-0.01 (-1.2)	-0.01 (-1.3)	-0.003 (-0.8)	-0.01 (-1.5)	-0.01 (-1.4)
ΔLstocks_Wheat		-0.07 (-1.7)	-0.08 (-1.8)		-0.05 (-1.7)	-0.05 (-1.7)
ΔLstocks_Rice			0.06 (0.5)			0.01 (0.1)
ΔLWP_rice	0.35 (2.0)	0.34 (2.0)	0.34 (2.0)			
ΔLRP_rice				0.29 (1.9)	0.34 (2.2)	0.34 (2.2)
ΔLWP_coarse-grains	0.39 (2.5)	0.36 (2.3)	0.37 (2.3)	0.24 (2.5)	0.22 (2.2)	0.22 (0.03)
Dummy 1^{st} Season	-0.02 (-2.7)	-0.01 (-0.5)	-0.003 (-0.3)	-0.01 (-1.4)	0.003 (0.4)	0.002 (0.4)
Dummy 2^{nd} Season	0.02 (2.3)	0.02 (2.6)	0.03 (2.4)	0.01 (1.9)	0.01 (2.1)	0.01 (1.8)
Dummy 3^{rd} Season	0.01 (17)	0.02 (2.0)	0.01 (1.5)	0.01 (2.6)	0.01 (2.8)	0.01 (2.4)
R^{-2}	0.27	0.28	0.28	0.21	0.23	0.22
D-W	1.64	1.71	1.73	2.01	2.03	2.04
Note: WP = Wholesale Price RP = Retail Price						

Table 3.17 : Regressions of wholesale and retail prices of rice						
	ΔLWP rice	ΔLWP rice	ΔLWP rice	ΔLRP rice	ΔLRP rice	ΔLRP rice
Constant	0.01 (3.6)	0.01 (2.8)	0.01 (2.7)	0.01 (3.9)	0.01 (3.0)	0.01 (3.0)
ΔLstocks_Wheat			0.01 (0.3)			0.03 (1.6)
ΔLstocks_Rice		-0.01 (-0.2)	-0.01 (-0.2)		-0.001 (-0.02)	-0.01 (-0.3)
ΔLWP_wheat	0.12 (2.1)	0.12 (2.1)	0.12 (2.1)			
ΔLRP_wheat				0.12 (2.0)	0.12 (1.9)	0.15 (2.28)
ΔLWP_coarse-grains	0.12 (1.3)	0.12 (1.3)	0.12 (1.3)	0.08 (1.3)	0.08 (1.3)	0.08 (1.3)
Dummy 1^{st} Season	-0.02 (-3.5)	-0.02 (-2.1)	-0.01 (-2.0)	-0.01 (-2.8)	-0.01 (-1.6)	-0.01 (-1.4)
Dummy 2^{nd} Season	-0.01 (-2.9)	-0.01 (-2.3)	-0.01 (-2.1)	-0.01 (-3.1)	-0.01 (-2.5)	-0.01 (-2.0)
Dummy 3^{rd} Season	-0.005 (-1.0)	-0.005 (-0.9)	-0.001 (-0.9)	-0.003 (-0.9)	-0.003 (-0.8)	-0.01 (-1.6)
R^{-2}	0.15	0.14	0.14	0.12	0.11	0.13
D-W	2.16	2.16	2.16	2.00	2.00	2.00
Note: WP = Wholesale Price RP = Retail Price						

In sum, analysis carried out in this chapter shows that there has been acceleration in the rate of increase in the nominal prices of cereals. Higher growth in the nominal prices of cereals resulted into a positive and significant growth in their real prices during the 1990s. This is in sharp contrast to the trends observed during the 1980s, when the real prices of these crops exhibited a significant decline. The results for groundnut seed and groundnut oil on the other hand exhibit trends, which are at variance with the trends observed in the case of cereals. The rates of growth in both nominal as well as real prices of groundnut seed and groundnut oil clearly show deceleration in the 1990s as compared to the 1980s. One of the prime reasons for these changes in the prices of edible oils is the liberalisation of imports of edible oils during the 1990s. [6]

The results also indicate that despite significant reduction in inter year variability of wheat prices during the 1990s, intra year variability has increased. A detailed analysis of factors affecting seasonal price changes shows that the price stabilisation measures (buying and selling) were not successful in reducing the seasonal rise in the wholesale prices of rice in particular. Unexpected changes in the supply of cereals though have a strong influence on seasonal price movements of cereals.

The government interventions did have a desired affect on monthly changes in the prices of wheat, but there is no significant impact of the changes in stocks on monthly variations in the prices of rice. The results also suggest strong influence of the changes in the prices of substitutes on the movements of monthly wholesale and retail prices of these two cereals.

[6] Before 1994, the imports of edible oils were canalised through State Trading Corporation (STC) and Hindustan Vegetable Oils Corporation (HVOC). Imports (mainly palm oil) were managed so as to support domestic edible oil prices at levels far above world prices. Imports of oilseeds were also canalised, but there were no imports. In March 1994, however, imports of palmolein oil was put under OGL at 65 per cent import duty, which in principle allowed unlimited private sector imports at this tariff rate. Then in February 1995 this initial liberalisation was followed by a far more sweeping reform by which all edible oils except for coconut oil were put under OGL at an import duty of 30 per cent. In July 1996, the import duty was further reduced to 20 per cent and then to 15 per cent. This continued for about two and a half years. Q But, in December 1999 the basic duty on refined oil was raised from 15 per cent to 25 per cent, which was subsequently increased to 35 per cent in June 2000. Now the import duty on refined edible oils stands at 45 per cent.

Chapter 4
Inter- and Intra-Market Variability in Prices

The dynamics of growth and change in the prices of selected commodities at the national level usually hides the diversity of changes that occur in individual markets. Therefore, it is important to analyse variations in the prices of the selected commodities at the individual market level to understand the true dynamics that characterise movements in prices. The objective is to know how wholesale prices of the selected commodities in different markets has varied over the years. Is it possible to single out years and markets with extreme volatility?

We also evaluate how efficiently marketing systems for these commodities operate. This is accomplished using price spreads in different markets and relating them with the marketing margins and transportation costs. The level of price spread determines whether the existing marketing margins are excessive in relation to the services rendered by the intermediaries. In general, the prices of various commodities through space should vary no more than the cost of marketing incidentals and transportation from one point to another. If this is true, markets are generally considered to be efficient.

4.1 Inter- and Intra-Market Variations in Prices

Monthly wholesale prices of selected commodities and their substitutes for the period, 1990-91 to 1999-2000 have been used for examining variations in prices at the individual market level. Inter- and intra-market variability in the prices of rice, wheat and groundnut oil are presented in Tables 4.1 to 4.3.

Variations in the prices of rice reveal that inter-market variations in the annual prices of rice were high in the second half of 1990s - from 1994-95 to 1998-99 (Table 4.1). In 1995-96, variability was the highest. About 7 per cent decrease in the output of rice from 82 million tonnes in 1994-95 to 77 million tonnes in 1995-96, partly explains higher inter-market price variations during 1995-96.

The analysis also reveals that the pattern in intra-year variations in the prices of rice is not very clear. On an average, intra-year variability in the prices of rice is the highest in the Bangalore market, followed by Karnal and Lucknow markets, respectively. Variability in rice prices was by and large low in markets such as Calcutta, Ernakulum, Chennai, Thiruvanantpuram, Mumbai and Bhopal. Comparing intra-market variations in the prices of rice within a particular market, it was observed that higher variability occurred in markets that were in the vicinity of rice producing areas.

Table 4.1: Coefficient Of Variation In Monthly Wholesale Prices Of Rice In Selected Markets (1990-91 to 1998-99)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Average
Delhi	6.48	5.78	7.41	2.80	3.30	13.89	4.88	6.00	11.33	6.87
Karnal	16.60	3.77	8.31	6.13	1.68	6.90	5.29	12.13	10.33	7.90
Ludhiana	12.67	14.25	6.10	2.92	4.40	5.39	8.00	2.86	10.64	7.47
Lucknow	17.72	5.64	7.34	11.87	7.58	10.82	5.65	8.40	11.13	9.57
Jodhpur	8.51	9.57	6.53	3.08	5.10	8.78	7.28	8.75	9.48	7.45
Bhopal	8.76	7.07	3.41	5.47	3.04	3.78	8.69	7.45	4.84	5.83
Bhubaneshwar	18.34	5.33	4.76	8.45	5.04	7.55	4.24	6.35	10.06	7.79
Ahemdabad	5.08	8.96	6.03	6.75	1.83	14.03	16.42	1.15	1.75	6.89
Mumbai	8.74	7.17	6.92	6.75	4.82	3.47	0.00	5.97	8.51	5.82
Hyderabad	6.78	11.94	11.52	6.66	4.82	5.27	5.30	4.15	6.46	6.99
Bangalore	7.51	7.75	8.67	7.46	4.16	36.93	14.22	4.37	4.78	10.65
Thiruvanatpuram	3.35	5.53	7.07	4.69	4.58	9.75	4.31	8.40	1.62	5.48
Chennai	7.45	3.72	2.83	3.66	3.97	3.91	7.08	10.64	5.15	5.38
Ernakulam	5.01	6.22	2.13	10.63	3.48	6.75	3.23	4.82	4.32	5.18
Calcutta	-	6.05	8.38	1.39	1.61	3.50	1.86	9.33	7.23	4.92
Average of the above markets	9.50	7.25	6.49	5.91	3.96	9.38	6.43	6.72	7.17	6.95
Inter-market variation in annual average	9.38	11.88	12.36	13.02	15.40	15.98	15.47	13.76	14.05	13.48
Source: Computed.										

Table 4.2 shows that intra-year variations in the price of wheat were very high during the years 1990-91, 1991-92 and 1996-97. The average coefficient of variation for the selected markets during these three years exceeded 15 percentage points, while the average for other years was below 10 per cent. Comparing intra- and inter-year price variation across different markets, it was noted that years where there were low intra-year price variations (1992-93, 1994-95 and 1995-96) exhibited high inter-market variation in annual prices. On the other hand, years of high intra-year price variation (1990-91 and 1991-92) were associated with comparatively low inter-market variation in annual prices.

Table 4.2: Coefficient Of Variation In Monthly Wholesale Prices Of Wheat In Selected Markets (1990-91 to 1999-00)											
Year	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	Averages
Hyderabad	23.88	11.92	12.34	8.01	6.42	6.22	16.29	7.72	7.26	7.76	10.78
Ahemdabad	11.59	14.83	6.76	10.59	10.70	8.41	6.66	8.27	4.34	2.08	8.42
Karnal	16.22	16.20	7.21	5.50	5.11	6.37	17.00	11.48	8.21	6.91	10.02
Bangalore	12.59	14.85	5.46	11.62	6.89	6.50	13.14	7.96	7.24	10.70	9.70
Bhopal	15.52	16.97	6.71	6.77	6.48	7.35	18.40	10.09	9.29	11.50	10.91
Mumbai	15.04	26.99	9.46	5.86	4.33	3.90	23.24	7.07	5.40	6.92	10.82
Ludhiana	14.20	15.60	7.04	12.33	5.17	6.69	17.09	12.25	9.79	9.85	11.00
Jodhpur	14.03	14.94	7.66	12.98	7.54	7.70	17.30	5.74	11.20	12.03	11.11
Chennai	11.51	17.06	5.90	10.14	5.54	7.84	16.50	7.61	3.10	2.36	8.76
Lucknow	20.39	14.57	4.04	10.66	12.69	5.08	15.75	8.06	10.03	10.57	11.18
Delhi	15.66	18.52	4.21	6.98	4.73	5.24	16.06	9.19	9.83	6.92	9.73
Average of the above markets	15.51	16.59	6.98	9.22	6.87	6.48	16.13	8.68	7.79	7.96	10.22
Inter-market variations in average annual prices	17.84	19.78	28.25	22.35	24.83	24.73	23.06	24.18	20.53	14.86	22.04

Among various markets, the coefficients of variation were relatively higher in Lucknow, Jodhpur, Ludhiana, and Bhopal, which are in the major wheat producing states, whereas variability in markets situated in the wheat deficit states such as Ahmedabad, Chennai and Bangalore was observed to be low. The only explanation for this could be the impact of seasonality, which brings down prices during the peak marketing season to very low levels in the main wheat producing states but prices in the deficit areas continue to remain at a higher level.

Comparing variations in the prices of rice and wheat, it turns out that the price variations in rice are far lower than variations in the prices of wheat. This is reflected both in intra- as well as inter-market variations in the prices of rice and wheat. This could be due to the concentration of wheat production in just five states of the country. The output of rice on the other hand is spread across different states of the country. In addition, wheat is grown only in the rabi season, whereas rice is grown both during the kharif and rabi seasons. However, the kharif season output accounts for nearly 80 per cent of total rice output during both the seasons.

Inter- and intra-market variations in the prices of groundnut oil are shown in Table 4.3. It is evident from the table that barring two years, 1992-93 and 1997-98, when intra-year price variations were very high (in the range of 13 and 18 per cent respectively), fluctuations were generally low during other years. Inter- and intra-market variations during the years 1997-98 and 1998-99 exhibit two diverse patterns - high intra- market variability and low inter-market variability in 1997-98 and low intra-market variability but high inter-market variability in 1998-99.

Table 4.3: Coefficient Of Variation In Monthly Wholesale Prices Of Groundnut Oil In Selected Markets (1990-91 to 1998-99)

Year	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Averages
Hyderabad	6.83	5.10	13.89	9.86	4.24	2.83	3.78	18.42	3.72	7.63
Ahmedabad	6.66	7.82	14.79	7.40	6.91	4.67	4.97	19.51	3.47	8.47
Bangalore	5.76	4.59	11.57	9.06	4.27	5.13	2.46	9.54	6.93	6.59
Bhopal	5.62	5.66	12.07	8.62	7.03	6.70	4.81	17.69	10.57	8.75
Mumbai	5.21	5.00	11.62	11.08	6.05	4.98	4.97	19.12	6.75	8.31
Cuttack	13.59	6.59	9.08	6.67	7.41	1.79	3.77	14.99	7.42	7.92
Jodhpur	6.53	4.96	11.33	13.22	10.30	6.91	8.60	17.54	3.28	9.19
Chennai	7.46	6.22	14.39	9.18	3.68	4.42	3.92	20.98	6.88	8.57
Delhi	5.85	6.63	9.87	9.03	4.08	5.58	1.89	24.97	6.85	8.31
Pondicherry	6.21	9.10	17.87	7.43	5.21	6.60	3.93	17.71	8.73	9.20
Average of the above markets	6.97	6.17	12.65	9.16	5.92	4.96	4.31	18.05	6.46	8.29
Inter Market variations in annual averages	3.79	6.90	8.05	7.26	5.80	7.26	9.00	6.72	15.14	7.77

Like rice, groundnut is also grown during both kharif and rabi seasons; as a result, the effect of seasonal factors on monthly prices is less pronounced. The results, however, indicate that the range between the highest and the lowest coefficient of variations is much lower in the case of groundnut compared to cereals, wheat in particular.

4.2 Marketing Efficiency

For measuring marketing efficiency two broad approaches have been used in the literature: (a) price spreads and marketing margins, and (b) working of the markets, their structure, conduct and performance with a view to exploring the sources of inefficiency in the system (Subbarao, 1989). Price spread is the difference between the price received by the producer and the price paid by the consumer for a given commodity in the market at a given point of time. Studies on price spreads determine whether existing marketing margins are excessive in relation to the services rendered by the market. Under the market structure methodology marketing efficiency is measured by comparing the present marketing system with the requirements of a competitive market. The approach aims at assessing economic efficiency of markets on the basis of degree of departure of actual market conditions from the conditions of a perfectly competitive market[1]. Though no marketing system is perfect it would be relatively rare for prices to be consistently out of line in time, space or form in a competitive marketing system. This is because any known divergence from perfect pricing should immediately attract traders who, seeking profits, would equalise prices by buying in the low priced markets and selling in the high priced ones (Moore, et al., 1973).

In the next section, we compare the spread of marketing margins plus transportation costs among different markets and the actual difference in prices of the selected commodities as an indicator of competitive markets. The hypothesis is that prices through space should vary no more than the cost of shipment from one point to another. The shipment costs include: (a) incidentals incurred in the wholesale market in the process of trading such as handling charges, market fee, *arhatia's* commission, *mandi* labour, local taxes, etc.[2], and (b) cost of transportation.

[1] Market structure relates to the organisational aspects of market such as number and type of buyers/agents operating in the market, ease or difficulty of entry into the trade, modes of disposal and the sale alternatives available. Market conduct relates to the patterns and trading practices which market agents follow. It includes such aspects as handling, grading and storage followed by different agencies. Finally, market performance relates to the temporal and spatial pricing efficiency and the ability of the system to adapt to new and changing situations.

[2] The cost of transportation has been approximated using freight charges for trucks. Such data are available for limited centres of the country. For the remaining centres, we multiplied per kilometre transportation charges with the distance in kilometres.

4.2.1 Cost of Shipment and Regional Price Differentials

Table 4.4 shows the frequency with which the price difference between the two markets exceeds the shipment cost in the case of rice. As production of rice is wide spread in the country, we have calculated price differentials among different markets rather than taking one market as the central market. The data reveal that barring the exceptions of Delhi-Jodhpur, Hyderabad-Thiruvananthpuram and Hyderabad-Ernakulum, the frequency with which the price difference exceeds the transportation costs is much lower compared to the frequency with which transit costs exceed the price difference. Not only the number of months but the excess of transit cost over price difference is also much lower. This is also reflected in the average ratio of the price difference to the transit costs (Figure 4.1)[3]. On an average, ratio of the price difference and transit cost was observed to be 38 and 45 per cent in Hyderabad-Thiruvananthpuram and Hyderabad-Ernakulum, respectively.

Following the criteria of dynamic margin that prices through space should vary no more than the cost of transportation from one point to another, we ranked different markets according to the ratio of the actual differences in rice prices between markets to transportation costs between markets. Table 4.5 indicates that in addition to Hyderabad-Thiruvananthpuram and Hyderabad-Ernakulum, there were some other markets as well where the actual price differences of rice between markets exceeded the transportation costs, e.g. Delhi and Bhopal (1991-92), Delhi and Lucknow (1997-98), Calcutta and Bhubneshwar (1998-99) and Delhi-Karnal, Delhi-Ludhiana and Delhi-Lucknow (1999-2000), respectively.

In the case of wheat, since production is mostly concentrated in the north, price differences between markets were calculated with respect to the Delhi market being considered as the central market. It was observed that the difference in prices of wheat between Delhi and nearby markets, i.e. Ludhiana, Karnal, Lucknow, Jodhpur and Bhopal was low in comparison to the transportation costs. The price differences between Delhi and these markets are not even sufficient to cover the transport and handling cost, which implies that there is very little opportunity for the traders to earn substantial profits through buying and selling.

Table 4.4 Frequency With Which The Actual Price Of Rice Exceeds The Shipment Costs

		Delhi – Karnal	Delhi - Ludhiana	Delhi-Lucknow	Delhi-Jodhpur	Delhi-Bhopal	Delhi-Ahmbad	Bopal – Ahmedabad	Luck-Calcutta	Calct-Bubenesh	Hyd-Mumba	Hyd - Bnglore	Hyd - Trivend	Hyd - Chennai	Hyd - Ernacul
90-91	Above	3	2	1	5	1	2	0	-	-	2	3	11	1	10
	%	(61)	(23)	(29)	(20)	(14)	(4)	(0)	-	-	(26)	(33)	(27)	(5)	(35)
	Below	9	10	11	7	11	10	12	-	-	10	9	1	11	2
	%	-(61)	-(61)	-(70)	-(31)	-(40)	-(37)	-(84)	-	-	-(30)	-(56)	-(9)	-(28)	-(5)
91-92	Above	3	1	0	10	9	0	2	1	1	8	0	7	2	7
	%	(34)	(58)	(0)	(49)	(17)	(0)	(6)	(25)	(10)	(41)	(0)	(36)	(29)	(47)
	Below	9	11	12	2	3	12	10	11	11	4	12	5	10	5
	%	-(50)	-(59)	-(76)	-(5)	-(26)	-(44)	-(52)	-(50)	-(32)	-(47)	-(68)	-(61)	-(58)	-(30)
92-93	Above	0	0	1	10	1	0	0	1	4	4	6	10	4	9
	%	(0)	(0)	(7)	(32)	(30)	(0)	(0)	(27)	(18)	(54)	(86)	(43)	(43)	(40)
	Below	12	12	11	2	11	12	12	11	8	8	6	2	8	3
	%	-(44)	-(76)	-(38)	-(23)	-(51)	-(77)	-(59)	-(41)	-(36)	-(47)	-(66)	-(38)	-(41)	-(19)
93-94	Above	2	0	3	12	0	1	1	7	7	0	0	9	0	8
	%	(30)	(0)	(14)	(57)	(0)	(20)	(11)	(20)	(28)	(0)	(0)	(26)	(0)	(38)
	Below	10	12	9	0	12	11	11	5	5	12	12	3	12	4
	%	-(28)	-(45)	-(47)	(0)	-(75)	-(60)	-(69)	-(61)	-(36)	-(61)	-(72)	-(41)	-(67)	-(33)
94-95	Above	1	2	1	12	0	8	0	1	0	0	0	11	0	11
	%	(21)	(23)	(13)	(109)	(0)	(17)	(0)	(12)	(0)	(0)	(0)	(51)	(0)	(47)
	Below	11	10	11	0	12	4	12	11	12	12	12	1	12	1
	%	-(39)	-(56)	-(59)	(0)	-(42)	-(10)	-(51)	-(51)	-(67)	-(45)	-(70)	-(15)	-(63)	-(10)
95-96	Above	5	2	5	5	1	1	5	0	0	4	2	12	1	11
	%	(23)	(26)	(44)	(74)	(5)	(63)	(37)	(0)	(0)	(9)	(424)	(96)	(9)	(65)
	Below	7	10	7	7	11	11	7	12	12	8	10	0	11	1
	%	-(50)	-(55)	-(65)	-(69)	-(51)	-(65)	-(51)	-(62)	-(61)	-(35)	-(65)	(0)	-(43)	-(7)
96-97	Above	0	7	1	10	0	3	3	0	0	4	4	12	2	12
	%	(0)	(57)	(2)	(44)	(0)	(59)	(47)	(0)	(0)	(30)	(82)	(74)	(15)	(70)
	Below	12	5	11	2	12	9	9	12	12	8	8	0	10	0
	%	-(59)	-(28)	-(39)	-(62)	-(69)	-(73)	-(63)	-(41)	-(64)	-(21)	-(50)	(0)	-(45)	(0)
97-98	Above	1	8	8	7	0	1	2	7	3	10	1	5	0	12
	%	(2)	(29)	(32)	(50)	(0)	(16)	(2)	(54)	(32)	(34)	(38)	(33)	(0)	(33)
	Below	11	4	4	5	12	11	10	5	9	2	11	7	12	0
	%	-(54)	-(31)	-(33)	-(43)	-(81)	-(55)	-(42)	-(28)	-(22)	-(13)	-(23)	-(22)	-(57)	(0)
98-99	Above	4	4	5	3	2	0	0	9	9	9	2	8	3	12
	%	(27)	(99)	(13)	(56)	(7)	(0)	(0)	(76)	(64)	(61)	(36)	(16)	(26)	(61)
	Below	8	8	7	9	10	12	12	3	3	3	10	4	9	0
	%	-(78)	-(25)	-(45)	-(48)	-(67)	-(50)	-(61)	-(42)	-(50)	-(36)	-(35)	-(8)	-(58)	(0)
99-00	Above	1	3	1	0	0	1	1	1	0	3	0	2	0	3
	%	(11)	(30)	(14)	(0)	(0)	(48)	(60)	(8)	(0)	(30)	(0)	(10)	(0)	(46)
	Below	2	0	2	3	3	2	2	2	3	0	3	1	3	0
	%	-(17)	(0)	-(24)	-(100)	-(80)	-(45)	-(59)	-(16)	-(40)	(0)	-(45)	-(1)	-(51)	(0)

Note: (1) For 1999-2000 the data are available for only 3 months.
(2) The row denoting (%) exhibits the percentage by which the price exceeds shipment cost.

In the case of distant markets such as Mumbai, Hyderabad, Bangalore and Chennai, however, the differences in the prices of wheat between Delhi and these markets exceed the transit costs. The differences are more pronounced in those years when there was a fall in the output of wheat, 1992-93, 1994-95 and 1995-96 for example (Table 4.6). In other years, the differences in prices and transportation costs were comparable.

[3] See also Annex Table 4.4.

Table 4.5 Efficiency Of Markets In Terms Of The Ratio Of The Actual Price Difference Of Rice Between Markets And Shipment Costs

	Efficient	Inefficient
1990-91	Delhi ---- Karnal, Ludhiana, Lucknow, Jodhpur, Bhopal, Ahmedabad Hyderabad ---- Mumbai, Bangalore, Chennai Bhopal-Ahmedabad,	Hyderabad ---- Thiruvanantpuram, Ernakulam
1991-92	Delhi ---- Karnal, Ludhiana, Lucknow, Ahmedabad Hyderabad ---- Bangalore, Thiruvanantpuram, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Delhi ---- Jodhpur, Bhopal Hyderabad ---- Mumbai, Ernakulam
1992-93	Delhi ---- Karnal, Ludhiana, Lucknow, Bhopal, Ahmedabad Hyderabad ---- Mumbai, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Delhi-Jodhpur Hyderabad ---- Bangalore, Thiruvanantpuram, Ernakulam
1993-94	Delhi ---- Karnal, Ludhiana, Lucknow, Bhopal, Ahmedabad Hyderabad ---- Mumbai, Bangalore, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Delhi-Jodhpur Hyderabad ---- Thiruvanantpuram, Ernakulam
1994-95	Delhi ---- Karnal, Ludhiana, Lucknow, Bhopal Hyderabad ---- Mumbai, Bangalore, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Delhi ---- Jodhpur, Ahmedabad Hyderabad ---- Thiruvanantpuram, Ernakulam
1995-96	Delhi ---- Karnal, Ludhiana, Lucknow, Jodhpur, Bhopal, Ahmedabad Hyderabad ---- Mumbai, Bangalore, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Hyderabad ---- Thiruvanantpuram, Ernakulam
1996-97	Delhi ---- Karnal, Ludhiana, Lucknow, Bhopal, Ahmedabad Hyderabad ---- Mumbai, Bangalore, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Delhi-Jodhpur Hyderabad ---- Thiruvanantpuram, Ernakulam
1997-98	Delhi ---- Karnal, Ludhiana, Bhopal, Ahmedabad Hyderabad ---- Bangalore, Chennai Bhopal-Ahmedabad, Calcutta-Bhubneshwar	Delhi ---- Lucknow, Jodhpur Hyderabad ---- Mumbai, Thiruvanantpuram, Ernakulam Lucknow-Calcutta
1998-99	Delhi ---- Karnal, Ludhiana, Lucknow, Jodhpur, Bhopal, Ahmedabad Hyderabad ---- Bangalore, Chennai Bhopal-Ahmedabad	Hyderabad ---- Mumbai, Thiruvanantpuram, Ernakulam Lucknow-Calcutta, Calcutta-Bhubneshwar,
1999-00	Delhi ---- Jodhpur, Bhopal, Ahmedabad Hyderabad ---- Bangalore, Chennai Bhopal-Ahmedabad, Lucknow-Calcutta, Calcutta-Bhubneshwar	Delhi ---- Karnal, Ludhiana, Lucknow Hyderabad ---- Mumbai, Thiruvanantpuram, Ernakulam

Note: Markets where the actual ratio of prices is equal to or below shipments costs are considered as efficient markets and markets where the actual ratio of prices is above shipments costs are considered as inefficient.

Table 4.6 Frequency With Which The Actual Price Of Wheat Exceeds The Shipment Costs

		Ludhiana	Karnal	Lucknow	Jodhpur	Bhopal	Ahmedabad	Mumbai	Hyderabad	Bangalore	Chennai
1990-91	Above	0	0	0	0	0	11	5	0	11	0
	%	(0)	(0)	(0)	(0)	(0)	(48)	(12)	(0)	(21)	(0)
	Below	12	12	12	12	12	1	7	12	1	12
	%	-(68)	-(80)	-(78)	-(83)	-(72)	-(26)	-(22)	-(67)	-(10)	-(47)
1991-92	Above	3	0	1	1	0	6	7	10	6	2
	%	(10)	(0)	(21)	(25)	(0)	(37)	(40)	(21)	(31)	(11)
	Below	9	12	11	11	12	6	5	2	6	10
	%	-(45)	-(46)	-(65)	-(69)	-(78)	-(49)	-(22)	-(39)	-(28)	-(19)
1992-93	Above	0	0	0	0	0	12	12	12	12	12
	%	(0)	(0)	(0)	(0)	(0)	(79)	(70)	(54)	(50)	(31)
	Below	12	12	12	12	12	0	0	0	0	0
	%	-(55)	-(42)	-(82)	-(78)	-(28)	(0)	(0)	(0)	(0)	(0)
1993-94	Above	0	0	0	0	0	12	4	12	9	7
	%	(0)	(0)	(0)	(0)	(0)	(53)	(14)	(35)	(24)	(14)
	Below	12	12	12	12	12	0	8	0	3	5
	%	-(70)	-(51)	-(84)	-(79)	-(83)	(0)	-(20)	(0)	-(6)	-(6)
1994-95	Above	0	0	1	0	0	10	12	12	12	12
	%	(0)	(0)	(13)	(0)	(0)	(79)	(58)	(36)	(34)	(19)
	Below	12	12	11	12	12	2	0	0	0	0
	%	-(62)	-(72)	-(74)	-(51)	-(82)	-(10)	(0)	(0)	(0)	(0)
1995-96	Above	0	0	0	0	0	12	12	12	11	11
	%	(0)	(0)	(0)	(0)	(0)	(50)	(33)	(24)	(29)	(24)
	Below	12	12	12	12	12	0	0	0	1	1
	%	-(65)	-(70)	-(76)	-(87)	-(85)	(0)	(0)	(0)	-(1)	-(4)
1996-97	Above	4	0	0	0	0	8	5	4	12	9
	%	(33)	(0)	(0)	(0)	(0)	(49)	(68)	(27)	(50)	(36)
	Below	8	12	12	12	12	4	7	8	0	3
	%	-(44)	-(57)	-(68)	-(77)	-(75)	-(41)	-(68)	-(40)	(0)	-(17)
1997-98	Above	1	0	0	0	0	11	11	5	10	12
	%	(16)	(0)	(0)	(0)	(0)	(41)	(75)	(25)	(42)	(44)
	Below	11	12	12	12	12	1	1	7	2	0
	%	-(63)	-(78)	-(76)	-(85)	-(72)	-(8)	-(4)	-(41)	-(7)	(0)
1998-99	Above	0	0	0	0	0	2	10	0	2	5
	%	(0)	(0)	(0)	(0)	(0)	(41)	(71)	(0)	(28)	(22)
	Below	12	12	12	12	12	10	2	12	10	7
	%	-(79)	-(89)	-(53)	-(82)	-(85)	-(54)	-(16)	-(70)	-(14)	-(16)
1999-00	Above	0	0	0	0	0	0	0	0	0	3
	%	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(19)
	Below	9	12	12	12	12	12	12	12	12	9
	%	-(66)	-(88)	-(80)	-(79)	-(85)	-(70)	-(28)	-(56)	-(35)	-(25)

Note: (1) For 1999-00 the data are available for only 9 months.
(2) The row denoting (%) exhibits the percentage by which the price exceeds shipment cost.

The Ahmedabad market is an exception, however, as the price difference mostly exceeds the cost of shipment implying huge margins for the traders. Figure 4.2 shows the margins between the price difference with respect to the Delhi market and shipment costs from Delhi in selected markets for the period 1990-91 to 1999-2000. The excess of price over shipment costs turns out to be 20 per cent higher in the case of Ahmedabad on an average.

Thus a comparison of differences in prices between markets and transportation costs strongly supports the hypothesis of highly competitive wheat markets in areas which are in the vicinity of production centres. In the case of distant markets, however, differences in prices have exceeded the shipment costs in general, indicating inefficiency.

Table 4.7 Efficiency Of Markets In Terms Of The Ratio Of The Actual Price Difference Of Wheat Between Markets And Shipment Costs

	Efficient	Inefficient
1990-91	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Mumbai, Hyderabad, Chennai	Ahmedabad, Bangalore
1991-92	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Ahmedabad, Bangalore, Chennai	Mumbai, Hyderabad
1992-93	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal	Ahmedabad, Mumbai, Hyderabad, Bangalore, Chennai
1993-94	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Mumbai	Ahmedabad, Hyderabad, Bangalore, Chennai
1994-95	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal	Ahmedabad, Mumbai, Hyderabad, Bangalore, Chennai
1995-96	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal	Ahmedabad, Mumbai, Hyderabad, Bangalore, Chennai
1996-97	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Mumbai, Hyderabad	Ahmedabad, Bangalore, Chennai
1997-98	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Hyderabad	Ahmedabad, Mumbai, Bangalore, Chennai
1998-99	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Ahmedabad, Hyderabad, Bangalore	Mumbai, Chennai
1999-00	Ludhiana, Karnal, Lucknow, Jodhpur, Bhopal, Ahmedabad, Mumbai, Hyderabad, Bangalore, Chennai	None

Note: Markets where the actual ratio of prices is equal to or below shipments costs are considered as efficient markets and markets where the actual ratio of prices is above shipments costs are considered as inefficient.

A similar exercise for groundnut oil reveals that except for Hyderabad-Cuttack, price spreads in other markets are not out of tune with the transit cost[4]. On an average differences in prices between markets remained below the transportation cost in the case of Ahmedabad-Bhopal, Ahmedabad-Mumbai, Ahmedabad-Jodhpur, Hyderabad-Mumbai, Hyderabad-Bangalore, Hyderabad-Pondicherry and Hyderabad-Chennai, respectively (Table 4.8).

There were a few exceptions in 1998-99 and 1999-2000. Figure 4.3 indicates that in Hyderabad-Cuttack the ratio of difference in price to transit cost is 1.5. In all other markets the ratio is below one, indicating efficiency of markets. This indicates that the existing marketing set up does not provide unnecessarily high profit margins to either speculators or traders.

Summing up, it emerges from the above analysis that in the majority of markets, differences in prices were in general just enough to cover the costs of shipment. However, there were some markets where the differences in prices were higher than the shipment cost. In the case of wheat, price differences in Ahmedabad, Mumbai and Bangalore markets were observed to be out of tune with the shipment cost. Similarly, in the case of rice, price differences between Delhi-Jodhpur, Hyderabad-Thiruvananthpuram and Hyderabad-Ernakulum were in general higher than the shipment cost.

In the case of groundnut oil the price differences between markets were on the whole in tune with the shipment costs. There was only one exception - Hyderabad and Cuttack markets where the price difference was much higher in relation to the shipment cost. Though, it is quite possible that higher margins over transportation costs observed in some cases could be due to the long distances included in our analysis, the actual flow of trade might be different. The data on actual trade flows between markets could throw some light on these issues; however, such data are not generally available.

[4] The freight charges for groundnut oil have been considered 40 per cent higher than that of wheat as groundnut oil is transported by tankers instead of trucks. The market incidentals in the case of wheat and rice were taken as 15 per cent of the wholesale price (Annex Table 4.1). For groundnut oil, however, these incidentals were taken as 11 per cent.

Table 4.8 Frequency With Which The Actual Price Of Groundnut Oil Exceeds The Shipment Costs

		Ahm-Bhopal	Ahm-Mumbai	Ahm-Jodhpur	Ahm – Delhi	Ahm-Cuttack	Jodhpur - Delhi	Bhopal – Delhi	Hyd – Mumbai	Hyd – Bangalore	Hyd - Pondicherry	Hyd – Chennai	Hyd – Cuttack
90-91	Above	0	0	2	0	3	0	0	1	0	1	0	3
	%	(0)	(0)	(12)	(0)	(22)	(0)	(0)	(23)	(0)	(39)	(0)	(59)
	Below	12	12	10	12	9	12	12	11	12	11	12	9
	%	-(75)	-(78)	-(57)	-(55)	-(45)	-(80)	-(74)	-(54)	-(56)	-(60)	-(73)	-(62)
91-92	Above	0	0	0	1	7	0	1	0	0	2	0	12
	%	(0)	(0)	(0)	(25)	(21)	(0)	(6)	(0)	(0)	(12)	(0)	(47)
	Below	12	12	12	11	5	12	11	12	12	10	12	0
	%	-(75)	-(72)	-(50)	-(58)	-(24)	-(74)	-(68)	-(60)	-(67)	-(67)	-(73)	(0)
92-93	Above	0	0	0	2	9	1	0	1	5	0	0	12
	%	(0)	(0)	(0)	(20)	(51)	(7)	(0)	(21)	(39)	(0)	(0)	(97)
	Below	12	12	12	10	3	11	12	11	7	12	12	0
	%	-(56)	-(63)	-(55)	-(56)	-(56)	-(50)	-(56)	-(57)	-(46)	-(60)	-(81)	(0)
93-94	Above	0	3	2	0	5	1	0	0	0	0	1	12
	%	(0)	(15)	(62)	(0)	(32)	(4)	(0)	(0)	(0)	(0)	(1)	(60)
	Below	12	9	10	12	7	11	12	12	12	12	11	0
	%	-(79)	-(47)	-(69)	-(60)	-(43)	-(63)	-(74)	-(85)	-(71)	-(78)	-(72)	(0)
94-95	Above	0	0	1	3	8	4	3	0	0	0	0	11
	%	(0)	(0)	(11)	(88)	(55)	(20)	(46)	(0)	(0)	(0)	(0)	(53)
	Below	12	12	11	9	4	8	9	12	12	12	12	1
	%	-(63)	-(85)	-(39)	-(63)	-(25)	-(42)	-(82)	-(75)	-(69)	-(79)	-(70)	-(71)
95-96	Above	0	0	2	0	8	1	0	1	2	1	0	12
	%	(0)	(0)	(48)	(0)	(27)	(44)	(0)	(14)	(8)	(21)	(0)	(74)
	Below	12	12	10	12	4	11	12	11	10	11	12	0
	%	-(77)	-(74)	-(54)	-(79)	-(9)	-(50)	-(71)	-(67)	-(55)	-(66)	-(70)	(0)
96-97	Above	0	0	4	1	10	0	0	0	0	0	0	11
	%	(0)	(0)	(61)	(9)	(80)	(0)	(0)	(0)	(0)	(0)	(0)	(103)
	Below	12	12	8	11	2	12	12	12	12	12	12	1
	%	-(47)	-(69)	-(86)	-(54)	-(19)	-(41)	-(74)	-(73)	-(80)	-(70)	-(51)	-(27)
97-98	Above	1	0	1	3	8	2	2	0	3	0	1	7
	%	(6)	(0)	(0)	(133)	(55)	(125)	(101)	(0)	(60)	(0)	(24)	(39)
	Below	11	12	11	9	4	10	10	12	9	12	11	5
	%	-(59)	-(67)	-(71)	-(43)	-(71)	-(67)	-(65)	-(62)	-(70)	-(68)	-(64)	-(44)
98-99	Above	1	0	0	12	11	12	11	0	0	0	2	10
	%	(93)	(0)	(0)	(204)	(72)	(122)	(162)	(0)	(0)	(0)	(3)	(114)
	Below	11	12	12	0	1	0	1	12	12	12	10	2
	%	-(52)	-(71)	-(38)	(0)	-(42)	(0)	-(14)	-(64)	-(61)	-(63)	-(48)	-(8)
99-00	Above	0	0	0	2	0	2	2	0	0	0	0	2
	%	(0)	(0)	(0)	(191)	(0)	(104)	(140)	(0)	(0)	(0)	(0)	(56)
	Below	2	2	2	0	2	0	0	2	2	2	2	0
	%	-(61)	-(25)	-(30)	(0)	-(22)	(0)	(0)	-(80)	-(80)	-(86)	-(35)	(0)

Note: 1) For 1999-00 the data are available for only 2 months.
(2) The row denoting (%) exhibits the percentage by which the price exceeds shipment cost.

Table 4.9 Efficiency Of Markets In Terms Of Ratio Of Actual Price Difference Of Groundnut Oil Between Markets And Shipment Costs		
	Efficient	Inefficient
1990-91	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi, Cuttack Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai, Cuttack Jodhpur-Delhi, Bhopal-Delhi	None
1991-92	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi, Cuttack Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Hyderabad-Cuttack
1992-93	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Ahmedabad-Cuttack Hyderabad-Cuttack
1993-94	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi, Cuttack Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Hyderabad-Cuttack
1994-95	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Ahmedabad-Cuttack Hyderabad-Cuttack
1995-96	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Ahmedabad-Cuttack Hyderabad-Cuttack
1996-97	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Delhi Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Ahmedabad-Cuttack Hyderabad-Cuttack
1997-98	Ahmedabad ---- Bhopal, Mumbai, Jodhpur Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai, Cuttack Jodhpur-Delhi, Bhopal-Delhi	Ahmedabad ----- Delhi, Cuttack
1998-99	Ahmedabad ---- Bhopal, Mumbai, Jodhpur Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai	Ahmedabad ----- Delhi, Cuttack Hyderabad-Cuttack Jodhpur-Delhi, Bhopal-Delhi
1999-00	Ahmedabad ---- Bhopal, Mumbai, Jodhpur, Cuttack Hyderabad ---- Mumbai, Bangalore, Pondicherry, Chennai Jodhpur-Delhi, Bhopal-Delhi	Ahmedabad-Delhi Hyderabad-Cuttack Jodhpur-Delhi, Bhopal-Delhi

Note: Markets where the actual ratio of prices is equal to or below shipments costs are considered as efficient markets and markets where the actual ratio of prices is above shipments costs are considered as inefficient.

Chapter 5

Structure of Markets for Selected Commodities in Four Metropolitan Cities

The structure of markets for the selected commodities in four metro cities of the country is discussed in this chapter. Such an analysis is important to understand the organisation of marketing systems and the structure of markets. Does the structure of markets have any effect on the performance of the market? The answer to this and related questions is important to assess the efficiency of markets.

5.1 Markets for Rice and Wheat

In Delhi, there are three regulated markets namely, Narela, Nazafgarh and Shahdra Anaz Mandi. Narela and Nazafgarh are the two markets that have been selected for the purpose of this study. The two major commodities traded in Narela and Nazafgarh are wheat and paddy and wheat and mustard seed, respectively. Marketing of paddy has been recently introduced in the Nazafgrah market. Being in the vicinity of surplus areas, these markets serve as transit markets, because a large portion of both wheat and paddy is exported to distant markets. There are about 400 wholesalers in the Narela market and about 237 in the Nazafgarh market. However, around 10 wholesale traders in the Narela market and about 20 traders in the Nazafgarh market account for the major share of the wheat trade, respectively (see Annex Table 5.1). And, in the case of rice, around 20 wholesalers accounted for the major share of trade in the Narela market.

The grain market in Mumbai is different from the Delhi markets - Narela and Nazafgarh - which are mainly the transit markets. The Mumbai grain market is a terminal market, which supplies these commodities mainly to the city consumers. Unlike the Delhi markets, the produce for sale is mainly brought by wholesalers and traders and not by the farmers. In all there are around 650 licensed commission agents cum wholesalers in this market. Nonetheless, the major share of the trade both in wheat and rice is accounted for by around 50-60 traders/wholesalers in this market.

In Kolkata, the grain markets are non-existent, as there are no agricultural produce market committees. There are small husking mills in the periphery of villages across the state and farmers mostly sell their produce (paddy) to these small husking mills. In addition, there are some large mills as well. The rice is then sold to the FCI and the residual amount is sold to the 'mahajans' (big traders). These mahajans have their shops in the nearby cities. Trade between the mills and mahajans takes place through commission agents. The mahajans then sell their produce to wholesalers or retailers through commission agents.

In West Bengal there is a system of statutory and modified rationing. Under statutory rationing, open market sale of certain commodities is banned and only PDS sale is allowed. Under modified rationing, both open market sale and PDS exist together. The statutory rationing is assumed to take care of the whole requirement of the city. The areas under statutory rationing are Kolkata municipal-corporation, Hawra, industrial belt of north 24 Parganas, industrial belt of Hoogly and industrial belt of Bardwan. The open trading in rice was banned in Kolkata until about a year and a half ago. However, trading of rice in small quantities by petty retailers has been in existence.[1]

Open trading in wheat, however, is banned in Kolkata, but trading of wheat products is open. There are a few big wheat flourmills, which have been given licenses by the West Bengal Government and they are allowed to import a fixed quota of wheat from West Bengal or from the other states. However, because of the interference from the state government, only one or two big flourmills are presently working in Kolkata. A larger proportion of the city's wheat flour requirements is met through supplies from other states such as Madhya Pradesh, Uttar Pradesh, Rajasthan, Haryana and Punjab. There are around 30 big wholesalers in Kolkata who deal with trade in wheat products. Around 20 of these are in the Posta market. These wholesalers supply wheat flour to retailers through dealers and commission agents.

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[1] The petty traders now account for a substantial amount, about 65 per cent of the total rice consumption in Kolkata (Posta Market's Merchants Association). Even before liberalisation of the rice trade, these traders supplied quite a sizeable proportion of Kolkata's rice consumption. These traders get their supplies from North and South 24 Parganas and Barasat (30-40 km from Kolkata). Barasat is a big collection centre for rice, from where the rice is supplied to Sialdah, and Dumdum stations through rail. These outlets supply rice to North Kolkata through stockists, *shenties*, retailers and petty shopkeepers. Supply to South Kolkata comes from Baruipur, Sonarpur and Garia in South 24 Parganas. Jadhavpur and Ballygunj are the collection centres for this part of the town.

In Chennai, like Delhi and Mumbai, there are regulated markets under the Agricultural Produce Market Committees where producers or traders buy and sell grains. There are seven wholesale markets for rice and wheat spread over the entire city. These are Kothuwal Chavady, Washermanpet, Vadapalani, Tambaram, Redhills, Alanthur and Mint Street. Among these, the biggest is the Kothuwal Chavadi, which accounts for about 70 per cent of the total volume of trade in rice and wheat. In total there are around 200 wholesale dealers in the Kothwal Chavadi market and around 30 in the other markets. Out of these 230 wholesalers, 24 account for about 90 per cent share of the total wheat market and 62 wholesale dealers account for 90 per cent of total rice trade in Chennai, respectively. The main inflow of rice in Chennai is from Andhra Pradesh, Karnataka and Thanjanvoor district of Tamil Nadu.[2] And, the main sources of supply of wheat to Chennai City are Madhya Pradesh, Rajasthan and Delhi.

5.1.1 Structure of Markets for Rice and Wheat

By and large markets for cereals in the four metro cities of the country appear to be competitive. However, it will be more informative if we analyse the degree of concentration among the selected traders (from whom the purchase and the sale figures were collected) rather than their concentration in the share of total arrivals in the market. To examine this we work out a percentile distribution of traders and amount of trading in each commodity to make a graphical presentation of the data. We use the Lorenz curve and Gini Coefficient[3] to calculate the degree of concentration among different commodities.

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[2] Rice mills from within the state and from other states send sample packets of rice to the commission agents (sometimes sample packets of rice are personally brought by local agents). If the quality of such samples is satisfactory the commission agents place the order after fixing the price for each variety of rice. The local brokers also take samples from the wholesale dealers to retail dealers. The broker gets Rs. 2.50 from the owner of the product and Rs. 1-2 from the recipient for each bag as his brokerage. The marketing incidentals in Chennai are Rs. 2 for loading and Rs. 0.75 for unloading per bag. The weighing charges are Rs. 0.70 for each bag. The commission agents charge 3.5 per cent commission. In addition, there are charges for godown rent at the rate of Rs. 3 per bag and unloading and insurance charges extra. The total marketing incidentals add up to 5 per cent of the wholesale price.

[3] Gini coefficient = $(1/100)*100 \sum_{I=}^{n} \left| x_I y_{I+1} - x_{I+1} y_i \right|$,

where n is the number of traders, x_I is cumulative percentage of traders and y_I is the cumulative percentage of sale.

It may, however, be noted that government through FCI also intervenes in the wholesale market and there are other channels outside the market through which grains are distributed to the consumers. Therefore, these concentration ratios should be interpreted with due caution due to the existence of alternative channels for distribution of cereals.

Notwithstanding this, the degree of concentration of the wholesale trade at market level is an important piece of information, which to a certain extent indicates the non-competitive behaviour of the markets. The data presented in Table 5.1 and Figure 5.1 indicate that the concentration ratio for wheat is at maximum in the Chennai market followed by the Narela market, where the top 20 per cent of traders share about two-third and half the sales of the total wheat traded in these markets, respectively. The computed Gini coefficient is about 0.54 for Chennai, indicating a higher inequality in terms of the volume of trade handled. While in the case of Mumbai, the proportion of the top 20 per cent traders in total trade of wheat is slightly more than one-third and in Nazafgarh it is somewhat less than one-third.

Table 5.1 Concentration of Wheat Trade in the Selected Markets

Cumulative percentage of traders	Cumulative percentage of sale			
	Narela	Nazafgarh	Mumbai	Chennai
20.00	46.30	29.80	37.41	61.44
40.00	67.57	50.75	59.69	77.83
60.00	82.45	68.64	80.45	87.47
80.00	91.97	84.84	93.81	94.67
100.00	100.00	100.00	100.00	100.00
Gini Coefficient	(0.380)	(0.146)	(0.308)	(0.548)

The degree of concentration in the case of rice is the highest in Kolkata, which is reflected in the higher Gini coefficient (0.64), followed by Chennai (0.52), Mumbai (0.42) and Narela (0.32) in that order, respectively (Table 5.2). This implies that there is higher inequality in terms of the volume of trade handled in Kolkata compared to the other three metros of the country (Figure 5.2).

Table 5.2: Concentration Of Rice Trade In The Selected Markets

Cumulative percentage of traders	Cumulative percentage of sale			
	Narela	Kolkata	Mumbai	Chennai
20.00	38.40	67.46	48.45	55.75
40.00	62.35	84.96	70.53	79.42
60.00	80.37	94.49	85.82	89.59
80.00	92.93	99.18	94.49	95.47
100.00	100.00	100.00	100.00	100.00
Gini Coefficient	(0.315)	(0.637)	(0.423)	(0.520)

5.2 Structure of Markets for Oilseeds and Oils

For oilseeds, the data are available for only mustard seed and mustard oil for Kolkata and groundnut seed for Mumbai. Table 5.3 presents the percentile distribution of the volume of trade handled by the traders in these markets. The data reveal that the concentration of the volume of trade in Chennai for edible oils is the highest (Gini coefficient is 0.5). In the case of mustard seeds and mustard oil, the Gini coefficients for Kolkata were observed to be 0.45 and 0.43, respectively. The concentration is less pronounced in the Mumbai market, as the Gini coefficient is about 0.30. High values of Gini coefficients in the case of Chennai and Kolkata markets indicate higher inequality in terms of the volume of trade handled in these markets (Figure 5.3).

Table 5.3 Concentration of Trade in Oilseeds and Edible oils				
Cumulative percentage of traders	Cumulative percentage of sale			
	Mustard seed (Kolkata)	Mustard oil (Kolkata)	Groundnut seed (Mumbai)	Edible Oils (Chennai)
20.00	48.64	47.88	36.49	56.276
40.00	75.46	71.70	60.04	75.555
60.00	87.72	86.54	78.52	87.412
80.00	95.52	96.98	93.35	95.245
100.00	100.00	100.00	100.00	100.00
Gini Coefficient	(0.445)	(0.431)	(0.288)	(0.495)

5.3 Structure of Markets and Margins between Wholesale and Retail Prices

Based on the above discussion, we examine whether the structure of markets has any effect on the performance of markets. This is analysed by looking at the wedges between the wholesale prices and the retail prices. If there is a fair amount of competition in the market and there is no vertical collusion in the hierarchy of traders, price difference between the wholesale and the retail price is not disproportionately high. On the other hand, if traders collude and share information to create oligopsonist practices, the price spread is generally much higher.[4]

Tables 5.4 and 5.5 present data exhibiting the wedges between the wholesale and the retail prices in the four metropolitan cities of the country. It is apparent from the data that the margins between the wholesale and the retail prices are excessive in Delhi, for rice in particular. Taking the average values for the 1990s it is observed that these margins were around 24 per cent in Delhi and around 14 per cent in Mumbai for rice and around 17 per cent for wheat in both the cities, respectively. Compared to

[4] Kohls and Uhl (1985) suggest that if the market share of the largest four firms is less than or equal to 33 per cent, the markets are considered to be competitive, while market shares of the largest four firms between 33 per cent to 50 per cent and above 50 per cent indicate weak and strongly oligopsonistic market structures. It may, however, be added that larger wedges between the wholesale price and the retail price may also be due to the multiple layers of traders between the producers and consumers. These multiple layers of traders cause uncertainties in the market through their actions and thus result in a huge gap between the price received by the producers and price paid by the consumers.

these two cities, margins in Kolkata and Chennai are quite low, 8 per cent in Kolkata for rice and around 11 per cent in Chennai for wheat as well as rice, in that order.

A range of 10 to 15 per cent price spread is not excessive if one compares this with the marketing costs and margins. Studies have shown that marketing costs and margins in India add up to about 17 to 18 per cent of the consumer price for rice and 14 to 20 per cent of consumer price for wheat respectively[5].

In the case of groundnut oil, margins between the wholesale and the retail prices were around 16-17 per cent in Kolkata and Delhi, while in the other two metros the margins were less than 10 per cent. The margins between the wholesale and the retail prices in the case of mustard oil were less than 15 per cent in all the three metropolitan cities for which the data were available. This implies that vertical spreads in prices of edible oils are far lower than vertical spreads in the prices of cereals.

Table 5.4 Ratio of Wholesale to Retail Prices of Rice and Wheat

Period	Rice				Wheat		
	Delhi	Mumbai	Kolkata	Chennai	Delhi	Mumbai	Chennai
1990-91	70.56	84.09		91.89	86.74	86.95	87.88
1991-92	73.58	89.41	94.37	92.42	83.04	86.45	88.78
1992-93	76.69	82.37	96.89	92.65	81.20	83.42	87.75
1993-94	73.47	82.99	98.21	90.58	82.63	72.09	87.12
1994-95	74.93	86.85	94.16	89.13	77.81	87.43	90.07
1995-96	74.37	87.73	80.62	88.30	77.30	85.18	89.32
1996-97	69.52	88.51	95.33	85.50	87.40	80.96	90.92
1997-98	83.68	80.96	87.31	86.58	80.37	80.98	86.10
1998-99	79.47	85.31	90.57	88.84	85.63	79.47	86.07
1999-00	80.77	90.40	89.19	84.11	88.69	86.67	87.44
Averages							
1990-94	73.85	85.14	95.91	91.33	82.28	83.27	88.32
1995-99	77.56	86.58	88.60	86.67	83.88	82.65	87.97
1990-99	75.70	85.86	91.85	89.00	83.08	82.96	88.15

Comparing vertical margins across cities, it is evident that for rice, margins were quite excessive (around 25 per cent) in Delhi, which is close to the surplus areas. The reasons for such a high spread between the wholesale and retail prices could be due to several reasons such as relatively high concentration of rice trade, high

[5] Government of India, Ministry of Industry, Bureau of Industrial Costs and Prices (1991). *Report on Operations of Food Corporation of India*.

transaction costs, weak of infrastructure and information systems. It is a fact that transaction costs in the northern states of the country are high compared to the other states. Yet another reason could be the larger number of intermediaries in between the wholesalers and the retailers which raise the transaction costs.[6]

There are several other reasons, which have been cited in the literature such as adverse information. It has been pointed out by Jha et al. (1999)[7] that for those centres where local consumption is low and distant trade is high, the correlation coefficient

Table 5.5 Ratio of Wholesale to Retail Prices of Groundnut oil and Mustard oil

Period	Groundnut Oil				Mustard Oil		
	Delhi	Mumbai	Kolkata	Chennai	Delhi	Mumbai	Kolkata
1990-91	86.55	94.95	-	94.44	93.02	87.05	92.09
1991-92	87.82	90.53	96.00	94.02	91.97	83.16	91.36
1992-93	84.22	87.48	-	91.78	90.21	81.56	88.42
1993-94	84.41	89.29	-	91.29	91.20	90.75	88.52
1994-95	89.83	92.86	-	92.77	93.12	93.05	91.88
1995-96	81.08	90.12	83.32	91.39	86.89	95.86	88.12
1996-97	74.56	87.88	85.98	89.21	83.84	93.91	86.39
1997-98	89.93	93.76	86.62	90.55	88.45	92.15	92.01
1998-99	79.21	94.67	74.26	89.11	75.61	74.61	90.04
1999-00	83.26	95.00	68.92	89.61	79.72	62.96	87.64
Averages							
1990-94	86.57	91.02	96.00	92.86	91.90	87.11	90.45
1995-99	81.61	92.29	79.82	89.97	82.90	83.90	88.84
1990-99	84.09	91.65	82.52	91.42	87.40	85.51	89.65

between adverse information and the proportion of trade with the other centres was high. They further observed that in these centres the dominant cost components were the adverse information and the inventory holding costs (pp. 187).

[6] During the survey, it was pointed out that the local supply of wheat, rice and other commodities in Delhi is met through Nayya bazar and not through Narela or Nazafgarh markets. In the case of rice for example, millers purchase paddy from the Narela market and sell rice in the Nayya bazar market, from where it is sold to the retailers and shopkeepers and reaches consumers. The same is the case with wheat. These transactions add additional expenses such as commission (1.75 per cent), loading/unloading and transportation charges.

[7] Jha et al.(1999).

Price Asymmetry

The vertical spreads between the wholesale and retail prices of the selected commodities in the four metro cities show diverse results. Such diverse variations in price spread between the wholesale and retail prices could be due to asymmetry in the transmission of price signals from wholesale to retail prices and vice versa. Which implies that shocks in the prices at the wholesale level are not transmitted in an identical manner to the prices at the retail level. This asymmetry in the transmission of prices normally occurs due to the actions of intermediaries in the vertical chain who would not allow the price changes at one level to reflect changes at another level.

Such actions of intermediaries in the market make prices sticky downwards, while prices remain flexible upwards, thereby generating rigidity in the adjustment process. In a well-integrated vertical marketing system, markets transmit the increase in the price at the wholesale level to the retail level to the same extent as the decrease in price, i.e. prices are flexible upwards and downwards. This flexibility of the price transmission mechanism can be specifically interpreted in terms of the symmetry of price adjustment. To explore these issues, the asymmetric price responses for the four metro cities were worked out (Houck, (1977) and Kinnucan and Forker, (1987).[8]

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[8] The method is explained here in greater detail. Let us assume that a variable Y depends upon the values taken by X and that both are time series variables. The hypothesis that is examined here is that one unit increase in X from one period to another has a different absolute impact on Y than does one unit decrease in X. Such a relationship can be written as

(1) $$\Delta Y_i = a_0 + a_1 \Delta X_i' + a_2 \Delta X_i''$$

for i = 1,2, …, t; where $\Delta Y_i = Y - Y_{i-1}$; $\Delta X_i' = X_i - X_{i-1}$ if $X_i > X_{i-1}$ and zero otherwise; $\Delta X_i'' = X_i - X_{i-1}$ if $X_i < X_{i-1}$ and zero otherwise; X_0 is the initial value of X; and Y_0 is the initial value of Y. The value of Y at any point 't' will be

(2) $$Y_t = Y_0 + \sum_{i=1}^{t} \Delta Y_i$$

for i = 1,2, ….., t, t+1, …., T; where T is the total number of observations beyond the initial value. The difference between the current and the initial value of Y is the sum of the period to period changes that have occurred. So,

(3) $$Y_t - Y_0 = \sum_{i=1}^{t} \Delta Y_i$$

inserting equation (1) into equation (3) and simplifying, For the wholesale and retail prices of wheat, the equations of asymmetric price response can be specified as follows:

$$\sum\Delta WP = a_0 t + a_2 \sum\Delta RP^{(+)} + a_3 \sum\Delta RP^{(-)} + \varepsilon_{1t}$$

$$\sum\Delta RP = a_1 t + a_4 \sum\Delta WP^{(+)} + a_5 \sum\Delta WP^{(-)} + \varepsilon_{2I}$$

Where, WP and RP are the wholesale and retail prices expressed as deviations from their respective initial values, 't' is the trend, $RP^{(+)}$ and $RP^{(-)}$ are increases and decreases in the retail prices and $WP^{(+)}$, $WP^{(-)}$ are increases and decreases in the wholesale prices and ε_t is random error term. The formal test of the asymmetry hypothesis is whether $a_2 = a_3$ and $a_4 = a_5$. The same procedure was used to specify equations for other commodities - rice, groundnut oil and rapseed-mustard oil. Seemingly unrelated regression (SURE) procedure was used for estimating the set of equations for wheat, rice, groundnut oil and mustard oil. The results are discussed below.

The estimated coefficients of the equations for wheat and rice shown in Tables 5.6 and 5.7 indicate that estimates provide a reasonably good specification of the price transmission process. This is reflected in the values of adjusted R^2. The hypothesis of symmetric price response of positive and negative changes in the wholesale and retail prices were tested using χ^2 test. Results of χ^2 test indicate that the hypothesis of symmetric response is rejected in the case of Chennai market for both wheat and rice and Mumbai and Kolkata markets for wholesale prices of rice. This suggests that in these cases responses of positive price changes are significantly different from negative price changes.

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(4) $$Y_t - Y_0 = a_0 t + a_1 (\sum\Delta X_i') + a_2 (\sum\Delta X_i'')$$

Let, Y_t^*, R_t^* and D_t^* equal to $Y_t - Y_0$, $\sum\Delta X_i'$ and $\sum\Delta X_i''$, respectively,

(5) $$Y_t^* = a_0 t + a_1 R_t^* + a_2 D_t^*$$

Where R_t^* is the sum of all period to period increases in X and D_t^* is the sum of all period to period decreases in X and a_0 is the trend coefficient. The variable R* is always positive, and D* is always negative. Non-reversibility in ΔY occurs if $a_1 \neq a_2$.

In the case of Chennai, the price elasticity estimates for both wholesale and retail prices with respect to positive and negative cumulative price changes are significant. These estimates show that the cumulative effect on both wholesale and retail prices of an increase in their respective prices exceeds the cumulative effect of their price decreases (Table 5.8).

Table 5.6: The asymmetry between wholesale and retail prices of wheat in the four metro cities (1990.04 to 1999.03)

	Time	WP (+)	WP (-)	RP (+)	RP (-)	Lagged Depend	χ^2	R^{-2}	D-W
ΔWP (Delhi)	-0.29 (-0.7)			0.41 (4.2)	0.39 (4.4)	0.51 (5.7)	0.50	0.94	1.30
ΔRP (Delhi)	1.26 (3.5)	0.55 (10.2)	0.63 (10.4)			0.44 (7.9)	5.22	0.96	2.06
ΔWP (Mumbai)	0.48 (1.0)			0.36 (7.9)	0.37 (7.7)	0.47 (7.3)	0.17	0.92	1.60
ΔRP (Mumbai)	-1.17 (-1.0)	0.75 (7.3)	0.63 (5.6)			0.38 (4.9)	1.73	0.90	1.45
ΔWP (Chennai)	3.30 (7.1)			0.76 (14.0)	1.06 (14.4)	0.001 (0.02)	44.3*	0.99	1.44
ΔRP (Chennai)	-1.69 (-4.8)	0.77 (14.0)	0.67 (14.6)			0.36 (7.7)	21.4*	0.99	1.44

Note:
1) χ^2 is the calculated test statistics of RP (+) = RP (-) in wholesale price equations and WP (+) = WP (-) in retail price equations as given above
2) the figure in parentheses are ‘t’ values

Table 5.7: The asymmetry between wholesale and retail prices of rice in the four metro cities (1990.10 to 1999.09)

	Time	WP (+)	WP (-)	RP (+)	RP (-)	Lagged Depend	χ^2	R^{-2}	D-W
ΔWP (Delhi)	0.97 (1.1)			0.15 (2.0)	0.10 (1.6)	0.56 (7.3)	0.44	0.94	1.75
ΔRP (Delhi)	1.05 (2.1)	0.09 (1.2)	0.11 (1.4)			0.81 (14.6)	0.93	0.96	2.06
ΔWP (Mumbai)	-0.32 (-0.6)			0.25 (4.9)	0.14 (2.3)	0.62 (9.6)	4.64**	0.97	1.75
ΔRP (Mumbai)	1.60 (1.7)	0.33 (3.6)	0.40 (4.3)			0.55 (7.6)	1.25	0.96	1.95
ΔWP (Chennai)	0.70 (2.6)			0.81 (14.2)	0.84 (14.3)	-0.03 (-0.4)	2.86***	0.96	0.91
ΔRP (Chennai)	-0.56 (-2.4)	0.86 (18.0)	0.83 (17.9)			0.31 (7.8)	5.52**	0.98	0.96
ΔWP (Kolkata)	-0.53 (-2.1)			0.14 (3.3)	0.06 (1.1)	0.71 (11.0)	7.64*	0.96	1.66
ΔRP	1.03	0.47	0.60			0.58	1.70	0.92	1.83

(Kolkata)	(1.9)	(5.4)	(4.1)			(8.3)			

Note:
3) χ^2 is the calculated test statistics of RP (+) = RP (-) in wholesale price equations and WP (+) = WP (-) in retail price equations as given above
4) the figure in parentheses are ‘t’ values

Table 5.8 : Elasticity estimates of cumulative wholesale and retail price transmissions in the four metro cities

	WP (+)	WP (-)	RP (+)	RP (-)
	Wheat			
Delhi	1.27	0.98	1.14	0.56
Mumbai	1.78	1.01	1.39	0.95
Chennai	**1.76**	**0.86**	**1.49**	**0.97**
	Rice			
Delhi	0.17	0.13	0.37	0.12
Mumbai	0.65	0.43	**0.65**	**0.21**
Chennai	**1.76**	**0.94**	**1.70**	**0.84**
Kolkata	1.08	0.95	**0.76**	**0.23**

The results for groundnut oil and mustard oil are exhibited in Tables 5.9 and 5.10 also show that the estimates provide a convincingly good specification of the price transmission process in these two edible oils as reflected in the high values of adjusted R^2. Results of χ^2 test indicate that the hypothesis of symmetric response is rejected in the case of Mumbai market for groundnut oil and Delhi market (wholesale price). In the case of mustard oil the hypothesis of symmetric response stands rejected in Delhi and Mumbai markets. These results suggest that in these two edible oils responses of positive price changes are significantly different from negative price changes both at the wholesale as well as at the retail level. This is true in the case of Mumbai market for groundnut oil and Delhi market for mustard oil.

Similarly, estimates for retail prices with respect to positive and negative cumulative price changes in the wholesale prices of groundnut oil are significantly different in Delhi market. Likewise, in Mumbai market the cumulative effect of negative price changes and positive price changes at the wholesale level has a varying effect on the retail prices of mustard oil (Table 5.11).

Table 5.9 : The Asymmetry between wholesale and retail prices of groundnut oil in the four metro cities (1990.04 to 1999.03)									
	Time	WP (+)	WP (-)	RP (+)	RP (-)	Lagged Depend	χ^2	R^{-2}	D-W
ΔWP (Delhi)	1.66 (1.2)			0.16 (2.5)	0.16 (1.7)	0.76 (10.9)	0.00	0.91	1.49
ΔRP (Delhi)	-12.1 (-2.8)	0.50 (8.3)	0.31 (5.1)			0.58 (10.3)	7.31*	0.96	1.56
ΔWP (Mumbai)	-17.1 (-4.5)			1.03 (10.9)	0.82 (12.1)	0.08 (1.1)	17.7*	0.89	1.03
ΔRP (Mumbai)	16.4 (5.8)	0.64 (14.7)	0.85 (17.9)			0.26 (6.3)	30.0*	0.91	1.60
ΔWP (Chennai)	-3.70 (-1.9)			1.07 (30.2)	1.06 (30.6)	-0.05 (-1.4)	0.06	0.95	1.83
ΔRP (Chennai)	3.64 (1.7)	0.92 (30.1)	0.93 (32.0)			0.06 (2.2)	0.13	0.96	1.93

Note:
5) χ^2 is the calculated test statistics of RP (+) = RP (-) in wholesale price equations and WP (+) = WP (-) in retail price equations as given above
6) the figure in parentheses are 't' values

Table 5.10: The asymmetry between wholesale and retail prices of mustard oil in the four metro cities (1990.04 to 1999.03)									
	Time	WP (+)	WP (-)	RP (+)	RP (-)	Lagged Depend	χ^2	R^{-2}	D-W
ΔWP (Delhi)	5.83 (3.1)			0.85 (17.3)	0.98 (16.8)	-0.21 (-3.2)	17.2*	0.91	0.54
ΔRP (Delhi)	-4.69 (-2.5)	0.97 (25.9)	0.88 (26.0)			0.33 (12.1)	9.94*	0.97	1.16
ΔWP (Mumbai)	4.66 (0.9)			0.31 (4.7)	0.33 (3.7)	0.47 (6.0)	0.07	0.85	1.71
ΔRP (Mumbai)	-8.34 (-2.3)	0.43 (6.2)	0.33 (5.5)			0.71 (13.2)	4.84**	0.93	1.63
ΔWP (Kolkata)	-2.79 (-1.5)			1.10 (23.8)	1.10 (23.8)	-0.08 (-1.9)	0.003	0.96	1.12
ΔRP (Kolkata)	2.64 (1.7)	0.87 (27.6)	0.87 (28.6)			0.12 (4.0)	0.09	0.97	1.34

Note:
7) χ^2 is the calculated test statistics of RP (+) = RP (-) in wholesale price equations and WP (+) = WP (-) in retail price equations as given above
8) the figure in parentheses are 't' values

Table 5.11 : Elasticity estimates of cumulative wholesale and retail price transmission in the four metro cities				
	WP (+)	WP (-)	RP (+)	RP (-)
	Groundnut Oil			
Delhi	**1.83**	**0.83**	0.34	0.18
Mumbai	2.21	2.20	4.15	2.36
Chennai	4.05	3.30	5.23	3.96
	Mustard Oil			
Delhi	6.82	5.70	8.22	7.91
Mumbai	**2.33**	**1.49**	1.64	1.39
Kolkata	7.05	6.48	12.36	10.83

Causality between the wholesale and retail prices

After having discussed asymmetry in the transmission of price changes, we tested causality between the wholesale and retail prices. Such an exercise is important to identify the causation and direction of causality. For example, retail prices are said to be Granger caused by the wholesale prices if current and past information on wholesale prices helps improve the forecasts of retail prices.[9] The results are shown in Table 5.12.

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[9] Thus to check causality between retail and wholesale prices the procedure suggested by Granger (1969) was used. The model proposed is

$$RP_i = \sum_{i=1}^{m} a_i RP_{t-i} + \sum_{i=1}^{m} b_i WP_{t-i} + V_t$$

$$WP_i = \sum_{i=1}^{m} \alpha_i WP_{t-i} + \sum_{i=1}^{m} \beta_i RP_{t-i} + V_t$$

However since the series of wholesale and retail prices are non-stationary and integrated of order one I (1), we took the first difference instead which is stationary. The optimal lag length was determined by minimising Akaike's Final Prediction Error (FPE). Since the inferences are drawn on the basis of monthly data we tried a lag length of up to 12 months. The hypothesis, WP Granger causes RP if H_0: $b_1 = b_2 = b_3 = \cdots = b_n = 0$ is rejected against the alternative H_1: at least one $b_i \neq 0$, i = 1,. ,n. Similarly, RP Granger Causes WP, if H_0: $\beta_1 = \beta_2 = \beta_3 = \cdots = \beta_n = 0$ is rejected against the alternative H_1: at least one $\beta_i \neq 0$, i = 1,..,n.

Table 5.12: Granger causality tests between wholesale and retail prices in the four metro cities			
Market	Direction	F* Statistics	No of Lags
Rice			
Delhi	RP to WP	2.1***	3
	WP to RP	0.62	1
Mumbai	RP to WP	2.7***	1
	WP to RP	0.03	1
Chennai	RP to WP	1.7***	12
	WP to RP	4.0*	3
Kolkata	RP to WP	3.2**	5
	WP to RP	3.1***	1
Wheat			
Delhi	RP to WP	2.0**	9
	WP to RP	9.6*	8
Mumbai	RP to WP	2.8***	2
	WP to RP	1.9	4
Chennai	RP to WP	4.8*	8
	WP to RP	0.1	1
Groundnut Oil			
Delhi	RP to WP	3.1**	4
	WP to RP	26.0*	1
Mumbai	RP to WP	0.4	1
	WP to RP	6.6*	12
Chennai	RP to WP	1.5	4
	WP to RP	10.8*	2
Mustard Oil			
Delhi	RP to WP	2.6*	3
	WP to RP	5.4*	4
Mumbai	RP to WP	1.3	10
	WP to RP	2.6*	10
Kolkata	RP to WP	3.0*	5
	WP to RP	3.5*	9
Note: * Significant at one percent level ** Significant at five percent level *** Significant at ten percent level			

It is clearly evident from the results that except for a few cases causality runs in both the directions, i.e., from the wholesale to the retail prices and vice versa. This is particularly true for edible oils. But in the case of cereals the results suggest a mixed picture. The movements in the retail prices of rice in Delhi and Mumbai are autonomous of the movements in the wholesale prices, i.e., movements in the retail prices are independent of the movements in the wholesale prices. But, movements in the wholesale prices are not independent of the movements in the retail prices. Similar results were obtained in the case of wheat prices in Mumbai.

The absence of causality between the wholesale to retail prices in the case of rice provides further explanation to the higher margin observed between the wholesale and retail prices of rice. The uncertainties caused by the traders expectations of future price might have led to movement of prices at the wholesale and retail level into two different directions.

5.4 Rise in Prices of Cereals and Edible Oils during 1998-99

As mentioned in Chapter 2, one of the reasons of the price rise, particularly in the case of cereals during 1998-99 was the increase in procurement prices. The other reason is the fall in the availability of cereals during 1997-98 and 1998-99. The prices of wheat increased sharply during the year 1998-99 because of the poor wheat output during the preceding year. The output of wheat fell by 7.62 per cent from 69.35 million tonnes during 1996-97 to 66.35 million tonnes during 1997-98. Similarly, the output of coarse cereals fell by 10.85 per cent during 1997-98, from 34.1 million tonnes to 30.4 million tonnes. There was a slight increase in the output of rice (0.97 per cent), but it was not able to make up for the reduction in the output of cereals. This is reflected in the 3.2 per cent drop in the net supply of cereals (Table 5.13). This coupled with mopping up of 6.1 million tonnes by the FCI due to higher procurement prices and net exports of about 2.8 million tonnes reduced the net availability of cereals in the economy by 9.31 per cent. The fall in the per capita availability of cereals was even higher at about 11.52 per cent. There was a recovery in the net availability of cereals during 1998-99, but not enough to match the availability of earlier years again due to mopping up of 8 million tonnes by the FCI.

Due to crop failure in Bangladesh, exports of rice also recorded a sharp increase during 1998-99. The exports of rice increased to 4.96 million tonnes (both basmati and non-basmati) during 1998-99 from 2.40 million tonnes during 1997-98. Nearly 88 per cent of this was non-basmati rice out of which 47 per cent was exported to Bangladesh. It also appears that there was increase in the smuggling of grains, in addition to increase in the level of exports. Studies have shown that considerable illegal trade takes place along the Indo-Bangladesh border.

Table 5.13: Net Availability Of Cereals					
Year	Net production (million tonnes)	Net imports (million tonnes)	Changes in Government stocks (million tonnes)	Net availability (million tonnes)	Net availability (per capita g per day)
1990-91	141.90	-0.60	-4.40	145.70	468.50
1991-92	136.80	-0.70	-1.60	137.70	434.50
1992-93	145.80	2.60	10.30	138.10	427.90
1993-94	149.60	0.50	7.50	142.60	434.00
1994-95	155.30	-3.00	-1.70	154.00	457.50
1995-96	147.10	-3.50	-8.50	152.10	443.60
1996-97	162.00	-0.60	-1.80	163.20	468.20
1997-98	156.90	-2.80	6.10	147.90	417.30
1998-99	164.70	-1.50	7.00	156.20	433.70
1999-00	168.70	-1.00	8.70	159.10	434.80
Source: Economic Survey.					

The shortage of cereals in the market is reflected in the high coefficients of variation in the prices of coarse cereals during the year 1998-99 (Table 5.14 to 5.16). A comparison of the intra-market variations in the prices of coarse cereals clearly shows that after 1990-91, variations in their prices were high again in 1998-99. These variations show that there was a drop in coarse cereal production, the burden of adjustment obviously falling on wheat (Figures 5.4 to 5.6). This is discussed in a greater detail in the next chapter, where we analyse inter-commodity price linkages.

In the case of edible oils, the increase in prices during 1998-99 was due to the events that created a shortage of edible oils in the market. In August 1998, the edible business was severely hit by the deaths from dropsy that broke out as a result of the consumption of adulterated mustard oil. A majority of state governments banned the sale of loose mustard oil due to which the edible oil market was completely shaken up. This is reflected in the sudden and steep hike in the coefficients of variation in the prices of mustard oil, vanaspati oil and groundnut oil during 1997-98 and 1998-99 (Table 5.17

Table 5.14: Coefficient Of Variation In Monthly Wholesale Prices Of Jowar In Selected Markets (1990-91 To 1998-99)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Avg intra year
Hyderabad	21.59	11.46	20.11	12.25	16.88	9.99	5.00	9.30	16.02	13.62
Patan	12.42	23.44	24.44	18.06	22.80	24.20	18.05	12.67	13.35	18.83
Gulbarga	22.81	5.96	27.23	12.64	14.33	6.75	7.92	9.11	15.53	13.59
Nagpur	16.38	13.27	16.92	10.40	12.95	11.21	8.31	23.97	27.91	15.70
Baran	26.69	22.35	6.54	16.16	34.37	5.88	31.01	23.53	24.32	21.21
Coimbatore	17.03	15.46	9.34	14.41	9.71	0.46	3.46	6.20	12.71	9.86
Kanpur	25.27	22.06	13.94	14.95	8.45	4.74	9.50	11.27	20.63	14.53
Avg intra-year	20.31	16.29	16.93	14.12	17.07	9.03	11.89	13.72	18.64	-
Inter-year among markets	14.54	17.89	28.29	14.75	20.88	25.46	17.48	26.69	20.50	-

Table 5.15: Coefficient Of Variation In Monthly Wholesale Prices Of Bajra In Selected Markets (1990-91 To 1998-99)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Avg intra year
Nellore	16.45	13.35	12.85	17.18	11.66	6.04	5.18	7.06	17.61	11.93
Rajkot	7.82	19.20	7.37	13.07	14.00	12.20	12.89	10.42	8.74	11.75
Hisar	17.08	16.02	9.16	13.57	9.56	4.06	7.91	4.88	15.71	10.88
Patharodi	15.71	15.22	12.93	14.26	11.37	4.05	6.68	10.88	13.10	11.58
Jodhpur	16.59	12.00	10.50	14.02	9.81	6.17	13.08	13.63	15.17	12.33
Erode	17.00	9.47	9.91	13.10	13.59	8.19	5.97	7.52	9.84	10.51
Agra	18.39	14.18	12.62	14.60	7.35	4.59	6.53	7.58	20.44	11.81
Average intra-year	15.58	14.20	10.77	14.26	11.05	6.47	8.32	8.85	14.37	
Inter-year among markets	8.05	11.29	20.75	9.49	14.91	13.98	19.64	22.23	12.74	

Table 5.16: Coefficient Of Variation In Monthly Wholesale Prices Of Maize In Selected Markets (1990-91 To 1998-99)										
	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Avg intra year
Bahagalpur	15.57	14.51	10.20	8.80	9.17	12.96	16.18	9.13	6.97	11.50
Modasa	18.21	9.63	10.01	16.20	5.90	10.13	7.31	15.86	14.28	11.95
Jhabua	18.97	6.74	13.79	24.13	7.17	12.13	5.59	5.01	11.16	11.63
Nawashar	15.37	5.57	13.16	9.19	6.16	6.63	9.68	4.57	13.79	9.35
Bhilwara	17.74	8.48	8.13	14.97	5.13	11.11	6.75	10.95	11.40	10.52
Bahraich	10.65	9.20	6.92	10.32	5.05	5.65	9.34	7.87	11.11	8.46
Average intra-year	16.09	9.02	10.37	13.94	6.43	9.77	9.14	8.90	11.45	-
Inter-year among markets	7.19	10.21	9.28	9.74	10.02	8.62	7.50	11.16	8.24	-

and 5.18). There was a sudden increase in the prices of all edible oils during the year 1998 (Figures 5.7 to 5.9). Prices of edible oils continued to rise till end of October, after which they started falling, but it took almost six months for prices to return to their old levels.

It was a clear case of markets getting affected due to the shortage of edible oils in the market. A shortage forces consumers to shift their consumption patterns to close substitutes in response to an increase or decrease in the price of a particular commodity. This is explained in the next chapter. In addition, asymmetry in the transmission of price signals from the wholesale level to the retail level further widened the differences between the wholesale prices and retail prices.

Table 5.17: Coefficient Of Variation In Monthly Wholesale Prices Of Vanaspati Oil In Selected Markets (1990-91 To 1998-99)

COV	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Avg intra year
Hyderabad	7.28	6.53	10.98	5.71	4.25	9.92	2.75	19.04	11.79	8.69
Ahmedabad	7.07	4.50	7.47	7.73	1.29	3.05	8.24	13.16	12.60	7.24
Hisar	5.95	6.05	9.30	5.80	1.49	3.56	3.80	16.99	11.12	7.12
Bangalore	7.09	7.72	9.39	7.16	1.98	2.78	3.59	11.60	9.38	6.74
Bhopal	7.94	8.37	6.87	7.34	2.71	6.11	5.10	12.60	10.84	7.54
Mumbai	7.89	7.29	7.39	6.37	2.34	2.10	3.93	13.40	11.41	6.90
Bhubeneshwar	8.00	8.79	8.34	6.92	3.19	2.74	3.55	10.75	11.76	7.12
Ludhiana	7.58	5.80	8.10	8.19	7.58	4.65	3.45	15.50	12.29	8.13
Jodhpur	10.21	6.16	7.05	8.16	5.51	3.94	6.23	16.38	13.06	8.52
Chennai	6.10	7.09	5.51	8.19	2.59	8.62	5.51	14.92	11.78	7.81
Lucknow	5.59	4.96	4.69	5.75	7.79	1.56	5.90	15.42	12.38	7.12
Calcutta	7.50	6.51	5.51	9.39	1.26	2.30	3.16	16.18	10.97	6.98
Delhi	8.95	6.55	6.38	7.15	4.91	6.69	3.36	12.47	12.39	7.65
Pondicherry	3.68	4.47	16.12	5.98	3.43	10.16	1.79	8.37	9.64	7.07
Avg intra-year	7.20	6.49	8.08	7.13	3.59	4.87	4.31	14.06	11.53	
Inter-year among markets	3.48	4.14	3.68	4.64	5.35	7.51	5.60	6.16	5.44	

Table 5.18: Coefficient Of Variation In Monthly Wholesale Prices Of Mustard Oil In Selected Markets (1990-91 To 1998-99)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Avg intra year
Hisar	8.27	10.99	8.21	7.94	3.54	6.20	4.37	19.42	18.63	9.73
Bhopal	9.92	8.45	7.02	7.09	4.39	4.12	6.80	19.91	26.32	10.45
Mumbai	13.40	8.42	11.26	4.33	4.77	9.48	3.96	18.94	12.43	9.66
Bhubaneshwar	9.27	7.38	6.47	3.74	3.82	5.93	7.65	16.01	20.50	8.98
Ludhiana	8.87	8.16	6.13	4.72	5.29	6.30	5.84	22.35	18.15	9.54
Jodhpur	9.37	14.41	11.08	5.59	2.26	1.19	8.13	29.55	19.72	11.26
Lucknow	10.57	8.51	7.83	6.25	2.93	2.84	7.80	18.58	18.72	9.34
Calcutta	11.67	9.65	8.46	7.06	4.47	6.14	4.72	23.09	21.79	10.78
Delhi	11.56	8.52	7.94	6.73	5.64	5.63	4.05	28.72	21.32	11.12
Avg. intra-year	10.32	9.39	8.27	5.94	4.12	5.31	5.92	21.84	19.73	
Inter-year among markets	5.78	6.35	8.36	8.92	6.97	8.45	10.46	7.17	11.52	

Chapter 6

Explaining Inter-Commodity Price Linkages[1]

It is an accepted fact that despite varying food habits, consumers switch their consumption patterns to close substitutes in response to an increase or decrease in the price of a particular commodity. To the extent they do so, any shortage in one commodity in the market is likely to increase the demand for another, which will be reflected in the increase in the price of that particular substitute. Therefore, it becomes important to know how the movements in the prices of one substitute are transmitted to another. An understanding of transmission of price signals from one commodity to another and their degree of association is central to the implementation of price stabilisation of commodities. If the prices of two commodities are perfectly integrated, an increase in the price of one will also raise the price level of the other. In the absence of any external disturbances, prices of substitutes should move in unison in response to the forces of demand and supply. The accuracy and speed with which prices adjust in relation to one commodity is taken as an index of interdependence among the markets, which is an indicator of market efficiency.

To work out price linkages the commodity complexes considered in this analysis are cereals, oilseeds and edible oils. Among cereals, rice continues to dominate production with its overwhelming share (45 per cent). However, over the years, the composition of cereals has undergone a significant change. The growing importance of wheat in the total basket of cereals is evident in recent years from its rising share in production - from 14 per cent in 1949-50 to 37 per cent during the period 1997-99. On the other hand, the share of coarse cereals has come down drastically - from 36 per cent to 18 per cent during the same period. There is a marginal decline in the share of rice also during this period (from 50 per cent in 1949-50 to 45 per cent during 1997-99). From these changes in the composition of cereals, it is apparent that the declining shares of coarse grains and rice have given way to increased importance of wheat. Since wheat is a close substitute for coarse grains it is likely that when there is a shortfall in the production of cereals, particularly coarse grains, the pressure of adjustment in demand falls on wheat (Sharma, Ghosh and Kumar (2000).

[1] The authors wish to express their sincere thanks to Dr. H. K. Nagarajan for his comments and help in understanding the technique used in this chapter.

Similar changes have also occurred in the case of oilseeds and the composition of oilseeds has undergone a significant change over time. Among oilseeds, groundnut still stands out as the leading oilseed crop, despite a significant reduction in its share in total oilseeds from 64 per cent during 1951-53 to 35 per cent during 1997-99. But, soybean, which had a tiny share in oilseeds until the 1970s, is the second most important oilseed crop with a share of 26 per cent during 1997-99. In terms of oil, rapeseed-mustard is still the second most important crop after the groundnut accounting for about 24 per cent of the total oilseeds production and about 31 per cent share of the total edible oils. The remaining oilseeds together account for 15 per cent share of the total oilseeds production of about 23.64 per cent during the same period. These changes in the oilseeds complex point to the fact that being close substitutes, it is likely that a shortfall in the production of one exerts pressure on the other leading to adjustment in demand patterns.

Considering these changes in the composition of both cereals and oilseeds it is essential to know the pattern of interdependence among different substitutes. Although, these issues are already known, there is very little understanding of transmission of price signals from one commodity to another and their degree of association. Further, the speed with which prices of one commodity adjust to a shock in prices of other commodities in the system is also not known. Therefore, after analysing the movements in the prices of the selected commodities and their substitutes in the previous chapter, we try to establish the linkages in the prices of various commodities in this chapter. To carry out this analysis we have used monthly wholesale price indices for rice, wheat and coarse grains for the cereals group, groundnut seed, rapeseed-mustard, cotton seed and other oilseeds for the oilseeds complex; and groundnut oil, rapeseed-mustard oil, vanaspati oil, imported edible oil and other edible oils for the edible oils complex. These commodities, particularly the oilseeds and edible oils were selected on the basis of their relative importance in the total wholesale price index for a particular group, i.e. cereals, oilseeds and edible oils. The data used are the monthly wholesale price indices for the period April 1990 to March 1999.

6.1 Methodological Framework

In a simple framework, correlation coefficients are used to find out the degree of association between two price series. If the correlation coefficient between two price series is close to one, then the interpretation is that the two price series are closely related. However, such a method of establishing price linkages and testing market integration is open to question. This has been demonstrated in a number studies on the subject.[2] Besides the problem of spurious correlation, there are other serious limitations related to this measure, such as the non-stationary nature of the price series. Alternative procedures for evaluating linkages have been developed within the framework of co-integration tests.[3] These developments led to number of studies on co-integration analysis during the late 1980s and early 1990s.[4] A group of non-stationary time series is co-integrated if there is a linear combination of them that is stationary.[5] The linear combination of these series is called the co-integrating equation, which implies a stable long run equilibrium relationship. However, even the simple co-integration tests developed by Granger (1986) and Engle and Granger (1987) fail to address linkages, which might operate through a third variable and issues such as endogeneity caused by prices that are simultaneously determined. This is due to the fact that these methods were developed in a bi-variate framework. To overcome these limitations, a better and more powerful test for co-integration was developed by Johansen (1988) and Johanson and Juselius (1990). This test is carried out in a Vector Auto Regressive mode and is a reduced form method. This test for co-integration is particularly important when one is dealing with co-integration in a multi-variate framework. The advantage of this method is that it takes care of both the endogeneity as well as simultaneity problems associated with simple con-integration tests.

To make the procedure more simple and clear, consider an example of three commodities - price of rice (PR_t), price of wheat (PW_t) and price of coarse grains (PCG_t) with one co-integrating equation. The co-integrating equation is;

$$aPR_t + bPW_t + cPCG_t = 1$$

The above co-integrating vector can be normalised as:

$$aPR_t + bPW_t + cPCG_t -1 = 0$$

[2] Blyn (1973), Harris (1979), Timmer (1974, 1984), Boyd and Brorsen (1986), Heytens (1986) and Ravallion (1986).
[3] Granger (1986) and Engle and Granger (1987).
[4] Goodwin and Schroeder (1991), Palaskas and Hariss (1993), Alexander and Wyeth (1994) and Goletti and Babu (1994).
[5] A time series is said to be stationary if the joint distribution of any set of ‘n’ observations X(t1), X(t2)…,X(tn) is the same as the joint distribution of X(t1+k), X(t2+k),…,X(tn+k) for all ‘n’ and ‘k’.

$$PR_t = (-b/a)\, PW_t + (-c/a)\, PCG_t + (1/a)$$

Or

$$PR_t = c^* - a^* PW_t - b^* PCG_t$$

Where,

$$a^* = b/a,\ b^* = c/a, \text{ and } c^* = 1/a.$$

This equation shows the long run linear relationship between the price series, which implies that prices are moving towards a long run equilibrium.

The Vector Error Correction model is nothing but a Vector Auto Regression that builds in co-integration. The vector error-correction model consists of the following set of equations:

$$\Delta PR_t = \alpha_1 + \sum_{i=1}^{l} \beta_{1i}\, \Delta PW_{t-i} + \sum_{i=1}^{m} \gamma_{1i}\, \Delta PR_{t-i} + \sum_{i=1}^{n} \delta_{1i}\, \Delta PCG_{t-i} + \sum_{i=1}^{r} \xi_{1i}\, ECT_{r,\, t-1} + u_{1t}$$

$$\Delta PW_t = \alpha_2 + \sum_{i=1}^{l} \beta_{2i}\, \Delta PW_{t-i} + \sum_{i=1}^{m} \gamma_{2i}\, \Delta PR_{t-i} + \sum_{i=1}^{n} \delta_{2i}\, \Delta PCG_{t-i} + \sum_{i=1}^{r} \xi_{2i}\, ECT_{r,\, t-1} + u_{2t}$$

$$\Delta PCG_t = \alpha_3 + \sum_{i=1}^{l} \beta_{3i}\, \Delta PW_{t-i} + \sum_{i=1}^{m} \gamma_{3i}\, \Delta PR_{t-i} + \sum_{i=1}^{n} \delta_{3i}\, \Delta PCG_{t-i} + \sum_{i=1}^{r} \xi_{3i}\, ECT_{r,\, t-1} + u_{3t}$$

Where, Δ is a difference operator and ECT refers to the error-correction term derived from the long run co-integrating relationship defined above. The residual captures the white noise not explained by the variables themselves.

These equations illustrate price variability and decompose various sources of variability, i.e. impact of own price variability and variability of all other prices in the system. The test for market efficiency is based on edogeneity (price discovery) of a particular variable and the response to shocks (both market wide and commodity specific).

6.2 Estimation and Results

The three systems – cereals, oilseeds and edible oils were estimated using an initial lag of 12. The Akaike Information Criterion (AIC)[6] suggested a VAR of the order 6 in the system for cereals, one in the system for oilseeds and 11 in the system

[6] The Akaike Information Criterion (AIC) is used to determine the order of the lag (Akaike 1969).

of edible oils respectively.[7] Thus, keeping the above in view, the number of lags in the VAR were assumed to be six in the case of cereals, one in the case of oilseeds and eleven in the case of edible oils.

Having determined the optimum lag length for each system, we performed the Johansen test for the presence of co-integrating vectors for each system separately. In carrying out the co-integration test we assumed the presence of an intercept and a trend in our model. Table 6.1 presents the maximum likelihood values of the test statistics and their critical values at 5 per cent and 1 per cent critical value. The eigen values reject the null hypotheses of no co-integration and indicate the existence of one co-integrating vector in the case of cereals, two co-integrating vectors for oilseeds and edible oils, respectively. The results suggest complex long run relationships among rice, wheat and coarse grains; groundnut seed, mustard seed, cottonseed and other oilseeds; groundnut oil, vanaspati oil, mustard oil and other edible oils.

These long run relationships are given below;

Cereals

PRice - 1.08 PWheat - 0.94 PCGrain = 0

Oilseeds

PGnut - 1.25 PMustard - 1.49 POSeeds + 0.67 PCSeed = 0

PGnut - 0.99 POSeeds + 0.36 PMustard + 0.18 PCSeed = 0

Edible oils

PVoil - 0.83 PMoil - 0.63 POOils + 0.14 PGnut oil = 0

Pvoil - 0.30 PGnut oil - 1.29 PMoil + 1.94 POOils = 0

After this, the results of unrestricted VAR with Error Correction terms, which establish short-term causation among the price series considered in the three systems are reported in Annex Tables 6.1 to 6.3 along with their standard errors and t values.

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[7] Lags with a local minimum value of AIC were selected.

Table 6.1 Tests Of Integration					
Group	Eigen value	Likelihood	5 %	1 %	Hypothesized
		Ratio	Critical Value	Critical Value	No. of CE(s)
Cereals	Lags interval: 1 to 6				
	0.2448	40.3901	34.55	40.49	None *
	0.0720	12.0278	18.17	23.46	At most 1
	0.0434	4.4817	3.74	6.40	At most 2 *
	Un-normalised Co-integrating Coefficients:				
	RICE	WHEAT	CGRAN		
	-1.8671	2.0088	0.9400		
	3.3126	-2.3977	0.1566		
	-2.6843	-0.3736	1.0778		
Oilseeds	Lags interval: 1 to 1				
	0.2756	72.6772	54.64	61.24	None **
	0.1660	38.5002	34.55	40.49	At most 1 *
	0.1059	19.2549	18.17	23.46	At most 2 *
	0.0673	7.3847	3.74	6.40	At most 3 **
	Un-normalised Co-integrating Coefficients:				
	GSEED	MSEED	CSEED	OSEED	
	-0.8481	1.0633	-0.5654	1.2668	
	1.3666	0.4944	0.2431	-1.3488	
	0.3145	0.7309	-1.1245	-0.8557	
	-1.0163	0.8390	0.6531	-1.1513	
Edible oils	Lags interval: 1 to 11				
	0.3309	86.5616	54.64	61.24	None **
	0.2819	47.9859	34.55	40.49	At most 1 **
	0.1344	16.2018	18.17	23.46	At most 2
	0.0242	2.3493	3.74	6.40	At most 3
	Un-normalised Co-integrating Coefficients:				
	VOIL	GOIL	MOIL	OOIL	
	4.2315	0.6022	-3.5271	-2.6662	
	2.5971	-0.7856	-3.3403	5.0370	
	-6.0104	-3.2333	2.4809	5.6181	
	-6.9191	3.4656	-2.9094	5.4855	
Notes:	*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
	L.R. test indicates 2 co-integrating equation(s) at 5% significance level				

The results of the three systems are described below in greater detail. First, we interpret the results of error correction terms, which indicate (a) the nature of market (stable or unstable or random), and (b) edogeneity and the movement towards the long run equilibrium, i.e., efficiency of the market. Thereafter, we explain the short-term causality in the prices of various commodities included in the system, i.e., which commodity is impacting the price of which other commodity. Then we move on to discuss the impulse responses, which trace the effect of one standard deviation shock to one of the variables in the system on current and future values of the endogenous variables. Following this variance decomposition is discussed to know the relative importance of the random shocks in explaining the variability in the prices of three commodities in the system

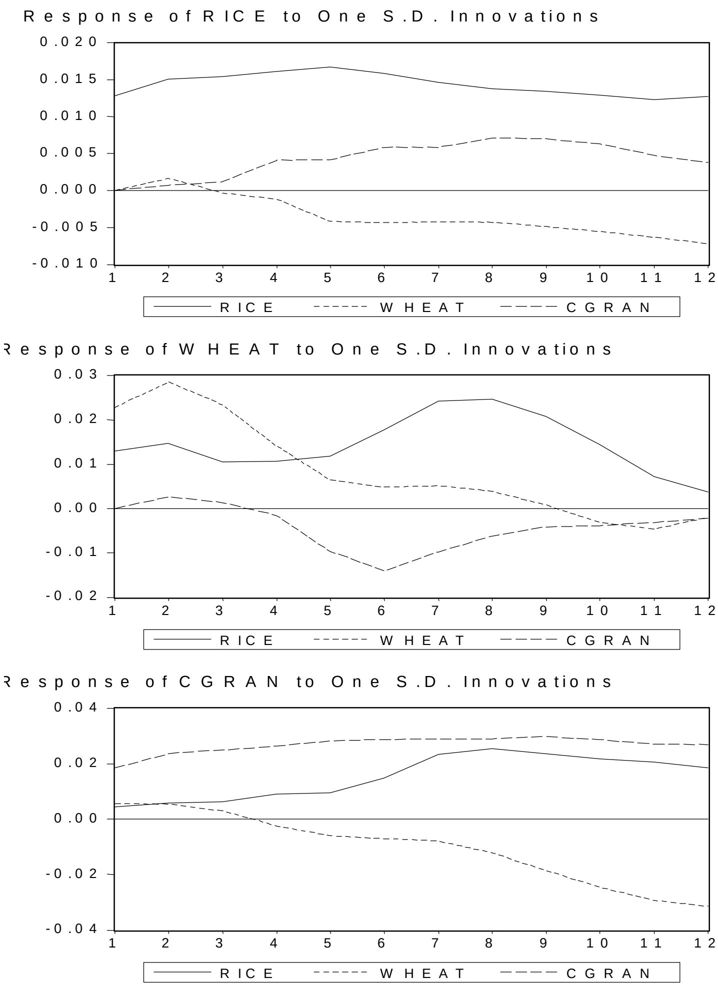
6.2.1 Cereals

The results for the cereals show that the estimates of the error correction coefficients are highly significant for wheat and coarse grains, but not for rice. Comparing the signs of the first co-integrating vector with the signs of the un-normalised co-integrating coefficients in the Johansen test, it turns out that the signs for wheat and coarse cereals are negative. This implies that the short run price movements are stable. The coefficients of the error correction terms indicate the speed of convergence to the long run equilibrium rate of growth to a shock in their own prices. The estimated coefficients show that the speed of adjustment to a shock in their own prices is much faster in the case of wheat and coarse grains and very slow in the case of rice. The estimated EC coefficients indicate that about 18 to 19 per cent adjustment towards long run equilibrium rate of growth in the case of wheat and coarse grains occurs in one month.

The coefficients of the own lagged prices and prices of the substitutes reveal that rice price is affected by wheat, with a one month lag, while the impact of its own price takes place with a five month delay; and with respect to coarse grains with a delay of three months, respectively. Wheat price is affected by its own lagged price and also by the lagged prices of the other two cereals, i.e., rice with a lag of five months and coarse grains with a lag of one, four and six months. In the case of coarse grains, there is a significant impact of changes on their own prices and the prices of wheat with a month lag. Rice price is also affected by coarse grain prices but with a lag of 6 months. These results point to the fact that prices of the cereals are revealed (discovered) in wheat as its price affects all other grains after a lag of one month.

Following this, we estimated impulse responses to shocks in the prices of the three cereals. A commodity specific shock in the prices of one commodity such as wheat will change prices of other related commodities. In the context of linked markets, it is important to examine the speed of adjustment in reaction to such shocks. The impulse response functions trace the effect on current and future values of the endogenous variables to one standard deviation shock to the exogenous variables. The responses of the one standard deviation shock to all the three grains are shown in Figure 6.1.

Figure 6.1



The shapes of the response functions with respect to one standard deviation shock to rice prices to its own price, prices of wheat and coarse grains reveal that the prices of rice continue to rise for about five months and then they start falling but the impact sustains for quite a long time. There is an impact on wheat, but the movement towards equilibrium is quite fast. The impact on coarse grains continues to rise until the 8th month and afterwards it starts moving towards equilibrium.

The other two figures for wheat and coarse grains show the responses of each variable to one standard deviation shock in wheat and coarse grain prices. The initial impact of a shock to wheat prices is largely concentrated on wheat and the movement of wheat price towards equilibrium is in cycles. In the case of coarse grains, the initial impact is largely on wheat but there is a sustained increase in the price of rice as well. There is very little impact on own prices, but shocks to both wheat and rice prices persist for a long time before returning to the equilibrium level.

After this we carried out variance decomposition of VAR to examine the extent to which the variability of any given variable can be explained by the other commodities in the system using alternative ordering of variables (Tables 6.2). The alternative orderings were tried to find out the robustness of decomposition results to changes in the ordering of variables. The variance decomposition analysis shows that most of the variability in rice prices is explained by its own prices. In the case of wheat also, initially most of the variability is explained by the variability of own price, but in the later months, i.e. towards the end of 12th month, however, the major portion of the variability in wheat prices is explained by the variability in rice prices. In the case of coarse grains, most of the variability towards the end of the 12th month is explained by both rice and wheat prices.

6.2.2 Oilseeds

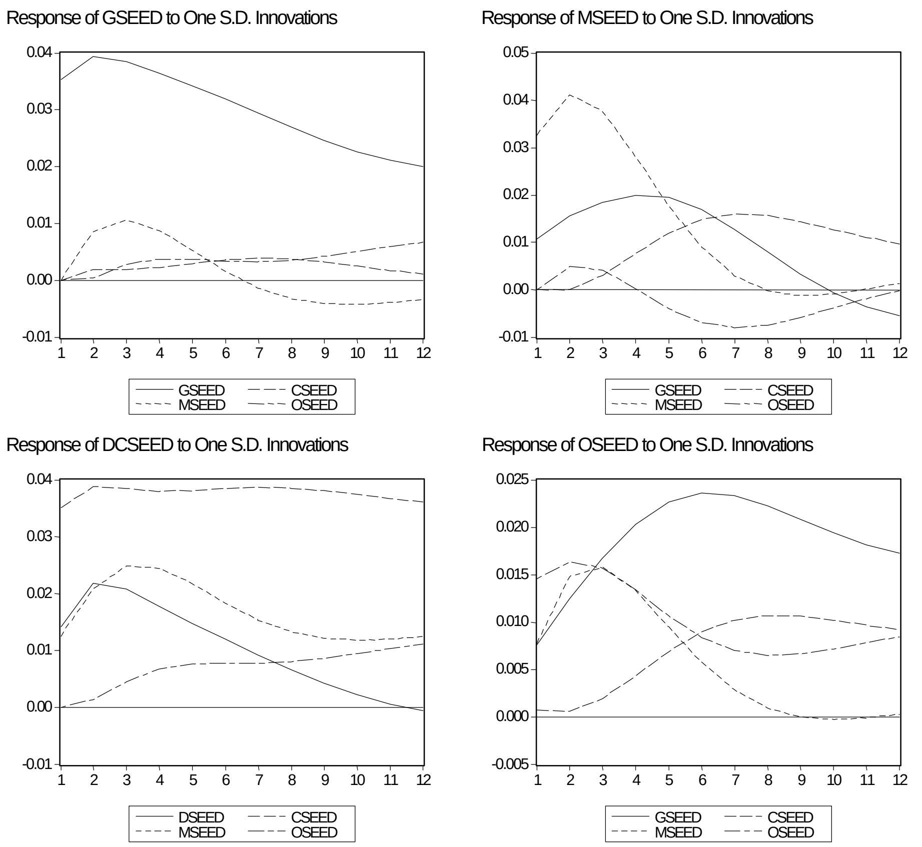
The estimates of the error correction coefficients in the case of oilseeds are highly significant for cottonseed and other oilseeds, but the level of significance for groundnut seed and mustard seed is low. A comparison of the signs of the first EC terms with the signs of the un-normalised co-integrating coefficients in the co-integration test implies that short run price movements in the oilseed markets are stable. The estimates of the second error correction term for rapeseed-mustard are however, positive and significant, which means that price movements in mustard seed are random. The speed of adjustment towards long run equilibrium is slow. In the case of cottonseed and other oilseeds it takes about 9 months and 10 months to return to the long run equilibrium. In the case of groundnut seed and mustard seed the time taken to return to the long run equilibrium is about 14 months.

Table 6.2 Decomposition Of Forecast Error Variances (12 Months Ahead)			
Ordering	Due to innovations in		
	Rice	Wheat	Coarse grains
Rice	83.09	7.56	9.35
Wheat	52.18	39.25	8.57
Coarse grains	22.68	20.83	56.49
Rice	83.09	11.95	4.96
Coarse grains	52.18	37.60	10.22
Wheat	22.68	36.85	40.48
Wheat	81.03	9.62	9.35
Rice	27.48	63.95	8.57
Coarse grains	37.78	5.73	56.49
Wheat	77.45	9.62	12.93
Coarse grains	29.09	63.95	6.96
Rice	32.51	5.73	61.76
Coarse grains	77.45	5.54	17.01
Wheat	29.09	61.97	8.94
Rice	32.51	16.01	51.48
Coarse grains	71.04	11.95	17.01
Rice	53.46	37.60	8.94
Wheat	11.67	36.85	51.48

The estimated coefficients of own prices and prices of substitutes for oilseeds reveal that groundnut seed price is affected by the lagged price of mustard seed and cottonseed. In fact, mustard seed prices affect all other oilseeds in the system, i.e. positive changes in the mustard seed prices lead to positive and significant changes in all other oilseeds. The prices of cottonseed are not affected by own price but are affected by the lagged prices of groundnut and mustard seed, while prices of other oilseeds are influenced by their own lagged prices and lagged prices of mustard.

The impulse responses to one standard deviation shock to all the four oilseeds considered in the system are shown in Figure 6.2. The shapes of the response functions with respect to one standard deviation shock to groundnut seed prices indicate that the shock is mainly concentrated in the groundnut seed prices and has very little impact on the prices of mustard, cottonseed and other oilseeds. However, the speed of adjustment towards equilibrium is very slow. The impact of a shock on the prices of mustard seed is at first restricted to its own prices to a large extent but there is also a significant effect on the groundnut and cottonseed prices as well, which continues for a long time. In the case of cottonseed, the impact of one standard deviation shock in its prices has a prolonged impact on its own prices and also on mustard seed prices. The impact of the shock on groundnut prices, however, is limited to about 11 months. A shock to the prices of other oilseeds has a prolonged and stronger impact on their own prices and prices of groundnut. There is an impact on the mustard seed prices as well but it starts returning to equilibrium after about three months.

Figure 6.2



The variance decomposition analysis in the case of oilseeds using different alternative orderings reveals that most of the variability in the groundnut seed prices and cottonseed prices is explained by the variability in their own prices (Table 6.3). On the other hand, a significant amount of variability in the prices of mustard seed and other oilseeds is explained by the variability in the prices of groundnut seed, cottonseed and other oilseeds depending upon the ordering.

Table 6.3 Decomposition Of Forecast Error Variances (12 Months Ahead)

Ordering	Due to innovations in			
	Groundnut	Rapeseed-mustard	Cottonseed	Other oilseeds
Groundnut	94.68	3.04	0.68	1.60
Rapeseed-mustard	22.12	58.46	16.36	3.05
Cottonseed	8.32	15.45	73.22	3.01
Other oilseeds	59.73	11.25	10.19	18.83
Rapeseed-mustard	81.77	15.95	0.68	1.60
Groundnut	7.84	72.75	16.36	3.05
Cottonseed	2.83	20.94	73.22	3.01
Other oilseeds	45.36	25.62	10.19	18.83
Cottonseed	72.83	6.81	18.77	1.60
Rapeseed-mustard	4.61	53.76	38.58	3.05
Groundnut	3.10	1.72	92.18	3.01
Other oilseeds	32.35	12.31	36.50	18.83
Other oilseeds	69.46	2.83	0.60	27.11
Groundnut	11.73	43.86	16.91	27.51
Rapeseed-mustard	2.94	7.06	71.74	18.25
Cottonseed	28.40	2.38	9.31	59.91
Other oilseeds	68.37	3.92	0.60	27.11
Rapeseed-mustard	8.83	46.76	16.91	27.51
Groundnut	2.26	7.75	71.74	18.25
Cottonseed	28.36	2.42	9.31	59.91

6.2.3 Edible Oils

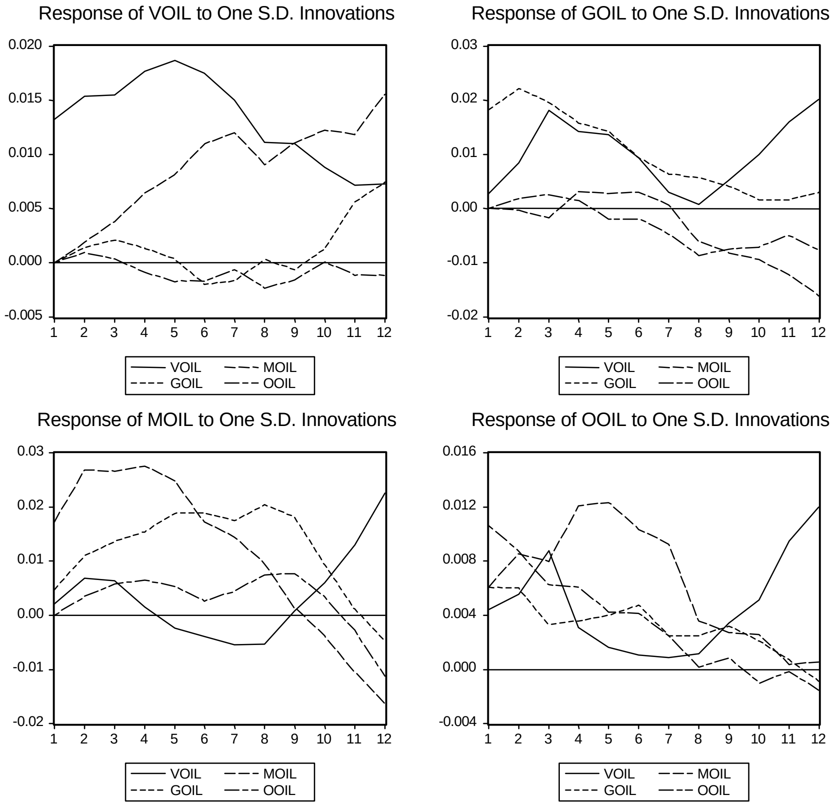
In sharp contrast to the results obtained in the case of oilseeds, coefficients of the error correction terms for edible oils show that their prices, groundnut oil in particular, are highly volatile. The speed of adjustment of a shock towards long run equilibrium, however, is much faster, about two and half months. This is reflected in the coefficient of EC term (0.41) in the groundnut oil equation. Short run price movements in all other edible oils included in the system are stable.

The impact of own prices and prices of substitutes exhibits that prices of vanaspati oil are affected by its own lagged price and also by groundnut oil prices with a delay of five and eight months, respectively. The prices of vanasapti oil in turn affect prices of mustard and other edible oils with a lag of two months and groundnut oil prices with a delay of three months. The impact of groundnut oil on its own prices occurs with a lag of two, three, five and eight months, while the impact of other edible oil prices is experienced with a lag of one month. The mustard oil prices are influenced by their own lagged prices and prices of other edible oils. The impact of groundnut oil prices on mustard oil prices is experienced with a lag of two months. The prices of other edible oils are influenced by their own prices with a lag of three months, but the impact of vegetable oils and groundnut oils is experienced with a delay of two months.

The impulse responses to one standard deviation shock to the prices of edible oils included in our analysis are exhibited in Figure 6.3. The response functions with respect to one standard deviation shock to vanaspati oil prices are initially concentrated on its own prices, but there is an impact on mustard oil prices as well. Further, there is a sustained impact on its own prices and prices of mustard oil, which continues for a long time. The impact of one standard deviation shock on groundnut oil price is mainly felt on its own price and the price of vanaspati oil. This shock induces cycles in vanaspati oil price.

A shock to the mustard oil prices is primarily felt on its own price, but there is a sustained increase in the prices of groundnut oil as well. The movement towards the equilibrium level is much faster in its own price compared to the groundnut oil price. The movements induced by a shock in the prices of other edible oils exhibit that there is a significant impact on their own price and the prices of other three edible oils. Their own price returns to equilibrium at a much faster rate; however, it takes a while for the prices of the other three edible oils to return to the equilibrium level. This is particularly true for the prices of vanaspati oil and groundnut oil.

Figure 6.3



The variance decomposition analysis for edible oils applying different alternative orderings shows that around 65 per cent of the variation in vanaspati oil prices is explained by their own prices (Table 6.4). A major part of the remaining variation is explained by the variations in mustard oil. In the case of groundnut oil 39 to 41 per cent of the variation is explained by its own price and the rest is mostly explained by vanasapti oil and also mustard and other edible oils to some extent.

Variations in mustard oil prices explain 32 to 52 per cent of the variation in its own prices while groundnut oil and other edible oils mainly explain the rest. Similarly, variability in the other edible oils is mainly explained by the variability in the prices of vanaspati oil and mustard oil.

Table 6.4 Decomposition Of Forecast Error Variances (12 Months Ahead)				
Ordering	Due to innovations in			
	Vanaspati oil	Groundnut oil	Rapeseed-mustard oil	Other edible oils
Vanaspati oil	64.57	2.95	31.93	0.54
Groundnut oil	37.60	41.24	14.21	6.94
Rapeseed-mustard oil	11.42	31.17	52.30	5.11
Other edible oils	26.22	10.32	43.79	19.68
Groundnut oil	62.24	5.29	31.93	0.54
Vanaspati oil	29.63	49.22	14.21	6.94
Rapeseed-mustard oil	12.44	30.16	52.30	5.11
Other edible oils	23.42	13.12	43.79	19.68
Rapeseed-mustard oil	56.79	1.93	40.74	0.54
Groundnut oil	31.50	47.25	14.31	6.94
Vanaspati oil	14.08	15.83	64.98	5.11
Other edible oils	21.51	3.92	54.89	19.68
Other edible oils	54.44	1.68	23.32	20.56
Groundnut oil	33.68	38.47	7.02	20.82
Rapeseed-mustard oil	16.56	10.75	31.98	40.71
Vanaspati oil	18.12	0.96	17.00	63.91
Other edible oils	54.44	1.76	23.24	20.56
Rapeseed-mustard oil	33.68	38.77	6.73	20.82
Groundnut oil	16.56	10.29	32.44	40.71
Vanaspati oil	18.12	1.03	16.93	63.91

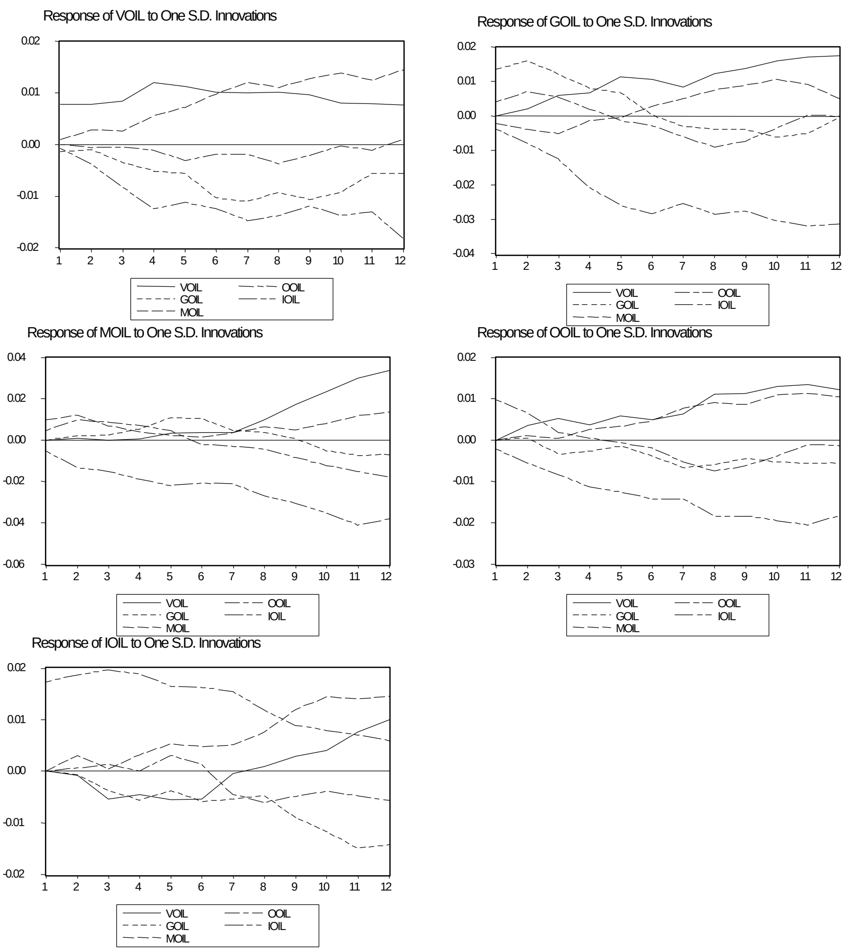
6.2.4 Impact of Imported Edible Oil

To examine the impact of imports of edible oils on the volatility of edible oils, we introduced the index numbers of imported edible oils in the system. The results show that the volatility in the groundnut oil, which was observed in the earlier case, where imported edible oils were not included in the system, is not witnessed in the current scenario with the inclusion of imported edible oils. The price movements in all the edible oil markets were observed to be stable and the adjustment towards long run rate of equilibrium is much faster, less than a month in the case of groundnut oil and mustard oil. These results imply that the imports of edible oils have stabilised the edible oils market, which indicates that the import liberalisation policy in edible oils has helped in reducing the impact of shocks on prices.

The coefficients of the lagged prices of the imported edible oils reveal that the price of imported edible oils affects other edible oils significantly. This is revealed in the highly significant coefficients of lagged prices of imported edible oils with lags, one to four, six, eight and ten, respectively. The prices of imported edible oils influence mustard oil prices with a delay of two months and vanaspati oil with a delay of four months, respectively. The impact on groundnut oil prices is felt with a delay of six months.

The positive and significant impact of imported edible oils on reducing the volatility in prices is also reflected in the impulse response functions after introducing imported edible oils in the system as shown in Figure 6.4. A comparison of Figures 6.3 and 6.4 suggests more orderly movements in response functions as shown in Figure 6.4 than the ones shown in Figure 6.3.

Figure 6.4



6.2.5 Price Asymmetry

Oilseeds and edible oils show contrasting results in terms of short run price movements - price movements in oilseed markets are stable but price movements in edible oils are unstable or volatile. These differences in the movements of prices could be due to asymmetry in the transmission of price signals from oilseeds to edible oils or from edible oils to oilseeds. This implies that shocks in the prices of oilseeds are not transmitted in an identical manner to the prices of edible oils and vice versa. As mentioned in chapter 5, the asymmetry in the transmission of prices from raw materials to the final product occurs due to the actions of intermediaries in the vertical chain who would not allow the price changes in edible oils to reflect changes in the prices of oilseeds. To explore this issue in the case of oilseeds and edible oils, the framework of market integration was extended to incorporate asymmetric price responses in oilseeds and oils.

For groundnut and groundnut oil, the equations of asymmetric price response can be specified as follows:

$$\sum\Delta GS = a_0 t + a_2 \sum\Delta GO^{(+)} + a_3 \sum\Delta GO^{(-)} + \varepsilon_{1t}$$

$$\sum\Delta GO = a_1 t + a_4 \sum\Delta GS^{(+)} + a_5 \sum\Delta GS^{(-)} + \varepsilon_{2I}$$

Where, GS and GO are price indices of groundnut seeds and groundnut oils expressed as deviations from their respective initial values, 't' is the trend, $GO^{(+)}$ and $GO^{(-)}$ are increases and decreases in the prices of groundnut oil and $GS^{(+)}$, $GS^{(-)}$ are increases and decreases in the price of groundnut seeds and ε_t is random error term.[8] The formal test of the asymmetry hypothesis is whether $a_2 = a_3$ and $a_4 = a_5$.

The estimated coefficients of the equations for mustard seed and mustard oil, groundnut seed and groundnut oil and other oilseeds and other edible oils shown in Table 6.5 indicate that estimates provide a reasonably good specification of the price transmission process for oilseeds and oils. This is reflected in the values of adjusted R^2. Results of χ^2 test indicate that the hypothesis of symmetric response is rejected in the case of groundnut seed, groundnut oil and other oils. This suggests that in these cases responses of positive price changes are significantly different from negative price changes.

[8] Seemingly unrelated regression (SUR) procedure was used for estimating the set of equations for groundnut seed and oil, mustard seed and oil, and other oilseeds and edible oils.

These estimates show that the cumulative effect on both groundnut seed and groundnut oil prices of an increase in their respective prices exceeds the cumulative effect of their price decreases. The elasticity estimates of price transmission further demonstrate that the rising price elasticities of groundnut oil exceed falling price elasticities by 2.1 times for groundnut seed and by 2.4 times for groundnut oil. In the case of other oils, however, the rising price elasticities of other oilseeds exceed falling price elasticities by 1.2 times only.

Table 6.5: The coefficients of the seemingly unrelated regression equations

	Time	Seed (+)	Seed (-)	Oil (+)	Oil (-)	Lagged Depend	χ^2	R^2	D-W
Δ M. Seed	0.13 (1.2)			0.29 (6.8) [0.83]	0.25 (5.0) [0.46]	1.00 (10.9)	1.20	0.96	1.75
Δ M. Oil	0.02 (0.1)	0.29 (4.1) [0.82]	0.33 (4.5) [0.62]			1.15 (9.8)	0.51	0.96	1.31
Δ G. Seed	-0.06 (-0.3)			0.46 (7.2) [1.21]	0.34 (5.3) [0.57]	0.41 (5.3)	4.05**	0.96	1.27
Δ G. Oil	-1.01 (-4.2)	0.62 (8.0) [1.68]	0.43 (6.3) [0.70]			0.64 (12.8)	10.74*	0.96	1.13
Δ O. Seeds	-0.41 (-1.5)			0.31 (4.5) [0.70]	0.16 (2.7) [0.20]	1.14 (12.7)	2.18	0.98	1.77
Δ O. Oils	0.37 (2.9)	0.26 (4.2) [0.55]	0.40 (4.9) [0.45]			0.85 (7.8)	7.56*	0.97	1.80

Note:
1) χ^2 is the calculated test statistics of oil (+) = oil (-) in seed equations and seed (+) = seed (-) in oil equations as given above
2) the figure in ( ) are 't' values and in [ ] are respectively elasticity of the variables

Chapter 7

Summary and Concluding Remarks

Despite significant expansion of the gross irrigated area in the country during the last five decades, the output of agricultural commodities continues to be vulnerable to weather changes. Price volatility affects both producers and consumers and has macroeconomic consequences as well. High growth in the prices of primary commodities spills over to other sectors of the economy leading to an increase in the overall rate of inflation. In view of this, reasons for the excessive variations in the prices of agricultural commodities need to be understood and improvements devised in the existing system. There is thus a need to study the price behaviour of essential agricultural commodities. The current study analyses the price behaviour of two staple cereals (rice and wheat) and edible oil (groundnut oil).

The purpose of this study is to assess (i) the behaviour of the procurement prices of the selected commodities; (ii) the relationship between procurement prices and costs of production, farm harvest prices and wholesale prices; (iii) the variability in the prices of these commodities; (iv) the structure of markets in the internal trade of these commodities; and (v) the possible explanations for changes in the prices of these commodities, particularly during the year 1998-99.

The main findings of the study are summarised below.

7.1 Behaviour of Procurement, Farm Harvest and Wholesale Prices

The analysis shows that procurement prices of cereals have been consistently fixed at a higher level than recommended by the CACP. The margin between the actual procurement prices and those that are recommended by the CACP was observed to be much higher during the 1990s in comparison with the 1980s. The mean excess of the procurement prices actually announced by the government over the cost of cultivation (Cost A2 + family labour) also exhibits substantially higher incentives provided to the producers of cereals during the 1990s in comparison to the 1980s.

This finding points to the significant pressure exercised by the producers of cereals in particular. One of the reasons for such excessive increases in prices could be the low level of procurement during some years when the procurement prices remained unattractive to the farmers. Maintaining parity with international prices is another reason for high prices necessitated by the depreciation of the rupee in the early 1990s. But even this does not justify the procurement prices, specifically with respect to international prices of wheat during the last two to three years (1997-98, 1998-99 and 1999-2000) in particular.

Hence, one of the reasons for the higher growth in the prices of cereals, particularly rice and wheat during the 1990s, is the significant increase in their procurement prices, which sets the floor for both farm harvest prices and wholesale prices. It is true that the objective of price policy is to promote improved technology. However, it is important to bear in mind that price support policy is only one among the many instruments for promoting growth of these essential commodities. Unnecessarily high procurement prices push up the procurement, as a consequence of which the government has to carry over huge stocks, which in turn pushes up their economic cost and raises the food subsidy bill. This is particularly true when prices both in the domestic as well as the international market are expected to remain low. Under such a situation traders in particular do not find it lucrative to buy, store and sell these commodities at a later date.

As the economic cost goes up, the government is compelled to raise issue prices, which reduces the off-take from the PDS and the level of stocks goes up. If central issue prices are not raised the widening difference between the wholesale price and the central issue price increases off-takes from the PDS. The widening spread between the wholesale price and the central issue price also provides strong incentives for leakage, i.e., diversion of cereals from the PDS to the open market. As a result, stocks start depleting, which forces the government to resort to all kinds of instruments such as unduly higher incentives in the form of procurement prices, ban on exports, credit controls, controls on stocking and licensing requirements for beefing up the depleted stocks.

The policy implication of the above findings is that when all the important factors that go into the determination of procurement prices are taken into account, there is hardly any need for raising procurement prices to such high levels as has been done in the recent past.

7.2 Inter- and Intra-Year Variations in Prices

The examination of price variations shows that there has been acceleration in the rate of growth of the nominal as well as real prices of cereals. This is in sharp contrast to the trends observed during the 1980s, when the real prices of these crops exhibited a significant decline. The results for groundnut seed and groundnut oil on the other hand exhibit trends contrary to those observed in the case of cereals. The rates of growth in both nominal as well as real prices clearly show a deceleration in the 1990s as compared to the 1980s.

A decomposition of prices into seasonal, trend and random elements reveals that seasonal fluctuations exhibit a slight increase in the case of wheat and coarse cereals. While for other crops seasonal fluctuations have narrowed down during the 1990s in comparison to the 1980s. The trend factors in monthly prices indicate similar patterns to those observed in the case of average annual prices during the 1980s and 1990s. The occurrence and amplitude of irregular factors exhibited a decline during the 1990s as compared to the 1980s for three commodities - wheat, rice and groundnut oil. In the case of coarse cereals, however, there is a significant increase in the occurrence of irregular factors during the 1990s in comparison to the 1980s.

A comparison of the variations in the prices of selected commodities shows that price fluctuations are generally higher in the case of coarse cereals, groundnut and groundnut oil as compared to rice and wheat. Among the selected commodities the price variability has been the least in the case of rice. The results also indicate that despite significant reduction in inter-year variability of wheat prices during the 1990s, variability within a year has shot up during this period.

Further analysis of factors affecting seasonal price changes shows that the price stabilisation measures (buying and selling) were not successful in reducing the seasonal rise in the wholesale prices of rice in particular. Unexpected changes in the supply of cereals on the other hand have a strong influence on seasonal price movements of cereals.

Though, government interventions did have a desired affect on monthly changes in the prices of wheat, but there is no significant impact of the changes in stocks on monthly variations in the prices of rice. The results also suggest strong influence of the changes in the prices of substitutes on the movements of monthly wholesale and retail prices of these two cereals.

7.3 Inter- and Intra-Market Variability in Prices

The results reveal that high intra-year variations were observed during 1990-91, 1991-92, and 1996-97 in the case of wheat, during 1990-91, 1991-92 and 1995-96 in the case of rice, and during 1992-93 and 1997-98 in the case of groundnut oil. Generally, higher intra-year variations were observed in markets in the vicinity of the main production areas. This implies that as the supply reaches its peak during the main marketing season, prices in surplus areas fall to their lowest levels, but prices in the deficit areas continue to remain high. Gradually, when the supplies start dwindling prices start rising and as the prices peak, private traders perceiving an incipient fall in prices off load their stocks just before the start of the next marketing season. But in the deficit areas, traders hold on to their stocks expecting a price rise depending upon the time lag and perceived shortfall in the supply.

It emerges that in the majority of markets, differences in the wholesale prices between markets were, in general, just enough to cover the costs of shipment between these markets. However, there were some markets where the differences in the wholesale prices were higher than the shipment cost. In the case of wheat, price differences between Delhi-Ahmedabad, Delhi-Mumbai and Delhi-Bangalore markets were observed to be out of tune with the shipment costs between these markets. Similarly, in the case of rice, price differences between Delhi-Jodhpur, Hyderabad-Thiruvananthpuram and Hyderabad-Ernakulum were in general higher than the shipment costs between these markets.

In the case of groundnut oil the price differences in the wholesale prices between the markets were in tune with the shipment costs between markets. There was only one exception, Hyderabad-Cuttack where the price difference was higher in relation to the shipment cost. It is quite possible that higher margins over transportation costs observed in some cases could be due to the long distances included in our analysis. But, the actual flow of trade might be different.

Thus, there is a need to monitor and document actual trade flows among markets, which could throw some light on the issues related to inter and intra market variability in the prices of various commodities.

7.4 Structure of Markets in the Four Metropolitan Cities of the Country

The analysis shows that by and large, markets for cereals in the four metro cities of the country appear to be competitive. Market level information though indicated higher inequality in terms of the volume of trade handled in Chennai, and Delhi (Narela) markets in the case of wheat and in Kolkata, Chennai and Mumbai markets in the case of rice. For edible oils, the Chennai market for edible oils and Kolkata market for mustard seed and mustard oil exhibited higher inequality in terms of the volume of trade handled. The concentration of trade among a few traders is less pronounced in the Mumbai market.

A comparison of the vertical margins among selected metros revealed that for both wheat and rice margins were excessive in Delhi, which is close to the surplus areas. The reasons for such a high spread between the wholesale and retail prices could be due to several reasons such as relatively high concentration of rice trade, high transaction costs, weak of infrastructure and information systems. It is a fact that transaction costs in the northern states of the country are high compared to the other states. Yet another reason could be the larger number of intermediaries in between the wholesalers and the retailers which raise the transaction costs.

The analysis also indicated asymmetric response between the wholesale and retail prices and the absence of causality between the wholesale to retail prices in the case of rice, in particular. All these factors create conditions, which lead to weak flow of information from the wholesalers to the retailers and *vice versa*. Other studies on this aspect have also observed that for those markets where local consumption is low and distant trade is high, the correlation coefficient between adverse information and the proportion of trade with the other markets is quite high. Therefore, for better policy formulation, it is suggested that market barriers and structural rigidities in the system that lead to higher transaction costs should be removed.

7.5 Prices of Cereals and Edible Oils during 1998-99

Apart from the increase in procurement prices of wheat and rice, the other reason for the increase in the prices of cereals during 1998-99 was the fall in net availability of total cereals. This occurred due to three main reasons (i) decrease in the output of cereals during the previous year, (ii) higher procurement due to the increase in procurement prices, and (iii) increase in exports and smuggling along the border. Studies have shown that much illegal trade activity takes place in food grains along the border.

In the case of edible oils, the increase in prices during the year 1998-99 was due to the events that created a shortage of edible oils in the market. The edible business during 1998-99 was severely hit by the several deaths caused by dropsy that broke out as a result of the consumption of adulterated mustard oil. Accordingly, the majority of state governments banned the sale of loose mustard oil due to which the edible oil market was completely shaken up. This is reflected in the sudden and very high increase in the coefficients of variation in the prices of edible oils and sudden increase in their prices. It was a clear case of markets getting affected by shortages of edible oils in the market.

7.6 Inter Commodity Price Linkages

Considering the changes in the composition of both cereals and oilseeds over a period of time, an attempt was made to understand transmission of price signals from one commodity to another and their degree of association. The results suggest complex long run relationships among rice, wheat and coarse grains; groundnut seed, mustard seed, cottonseed and other oilseeds; groundnut oil, vanaspati oil, mustard oil and other edible oils. Therefore, simply analysing the price behaviour of one commodity while ignoring the behaviour of the prices of substitutes will not be meaningful for price stabilisation purposes.

The results indicate that short run movements in the prices of cereals are stable and prices of grains are revealed (discovered) in wheat as its price affects all other grains after a lag of one month. Similarly, in the case of oilseeds, the prices are made known (discovered) in the rapeseed-mustard because their prices affect all other oilseeds in the system. The results also suggest that short run price movements in the prices of oilseeds are stable but short run movements in the prices of edible oils, groundnut oil in particular are highly volatile. The imported edible oils, however, stabilise the edible oil markets, which indicates that the import liberalisation policy in the case of edible oils has helped in reducing the impact of shocks to the prices of edible oils.

The differences in the behaviour of oilseeds and edible oils are due to asymmetry in the transmission of prices from oilseeds to edible oils and from edible oils to oilseeds. This is due to the actions of intermediaries such as traders and processors who do not allow the price changes in edible oils to reflect changes in the prices of oilseeds. Such actions of intermediaries in the market make prices sticky downwards, while prices remain flexible upwards, thereby generating rigidity in the adjustment process. In a well-integrated vertical marketing system, markets transmit the increase in the price of raw material to the processed commodity to the same extent as the decrease in price, i.e. prices are flexible upwards and downwards. The results suggest that oilseeds and edible oil markets need to be vertically integrated through a better policy framework which is able to take care of the structural rigidities in the vertical chain.

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Annex Table 4.1: Wholesale price spread and tranportation cost from Delhi to different markets (Wheat) (Rs. Per Quintal)

		Ludhiana	Karnal	Lucknow	Jodhpur	Bhopal	Ahmedabad	Mumbai	Hyderabad	Bangalore	Chennai
1990-91	P.Differ	14	9	0	5	0	102	91	17	152	64
	T.Cost	56	51	68	69	74	72	99	94	129	124
	Ratio	0.25	0.18	0.00	0.07	0.00	1.43	0.92	0.18	1.18	0.52
1991-92	P.Differ	48	34	35	26	3	77	153	155	154	146
	T.Cost	68	63	87	88	92	85	129	141	153	170
	Ratio	0.71	0.54	0.40	0.30	0.03	0.91	1.19	1.10	1.01	0.86
1992-93	P.Differ	30	38	12	12	75	171	252	252	275	270
	T.Cost	71	65	86	90	105	96	148	163	183	206
	Ratio	0.42	0.59	0.14	0.13	0.72	1.79	1.70	1.54	1.50	1.31
1993-94	P.Differ	2	35	8	4	8	156	126	228	212	219
	T.Cost	79	71	95	97	105	102	139	170	181	206
	Ratio	0.03	0.49	0.08	0.04	0.08	1.53	0.91	1.34	1.17	1.06
1994-95	P.Differ	23	16	18	52	11	178	260	242	266	267
	T.Cost	82	75	101	106	108	107	164	178	198	224
	Ratio	0.28	0.21	0.18	0.49	0.10	1.66	1.58	1.36	1.34	1.19
1995-96	P.Differ	30	20	18	3	4	172	213	220	252	283
	T.Cost	84	77	101	104	113	110	161	178	200	233
	Ratio	0.36	0.26	0.18	0.03	0.04	1.56	1.32	1.24	1.26	1.21
1996-97	P.Differ	84	45	37	13	12	152	160	185	354	354
	T.Cost	115	107	140	144	158	146	203	226	279	315
	Ratio	0.73	0.42	0.26	0.09	0.08	1.04	0.79	0.82	1.27	1.12
1997-98	P.Differ	20	7	12	1	10	171	297	190	322	419
	T.Cost	111	102	133	136	146	140	213	215	260	317
	Ratio	0.18	0.07	0.09	0.01	0.07	1.23	1.39	0.88	1.24	1.32
1998-99	P.Differ	1	5	69	24	18	88	315	76	238	340
	T.Cost	126	115	145	152	164	149	238	218	268	326
	Ratio	0.01	0.04	0.47	0.16	0.11	0.59	1.32	0.35	0.89	1.04
1999-00	P.Differ	46	15	31	5	7	47	148	112	203	292
	T.Cost	135	124	162	168	180	159	229	243	280	335
	Ratio	0.34	0.12	0.19	0.03	0.04	0.30	0.65	0.46	0.72	0.87

Note: Ratio is proportion of price difference to transportation cost

Annex Table 4.2: Wholesale price spread and transportation and other marketing cost among different markets (Rice) (Rs./Quintal)

		Delhi – Karnal	Delhi - Ludhiana	Delhi - Lucknow	Delhi - Jodhpur	Delhi - Bhopal	Delhi - Ahmbad	Bopal – Ahmedabad	Luck - Calcutta	Calct - Bubenesh	Hyd - Mumba	Hyd - Bnglore	Hyd - Trivend	Hyd - Chennai	Hyd - Ernacul
90-91	P.Differ	46	37	2	72	58	59	0	-	-	68	51	131	67	132
	T.Cost	73	75	82	80	89	84	83	-	-	86	78	106	90	103
	Ratio	0.63	0.49	0.02	0.90	0.65	0.70	0.00	-	-	0.79	0.66	1.24	0.75	1.28
91-92	P.Differ	58	18	20	145	123	59	64	72	77	127	9	128	64	153
	T.Cost	92	89	98	103	115	105	112	128	108	117	100	136	117	135
	Ratio	0.63	0.20	0.20	1.41	1.07	0.56	0.57	0.56	0.71	1.09	0.09	0.94	0.54	1.13
92-93	P.Differ	49	10	73	140	70	23	46	85	92	100	117	188	106	173
	T.Cost	101	99	100	115	125	116	114	132	112	117	108	145	123	140
	Ratio	0.49	0.10	0.73	1.22	0.56	0.20	0.40	0.64	0.82	0.85	1.09	1.30	0.86	1.24
93-94	P.Differ	86	60	79	203	34	60	26	127	130	47	1	182	42	187
	T.Cost	117	118	111	129	136	130	121	150	129	134	121	167	139	163
	Ratio	0.73	0.51	0.71	1.57	0.25	0.46	0.21	0.85	1.01	0.35	0.01	1.09	0.30	1.15
94-95	P.Differ	71	65	58	289	84	151	67	85	41	78	16	272	50	257
	T.Cost	119	123	121	138	145	140	137	157	135	147	131	188	151	181
	Ratio	0.60	0.53	0.48	2.09	0.58	1.08	0.49	0.54	0.30	0.53	0.12	1.45	0.33	1.42
95-96	P.Differ	11	39	129	115	40	49	89	70	50	124	137	435	101	323
	T.Cost	127	142	133	156	165	162	139	171	144	153	140	207	158	191
	Ratio	0.09	0.28	0.97	0.74	0.24	0.30	0.64	0.41	0.35	0.81	0.98	2.10	0.64	1.69
96-97	P.Differ	19	170	102	202	18	49	31	108	53	149	141	400	112	359
	T.Cost	133	165	140	160	169	162	148	183	158	164	149	215	169	205
	Ratio	0.14	1.03	0.73	1.26	0.11	0.30	0.21	0.59	0.34	0.91	0.95	1.86	0.66	1.75
97-98	P.Differ	46	165	191	194	7	81	88	240	169	207	130	258	60	311
	T.Cost	134	178	137	175	184	180	160	194	176	172	152	206	169	205
	Ratio	0.34	0.93	1.40	1.11	0.04	0.45	0.55	1.24	0.96	1.20	0.85	1.25	0.35	1.52
98-99	P.Differ	34	191	158	154	45	5	50	345	314	247	132	310	129	404
	T.Cost	152	198	163	191	201	194	168	237	215	194	171	234	195	236
	Ratio	0.22	0.96	0.97	0.81	0.22	0.03	0.30	1.46	1.46	1.27	0.77	1.33	0.66	1.71
99-00	P.Differ	167	250	200	150	50	200	150	250	143	253	107	303	105	383
	T.Cost	149	229	178	213	226	207	181	246	220	203	177	243	202	243
	Ratio	1.12	1.09	1.12	0.70	0.22	0.97	0.83	1.02	0.65	1.25	0.60	1.25	0.52	1.57

Note: Ratio is proportion of price difference to transportation cost

Annex Table 4.3: Wholesale price spread and transportation cost among different markets (G.Oil) (Rs./Quintal)

		Ahm-Bhopal	Ahm-Mumbai	Ahm-Jodhpur	Ahm - Delhi	Ahm-Cuttack	Jodhpur - Delhi	Bhopal - Delhi	Hyd – Mumbai	Hyd – Bangalore	Hyd - Pondicherry	Hyd - Chennai	Hyd - Cuttack
90-91	P.Differ	40	11	192	162	98	30	122	231	160	180	46	143
	T.Cost	444	456	456	469	508	482	477	447	428	469	454	471
	Ratio	0.09	0.02	0.42	0.35	0.19	0.06	0.26	0.52	0.37	0.38	0.10	0.30
91-92	P.Differ	49	5	207	200	526	7	151	176	141	122	98	707
	T.Cost	435	446	447	459	515	474	468	443	425	458	448	482
	Ratio	0.11	0.01	0.46	0.44	1.02	0.01	0.32	0.40	0.33	0.27	0.22	1.47
92-93	P.Differ	80	94	124	9	541	133	89	184	315	23	38	819
	T.Cost	385	394	395	403	458	410	415	378	364	392	383	416
	Ratio	0.21	0.24	0.31	0.02	1.18	0.32	0.21	0.49	0.86	0.06	0.10	1.97
93-94	P.Differ	25	308	106	75	466	180	50	5	124	26	135	779
	T.Cost	452	461	464	473	534	477	474	442	427	465	450	487
	Ratio	0.06	0.67	0.23	0.16	0.87	0.38	0.11	0.01	0.29	0.06	0.30	1.60
94-95	P.Differ	152	50	101	294	697	193	142	107	110	42	95	754
	T.Cost	475	489	489	499	555	505	523	500	482	523	508	545
	Ratio	0.32	0.10	0.21	0.59	1.26	0.38	0.27	0.21	0.23	0.08	0.19	1.38
95-96	P.Differ	82	107	310	50	668	260	32	173	259	141	53	948
	T.Cost	485	496	502	511	583	538	528	484	469	519	498	546
	Ratio	0.17	0.22	0.62	0.10	1.15	0.48	0.06	0.36	0.55	0.27	0.11	1.74
96-97	P.Differ	229	80	280	224	852	56	4	83	55	38	197	1014
	T.Cost	444	457	470	464	522	503	512	456	450	501	480	529
	Ratio	0.52	0.17	0.60	0.48	1.63	0.11	0.01	0.18	0.12	0.08	0.41	1.92
97-98	P.Differ	178	180	158	583	659	425	405	180	280	38	219	659
	T.Cost	529	543	558	554	622	577	598	562	553	622	597	655
	Ratio	0.34	0.33	0.28	1.05	1.06	0.74	0.68	0.32	0.51	0.06	0.37	1.01
98-99	P.Differ	227	28	349	1681	1028	1332	1454	149	171	125	340	1205
	T.Cost	518	533	558	553	631	599	595	533	527	589	564	622
	Ratio	0.44	0.05	0.63	3.04	1.63	2.22	2.44	0.28	0.32	0.21	0.60	1.94
99-00	P.Differ	200	400	400	1670	535	1270	1470	0	100	77	350	935
	T.Cost	514	530	576	573	686	623	613	510	510	564	537	601
	Ratio	0.39	0.75	0.70	2.91	0.78	2.04	2.40	0.00	0.20	0.14	0.65	1.56

Note: Ratio is proportion of price difference to transportation and other marketing cost

Annex Table 5.1: Percentage share of major traders in sale of wheat and paddy in Delhi			
	Wheat		Paddy
Share of	Narela Mandi	Nazafgarh Mandi	Narela Mandi
	%	%	%
Top 5	52.98	27.52	25.96
Top 10	77.05	46.66	43.10
Top 15	91.73	63.12	56.61
Top 20	102.29	77.95	68.11
Total	104.06	86.41	89.99
Total Number of Traders	21	23	37

Annex Table 5.2: Percentage share of major traders in sale of wheat, rice and groundnut in Mumbai			
	Wheat	Rice	Groundnut
Share of	%	%	%
Top 5	13.55	8.58	65.29
Top 10	21.16	17.65	-
Top 15	-	-	-
Top 20	-	-	-
Total	22.96	18.81	74.50
Total Number of Traders	13	14	7

Annex Table 5.3: Percentage share of major traders in sale of rice, mustard seeds and mustard oil in Kolkata			
	Rice	Mustard seed	Mustard oil
Share of	%	%	%
Top 5	17.42	47.99	54.21
Top 10	22.20	70.66	79.01
Top 15	24.87	81.02	93.54
Top 20	26.71	87.34	-
Total	27.81	88.83	96.65
Total Number of Traders	31	22	19

Annex Table 5.4: Percentage share of major traders in sale of wheat, rice and edible oils in Chennai			
	Wheat	Rice	Edible Oils
Share of	%	%	%
Top 5	56.27	30.54	45.73
Top 10	71.26	44.57	61.94
Top 15	79.97	55.62	72.61
Top 20	86.45	63.20	79.99
Total	90.36	90.05	90.21
Total Number of Traders	24	62	32

Annex Table 6.1: Error Correction Model for cereals			
Error Correction:	D(DRICE)	D(DWHEAT)	D(DCGRAN)
CointEq1	0.0274	0.1846	0.1942
	-0.0267	-0.0550	-0.0413
	-1.0278	-3.3541	-4.7021
D(DRICE(-1))	0.0758	-0.3238	-0.1161
	-0.1235	-0.2544	-0.1910
	-0.6144	(-1.27320)	(-0.60824)
D(DRICE(-2))	0.0806	-0.2309	-0.1114
	-0.1221	-0.2516	-0.1889
	-0.6601	(-0.91778)	(-0.59013)
D(DRICE(-3))	0.0073	0.2432	0.2081
	-0.1225	-0.2523	-0.1894
	-0.0594	-0.9640	-1.0988
D(DRICE(-4))	0.0573	0.0829	-0.2196
	-0.1205	-0.2483	-0.1864
	-0.4756	-0.3340	(-1.17812)
D(DRICE(-5))	-0.1569	0.3527	0.1805
	-0.1225	-0.2523	-0.1894
	(-1.28138)	-1.3979	-0.9529
D(DRICE(-6))	-0.2107	0.2925	0.4524
	-0.1275	-0.2626	-0.1972
	(-1.65302)	-1.1138	-2.2945
D(DWHEAT(-1))	0.0916	0.4117	0.1347
	-0.0631	-0.1300	-0.0976
	-1.4526	-3.1677	-1.3804
D(DWHEAT(-2))	-0.0799	-0.0369	0.1184
	-0.0640	-0.1319	-0.0990
	(-1.24881)	(-0.27955)	-1.1961
D(DWHEAT(-3))	-0.0021	-0.0760	-0.0085
	-0.0613	-0.1264	-0.0949
	(-0.03499)	(-0.60177)	(-0.08926)
D(DWHEAT(-4))	-0.0590	0.0300	0.0902
	-0.0587	-0.1210	-0.0908
	(-1.00429)	-0.2483	-0.9936
D(DWHEAT(-5))	0.0307	0.0803	0.2018
	-0.0577	-0.1188	-0.0892
	-0.5327	-0.6763	-2.2626

D(DWHEAT(-6))	0.0610	-0.0778	0.0970
	-0.0518	-0.1067	-0.0801
	-1.1774	(-0.72865)	-1.2113
D(DCGRAN(-1))	0.0524	0.2358	0.3829
	-0.0701	-0.1445	-0.1085
	-0.7470	-1.6320	-3.5296
D(DCGRAN(-2))	0.0147	-0.0464	0.0896
	-0.0740	-0.1525	-0.1145
	-0.1988	(-0.30417)	-0.7829
D(DCGRAN(-3))	0.1841	0.0235	0.1607
	-0.0727	-0.1498	-0.1125
	-2.5317	-0.1567	-1.4291
D(DCGRAN(-4))	-0.0497	-0.2713	0.1446
	-0.0735	-0.1515	-0.1137
	(-0.67560)	(-1.79105)	-1.2716
D(DCGRAN(-5))	0.1072	0.0064	0.0127
	-0.0768	-0.1582	-0.1187
	-1.3971	-0.0406	-0.1068
D(DCGRAN(-6))	-0.0789	0.2184	-0.0670
	-0.0724	-0.1492	-0.1120
	(-1.08996)	-1.4637	(-0.59820)
C	0.0072	0.0006	-0.0056
	-0.0022	-0.0045	-0.0034
	-3.2764	-0.1424	(-1.65561)
R-squared	0.2896	0.5531	0.5945
Adj. R-squared	0.1229	0.4483	0.4994
Sum sq. resids	0.0164	0.0698	0.0394
S.E. equation	0.0143	0.0294	0.0220
Log likelihood	297.1812	224.1656	253.1256
Akaike AIC	-8.3266	-6.8808	-7.4542
Schwarz SC	-7.8088	-6.3629	-6.9364
Mean dependent	0.0084	0.0092	0.0105
S.D. dependent	0.0152	0.0395	0.0312
Determinant Residual Covariance		0.0000	
Log Likelihood		795.7392	
Akaike Information Criteria		-23.0035	
Schwarz Criteria		-21.3464	

Annex Table 6.2: Error correction models for oilseeds				
Error Correction:	D(DGSEED)	D(DMSEED)	D(DCSEED)	D(DOSEED)
CointEq1	-0.0742	0.0766	-0.1150	0.0989
	-0.0573	-0.0559	-0.0650	-0.0295
	(-1.29406)	-1.3713	(-1.76992)	-3.3492
CointEq2	-0.0379	-0.2261	-0.0182	-0.0439
	-0.0429	-0.0419	-0.0487	-0.0221
	(-0.88305)	(-5.39839)	(-0.37290)	(-1.98588)
D(DGSEED(-1))	0.0929	-0.0658	0.2147	-0.0424
	-0.1180	-0.1150	-0.1337	-0.0608
	-0.7872	(-0.57221)	-1.6054	(-0.69848)
D(DMSEED(-1))	0.2722	0.4094	0.2123	0.2331
	-0.1232	-0.1201	-0.1396	-0.0634
	-2.2103	-3.4086	-1.5205	-3.6746
D(DCSEED(-1))	0.0617	-0.0984	0.1246	-0.0479
	-0.0966	-0.0942	-0.1095	-0.0497
	-0.6388	(-1.04436)	-1.1381	(-0.96244)
D(DOSEED(-1))	-0.0498	0.4922	-0.0380	0.2556
	-0.2224	-0.2168	-0.2521	-0.1145
	(-0.22408)	-2.2698	(-0.15076)	-2.2323
C	0.0030	0.0014	0.0044	0.0031
	-0.0037	-0.0036	-0.0042	-0.0019
	-0.8161	-0.3747	-1.0496	-1.6243
R-squared	0.1228	0.3690	0.1370	0.3809
Adj. R-squared	0.0697	0.3308	0.0847	0.3434
Sum sq. resids	0.1316	0.1252	0.1691	0.0349
S.E. equation	0.0365	0.0356	0.0413	0.0188
Log likelihood	204.2345	206.8976	190.9465	274.5756
Akaike AIC	-6.5593	-6.6095	-6.3086	-7.8865
Schwarz SC	-6.3834	-6.4336	-6.1327	-7.7106
Mean dependent	0.0060	0.0063	0.0082	0.0058
S.D. dependent	0.0378	0.0435	0.0432	0.0232
Determinant Residual Covariance		0.0000		
Log Likelihood		919.0356		
Akaike Information Criteria		-27.9748		
Schwarz Criteria		-27.0200		

Annex Table 6.3: Error correction models for edible oils				
Error Correction:	D(DVOIL)	D(DGOIL)	D(DMOIL)	D(DOOIL)
CointEq1	-0.112219	0.408872	0.304592	-0.011812
	-0.09233	-0.12836	-0.12532	-0.10014
	(-1.21544)	-3.18546	-2.43047	(-0.11796)
CointEq2	0.015582	0.096305	0.019256	0.071947
	-0.01834	-0.02549	-0.02489	-0.01989
	-0.84965	-3.77741	-0.77356	-3.61727
D(DVOIL(-1))	0.227555	-0.057668	-0.140664	0.123885
	-0.16832	-0.234	-0.22847	-0.18256
	-1.35191	(-0.24644)	(-0.61567)	-0.67861
D(DVOIL(-2))	0.072723	0.239078	-0.589571	0.314943
	-0.15418	-0.21434	-0.20927	-0.16722
	-0.47169	-1.11542	(-2.81724)	-1.88345
D(DVOIL(-3))	0.256657	-0.885324	-0.780919	-0.313306
	-0.17799	-0.24745	-0.2416	-0.19304
	-1.44197	(-3.57785)	(-3.23231)	(-1.62297)
D(DVOIL(-4))	0.284289	-0.150436	-0.408879	0.138648
	-0.21192	-0.29461	-0.28765	-0.22984
	-1.34152	(-0.51063)	(-1.42146)	-0.60324
D(DVOIL(-5))	0.188229	-0.725341	-0.364392	-0.058597
	-0.20399	-0.2836	-0.27689	-0.22125
	-0.92272	(-2.55766)	(-1.31600)	(-0.26485)
D(DVOIL(-6))	0.06339	-0.576446	-0.434122	0.238427
	-0.21211	-0.29488	-0.28791	-0.23005
	-0.29885	(-1.95484)	(-1.50783)	-1.03641
D(DVOIL(-7))	0.043926	-0.188578	-0.257794	0.21941
	-0.23016	-0.31997	-0.31241	-0.24963
	-0.19085	(-0.58936)	(-0.82517)	-0.87895
D(DVOIL(-8))	0.085912	-0.087562	-0.126561	0.409051
	-0.21136	-0.29383	-0.28689	-0.22923
	-0.40648	(-0.29800)	(-0.44115)	-1.78444
D(DVOIL(-9))	-0.104304	-0.093644	-0.339033	0.100006
	-0.19688	-0.27371	-0.26724	-0.21353
	(-0.52978)	(-0.34213)	(-1.26866)	-0.46834
D(DVOIL(-10))	0.109479	0.082682	0.348811	0.388533
	-0.1599	-0.2223	-0.21704	-0.17342
	-0.68467	-0.37195	-1.60712	-2.24037
D(DVOIL(-11))	-0.069255	0.010316	0.032777	0.252687

	-0.14364	-0.1997	-0.19498	-0.15579
	(-0.48213)	-0.05166	-0.16811	-1.62193
D(DGOIL(-1))	0.012264	0.08754	0.100437	-0.068961
	-0.12106	-0.1683	-0.16432	-0.1313
	-0.10131	-0.52014	-0.61122	(-0.52522)
D(DGOIL(-2))	-0.0108	-0.269616	-0.001228	-0.18367
	-0.10415	-0.14479	-0.14137	-0.11296
	(-0.10370)	(-1.86211)	(-0.00869)	(-1.62600)
D(DGOIL(-3))	-0.075697	-0.284128	0.090273	-0.136399
	-0.09684	-0.13463	-0.13145	-0.10503
	(-0.78166)	(-2.11043)	-0.68675	(-1.29865)
D(DGOIL(-4))	-0.091372	-0.029021	0.277137	-0.091922
	-0.09366	-0.13021	-0.12713	-0.10158
	(-0.97554)	(-0.22287)	-2.17987	(-0.90488)
D(DGOIL(-5))	-0.249916	-0.36256	0.070319	-0.098166
	-0.10444	-0.14519	-0.14176	-0.11327
	(-2.39303)	(-2.49719)	-0.49606	(-0.86667)
D(DGOIL(-6))	-0.082335	-0.004639	-0.002669	-0.200819
	-0.11115	-0.15452	-0.15087	-0.12055
	(-0.74075)	(-0.03002)	(-0.01769)	(-1.66584)
D(DGOIL(-7))	0.090736	0.090724	0.237202	0.001716
	-0.10307	-0.14329	-0.1399	-0.11179
	-0.88033	-0.63314	-1.69547	-0.01535
D(DGOIL(-8))	-0.249565	-0.454066	-0.192536	-0.265267
	-0.10072	-0.14002	-0.13671	-0.10924
	(-2.47778)	(-3.24278)	(-1.40830)	(-2.42830)
D(DGOIL(-9))	0.029341	-0.149385	0.089879	-0.114637
	-0.10575	-0.14701	-0.14354	-0.11469
	-0.27747	(-1.01615)	-0.62618	(-0.99954)
D(DGOIL(-10))	0.122583	-0.104218	0.018121	-0.116712
	-0.09601	-0.13348	-0.13032	-0.10413
	-1.27675	(-0.78079)	-0.13905	(-1.12081)
D(DGOIL(-11))	-0.085534	-0.102026	-0.034743	-0.213229
	-0.09732	-0.1353	-0.1321	-0.10556
	(-0.87886)	(-0.75407)	(-0.26300)	(-2.02006)
D(DMOIL(-1))	-0.045405	0.220282	0.717566	0.128027
	-0.12307	-0.1711	-0.16705	-0.13348
	(-0.36893)	-1.28747	-4.29544	-0.95914
D(DMOIL(-2))	-0.051331	0.200706	-0.073194	-0.092149
	-0.13965	-0.19414	-0.18955	-0.15146

	(-0.36758)	-1.03384	(-0.38615)	(-0.60842)
D(DMOIL(-3))	0.048792	0.542661	0.483607	0.221397
	-0.13261	-0.18436	-0.18	-0.14383
	-0.36792	-2.94345	-2.68663	-1.5393
D(DMOIL(-4))	-0.097256	0.039535	-0.086247	-0.102968
	-0.1359	-0.18893	-0.18446	-0.14739
	(-0.71565)	-0.20926	(-0.46755)	(-0.69860)
D(DMOIL(-5))	0.055742	0.361703	0.238484	0.029388
	-0.12761	-0.1774	-0.17321	-0.1384
	-0.43683	-2.0389	-1.37686	-0.21234
D(DMOIL(-6))	-0.153806	0.161654	0.261089	0.036995
	-0.13593	-0.18898	-0.18451	-0.14743
	(-1.13148)	-0.85542	-1.41504	-0.25093
D(DMOIL(-7))	-0.155035	0.137805	-0.079803	-0.207652
	-0.11604	-0.16132	-0.15751	-0.12585
	(-1.33606)	-0.85424	(-0.50667)	(-1.64996)
D(DMOIL(-8))	0.207921	0.593226	0.260134	0.220936
	-0.12214	-0.1698	-0.16579	-0.13247
	-1.70228	-3.49358	-1.56905	-1.66778
D(DMOIL(-9))	-0.164938	0.016097	-0.007818	-0.038804
	-0.13078	-0.18181	-0.17751	-0.14184
	(-1.26120)	-0.08854	(-0.04404)	(-0.27357)
D(DMOIL(-10))	0.117797	0.038125	-0.000878	-0.085415
	-0.10993	-0.15282	-0.14921	-0.11922
	-1.07161	-0.24947	(-0.00589)	(-0.71644)
D(DMOIL(-11))	0.241312	0.16868	0.341723	0.142439
	-0.10882	-0.15129	-0.14771	-0.11803
	-2.21751	-1.11498	-2.31348	-1.20686
D(DOOIL(-1))	0.192568	0.646463	0.372259	0.230798
	-0.17434	-0.24237	-0.23665	-0.18909
	-1.10453	-2.66721	-1.57306	-1.22058
D(DOOIL(-2))	0.030809	0.530878	0.156748	0.070254
	-0.17369	-0.24146	-0.23576	-0.18838
	-0.17738	-2.19858	-0.66487	-0.37294
D(DOOIL(-3))	-0.037624	0.456979	0.244025	0.246725
	-0.16615	-0.23099	-0.22553	-0.18021
	(-0.22644)	-1.97837	-1.08201	-1.36914
D(DOOIL(-4))	-0.074143	0.301328	0.040872	0.096082
	-0.16283	-0.22637	-0.22102	-0.1766
	(-0.45535)	-1.33116	-0.18493	-0.54407

D(DOOIL(-5))	0.039267	0.598881	-0.027499	0.244457
	-0.1465	-0.20367	-0.19886	-0.15889
	-0.26803	-2.94046	(-0.13829)	-1.53851
D(DOOIL(-6))	0.150378	0.196377	0.292694	0.05454
	-0.15121	-0.21021	-0.20524	-0.16399
	-0.99453	-0.9342	-1.42611	-0.33257
D(DOOIL(-7))	-0.053656	0.112898	0.367217	-0.084776
	-0.15442	-0.21468	-0.20961	-0.16748
	(-0.34747)	-0.5259	-1.75195	(-0.50618)
D(DOOIL(-8))	0.15009	0.558136	0.482234	0.122428
	-0.16086	-0.22363	-0.21834	-0.17446
	-0.93305	-2.49581	-2.2086	-0.70174
D(DOOIL(-9))	-0.044829	0.251921	-0.11821	-0.158877
	-0.17262	-0.23998	-0.23431	-0.18722
	(-0.25969)	-1.04974	(-0.50450)	(-0.84860)
D(DOOIL(-10))	-0.14978	0.415849	0.046165	0.04719
	-0.16202	-0.22524	-0.21991	-0.17572
	(-0.92448)	-1.84627	-0.20992	-0.26855
D(DOOIL(-11))	-0.220359	0.167246	-0.213732	0.013853
	-0.1544	-0.21464	-0.20957	-0.16745
	(-1.42724)	-0.77918	(-1.01986)	-0.08273
C	0.004479	-0.024138	-0.01819	0.004379
	-0.00666	-0.00926	-0.00904	-0.00723
	-0.67224	(-2.60619)	(-2.01144)	-0.60604
R-squared	0.658717	0.74422	0.798667	0.587638
Adj. R-squared	0.338329	0.504101	0.60966	0.200522
Sum sq. resids	0.016759	0.03239	0.030877	0.019713
S.E. equation	0.018494	0.02571	0.025103	0.020058
Log likelihood	279.1347	247.5067	249.8028	271.3406
Akaike AIC	-7.674017	-7.015099	-7.062934	-7.511639
Schwarz SC	-6.418555	-5.759637	-5.807472	-6.256177
Mean dependent	0.000938	0.002975	0.003711	0.003678
S.D. dependent	0.022735	0.03651	0.040179	0.022433
Determinant Residual Covariance		1.92E-15		
Log Likelihood		1081.723		
Akaike Information Criteria		-29.7624		
Schwarz Criteria		-24.47344		