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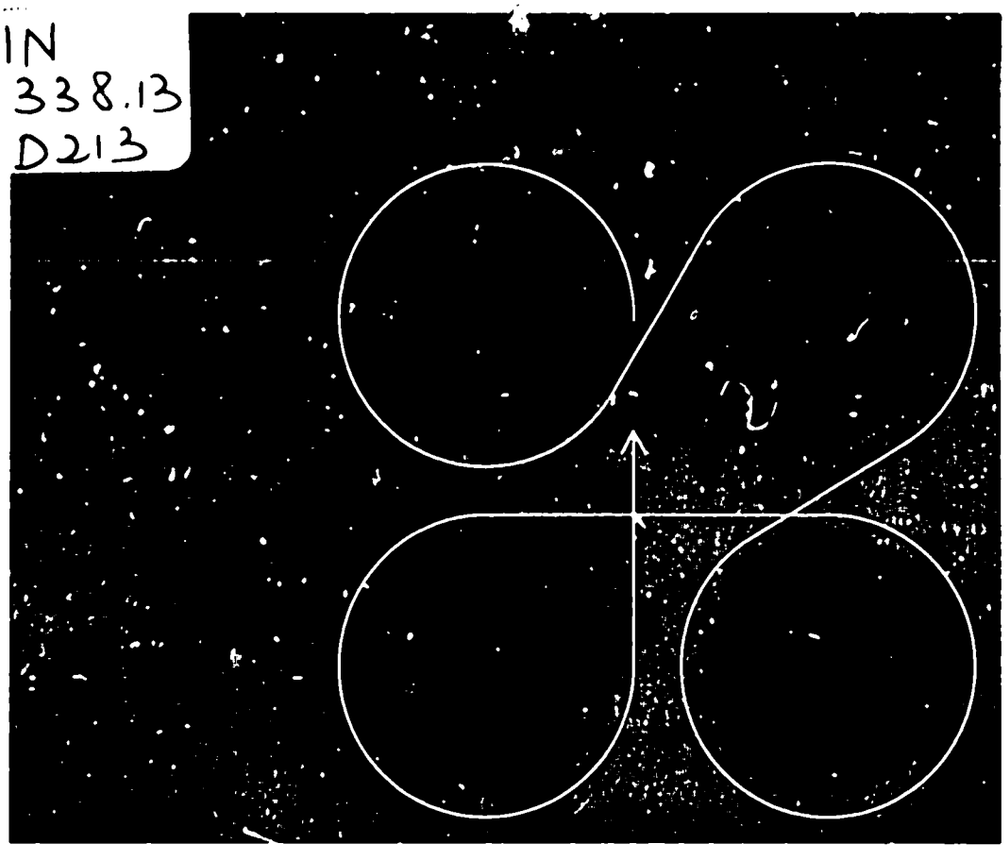

Domestic Terms of Trade and Economic Development of India 1952–53 to 1964–65

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Contents

Preface 3

Chapter I. Introduction 5

Chapter II. Price trends in India, 1952-53 to 1964-65 6
- Methods of fitting regression lines 7
- Nonparametric method 11
- Conclusions 14

Chapter III. Causes of change in food-grain prices 15
- Measurement of real demand 17
- Estimation of lag between production and prices .. 19
- Money supply 22
- Stock variable 25
- Trade factors 25
- Conclusions and implications to policy 26

Chapter IV. Causes of changes in prices of industrial raw-material crops 30

Chapter V. Analyses of the stability of prices 35
- Method 1 37
- Method 2 37
- Method 3 40
- Conclusions 40

Chapter VI. Causes of changes in industrial prices 41
- Case study of textile prices 44
- Estimates of coefficients of regression 46
- Conclusions 46

Chapter VII. Conclusions 47
- Implications to the theory of development 50

References 51
- Articles and books 51
- Statistical publications 52

PREFACE

The importance of relative movements of agricultural prices in determining the pattern and rate of economic growth in low-income nations has been neglected by development economists. This neglect traces in part from a lack of appreciation of the nature of the economic transformation from a predominantly agricultural to a predominantly industrial economy and a failure to see the multiple role that prices play in that process. Agricultural prices not only influence the level of production in the agricultural sector, but also profoundly influence income distribution between agriculture and nonagriculture and between various income strata as well. These influences in turn affect the processes and rates of capital formation in the respective sectors.

The fact that low-income economies are, in general, dominated by the agricultural sector, both with respect to use of resources and output, lends special emphasis to the agricultural sector in capital formation. As a consequence of these forces, one of the key questions of development is that of how income may be transferred from the agricultural sector to provide for the rapid development of the nonagricultural sector. A rapidly developing agriculture can facilitate such transfers and thereby provides one of the important reasons for developing the agricultural sector. But also of importance is the provision of mechanisms for bringing about the desired transfer of resources.

Various economies, depending on economic and political exigencies, may choose different methods. One that has played an important role in some economies is that of changes in price relationships. It is with this aspect of the question that Ashok Dar is concerned and which he treats through data from the Indian economy. His study commences with a description of price relationships, proceeds to analysis of the forces affecting these relationships, and then draws conclusions concerning their implications to the development process.

Ashok Dar's study of the domestic terms of trade in the Indian economy is one of a series of studies of agricultural prices being carried out at Cornell University as part of a USAID-financed contract for research on agricultural prices. We are grateful for the assistance provided by the Rural and Community Development Division of USAID and, in particular, to Douglas Caton and Louis Gill of that Division.

The broad program of study, of which Ashok Dar's work is one part, covers 3 major areas of enquiry: the role of prices in intersectoral income and capital transfers; the effect of price relationships on agricultural production and marketings and; the factors affecting urban prices of agricultural commodities. Thus in total, these studies are concerned with the effects

of agricultural prices on the nonagricultural sectors of the economy, with their effects in the agricultural sector, and with the manner in which agricultural prices are determined. Over the course of the contract a substantial number of studies will be carried on in various countries and dealing with various aspects of the processes. At the completion of these studies an effort will be made to pull them together into an integrated view of the role and functioning of agricultural prices in the development process.

A basic objective of the contract with USAID for the conduct of this research is not only to produce useful research results but also to provide structured research experience to young research persons so as to enlarge our pool of trained manpower for the analysis of such problems. For this purpose the research in this project is accomplished primarily through the use of Ph.D. candidates at Cornell University who use the specific studies conducted as Ph.D. dissertations. The definition of the overall project has purposefully been kept broad and flexible to facilitate the attainment of this additional objective. This study by Ashok Dar is part of that program and is drawn from his Ph.D. dissertation, of the same title as this monograph, completed at Cornell University in 1967.

Ithaca, New York
November, 1968

John W. Mellor

Domestic Terms of Trade and Economic Development of India†

Ashok K. Dar*

Chapter I.

Introduction

Statement of the problem

This study is concerned with change and causes of change in domestic terms of trade in the Indian economy. The analysis relates to the initial stages of Indian economic development and consists of years 1952-53 through 1963-64. In view of the paramount importance of food grains in the Indian economy, major emphasis has been placed on analyzing food-grain prices and their relationship to industrial prices. The effect of changes in prices of industrial raw material crops on prices of industrial goods has also been studied. The movements of different prices have been studied to determine the pattern of domestic terms of trade.

Importance of the problem

A movement of domestic terms of trade constitutes one of the means for shifts of income from one sector of the economy to another. If one sector of the economy is more efficient than another, the rate of growth of the entire economy is affected by transfers between the two sectors. Through its effect on incomes, a movement of terms of trade between agricultural and industrial sectors in India may prove to be a crucial factor in the rate of capital formation for the economy. Further, an analysis of causes of movement of prices is important in bringing out the force of various government policies on prices. A critical evaluation of the effect of policies provides information for future economic planning towards the objectives of stable prices and economic growth.

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† Adapted from a thesis presented to the faculty of the Graduate School of Cornell University, June 1967, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Objectives

This study has 2 main objectives. The first is to determine the movement in prices of various commodities, and thereby measure the extent of change in the terms of trade between the agricultural and industrial sectors in India. The second is to evaluate the effect of various real and monetary factors on the prices of different commodities. Implications to policy decisions and to the theory of development are also drawn from the empirical analysis.

Methodology

The methodology used for analysis of the food grains and other agricultural prices is mainly mixed estimation. The income-elasticity of demand estimates are taken from cross-section data and then are used as *a priori* estimates for determining price relationships from time-series data. In view of heavy dependence on rainfall, production has been taken as a predetermined variable. For industrial prices, where the textile industry is analyzed as a case study, a 4-equation system explaining the cost and demand factors is used. To determine the movement of terms of trade, both regression and nonparametric methods have been applied. For considering the aspects of stability of different prices, various methods including that of a second-order difference equation are applied.

Sequence of the analysis

The next chapter covers the analysis on the movement of different prices. The analysis includes the estimation of trend in prices by regression methods, determination of movements of terms of trade by nonparametric methods and, finally, calculations regarding the growth rates of prices and production of various commodities. Chapter III is devoted to the analysis of causes of changes in prices of food grains and includes the development of methodology which is also applied to analysis of prices of industrial raw-material crops in Chapter IV. Chapter V deals with the measurement of stability behaviour of various prices. A preliminary analysis of all industrial prices and a detailed evaluation of textile prices is considered in Chapter VI. Finally the conclusions are summarized in Chapter VII under the heading of the 2 most important items studied, namely, analysis of prices of food grains and causes of change in domestic terms of trade.

Chapter II.

Price Trends in India, 1952-53 to 1964-65

This chapter describes the price movement in India of various commodities for the period 1952-53 to 1964-65. The data pertain to wholesale prices and are presented in the form of index numbers issued by the economic advisor to the government of India and as reported by the Reserve

Bank of India. The indexes are compiled from weekly, wholesale price quotations to the government from important markets for each commodity in different regions of the country. The collection and processing of the data are systematic and well organized at the state and the central levels of the government.

In 1952–53 the government of India commenced a new series of index numbers of wholesale prices, with 1952–53 as the base year. This new series, which has a broader and better coverage than earlier ones, began after the years of the Korean War boom in prices. Also, it was preceded by 2 unusually poor crop years, 1950–51 and 1951–52. The last year of the period, 1964–65, was an unusually good crop year, just before the extremely poor years of 1965–66 and 1966–67. In general, the period studied appears to have a relatively normal sequence of years at the beginning and end. This is of importance in studying short-term price trends of agricultural commodities, the production of which is sharply altered from year to year by the vagaries of weather. In a short series, major deviations at the ends of the series have particularly great weight in determining the slope of the series.

Two methods are employed to estimate the movement of domestic terms of trade for the period 1952–53 to 1964–65. In the first method, trend lines have been fitted separately to the data on prices for different commodities, and then a comparison made of the relative rates of growth in various prices. The second method comprises of directly estimating the trend in the relative prices by the application of nonparametric tests. The two methods are discussed below.

Method of fitting regression lines

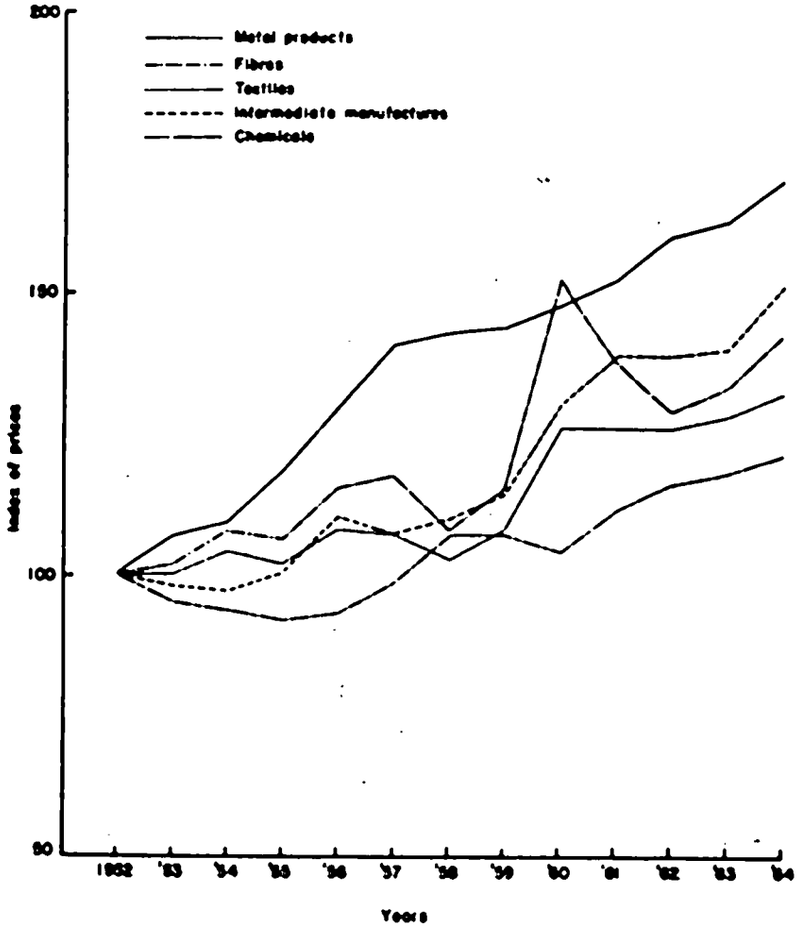
Lines are fitted to the prices of important agricultural and industrial commodities by the least squares procedure. The main problem in using this methodology are the errors that may arise in fitting a straight line to a fluctuating price series. To a significant extent, the fluctuations exist because an agricultural economy is subject to the vagaries of weather. To the extent, however, that different prices react similarly to the good or bad monsoon, a meaningful comparison of different price trends is possible. Thus, a bad monsoon or an increase in money supply is likely to increase all prices and the coefficients of all the prices would be biased upward, making a comparison of coefficients plausible.

Another problem confronted in the method of fitting lines is the possibility that differences in trends are not statistically significant. This difficulty arises in any economic series of a short period where the chance of widely different price series is small and where deviation from the trend may be quite large. For example (as shown later), the trend coefficient for food-grain prices is estimated at about 2.2 and that for textiles at about 2.8. The deviations leave little or no statistical support for an argument other than that relative prices between grains and textiles have remained constant.

To check the validity of such results, it was necessary to use the nonparametric procedures.

Table 1 and figure 1 present the data on wholesale prices for different agricultural and industrial commodities in India for the period 1952–53 to 1964–65. Cereals and pulses constitute the group under food grains, fruits and vegetables and milk and ghee comprise other food commodities, while oilseeds and fibres are the major industrial raw material crops. Table 2 presents the coefficients of trends of the different groups of commodities with the respective weights showing the relative importance of each commodity. The data are arranged in descending order of rate of growth.

Figure 1. Movement of prices of various commodities, India, 1952–53 to 1964–65.



Source: Table 1. (Years shown are for year commencing July 1.)

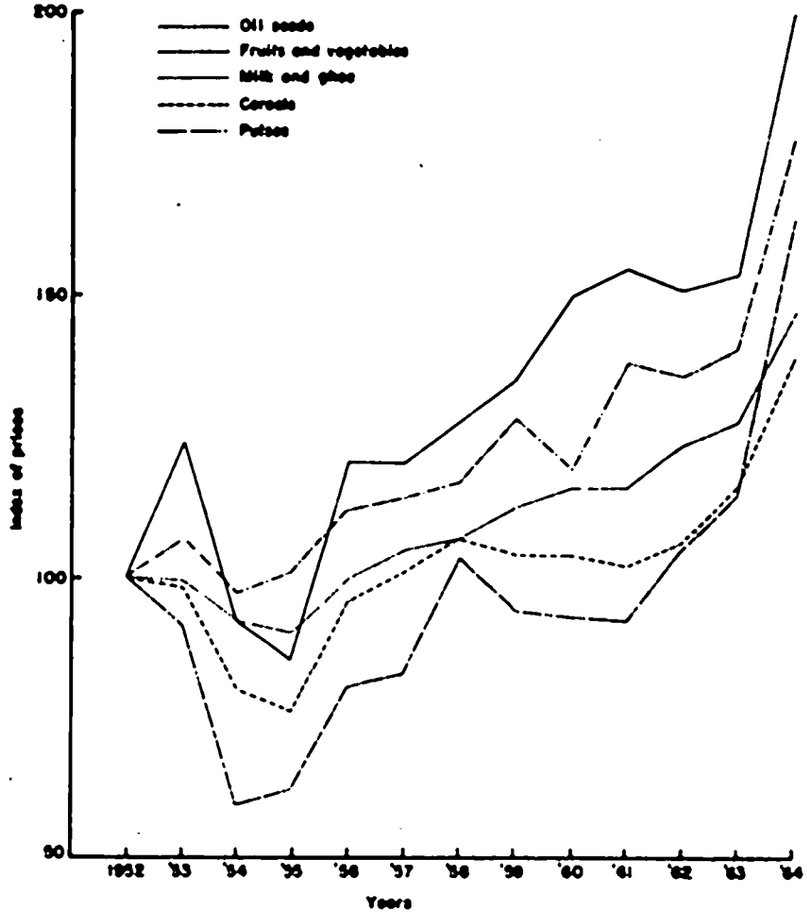


Figure 1 (continued)

The highest rate of growth in prices is for metal products. The second highest growth rate is for oilseeds, which constitute an important industrial raw-materials crop. At the bottom of the list is cereals. The different food, industrial raw-material, and industrial commodities are intermixed in the list. Using the weights from table 2, a weighted average price trend for pulses and cereals provides a price growth rate for food grains of about 2.3. Likewise grouping oilseeds and fibres to represent industrial raw-material crops, provides a price growth rate of about 3.6. Finally, taking into account

Table 1. **Indices of wholesale prices of various commodities**

India: 1952–53 to 1964–65

Commodity	1952–53	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64	1964–65
Cereals	100	98	80	76	96	101	107	104	104	102	106	116	139
Pulses	100	91	59	62	81	83	104	94	93	92	105	115	165
Fruits & vegetables	100	107	97	101	112	114	117	128	119	138	136	141	179
Milk & ghee	100	99	92	90	100	105	107	113	116	116	124	128	147
Oil seeds	100	124	92	85	120	120	127	135	150	156	151	154	200
Fibres	100	102	108	106	116	118	108	115	152	138	129	133	143
Intermediate mfrs.	100	98	97	100	111	107	110	114	131	139	139	140	152
Textiles	100	100	104	102	108	107	103	108	126	126	126	128	132
Metal products	100	107	109	118	130	141	143	144	148	152	160	163	170
Chemicals	100	95	94	92	93	98	107	107	104	111	116	118	121

Source: Reserve Bank of India. *Monthly Bulletin*, various months and years, 1953–54 to 1965–66. Bombay.

Table 2. **Estimate of trend for prices of various commodity groups India: 1952–53 to 1963–64**

No.	Commodity	Base year: 1952–53		
		Weight*	Trend value	Growth rate†
1.	Metal products	12	5.9	4.4
2.	Oil seeds	60	5.5	4.3
3.	Intermediate manufactures	41	4.4	3.8
4.	Fruits & vegetables	23	3.9	3.3
5.	Fibres	61	3.6	3.0
6.	Milk & ghee	84	3.1	2.9
7.	Pulses	43	2.6	2.5
8.	Textiles	147	2.8	2.5
9.	Chemicals	20	2.2	2.1
10.	Cereals	192	2.0	2.0

Source: Table 1.

* Weights based on estimated marketable surplus of all commodities: thus, agricultural commodities consumed without passing through a market, not taken into account. These weights used by government of India and given in *Index of Wholesale Prices in India*. A different weight system, e.g., one based on acreage or total production, would give more weight to food grains relative to other crops. However, for study of market prices, weights based on marketings seemed most appropriate.

† In percent per year; estimated by dividing trend coefficient by average price index for each commodity.

the high weight of textiles in the industrial commodities as well as the low price trend for textiles, the coefficient for industry falls between food grains and industrial raw-material crops at about 2.9.

Nonparametric method

The data for ratios of prices are tested for the existence of and sign of trend by a nonparametric method. The method is primarily used for a short series and does not assume any specific form of relationship between the variables. It consists of "ranking" each observation and computation of positive scores and of Kendell's rank-correlation coefficient (20, 22). The 3 sets of data tested by this method are the relative prices of food grains to all nonfood grains, food grains to industry, and agriculture to industry.

Relative prices of food grains to all nonfood grains: [1] Table 3 and figure 2 (part A) present the ratio between the 2 price indexes for the period 1952–53 to 1964–65. The calculations show that the total scores S = 8, and rank correlation coefficient works out as 0. 1.

The conclusion appears to be a slight trend movement against the prices

[1] Food grains include items 7 and 10 in table 2. All nonfood grain includes all items except 7 and 10.

Table 3. **Estimates of relative prices between food grains, industry, all agriculture, and all nonfood grains**

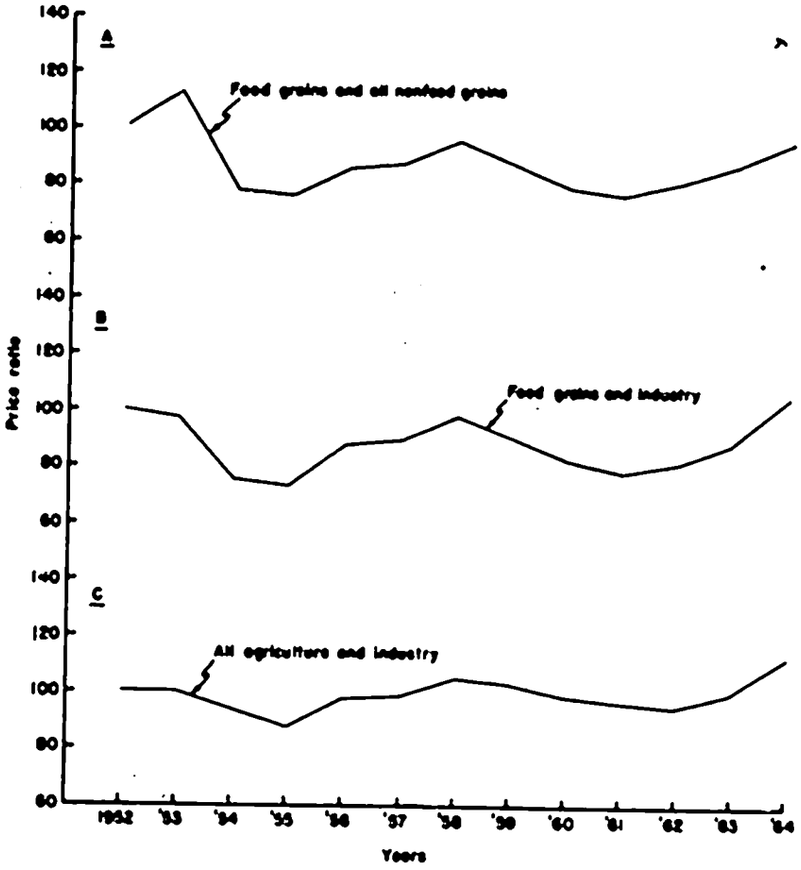
India: 1952–53 to 1964–65

Years	Price indices*				Ratios		
	Food grains	All agriculture	All nonfood grains	Industry	Food grains: industry	Food grains: all nonfood grains	All agriculture: industry
(1)	(2)	(3)	(4)	(5)	(2)/(5) = (6)	(2)/(4) = (7)	(3)/(5) = (8)
1952–53	100	100	100	100	100.0	100.0	100.0
1953–54	97	107	104	100	97.0	93.5	107.7
1954–55	76	96	99	102	74.5	76.5	94.1
1955–56	73	88	97	100	73.0	75.3	88.0
1956–57	93	104	108	106	87.7	85.8	98.1
1957–58	97	107	111	108	89.8	87.6	99.1
1958–59	106	114	111	108	98.1	95.7	105.6
1959–60	102	116	116	112	91.1	87.6	103.6
1960–61	102	123	129	124	82.3	78.8	99.2
1961–62	100	123	131	127	78.7	76.4	96.9
1962–63	106	123	131	129	82.2	81.0	95.3
1963–64	116	131	134	131	88.5	86.5	100.0
1964–65	144	155	150	137	105.1	96.8	113.1

Source: Reserve Bank of India. *Monthly Bulletin*, various months and years, 1953–54 to 1965–66. Bombay.

* "Price indexes" are weighted averages of groups in table 1. "Food grains" include items 7 and 10. "All agriculture" includes items 2, 4, 5, 6, 7, and 10 and "All nonfood grains" is all items except 7 and 10. "Industry" includes items 1, 3, 8, and 9.

Figure 2. **Movement of relative prices between foodgrains, all nonfood grains, industry, and all agriculture, India, 1952–53 to 1964–65.**



Source: Table 3. (Years shown are for year commencing July 1.)

of food grains during this period. This is consistent with the relative rates of growth calculated from fitting of least squares trend lines.

Relative prices of food grains to industry:[2] Table 3 and figure 2 (part B) give the ratio between the 2 price indexes for the period under consideration. The application of the nonparametric test gives the total score S = − 2, and the rank correlation coefficient = − 0.026.

The broad conclusion shows no positive or negative trend between the prices of food grains and industrial goods. Thus the terms of trade consist

[2] Industry includes items 1,2,8, and 9 in table 2.

only of fluctuations for the period 1952–53 to 1964–65. Our earlier results from fitting trends showed that the industrial prices rose at a higher rate than the prices of food grains. Thus, we may conclude that the terms of trade between food grains and industrial goods have large fluctuations with some indication of trend in favor of industrial goods.

However, it may be pointed out that the main increases in food grain prices appear to be in the last 2 years. If we were to exclude these, the test would be as follows: the total scores S = − 13, and rank correlation coefficient = −0.24. This result shows that, except for the last 2 years, the trend was slightly against food grains. Also, it incidentally brings out the importance of the time period considered while determining the value of trend.

Relative prices of agriculture to industry. Table 3 and figure 2 (part C) present the ratio between the 2 sets of price indexes. Calculations made for the purpose of testing the data show the total score S = + 14 and the rank correlation coefficient as (+0.2).

The conclusion appears to be that at about 15 percent level of significance, the terms of trade between agriculture and industry, have been slightly in favor of the agricultural sector. Thus we find that the tendency for food grains to demonstrate either no trend or perhaps a slight downtrend in relation to industrial prices is more than counterbalanced by the upward trend of the nonfood-grain agricultural commodities. In this respect the 2 tests are consistent.

Conclusions

The terms of trade have moved towards the agricultural sector in the period under consideration. The main reason for this movement, however, is that the industrial raw-material crops, which carry a heavy weight in the index, as well as fruit and vegetables and milk and ghee, moved up in price much more rapidly than food grain prices. Food grains showed the lowest trend in prices for the period under consideration. However, a nonparametric test shows no significant difference in the trend for food grains and that for industrial products.

The agricultural commodities for which prices trended upward most sharply were those with relatively high income elasticities of demand. One should expect the demand for these commodities to increase more rapidly in a period of rising per capita incomes, than for food grains with their less elastic demand with respect to income. This emphasizes that agriculture does much more in a situation of economic growth than just supply calories to a growing population. The roles of supplying industrial raw materials and foods with a high income elasticity of demand are also important. The Indian economy has obviously had greater difficulty in expanding the production of these other commodities in proportion to the demand for them than it has had in increasing production of food grains.

Chapter III.

Causes of Change in Food-Grain Prices

Food grains are a major item in the budget of most Indian consumers, hence fluctuations in food-grain prices vitally influence the economic health of the country. Further, changes in food prices may affect wages in the industrial sector, since food is an important wage-good, and a rise in wages may lead to either inflationary pressure in industrial prices or a decrease in industrial profits. On the other hand, a large part of the population are producers of grains and thus their income, consumption, and savings are vulnerable to variations in food-grain prices. These possibilities show the strategic role of the food-grain sector and indicate need for a careful analysis of the causes of price behavior in the food-grain economy.

In India, year-to-year variations in weather are extreme and induce substantial fluctuations in agricultural production and prices. However, a preliminary study of price relationships shows that other factors are also at work. Most important, development efforts have increased per capita incomes with a consequent increase in the demand for food. These activities have also increased the supply of money. Most of the developing countries find themselves with budget deficits and resort to "deficit financing", which in turn creates inflationary tendencies in the economy. The effect of increasing money supply depends largely on the income classes or occupations that receive it. Money supply may also affect the rate of interest and the liquid-assets pattern, which in turn may affect the aggregate investment schedule and hence, price levels.

Changes in imports and exports also affect food-grain prices. The government of India has been using several million tons per year of grains imported under the P.L. 480 agreement with the government of the United States. These quantities add in effect to the supply of grains and hence modify the prices of food grains.

The basic methodology of this study of the determinants of food grain prices is to develop the relevant variables into a single equation model. A substantial number of models were analyzed. It will facilitate discussion of the various alternatives if the preferred model is presented first. Its component parts will be examined, and the effect and implications of various alternatives will be discussed.

The estimated equation thought to be best specified for the purposes of this analysis is as follows: (standard errors in brackets)

$$P_t = 41.48 + \underset{(0.08)}{0.56}\,(D-S)_{t-1} + \underset{(0.80)}{2.25}\,(D-S)_{t-2} + \underset{(0.35)}{2.06}M_t \qquad (1)$$

$$R = 0.91,$$

where:

Table 4. **Estimates of per capita consumption of food grains**

India: for the base year 1949–50

Production* (for human consumption)	Imports	Changes in stocks	Apparent consumption	Population	Per capita consumption
	millions of long tons			mil.	tons
50.4	3.7	+0.4	53.7	357.5	0.15

Source: Dir. Econ. and Stat. *Bulletin on Food Statistics*, 1949–50. Min. Food and Agr., New Delhi.
* At 87.5% production.

P_t — index of food-grain prices in the first week of April of year (t);

D — estimated, aggregate, real demand for food grains for the year commencing July 1;

S — estimated, aggregate supply of food grains for the year commencing July 1;

t − 1 — the year commencing July 1 preceding April 1 of the year (t);
t − 2 — the year commencing July 1 of the year preceding t − 1; and
M_t — total money supply with the public, as defined by the Reserve Bank of India, in the first week of April of year (t).

The following sections will successively discuss the measurement of real demand and the derivation of D; the expected lag between production and its price effect, and hence the reason for choice of April price as the dependent variable; the effect of money supply and the alternatives to including M in the equation; the means of measuring changes in farm inventories and the reason for and significance of the lagged variable t − 2; and finally the international trade factors, including PL 480 imports, which are included in the supply variable S.

Measurement of real demand

Let us first concentrate on the problem of measuring the effect of excess real demand for food grains (over internal production) on prices of food grains, on the assumption that there was complete absence of any other factor. The relationship would be as follows:

Price of food = F (real demand for food grains − domestic production)

There are various problems that arise in estimating this function. If we assume that production is a given, predetermined variable, the problem consists of estimating the real demand for each year.

We have attempted to estimate the demand for food grains each year, allowing for changes in demand caused by income changes, but holding prices constant. Thus, basically, our method consists of estimating what the demand for the commodity would have been, had the price been constant during the period under consideration. Hence, but for the changes in prices, if we know the consumption in the chosen base year 1949-50, the increase in income since then, and the relationship of income and consumption, we can estimate the demand of the commodity for each year.

The data for arriving at the base-year, per capita consumption is available from various official publications and is taken from the *Bulletin on Food Statistics* for our study. We have allowed 12.5 percent of production for requirements for seed, feed, and wastage — a figure used by most Indian economists and the Indian government. Table 4 presents the derivation of the base-year, per capita consumption.

Table 5. **Estimates of food grains demand at constant and current prices**

India: 1949-50 to 1963-64

Years	Population	Per capita income at current prices	Aggregate* demand at current prices	Per capita income at constant prices	Aggregate* demand at constant prices
	millions	rupees	mil. l. tons	rupees	mil. l. tons
1949-50	357.5	256.0	53.7	250.6	53.7
1950-51	363.4	266.5	55.7	247.5	54.2
1951-52	369.6	274.2	57.4	250.3	55.4
1952-53	376.1	265.4	57.5	255.7	55.9
1953-54	382.9	278.1	59.9	266.2	59.2
1954-55	390.2	250.3	57.9	267.8	60.6
1955-56	397.8	255.0	59.6	267.8	61.7
1956-57	405.8	283.3	64.1	275.6	63.9
1957-58	414.3	279.6	65.0	267.3	64.2
1958-59	423.3	303.0	69.2	280.1	67.2
1959-60	432.7	304.8	70.9	279.2	68.6
1960-61	442.0	325.7	74.8	293.2	71.8
1961-62	450.5	333.6	77.2	294.3	73.3
1962-63	459.1	339.3	79.4	293.4	74.5
1963-64	468.1	370.7	84.6	299.8	76.9

Sources: (1) Dir. Econ. and Stat. *Bulletin on Food Statistics*, 1950–1965. Min. of Food and Agr., New Delhi.
(2) Reserve Bank of India. *Monthly Bulletin*, May 1965, p. 717. Bombay.

* Estimated.

The figures for increases in per capita real income are also available for the period under consideration and are presented in table 5. Regarding the estimate of income elasticity of demand for food grains from cross-section data, the main source is the National Sample Survey. This survey is carried for various years and for the different regions, and makes data on family expenditures available. For a summary and a critical evaluation of estimates derived from the National Sample Survey, see the study by Lele and Mellor (10). We have used the elasticity recommended by this study, namely 0.5, for our purposes.

Assuming the income elasticity of demand for food grains constant at 0.5 for the entire period, the corresponding estimates of per capita consumption are obtained. Per capita demand can be multiplied by the estimates of population for each year in order to arrive at the aggregate real demand for food grains. The differences between demand and domestic production and demand and total supply for each year are presented in table 6. Total supply is defined as domestic production plus net imports plus change in government stocks.

At this point we can examine whether the fluctuations in the prices of food grains can be adequately explained by the movements in domestic production for a given year and the changes in real incomes of the population. For, if the production and real demand could account for the variation in prices of food grains, one could stop at this stage and hypothesize that the influence of any other variable is irrelevant.

Let $Q_{F,t-1}$ = production of food grains, in period (t).

Then, using the same notation as before,[3] we get

$$P_{F,t-1} = 87.65 + 2.01 \quad (D - Q)_{F,t-1} \qquad \text{— (2)}$$

where R = 0.47.

A comparison with equation (1) shows that a large part of variation in food prices is not explained by equation (2), since the value for R of 0.47 is much lower than that of 0.91 for equation (1).

Estimation of lag between production and prices

On the basis of the considerations that follow, we have hypothesized that the production for a July-to-July crop year should be related to the price in April of that year. One major consideration consists of purely theoretical grounds for an "anticipatory" model; the second major consideration is mainly pragmatic, one related to the market-arrival timing from one season to another.

[3] Except that supply is defined as domestic production only (Q). In later equations, effect of including imports and changes in government stocks will be introduced. It will little affect closeness of fit or size of coefficients.

Table 6. **Estimates of food-grain price indexes and demand-supply balances**

India: 1949-50 to 1963-64

Years	Index of April 1 prices			Real demand minus domestic production	Money demand minus domestic production	Real demand minus total domestic supply	Money demand minus total domestic supply
	Cereals	Pulses	Food grains				
	1952-53 yearly average = 100			millions of long tons			
1949-50	91	79	89	+3.3	+ 3.3	0.0	0.0
1950-51	103	102	103	+8.5	+10.0	+4.3	+ 5.8
1951-52	96	88	93	+9.3	+11.3	+6.0	+ 8.0
1952-53	96	93	96	+4.6	+ 6.2	+2.1	+ 3.7
1953-54	89	74	87	−0.8	− 0.1	−1.4	− 0.7
1954-55	68	48	65	+1.8	− 0.9	+0.5	− 0.2
1955-56	89	74	87	+4.1	+ 2.0	+2.1	0.0
1956-57	101	74	97	+3.7	+ 3.9	+0.9	+ 1.1
1957-58	97	82	95	+6.8	+ 9.6	+5.4	+ 6.2
1958-59	99	95	98	+0.8	+ 2.8	−2.6	− 0.6
1959-60	104	89	102	+2.5	+ 4.8	−1.2	+ 0.2
1960-61	99	88	97	+2.1	+ 5.1	−1.4	+ 1.6
1961-62	103	94	102	+4.3	+ 8.2	+1.0	+ 4.0
1962-63	107	103	106	+6.7	+11.6	+2.2	+ 7.1
1963-64	124	134	126	+8.5	+16.2	+2.3	+10.0

Source: Dir. Econ. and Stat. *Bulletin of Food Statistics.* Min. Food and Agr., New Delhi. 1951 to 1965.

1. ***Theoretical considerations***: The problem consists of determining the relevant time lag between production and prices of food grains. The approach to the problem is best formulated by Working (23) in his hypothesis regarding anticipatory prices. The anticipations for future events are accounted for by the hypothesis of a gradual process of dissemination of knowledge among sellers and buyers. The sellers accumulate knowledge as time passes and also act accordingly to the newly growing information.

Working's theory of explaining the changes in prices in a gradual manner has been tested and found usable in the context of the Indian economy. The work on India was a case study of the jowar market in western India (9). The results reported were statistically very significant and showed a clear pattern of the graduality hypothesized by Working.

From the analysis of Working and Lele it appears that the most relevant month for relating price to production would be January for the *kharif* crop season of April to October, and July for the *rabi* crop season October to April. Since available production data will not allow separation for the two seasons, the month chosen as the dependent variable was April, on the basis of its being the midpoint between January and July and on the basis of correlation coefficients for different months.

2. ***Pragmatic considerations***: A great advantage in choosing the April price is that most of the information on crop size for the preceding year is available by April, and no adequate forecast for the next year can be made by April.

If May or June were chosen as the relevant time for taking the price, the next year's crop begins to affect the figures. This is particularly important in those regions where early monsoon showers occur. The problem of constantly changing assumptions about crop size becomes worse in the later months, until circumstances begin to clarify again as the following April draws near.

In our analysis below, we have compared the significance of correlations using April prices and yearly average price, and the results show a significantly lower relationship when the yearly price is used.

Let L_t = yearly average price, for the period (t).

Then, using the same notation as before, we get:

$$L_t = 72.26 + 0.7(D - S)_{t-1} + 0.9(D - S)_{t-2} + 1.24M_t \quad - \quad (3)$$

where $R = 0.65$.

A comparison with equation (1), where the independent variables are the same as in equation (3), while the dependent variable is changed from April price to the yearly average price, the value of the multiple correlation coefficient has dropped from 0.91 to 0.65. Thus the earlier equation is not only better specified (on theoretical and pragmatic considerations) but also has considerably less variance.

Money supply

Money supply with the public in India broadly includes currency and demand deposits. The data, collected and published by the Reserve Bank of India, are fairly accurate and reliable. Government deposits in the Central Bank are excluded from the money supply primarily because the government can always borrow any amount of funds from the bank and hence any particular level at any point of time is unimportant. On similar grounds, commercial banks' deposits with each other and with the Reserve Bank are also excluded. Also, as cash held in bank vaults does not act as money, this item is also deducted from the total money supply in order to estimate the money supply with the public.

Including the money factor as an additional variable to explain the fluctuations in prices of food grains is necessary, but it introduces complicated and controversial ideas. The basic problems are related to the causes and extent of correlations between money income, money supply, and prices. We have followed 2 approaches to this problem, namely, to take money supply as an additional independent variable and to establish its effect by taking increases in money income.

First, let us estimate an alternative to equation (1) by estimating the excess demand as before, but this time taking changes in per capita money income rather than in real income. Money income is defined in terms of current prices. The estimates of increases in per capita money income are given in table 6. The estimates of money demand for food grains, for each year, are made by the same procedure as before, and the final figures of deficits or excesses from year to year are presented in table 7. The internal production is again taken as a predetermined variable and the final estimated relationship is as below:

Using the same notation as before, except for defining:

d = estimated demand for food grains at current prices,

$$P_t = 82.79 + 2.19\,(d - Q)_{t-1} \qquad \text{— (4)}$$

where R = 0.81

$$P_t = 81.23 + 1.87\,(d - Q)_{t-1} + 0.62\,(d - Q)_{t-2} \qquad \text{— (5)}$$

where R = 0.82

$$P_t = 95.69 + 2.35\,(d - S)_{t-1} \qquad \text{— (6)}$$

where R = 0.64, and

$$P_t = 95.39 + 1.15\,(d - S)_{t-1} + 1.72\,(d - S)_{t-2} \qquad \text{— (7)}$$

where R = 0.68.

Equations 6 and 7 include total supply (S) as domestic production, net imports, and changes in government stocks. Equations 4 and 5 substitute (Q), domestic production only, for (S). The implications of this substitution will be discussed below. Inclusion of money factor does increase the value of multiple correlation coefficient from 0.47 in equation (2) to 0.81 in

Table 7. **Estimates of domestic supply of food grains and money supply**

India: 1949–50 to 1963–64

Years	Production	Imports	Changes in stocks	Total supply	Money supply
	millions of long tons				billion rupees
1949–50	50.4	3.7	+0.4	53.7	—
1950–51	45.7	4.7	+0.5	49.9	18
1951–52	46.1	3.9	+0.6	49.4	18
1952–53	51.3	2.0	−0.5	53.8	18
1953–54	60.0	0.8	+0.2	60.6	18
1954–55	58.8	0.6	−0.7	60.1	19
1955–56	57.6	1.4	−0.6	59.6	22
1956–57	60.2	3.6	+0.8	63.0	23
1957–58	55.4	3.2	−0.2	58.8	24
1958–59	66.4	3.8	+0.4	69.8	25
1959–60	66.1	5.1	+1.4	69.8	27
1960–61	69.7	3.4	−0.1	73.2	29
1961–62	69.0	3.6	+0.3	72.3	30
1962–63	67.8	4.5	0.0	72.3	33
1963–64	68.4	6.2	0.0	74.6	37

Sources: (1) Dir. Econ. and Stat. *Bulletin on Food Statistics*, 1951–1965. Min. Food and Agr., New Delhi. 1951–1965.
(2) Reserve Bank of India. *Monthly Bulletin*, Bombay.

equation (4), showing thereby that money factor is an important one in determination of food prices.

The variable for t − 2 has been included in equations (5) and (7) and the results show a negligible increase in the value of the multiple correlation coefficient, which still remains below 0.91. The reason for this situation of almost no increase between (5) and (7) and (4) and (6) is the inclusion of money factor within the "gaps" of demand and production. This inclusion of money factor in the gaps introduces multicollinearity, which was absent before. Thus the correlation between (t − 1) and (t − 2) terms including money factor in the gaps in equations (5) and (7) is about 0.55, while the correlation between (t − 1) and (t − 2) with only real factors in the equation (1) is about 0.2.

Thus, equation (1) has lesser variance unexplained than either (5) or (7), which makes it more suitable for our analytical purposes. Secondly, the separation of real and money factors is very useful. For example, in the estimation of elasticities or for the purpose of evaluating the impact of certain real or monetary policies, the study of real factors separated from money factors is necessary.

The estimates of per capita real income and per capita money income are given in table 5, and those of money supply are given in table 7. Let us compare the differences in real and money incomes against changes in money supply. Until 1956, money supply was more or less constant in India, the differences in the real and money incomes were small and fluctuating, with money income sometimes greater and sometimes lower than real income. Also, the period 1954–56 in India showed high real income figures, which ordinarily should indicate high demand for money and consequently higher supply of money. However, no monetary decisions were forthcoming, with the result that there must have been an excess demand for money, and consequently the actual per capita real income figures were higher than the actual per capita money income figures for 1954-56. For 1956-60, money supply showed gradual increases, and now the difference between real and money incomes had a larger magnitude and the money income was always higher than the real income. In the period 1960-65, the money supply rose much more quickly, and the money income was then substantially higher and increasing at a much higher rate than the real income. Rapid expansion of the money supply is associated with government deficit financing. The 2 basic reasons for the large deficit financing are that resources are not sufficient to carry out ambitious development plans and that money must constantly be increased to close the gap between the amount of foreign aid designated in the Plan and the typically inadequate sums actually available. In the early 1960's the India–China military engagements led to a large increase in military expenditures and a further expansion of the money supply.

Taking money supply as an additional and independent variable, we get

$$P_t = 53.25 + 1.15\ (D - Q)_{t-1} + 1.53M_t \qquad - \quad (8)$$
$$\text{where } R = 0.82.$$

Stock variable

In the context of an economy like India's, the importance of stocks to agricultural prices needs to be emphasized more. Here the unpredictability of next year's rainfall gives the farmer a strong motive to stock grains for his own future use. Thus, the availability of grains depends not only on the current crop but on the last crop as well. Two consecutive good years may have a different effect on prices than one bad year followed by a good one. Unfortunately there are no data available for changes in private stocks. The analytical procedure used for dealing with stocks, therefore, consists of taking an additional time lag variable in the excess demand for food grains as an independent variable.

The basic question to be answered here is to determine the effect of changes in stocks on the price of food grains. The use of 2-lagged variables for determining the inventory behavior is well established, and is basic in the modern analysis of business cycles (6).

Using the same notation as before, we can show the effect of including a variable that represents the stock variable, as follows:

$$P_t = 42.30 + 1.02\ (D - Q)_{t-1} + 2.01\ (D - Q)_{t-2} + 1.75\ M_t \qquad - \quad (9)$$
$$\text{where } R = 0.93.$$

Trade factors

India imports food grains under an agreement with the United States, wherein the purchase of grains is paid for in the local currency rather than in dollars. For this reason, many of the influences associated with commercial trading are excluded. The primary effect of food-grain imports is an indirect one, through the increase in the supply of food grains in the country. To evaluate this effect, we define imports as current imports plus net changes in stocks (accumulated primarily through past government imports) held by the government. The estimates of imports, supply, and deficits or surpluses of supply over demand are given in table 4.

We have examined the relationship with imports in equation (1), and without imports, in equation (9). A negligible increase appears in the coefficient of the real factor in equation (9) as compared with equation (1). The fact that the multiple correlation coefficient in both equations is large and of similar magnitude shows that each of the equations is statistically valid. The main statistical interpretation of the 2 equations implies that there must be a strong correlation between production and imports.[4] Thus, if production is large, the imports decrease (or stocks from imports

[4] Another statistical possibility is that imports, in relation to production (for consideration of price behavior), are random. Even this possibility implies that the effect of trade is not a trend type of movement of food prices.

increase), and vice versa: this clearly demonstrates the efficiency of the Indian government in using the P.L. 480 imports in the most effective manner.

Conclusions and implications to policy

The best way to interpret the relationships established in the last section is to estimate elasticities for various determining economic variables. Following that we will discuss the implications to the present agricultural price policy of the government of India.

For most of our analysis, we shall interpret the 2 best fitting, best specified relationships, one with imports (equation [1]) and the other without imports (equation [9].

$$P_t = 42.30 + 1.02\ (D - Q)_{t-1} + 2.01\ (D - Q)_{t-2} + 1.75, \quad \text{— (9)}$$
$$\text{where } R = 0.93;$$

and

$$P_t = 41.48 + 0.56\ (D - S)_{t-1} + 2.25\ (D - S)_{t-2} + 2.06\ M_t, \quad \text{— (1)}$$
$$\text{where } R = 0.91.$$

The first step consists of estimating the price flexibility coefficient from the above equations. We follow the assumptions made by Nerlove (15) for a similar purpose, though in a different type of problem, and combine the $(t - 1)$ and $(t - 2)$ terms for a value of 3.03 for equation (9) and 2.81 for equation (1). The coefficients in a linear model are equivalent to the concept of marginal propensities, so that in order to arrive at the figures for elasticities, these need to be multiplied by the relevant averages. The average gap between the real demand and production, for the period 1949–50 to 1963-64, is estimated at 4.34, and the average money supply was about 25.0 while the average price index is 96.38.

Thus, aggregate price flexibility with respect to gap is equal to $\frac{3.03 \times 4.34}{96.38} = 0.11$, or in other words a 1 percent increase in the gap between demand and production increases the price index by 0.11 percent. Similarly, the price flexibility with respect to money supply, is equal to $\frac{1.75 \times 25.5}{96.38} = 0.45$, or in other words, a 1 percent increase in money supply increases the price index of food grains by 0.45 percent.

It is possible, at this stage, to make certain tests about the reliability of the preceding estimates. If we hypothesize that the demand for food grains is largely dependent upon their production, then the pattern of behavior of production and demand would be similar to that of production. On the above assumption, the flexibility of price with respect to production would be $\frac{3.03 \times 59.5}{96.38} = 1.87$, where 59.5 is the average production. Or in other words, a 1 percent increase in production/demand would increase the price

index by 1.87 percent. Now, if we convert the above flexibility to make a crude estimate of price elasticity of demand, we get $\frac{1}{-1.87} = -0.54$.[5]

Consider the demand function of food grains per capita, and let us assume that income per capita and price determine the entire variation: and also a Cobb-Douglas type of demand model, where the price and income elasticities are assumed to be constant for the period under consideration. Then the price elasticity must be equal to 1 minus income elasticity.[6] If, as seen earlier, income elasticity of demand is about 0.5, the price elasticity should be about -0.5. This estimate comes quite close to -0.5, which gives an automatic check on the price flexibility models. Similarly we can work with equation (1) and estimate the price flexibility coefficient and the effect of percentage changes in money supply.

Let us again compute an elasticity with respect to the gap between real demand and supply. The flexibility coefficient would be obtained by dividing the marginal differences by the average ones. Here the average gap is $+1.4$, and hence the flexibility is $\frac{2.81 \times 1.4}{96.38} = 0.04$, meaning a 1 percent increase in gap between demand and supply will increase the price index by .04 percent. Using the same arguments as in the last section, we can estimate the price flexibility with respect to supply/demand. The average supply being 62.7, the flexibility is $\frac{2.81 \times 62.7}{96.38} = 1.83$, or in other words, a 1 percent increase in supply would decrease the price index by 1.83 percent. Again, under similar assumptions, as in the last section, we can arrive at the estimate of price elasticity of demand of -0.55, which comes close to the expected figure of -0.5.

The coefficient of money supply in equation (1) is quite close to the corresponding coefficient in equation (9). This implies no correlation between P.L. 480 and money supply. The above result is important since there is currently some controversy about this matter in India (5). The effect of a 1 percent increase in money supply, from equation (1) works out at a 0.53 percent increase in food-grain prices.

It is possible, similarly, to work out the effect of imports, the average level of imports being 3 times the average gap between demand and supply. Thus, from equation (1), a 1 percent increase in imports would decrease prices by about 0.13 percent, and from equation (9), the prices of food grains would be reduced by about 0.12 percent.

To illustrate the effect of the real factors, monetary factors, and trade factors, we have made a series of calculations from equation (1). To find the extent of the effect of real factors, we have held the money supply con-

[5] The change in sign is made because the gap in the equation is D−S rather than S−D.

[6] This implies a zero cross elasticity.

stant at its mean value, and then estimated the prices from equation (1). For the evaluation of the monetary factors, we hold the real gaps constant at their mean values: and for the realization of the import effect, we substitute (Q) instead of (S) in equation (1). The estimated prices and the comparison with the reported prices are shown in table 8 and figure 3.

Briefly, the graphs show the following phenomena:

- The real factors account for the basic up and down movement in prices, with a low in 1954–55 and a high in 1951–52. There is no indication of any type of trend movement in prices as a result of the real factors.

- The money supply factor results in a basic trend type of movement in food prices, with most of the fluctuations around this trend line.

- The imports show that the prices in bad years would have risen higher in absence of imports. The upward fluctuations are thus subdued by the introduction of imports.

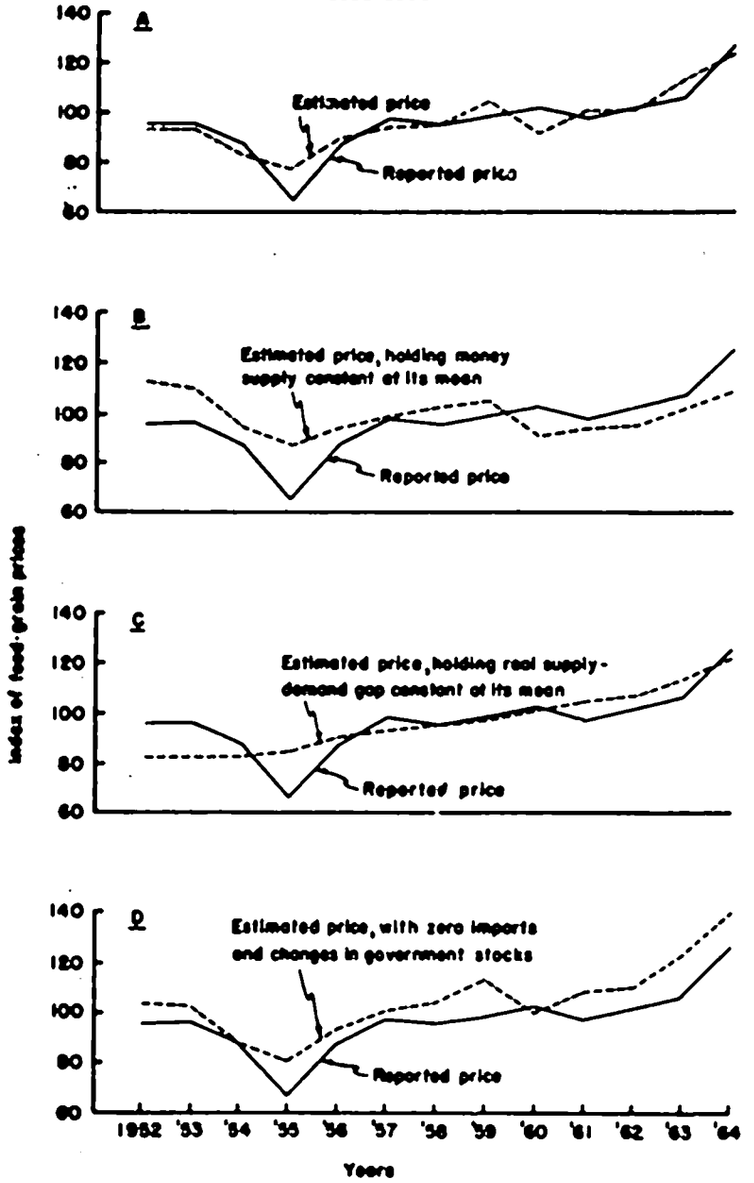
Some comment is needed for interpretation of a smaller coefficient for (t − 1) term in comparison to (t − 2) term. We also tried addition of (t − 3) term, not by just including it in the model as an additional variable, for that would have created serious problems of interpretation, but by dropping (t − 1) term and adding (t − 3) term. The results showed that the coefficient for the (t − 3) term was negligible.

Table 8. **Estimated and reported food-grain price indexes**
India: 1951–52 to 1963–64

Year	Reported prices	Estimated prices	Estimated price holding constant		
			Money supply	Demand-supply gap	Imports & govt. stocks
	1952–53 yearly average = 100				
1951–52	95	92	112	82	103
1952–53	96	93	109	82	102
1953–54	87	83	94	82	88
1954–55	65	77	86	84	80
1955–56	87	89	93	90	93
1956–57	97	94	98	93	100
1957–58	95	95	102	95	104
1958–59	98	104	104	97	113
1959–60	102	91	90	101	100
1960–61	97	100	93	105	108
1961–62	102	101	94	107	110
1962–63	106	113	101	113	123
1963–64	126	124	108	121	138

Source: Reported prices from table 6. Series for estimated prices refer to prediction of prices for each year from the price equation (1). Last 3 columns estimated from price equation (1), while holding the specified variables constant at their mean values as stated.

Figure 3. Comparison of reported with estimated April food-grain prices, India, 1951–1964



Note: In Figure 1A, the estimated prices are from the price equation. In Figures 1B, 1C, and 1D, the prices from price equation are shown holding specified variables constant.

Source: Table 8.

Therefore, unlike the usual distributed lag type of model, where the magnitude of the coefficients decreases as one moves backwards with time, our relationship shows (t − 1) coefficient as lower than (t − 2), (t − 2) being the highest, and zero coefficient for the (t − 3) term.

To what extent have policy variables like P.L. 480, selective credit controls, and state trading affected our analysis? From the comparison in table 8 it can be seen that the major discrepancies are:

1954–55, the estimated values overestimate the reported prices;

1958–59, the estimated values overestimate the reported prices;

1959–60, the estimated values underestimate the reported prices.

In all other years, the estimated values are fairly accurate in comparison with the observed values.

It is not possible to state precisely the reasons for the discrepancies observed between estimated and reported prices of food grains for the 3 years. After scrutinizing the facts and policy measures, our guess is that the stock factor caused the discrepancies in year 1954–55, and those in 1958–59 and 1959–60 were probably caused by the policy factor. Preceding production benavior for 1954–55 tends to show the possibility of sharp stock changes. Thus, the production for human consumption increased sharply from 51.3 million tons in 1952–53 to 60 million tons in 1953–54, leading to a possibility of large increases in stocks, which when released in 1954–55 (a good crop year itself) would abnormally lower the prices. The data also show a period of falling prices in 1958–59 that was probably the result of the state trading started in late 1957. There was a lag of several months before the program grew effective. The year 1959–60 is the year when the Reserve Bank, finding the government trade to be effective, significantly liberalized the advanced credit against food grains. This liberal credit policy could conceivably have shifted the prices of food grains higher than expected.

Chapter IV.

Causes of Changes in Prices of Industrial Raw Material Crops

We shall analyze the prices of cotton, oilseeds, and tobacco for the period 1952–53 to 1963–64. These 3 crops account for about 90 percent of acreage under all industrial raw material crops (table 9). The basic procedures for estimating the effect of various determining factors on prices will be similar to that followed in the case of food grains.

The demand for industrial raw-material crops is a case of derived demand. For example, the demand for cotton is the result of the demand for cotton textiles. Table 10 shows that year-to-year fluctuations of fibres and textiles are more or less similar. Thus, from 1955–56 to 1956–57, the price index of

Table 9. **Area under different crops**
India: 1959–60

Crops	Area			
	Mil. acres			Percent
Total food grains	286			81
Oilseeds		34	10	
Cotton		18	5	
Tobacco		1	—*	
Other raw material crops		8	2	
Total raw material crops	62			18
Other food crops	3			1
Total all crops	351			100

Source: Dir. of Econ. and Stat. *Agricultural Situation in India.* Min. Food and Agr., Govt. of India. New Delhi. Aug. 1964.
* Less than 1.

fibres rose sharply from 106 to 116, and a similar increase, though of lower magnitude, took place for textiles from 102 to 108. Again, from 1957–58 to 1958–59, the fibre index decreased from 118 to 108 and the textile price index fell from 107 to 103. During the first period, the stocks of textiles decreased by 382 million yards and, in the second period, increased by 269 million yards, which illustrates the damping effect of stock changes in the textile sector.

Another problem in relation to these crops is that of aggregation of crops under this category. We use the same set of weights as the government of

Table 10. **Comparison of price indexes of fibres and textiles**
India: 1952–53 to 1964–65

Years	Fibre prices	Textile prices
	1952–53 yearly average = 100	
1952–53	100	100
1953–54	102	100
1954–55	108	104
1955–56	106	102
1956–57	116	108
1957–58	118	107
1958–59	108	103
1959–60	115	108
1960–61	152	126
1961–62	138	126
1962–63	129	126
1963–64	133	128
1964–65	143	132

Source: Table 1.

India for computing price indexes (table 2). These are essentially based on value of marketable surplus, which for these crops is about equal to value of production.

To estimate the demand for these crops, the demand for cotton textiles, vegetable oils, and tobacco products must be determined first. Though most of the raw cotton goes for the production of cotton textiles, oilseeds for vegetable oils, and raw tobacco for tobacco products, there are some small users of these crops. To arrive at various conversion factors from raw cotton to cotton textiles and others, we have used the figures that seem reasonable from another study (14).

Table 11. **Per capita consumption and income elasticity of demand — industrial raw-material crops**
India: 1949–50

Commodity	Unit	Per capita consumption	Income elasticity
Cotton textiles	yards	15.22	1.2
Edible oils	pounds	4.86	0.8
Tobacco	ounces	20.12	1.0

Sources: (1) Natl Coun. Appl Econ Res. Long-term projections of demand for and supply of selected agricultural commodities New Delhi. April 1962.

(2) Min. Food and Agr. Agricultural projections in India. Govt. of India, New Delhi. Sept. 1963. (Mimeo).

Table 12. **Estimates of aggregate derived demand for industrial raw-material crops**
India: 1950-51 to 1963-64

Years	Real demand			Money demand		
	Raw cotton	Oilseeds	Tobacco	Raw cotton	Oilseeds	Tobacco
	1000 tons					
1950–51	868.4	4,795.5	201.5	916.0	4,975.4	212.3
1951–52	857.0	4,686.5	207.2	917.2	4,932.8	222.2
1952–53	855.4	5,177.2	215.3	870.8	5,234.3	218.8
1953–54	923.0	4,789.0	228.2	946.3	4,862.8	233.4
1954–55	977.2	5,478.3	234.1	891.5	5,152.2	214.1
1955–56	982.8	6,157.3	238.6	912.8	5,892.2	222.4
1956–57	1,022.3	5,495.4	250.6	1,029.8	5,521.6	252.0
1957–58	1,017.8	5,370.0	248.1	1,044.1	5,466.4	254.1
1958–59	1,053.4	5,585.1	265.5	1,125.4	5,838.1	281.2
1959–60	1,104.1	5,902.9	270.5	1,187.1	6,202.5	289.1
1960–61	1,165.9	6,060.7	290.2	1,279.9	6,464.8	315.7
1961–62	1,192.6	6,095.7	296.9	1,338.6	6,610.2	329.6
1962–63	1,190.5	6,442.9	301.6	1,370.3	7,074.6	341.7
1963–64	1,244.3	6,871.5	314.2	1,545.3	7,903.0	380.6

By a procedure similar to that used for food grains, the real demand for the respective agricultural raw materials were derived from estimates of income elasticity for different industrial goods (table 11). The base-year, per capita consumption of textiles, oils, and tobacco were derived by adding imports to production and subtracting exports, adjusting for stocks, and finally dividing by population. The per capita increases in income, along with the elasticities, were applied to the derived base-year consumption to estimate the increases in demand at per capita level. Multiplication by population for each year provided the estimates of aggregate demand, as given in table 12. The procedure was carried out for both real and money changes in demand, and for each commodity separately. Table 12 gives the derived demand for the crops from the estimated demand for industrial goods. Table 13 gives the production and supply data.

Using the same notation as in Chapter III, we get:

Let P_M be the price of industrial raw material crops.

$$\text{Then } P_{M,t} = 54.54 + .0033\ (D - S)_{M,t-1} + .0011\ (D - S)_{M,t-2} + 2.44_{Mt}$$
$$\text{where } R = 0.90.$$

Using this equation as a basis, prices for raw material crops were estimated year by year for the period under consideration. Table 14 and figure 4 give the estimates of prices along with the reported prices.

Making the same calculations as in deriving the figures for price flexibility coefficient, we note that the average supply of industrial raw-material crops is 7227, average money supply is 25, and average price index is 113.8.

$$\text{The price flexibility coefficient is } \frac{.044 \times 7227}{113.8} = 0.28.$$

Thus, the effect of increase in real production/demand by 1 percent would be a change of 0.3 percent in the prices of industrial raw-material crops (for the period under consideration). The 0.3 coefficient is very much below the 2.38 coefficient observed for food grains. The 1 percent increase in money supply increases the price index by 0.5 percent. The effect for food grains was also 0.5 percent.

It is not possible to derive precise estimates of demand elasticity from the coefficient of flexibility, because the cross elasticity of the industrial raw material crops is likely to be high. Thus, in periods of high prices of food grains in India, for example, it is well recognized that demand for cotton textiles declines and large increases in textile stocks take place. In a situation of significant cross elasticities, an inverse of price flexibility gives the minimum (8) value of the price elasticity coefficient, which in this case is 3. The fact that the flexibility coefficient for industrial raw-material crops is lower than that for food grains does imply a higher price elasticity for industrial raw-material crops.

When the determining equation for raw-material crops is compared with that for food grains, the coefficient for $(t-2)$ term in raw-material crops is

Table 13. **Estimates of production and internal supply of industrial raw-material crops**
India: 1950–51 to 1963–64

Years	Raw cotton			Oilseeds			Tobacco		
	Production*	Net imports†	Supply	Production*	Exports	Supply	Production*	Exports	Supply
1950–51	514	+135	649	5,072	138	4,934	257	42	215
1951–52	554	+158	712	5,015	34	4,981	206	45	161
1952–53	562	+ 6	568	4,732	17	4,715	241	34	207
1953–54	705	+ 19	724	5,340	10	5,330	268	31	237
1954–55	760	+ 34	794	6,313	33	6,280	251	38	213
1955–56	715	− 62	653	5,592	38	5,554	298	40	258
1956–57	842	+ 7	849	6,194	..	6,194	300	37	263
1957–58	831	+ 71	902	6,128	..	6,128	236	36	200
1958–59	817	− 38	779	7,044	..	7,044	312	48	264
1959–60	615	+ 13	628	6,452	..	6,452	287	37	250
1960–61	945	+190	1,135	6,591	..	6,591	307	45	262
1961–62	791	+ 78	869	6,921	..	6,921	342	44	298
1962–63	938	+ 72	1,010	7,090	..	7,090	359	60	299
1963–64	958	+ 38	996	6,879	..	6,879	330	63	267

Sources: (1) Natl. Coun. Appl. Econ. Res. Long-term projections of demand for and supply of selected agricultural commodities. New Delhi, India. April 1962.

(2) United Nations. Yearbook of International Trade Statistics, various years. Dept. Econ. Affairs. New York.

(3) Min. Food and Agr. Agricultural situation in India, p 515. Govt of India. Aug. 1964.

Notes: * Estimated from Index of Agr. Prod. Series as available from source (3) above.
† Imports include raw cotton, textile yarn, and thread, while exports include raw cotton, cotton waste, and shoddy.
.. Negligible or not available.

Table 14. **Estimated and reported price indexes of industrial raw-material crops India: 1951–52 to 1963–64**

Years	Reported prices*	Estimated prices
1951–52	94	95
1952–53	110	100
1953–54	100	97
1954–55	79	97
1955–56	105	110
1956–57	113	110
1957–58	109	110
1958–59	118	112
1959–60	123	119
1960–61	133	124
1961–62	128	126
1962–63	128	132
1963–64	139	145

* Reported prices derived from table 1 by aggregating index of wholesale cotton, tobacco, and oilseed prices as of April 1 each year; weights are marketable surplus of each commodity. Estimated prices calculated as stated in text.

shown to be lower than that of $(t-1)$ term, while $(t-2)$ term has a higher coefficient in the case of food grains. This is an expected result since raw-material crops, by the nature of their economic function, are mainly marketed.

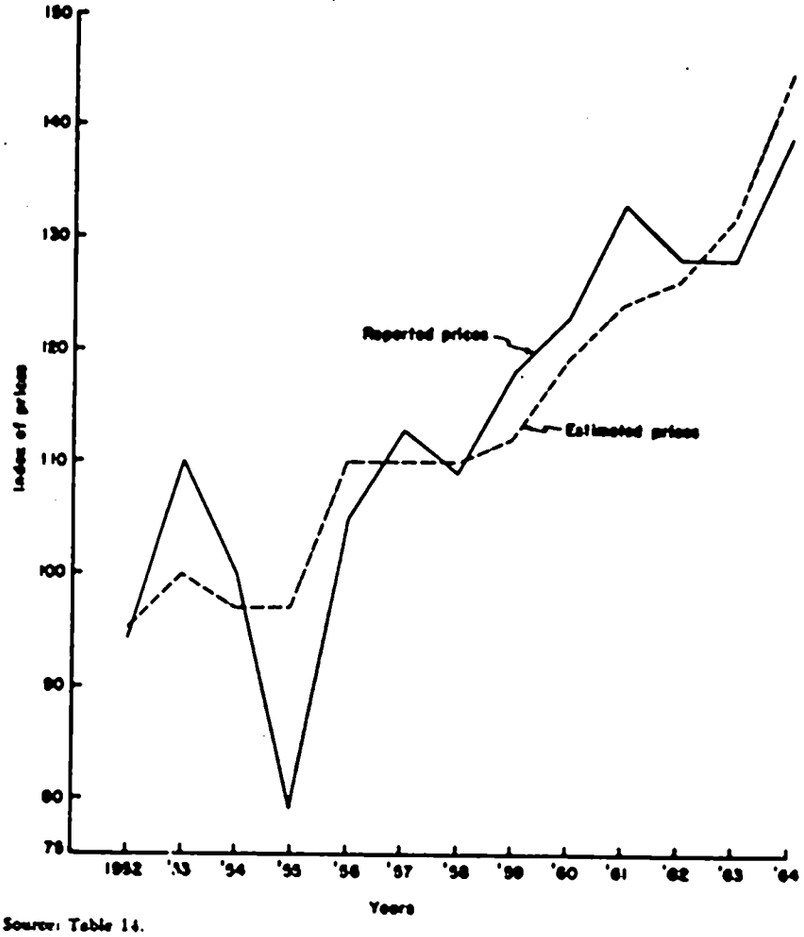
Chapter V.

Analyses of the Stability of Prices

In this chapter we intend to determine whether agricultural or industrial prices show the more unstable characteristics for the period 1952–53 to 1963–64 in India. We are also examining the problem of the extent of variations in prices — particularly to determine whether the price rise of food grains since the beginning of the Second Five-Year Plan has an explosive or a monotonic pattern. In other words, have the prices of food grains become dynamically stable (moving toward equilibrium) since they began to increase in 1955–56.

A study of stability is important for 2 reasons. The first deals with the direct relationship of fluctuations in the prices and development of a sector. A stable price level is linked with a stable level of expectations, which leads, according to Keynesian theory, to a higher investment level. The higher investment level, in turn, is causal for a faster rate of growth of income through the multiplier effect. Thus, according to this theory of expectations, if the agricultural prices are more fluctuating, the level of growth of income

Figure 4. Estimated and reported April prices of industrial raw-material crops in India, 1952–53 to 1963–64.



Source: Table 14.

in the agricultural sector would be less. An alternative theory favors fluctuating prices, higher prices (providing the added incentive to invest in the face of uncertainty), and investment that is not reduced when prices decline. The second reason relates to the possibility of ascertaining the type of movement the prices have been following, in order to determine any hyper-inflationary tendencies

We have studied 3 basic approaches to the problem of stability:

(1) A pragmatic approach to the problem of stability with consideration of the extent of fluctuations in prices from year to year. The standard pro-

cedure followed is to estimate and compare the coefficient of variation for prices of different commodities. In this analysis, deviations from the trend lines, rather than from means, are also studied.

(2) An analysis based on the dynamic aspects of movement of the position of equilibrium. Here the path of adjustment from one position of equilibrium to another is studied. The procedure is again mathematical and a second-order difference equation needs to be solved. The solution of the difference equation shows whether the movements were increasing or decreasing over time.

(3) An analysis of the question of stability within the theoretical framework of a static or comparatively static equilibrium position. The main methodology consists of examining whether a movement of the point of equilibrium is such that it comes back to its original position if shifted. The solution is mathematical in nature, where the second derivative is studied for its sign. In a multimarket situation, the main condition for stability is the negative sign for the substitution term (7).

Method 1. The coefficient of variation for various commodities is shown in table 15. The results based on the data given in Chapter II are shown in table 15.

The main limitation of the method for comparing coefficients of variation is that we compare the deviations from the mean price of each commodity. If a clear trend in prices exists then the prices with a higher trend will show more deviations from the mean, irrespective of the level of fluctuations from the trend line. Deviations from trend are also shown in table 15.

Method 2. Here, we solve a second order difference equation in order to evaluate the type of movement of prices, namely whether these are monotonically increasing or decreasing over time. The condition of stability requires the movement to be converging to the equilibrium value over the period under consideration. We have made a case study of only 3 important food commodities: rice, wheat and jowar. The data are taken with months as the unit of time, and the source of data used was the *Bulletin on Food Statistics* referred to earlier.

The basic approach followed is similar to Professor Tinbergen's model in dealing with business cycles (21).

The model is defined as below:

$$Y_t + a\,Y_{t-1} + b\,Y_{t-2} = A$$

Y_t = price of commodity in the current month;
Y_{t-1} = price of commodity in the preceding month;
Y_{t-2} = price of commodity in the second month preceding; and
A = constant.

And general solution to (1) is

Table 15. **Estimates of coefficient of variation of and deviation from trend of price indexes of various commodities**

India: 1952-53 to 1963-64

Commodity	Mean price index	Standard deviation	Coefficient of variation	Deviations from trend	Deviations from trend as a proportion of total variation
Pulses	89.9	16.6	0.18	1239	0.89
Metal products	[illegible]4.4	22.6	0.17	2098	0.69
Oilseeds	126.7	21.2	0.17	805	0.58
Intermediate manufactures	115.5	17.1	0.15	583	0.45
Fibres	118.7	16.1	0.14	960	0.34
Fruits and vegetables	117.5	15.3	0.13	278	0.19
Milk and ghee	107.5	12.1	0.11	262	0.16
Cereals	99.2	11.2	0.11	324	0.13
Minerals	96.5	10.6	0.11	582	0.12
Chemicals	102.7	10.9	0.11	380	0.12
Textiles	111.5	11.4	0.10	629	0.11

Source: Computed from data in table 1.

$$Y_x = \frac{A}{1 + a + b} + (A_1 + A_2^x) \left(-\frac{a}{2}\right)^x$$

if (a) is less than zero, we get steady variation;

if (a) is greater than zero, we get seasonal fluctuations;

if (a) is (numerically) greater than 2, explosive moments; and

if (a) is (numerically) less than 2, damped to zero.

Results: Multiple correlation equations of the type,

$$Y_x = c_1 Y_{x-1} + c_2 Y_{x-2} + C,$$

therefore, were worked out. The results are as follows (standard errors in brackets):

Rice:

$$Y_x = 11.7 + \underset{(.089)}{(1.3)} Y_{x-1} - \underset{(.087)}{(.4)} Y_{x-2}$$

Both the coefficients are significant; further, the multiple correlation coefficient = 0.95.

Wheat:

$$Y_x = 11.7 + \underset{(.094)}{(1.4)} Y_{x-1} - \underset{(.0934)}{(.5)} Y_{x-2}$$

Again the coefficients are significant, and multiple correlation coefficient = 0.93.

Jowar:

$$Y_x = 15.4 + \underset{(.094)}{(1.3)} y_{x-1} - \underset{(.088)}{(.4)} Y_{x-2}$$

Again the coefficients are significant and the multiple correlation coefficient = 0.93.

To interpret the results, we have to put the regression equations in the form of (1); and then we get,

for rice: $a = -1.3$; $b = 0.4$;

for wheat: $a = -1.4$; $b = 0.5$;

for jowar: $a = -1.3$; $b = 0.4$.

In approximately all cases, (a^2) is almost equal to $(4b)$.

Further, in all, $a < 0$; and numerically < 2.

Therefore, all the movements are steady, not seasonal, and damped towards zero; thus the equilibrium is stable. For an accurate illustration, let us consider rice prices.

Here, $a^2 = 1.7$

and $4b = 1.6$.

Then we get $K^2 + aK + b = 0$,

or $K_1, K_2 = \dfrac{1.3 \pm \sqrt{1.7 - 1.6}}{2}$

$$= \frac{1.3 \pm 0.32}{2}$$

$$= 0.81, \ (0.51).$$

Both the roots are less than 1; which again meets the stability conditions. The conclusions seem to be as follows:

(1) The short-term fluctuations are not just seasonal, most likely because of stocking effects.

(2) All movements are damped towards zero, which means the equilibrium is stable.

Method 3: We have already calculated the price flexibility coefficients. Adding the inverse of the price flexibility to the income-elasticity coefficient gives the estimates of the cross elasticity (8). The inverse of the price-flexibility coefficient gives the minimum value of price elasticity and the residual is an estimate of the maximum value of cross elasticity. The figures are given in table 16.

Being positive, the cross elasticities show that the different goods are substitutable and not complete complements. Substitutability is the major condition for stability.

Conclusions

All the methods show that the movements of prices have been stable in the context of Indian economy. Thus, any inflationary pressures built in the economy so far are unlikely to lead to hyperinflation.[7] Thus policy tools, like the monetary policy, have remained within reasonable bounds so that no expansionary or explosive movement in prices is noticeable. The growth of production in various commodities, except industrial raw-material crops, has been at a higher rate than that of corresponding prices. Another confirming result is examined in the next chapter, where the movements of prices and wages are shown to be similar.

Table 16. **Estimates of demand cross elasticity for different crops**

India: 1952-53 to 1963-64

Commodity	Income elasticity	Minimum price elasticity	Maximum cross elasticity
Food grains	0.50	−0.55	+0.05
Raw-material crops	1.00	−3.00	+2.00

[7] A situation where inflationary prices reach such a level that the public's faith in the value of the currency is undermined.

Food grains in particular have shown a significantly higher level of fluctuations as compared with other commodities such as fibres and oilseeds. Industrial commodities in general have been more stable. The main conclusion appears to be that, though the terms of trade have moved in favor of the agricultural sector, the gains to that sector through favorable prices may have been partly offset by the nature of fluctuations in agricultural prices.

Chapter VI.

Causes of Changes in Industrial Prices

To provide a background for analyzing the causes of industrial price changes, facts and figures about Indian industry are given. The basic source of data is provided in a study by Palekar, from the period 1939 to 1950. We shall look at his conclusions and review these with reference to the data from 1950 to 1959. Then a model will be developed and applied to the textile industry.

Palekar's data are presented in table 17 and relate to the period 1939 to 1950. Supplementary data for 1950 to 1959 are presented in table 18. In addition to providing the series for index of money wages, real wages, general wholesale prices, prices of manufactured articles, industrial profits, and labor productivity, 2 series on index of product wages are also shown. Series A relates to the money wage index deflated by the general wholesale price index, and Series B consists of the index of money wages as deflated by the prices of manufactured articles.

The main conclusions drawn by Palekar are as follows:

- There is a close association between the money wages and the wholesale prices.
- There is an even closer relationship between money wages and the cost-of-living series.
- Wholesale prices are weighted heavily by the set of agricultural commodities, and thus a close relationship between money wages and wholesale prices does not necessarily imply a close relationship between industrial prices and money wages.
- The movement of money wages and product wages are not closely related to the prices of manufactured articles.

His main conclusion is that the increases in prices of industrial goods are not due to increates in money wages and that no type of wage-induced inflation exists. He seems to give more weight to demand-pull factors and points out, "Monetary inflation during the period raised prices and the cost of living and this in turn, under the prevalent system of paying allowance, raised money wages." (17:p. 174)

Table 17. **Index numbers of wages, prices, profits, and productivity (for all industry as a group. Base year: 1939 = 100)**

India: 1939–1950

Year	Index of money wages	Index of real wages	Index of product wages (Series A)	General index of wholesale prices	Index of wholesale prices of manufactured articles	Index of product wages (Series B)	Index of industrial profits	Index of labor productivity
1939	100	100	100	100	100	100	100	100
1940	108	106	106	102	101	107	138	102
1941	113	100	101	112	121	93	187	93
1942	133	92	96	138	147	90	222	83
1943	172	70	87	197	202	85	245	82
1944	196	78	95	207	212	92	239	79
1945	201	80	95	209	201	100	234	80
1946	218	82	96	228	206	106	220	84
1947	269	91	106	254	229	117	192	77
1948	322	96	102	315	282	114	260	82
1949	352	102	108	326	214	124	182	82
1950	352	100	103	343	288	122	247	79

Source: Shreekant A. Palekar. Real wages and profits in India. *Indian Economic Review* 3(4):36. Aug. 1957. Product wages Series A calculated by deflating money wage index by general wholesale price index, while in Series B it is deflated by prices of manufactured articles.

Though one can agree with this conclusion, 4 major considerations need to be discussed to fully comprehend the implications of Palekar's study. They are as follows:

(A) Most Indian industry uses agricultural commodities as the principal raw material. Changes in the prices of these materials almost certainly affect the prices of the industrial goods for which they are used.

(B) Monetary policy undoubtedly influences industrial prices, however, an increased demand for industrial goods is limited by the elastic supply conditions in an industry. On the other hand, a monetary policy that has a strong influence on food prices increases wages and thus has more effect on the price of the final good. Hence, the effect of a liberal monetary policy is likely to be more of a cost-push than demand-pull situation in the context of the industrial sector.

(C) Some noted economists, such as D. R. Gadgil (4), have pointed out the possibility that, for the period under consideration, an increase in wages in India was perhaps required to bring wages up to the level of the marginal productivity of labor. Thus, if productivity has been higher than the wages, an increase in wages should not be inflationary.

D) There must be more than one factor that determines the industrial prices and explains the year-to-year variations. It is therefore somewhat inaccurate to try to locate just one factor, such as wages or money supply, and attempt to identify it as the culprit in any inflation of industrial prices.

Therefore let us look more closely at the factors that have not been taken account of fully in the above analysis. The first factor is, as noted earlier, the effect of the prices of the industrial raw material crops on the prices of the industrial goods. The second factor consists of establishing a clear relation-

Table 18. **Estimates of prices of food, money wages, and profits**

India: 1950–1959

Years	Prices of food articles (index)	Money wages Rs./worker (index)	Profits before tax (index)	Profits after tax (index)
1950	—	—	100	100
1951	—	—	129	132
1952	100	1,112 (100)	99	79
1953	107	1,111 (100)	110	98
1954	98	1,111 (100)	125	115
1955	85	1,175 (103)	151	150
1956	99	1,208 (109)	165	158
1957	107	1,234 (111)	152	116
1958	112	1,295 (116)	169	114
1959	120	1,333 (120)	—	—

Source: Cent. Stat. Organ. *Statistical Abstract, 1961*, pp. 178, 222, 575. Govt. of India. New Delhi. 1961.

ship between the movement of prices of food grains and wages over the period under consideration. Lastly, to bring out the relevance of profits, those after, rather than before, tax should be examined to determine an indicator of funds available for further capital formation.

The approach used here involves estimating 4 equations separately and then resolving the effect of the required variables. The equations are as follows:

Let P_t = index of price of textiles,
P_c = index of price of fibres,
P_F = index of price of food grains,
W = money wage rate in Rs.,
V = money profits in Rs.,
M = money supply in Rs.,
ED = excess of demand over supply,
I refers to textile industry,
C refers to cotton, and
F refers to food grains.

Then,

$$P_t = f(P_{c,t}, W_{t-1}) \quad — (1)$$
$$P_c = f(ED_c, M) \quad — (2)$$
$$P_F = f(ED_F, M) \quad — (3)$$
$$W = f(V, P_F) \quad — (4)$$

Equations (2) and (3) have already been estimated. The effect of price of raw-material crops can be found from equation (1). The effect of price of food grains can be found from equations (4) and (1). The effect of money supply can be estimated from (1), (2), (3), and (4) solved together.

Case study of textile prices

In this part of the chapter, we shall carry out an analysis for textiles on the lines of the methodology developed above. The main reason for choosing this particular industry consists of the consideration that it accounts for the largest weight in the price index of industrial commodities. (See table 2 in Chapter II). Secondly, textiles use fibres as a major raw material, which makes it possible to establish a direct relationship between the price of an industrial raw material crop and that of an industrial good. Thirdly, the final product of the industry, textile clothing, constitutes a direct consumer good that is used by large masses of people (see table 19).

The basic data on the variables are presented in table 20. The various relationships, as discussed in an earlier section were estimated as follows:

$$P_{t,t} = 20.92 + 0.44.P_{c,t} + 0.03.W_{t-1}$$
where R = 0.97.

$$W_t = 482.5 + 6.60.\ P_{F,t} + 0.97.\ V_{t-1} \quad — (2)$$
where R = 0.85

$$P_{c,t} = 79.78 + 0.0044.\ ED_c + 2.44.\ M_t \qquad \text{where } R = 0.90 \qquad — (3)^*$$

$$P_{F,t} = 33.14 + 2.81.\ ED_F + 2.06.M_t \qquad \text{where } R = 0.91 \qquad — (4)^\dagger$$

* From Chapter IV with t-1 and t-2 pooled.
† From Chapter III with t-1 and t-2 pooled.

Table 19. **Importance of textile industry in the industrial sector**

India: 1958

Industry	Value added by manufacturer	Wages and salaries	Weight in wholesale price index
	mil. rs.	mil. rs.	
Textile industry	1,353	1,047	147
All industries	4,635	2,516	225
Next highest industry (sugar industry)	36[1]	124	—

Source: Cent. Stat. Organ. *Statistical Abstract.* Govt. of India, New Delhi. 1961.

Table 20. **Estimates of wages, prices, and profits for textile industry**

India: 1951 to 1963

Year	Index of food-grain prices	Labor wages	Index of cotton prices	Index of cotton textile prices	Index of profits	Money supply
		rupees				bil. Rs.
1951	99	1,044	107	—	145	18
1952	100	1,222	100	100	72	18
1953	97	1,116	102	100	91	18
1954	76	1,090	108	104	93	19
1955	73	1,191	106	102	145	22
1956	93	1,244	116	108	143	23
1957	97	1,243	118	107	72	24
1958	106	1,305	108	103	81	25
1959	102	1,337	115	108	155	27
1960	102	1,403	152	126	271	29
1961	100	1,492	138	126	310	30
1962	106	1,574	129	126	238	33
1963	116	—	133	128	—	37

Sources: (1) Cent. Stat. Organ. *Statistical Abstract*, various years. Govt. of India, New Delhi.
(2) Min. of Labor. *Indian Labor Year Book*, various years. Govt. of India, New Delhi.
(3) Reserve Bank of India. *Monthly Bulletin*, various years. Bombay.

Estimates of coefficients of regression

The effect of price of fibres is given directly from the first estimated equation as 0.44.

To find the coefficient for the price of food grains on the price of the textiles, we have to substitute the value of wages (W) from equation (2) in equation (1). Thus the coefficient is (0.03) × (6.60) = 0.02.

To find out the effect of money supply on the price of textiles, we have to make use of all the above equations. The coefficient is given:

$$(0.44) \quad (2.44) \quad + \quad (0.02) \quad (2.06) = 1.1.$$

Estimates of coefficients of elasticity:

i) for price of fibre: $\frac{44 \times 130}{100 \times 115} = 0.5$

ii) for price of food grains: $= \frac{2}{100} \times \frac{100}{115} = 0.13$

iii) for money supply: $= \frac{110}{100} \times \frac{25}{115} = 0.24$

Thus the results are as follows.

a) 1% increase in price of fibre increases the price of textiles by 0.5%
b) 1% increase in price of food grains will increase the price of textiles by 0.13%
c) 1% increase in money supply will increase the price of textiles by 0.24%

Conclusions

The basic premise in Lewis's theory of development relates to the possibility of holding real wages constant in the industrial sector while the industrial output is expanding. The availability of an unlimited labor supply in the labor market was considered a sufficient condition for that situation.

The real wages of industrial labor, defined as money wages deflated by food prices, have remained more or less constant in India. We have shown, in fact, that prices of food grains are the main determinants of money wages (see equation 2). In an earlier chapter, we saw that the trend in industrial prices is somewhat higher than in food grain prices and, therefore, the real wages (defined now as money wages deflated by industrial prices) have slightly decreased. The implication of using this concept of real wages is that the real profits to the industry, therefore, have somewhat increased. We also showed that while real profits before taxes have increased a little, the government has been taking away more of these profits with higher taxes (table 18). Thus, the original theory of development, which was seen as growing on the industrial surpluses that would generate over time, seems to

depend upon the final question of how the government invests (or spends) the additional revenue.

Now, if real wages have not increased, there must be some other reason why real profits do not rise correspondingly in a year when industrial output has increased significantly. The main reason is that most of industry is dependent on raw material crops, which are in short supply. Thus, as shown in an earlier chapter, the prices of industrial raw material crops are rising more rapidly than those for industrial goods. A major deterent to increased real profits (before tax) therefore, is the rising cost of raw materials.

These phenomena are also confirmed by our case study of the textile industry in India, for which the main conclusions are:

a) That expansion of the money supply moves the relative prices of industrial and agricultural goods in favor of agriculture (elasticity for industry = 0.24, elasticity for agriculture = 0.5);

b) That food-grain prices have a strong influence on money wages, but wages in turn have a weak role in determining industrial prices. Thus the effect of prices of food grains on industrial prices is of little significance (elasticity = 0.13);

c) That the industrial raw-material crops are most important in explaining the variation in industrial prices (elasticity = 0.50).

Chapter VII.

Conclusions

The conclusions presented in the previous chapters are summarized here. They are grouped by their relevance to the 2 main issues of the study, namely, the causes of changes in food-grain prices, and an analysis of domestic terms of trade. A brief summary of the implications of the empirical analysis to the theory of development is also presented.

Causes of changes in food-grain prices

The first conclusion deals with the fact that agricultural income in India has not significantly decreased in relation to national income during the period under study. The urban income thus continues to remain a small portion of total income, and the changes in urban demand continue to carry a smaller weight in the aggregate real demand for food grains. The changes in total demand, in other words, are largely dependent on the changes of farmers' income and hence closely related to production of food grains. The effect of real factors in demand for and supply of food grains is that they cause fluctuations in food grain prices rather than follow any trend type of movement. *The analysis shows that the real factor was the major cause of changes in prices till about 1958–59, while after that period the increases in*

rioney supply became more important. Only after 1958-59 did the Indian economy experience a trend type of increase in food grain prices. One may conclude that the inflationary tendencies in prices of food grains in India have been mainly due to increases in money supply.

The second conclusion relates to the possible behavior of the farmers in the matter of stocking food grains. It is derived from the interpretation of the price equation used in the analysis of the prices of food grains The real factor was introduced in the relationship with lags in order to evaluate the effect of previous years. The estimated relationship showed that the coefficient of the second lagged term was higher than the coefficient of the first one. The implication appears to be that the changes in private stocks have more influence on current price than the current production. One possible interpretation of this behavior could be that farmers who produce grains stock a large part of their produce to establish a margin for consumption next year because next year's rain is always an uncertainty It may be noted that the price equation for industrial raw material crops did not show a higher coefficient for the second lagged term and that this result is consistent with the fact that raw material crops are not directly consumable.

The last important conclusion relates to the efficacy of the government food policy on food prices Only the direct policies have been considered; these consist of import policy, credit policy, state trading, and direct price controls. Imports were found to mainly reduce the large up and down movement in grain prices and did not significantly affect the trend. An increase of 1 percent in imports was estimated as decreasing food prices by 0.13 percent. The impact of credit controls and state trading was found significant only in some specific instances The effects of direct price controls were not ascertained, since these controls became effective only after the period of study.

Change and causes of change in domestic terms of trade

First, the terms of trade between food grains and industrial raw-material crops within the agricultural sector are examined. The regression estimates showed the coefficient of trend for oilseeds at 5 5 and fibres at 3.6 as against a 2.2 coefficient for prices of food grains. A reasonable conclusion, therefore, from the above coefficients is that terms of trade within agriculture moved in favor of industrial raw-material crops and against food grains.

The effect of a 1 percent change in money supply has been found of the order 0.5 percent for prices of both food and industrial raw-material crops. It is unlikely, therefore, that monetary factors cause the movement of terms of trade in favor of industrial raw-material crops We have also seen that, by and large, the level of net imports or exports for agricultural commodities has not shown a significant trend for the period under study. Thus, again, it is unlikely that trade factors have been important in explaining the movement of terms of trade within the agricultural sector. Regarding the real factors, the rate of growth of production for both food and nonfood crops has been similar. On the real demand side, however, the income elasticity of

demand for food grains is about half of that for industrial raw-material crops. The conclusion appears to be, therefore, that the terms of trade have moved against food grains within the agricultural sector because of the low income elasticity of real demand for food grains as compared with industrial raw-material crops.

The movement of food grain prices in relation to industrial prices in the context of the Indian economy for the period studied, is considered next. The coefficient for metal products was 5.9, for intermediate manufactures about 4.4, and for textiles, 2.8 as compared with an estimated 2.2 for food grains. These coefficients indicate that price movements have been slightly against food grains. Also, a nonparametric test between the ratio of these prices was devised and the results were that for the period 1952–53 to 1962–63 the movement of food-grain prices was slightly less than that of industry, while for the period 1952–53 to 1964–65, the two were similar. Generally, food-grain and industrial prices have a similar trend, with a slight disadvantage for food grains

It is not possible to accurately guess the reason for this price behavior, since the factors that explain the variation between food-grain and industrial prices are not strictly comparable. We did determine that money supply favorably affects agriculture, in terms of trade. Thus, increased money supply could be one force to push industrial prices comparatively lower than agricultural prices. We also found that in the early stages, major industrial development takes place in those industries that use cotton, oilseeds, and other internally available agricultural crops as the main raw material.

Thus textile prices, for example, are linked to the price of cotton — the chief raw material. The force, therefore, that raises the price of industrial goods in comparison to food grains is the price of industrial, raw-material crops, since the prices of the latter show a steeper trend than those of food grains. Since the trend in wages and prices of food grains are similar, this factor is neutral. Thus, money supply can push down the relative price of industrial goods, while raw material costs can push it comparably higher than food-grain prices. We have earlier concluded that the reason for a higher trend for raw material crops is the high real demand factor. Hence, a reasonable assumption is that the terms of trade between food grains and industry remain somewhat constant, because the real demand factors push the relative price of industrial goods up, while the money factors pull it down, and the net balance effect is a stationary condition in the relative prices. (Note that we base this conclusion on the fact that supply conditions in the agricultural and industrial sectors are dissimilar).

From these discussions, it follows that between food grains and all other commodities combined (industrial goods as well as agricultural raw materials) terms of trade have gone against food grains, since the industrial raw-material crops, when added to the industrial group, push the prices much higher. Also, since food and industry have similar trends, although industrial raw-material crops have a higher one, the terms of trade between

agriculture as a whole and industry must have moved in favor of agriculture. These 2 results are also confirmed by the non-parametric tests applied on these ratios of prices.

Implications to the theory of development

Domestic terms of trade play a significant role in the theory of development by providing a measure for shifting income from one sector to another. The theory suggests using the surplus labor in the more efficient industrial sector of the economy, in order to maximize both labor use and rate of capital formation (11), (12). Surplus labor could be used to keep wages constant in industry, with additional gains accruing to the more efficient capitalist class. One crucial precondition for such a model of growth consists of not allowing prices of food grains to rise at a faster rate than industrial prices, to meet the objective of keeping real labor costs (per labor unit) constant. The question thus arises whether the relative price of food grains would increase as a consequence of normal development forces which might be prevalent in the early stages of development.

Briefly, our empirical analysis shows the following implications in relation to that statement.

1) A constant (and high) proportion of agricultural income to national income implies a large part of demand for food as being generated within the food-producing sector, which in turn results in stable food prices (13). If, on the other hand, the urban incomes increase their percentage share in national income to a significant extent, the real factors are likely to push the food prices up.

2) With a heavily agriculture-oriented economy and a low proportion of money supply to national income, the effect of monetary factors on absolute or relative prices is likely to be insignificant If, however, in an agricultural economy with a high (or increasing) proportion of money supply to national income, the effect on both absolute and relative prices will be appreciable. The effect on relative prices would be in favor of food prices, if the increase in money supply is caused by rising developmental expenditures which distributes a higher proportion of the increase in money supply to low-income classes.

3) In line with Lewis's theory, the real cost of labor to industry was not found increasing, however, the government sector was taxing away the possible "surplus" profits. The main bottleneck to industrialization was found to be an ever increasing cost of industrial raw-material crops rather than rising food prices.

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