INDUSTRIAL PRICING AND INFLATION

THE CASE OF INDIA 1960 TO 1988

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I hereby affirm that the research for this dissertation titled, "Industrial Pricing and Inflation: The Case of India 1960 to 1988" being submitted to the Jawaharlal Nehru University for the award of the Degree of Master of Philosophy, was carried out entirely by me at the Centre for Development Studies, Trivandrum.

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Certified that this dissertation is the bonafide work of Suresh Babu.M. This has not been considered for the award of any other degree by any other university.

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Chapter I

OVERVIEW

I.1 Project

The aim of this dissertation is to analyse the role of the industrial sector in inflationary process in the Indian economy. From the expression for price in non-competitive situations,

$$P = (w.\alpha + m.ß)\ (1 + \tau)$$

where, P = product price

w = wage rate

m = material cost

α = labour requirement per unit of output

ß = materials requirement per unit of output

τ = mark-up.

It can be noted that variations in price can occur due to variations in costs or variations in the mark-up or variations in both. Since, for the manufacturing sector taken as a whole, components of costs originate from outside the manufacturing sector, firms in this sector can play an independent role in the inflationary process only by varying the mark-up. Thus, the role of industrial sector in the inflationary process can be effectively analysed by studying the behaviour of mark-up.

Variations in mark-up can either be autonomous or induced by variations in demand. Autonomous variations could occur due to a variety of factors, of which investment decisions of the firms is the most important. In a predominantly agrarian economy, the possibility of induced vartaions in mark-up cannot be ruled out,

especially in the case of a negative agricultural supply shock. Such an event may lead to industrial inflation due to an increase in costs as well as through variations in demand (as demand for industrial goods come down), affecting the mark-up, especially in the case of mark-up behaving counter cyclically. Thus, an analysis of the relationship between demand fluctuations and mark-up becomes crucial to understand the role of industrial sector in the inflationary process. This study is set out to analyse the nature of price/cost/activity relations over the cycle in Indian industry and thereby, single out the role of industrial sector in the inflationary process.

The theoretical discussion begins by disaggregating the productive sectors of the economy into agricultural and industrial sectors which differ in their mechanisms of price formation arising out of different market conditions. Agricultural markets are flex-price markets in the Hicksian sense or `auction markets' in Okun's terminology, whereas markets for industrial goods are fix price or `customer' markets. Industry is oligopolistic in nature with price being fixed by producers and adjust via quantities, while agricultural supply is more or less inelastic. Industrial prices are cost determined unlike market determined prices of agricultural goods. Entire empirical analysis is undertaken within this framework.

The importance and relevance of the present study stems from three main reasons. First, even though inflation, specifically industrial inflation, has been examined by many studies, it has usually been part of a large macro-econometric model of the entire

economy. No study has attempted to single out the role of the industrial sector in the inflationary process explicitly. Second, most of these studies were conducted in a quasi closed economy framework. With the opening up of the economy accompanied by internal liberalisation in the 80's, the relevance of these studies is limited to a great extent. Third, different studies have reported different (contradicting) behaviour of the mark-up over the cycle. While some studies reveal pro-cyclical mark-up, others have shown counter-cyclical mark-up and some others find no change over the cycle. This raises doubts about the data and methodology of some of these studies. This is an attempt to cover the entire Factory Sector of the Annual Survey of Industries (ASI).

A note on the data base. As the study period is from 1960 to 1988, the question of comparability of data has been paid particular attention. This has been done by the preparation of a complete set of Factory Sector data. For the period 1960 to 1970, census and sample sector data are combined to get the Factory Sector data which is available for the period from 1970 onwards. Notable previous studies like Chatterji (1989) and Balakrishnan (1991) are limited to Census Sector data only. In this regard, the present study will be the first of its kind, making use of a complete Factory Sector data covering a period of 29 years.

As ASI data is available only till 1988/89, the study period concludes without incorporating the dynamics of 90's which witnessed the opening up of the Indian economy. Limitations exist regarding the use of concentration and capacity utilisation measures, as the study draws from existing studies. The low power

of the tests for unit roots and co-integration should be borne in mind wherever they are used. A more disaggregate analysis, say at the 3-digit level could have made the study more comprehensive. However, the comparability of data and non-availability of appropriate price indices are constraints to such an analysis. Although, the study argues that the behaviour of mark-up is crucial in the inflationary process, it does not venture to rule out the causation between mark-ups and inflation.

I.2 Perspective

The process of economic development has a close bearing upon the price level. Price rise tendencies are inherent characteristics of the growth process. This can be discerned from the evidence that attempts to raise the rates of capital formation and output have generally been accompanied by certain degrees of price increase. It is increasingly being recognised that a process of rapid economic development is likely to provoke inflationary pressure. In many developing economies, mainly Latin American countries, this phenomenon has developed into severe and prolonged inflation.

It is widely viewed that economic growth involving the use of modern technology which results in high per capita real income is inconceivable without the development of modern manufacturing industry. A country that is specialised entirely in primary production and obtain all its industrial goods from abroad could never be a country with high per capita real income. The development of manufacturing industry brings about changes in production structures. These changes can cause prolonged high rates of inflation depending upon the manner and circumstances in

which industrialisation and the associated development processes proceed. Attempts to interpret this inflationary process produced a proliferation of theories of inflation[1].

I.2.1 Inflation theory: The Structuralist alternative

The orthodox excess demand theory fails to explain situations of inflationary recession and its persistence even in the face of excess capacity and high unemployment. This inability to explain the mechanics of how inflation begins and how it proceeds once begun has led to a departure from the orthodox inflation theories.

It is in this context that the Structuralist alternative becomes relevant. "Structuralism is to be interpreted as an approach to studying economic development embodying a perspective and an analysis rather than a set of universally applicable doctrines"[2]. Structuralist methodology is well documented in Taylor (1991). According to this, money supply is often endogenous or 'passive', adjusting to the level of activity and the rate of inflation. The growth of money supply can be curtailed to slow down the inflation rate. But what is more common is that a tight money policy would result in a fall in production and not in the price level, aggravating the problem of inflation rather than solving it.

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[1] The traditional theories and empirical evidences of inflation have been extensively surveyed by Johnson (1963) and Bronfenbrenner and Holzman (1968). The modern theories have been surveyed by Laidler and Parkin (1975), Frisch (1981) and Kirkpatrick and Nixon (1987).

[2] Quoted from Balakrishnan, 1991: 4.

The `Structuralist' school is of the view that a rapid economic development based on industrialisation might lead to structural bottlenecks due to unbalanced growth of different sectors in the economy which could lead to inflation. This is mainly based on the experience of Latin America (conceived in the fifties and sixties). Structuralists trace the long run inflationary tendency to the interaction of 4 factors which are partly technological and partly behaviourial. These factors are:

(a) Differences in productivity in the industrial and service sectors;

(b) A uniform rate of growth of money wages in both sectors;

(c) Different price and income elasticities for the output of industrial and service sectors; and,

(d) Limited flexibility of prices and wages, that is, wages and prices are rigid in a downward direction.

According to Cardoso (1981), structuralist models contend that an expansion of industrial employment generates excess demand for food, the price of which therefore rises. Industrial prices might not fall to offset the increase in the price of food because they are set by entrepreneurs who operate under imperfect competition and at idle capacity. This leads to a rise in the general price level.

The existence of inflation according to the demand pull theory implies `aggregate' excess demand in the economy. It assumes that wages and prices are responsive to demand conditions. If this holds good, then an excess demand in some sectors of the economy balanced by excess supply in other sectors will only lead to a realignment of relative prices. Only aggregate excess demand will push up the price level and not excess demand in certain sectors.

However, the structuralist model argues that excess demand in certain sectors of the economy can cause inflation. The reasoning runs as follows. Suppose, in an economy, excess demand in agricultural goods market is matched by excess supply in the industrial goods market, there will be no aggregate excess demand in the economy. In this situation the relative prices will shift in favour of agriculture. The entire burden of adjustment will be on agricultural prices if the wage costs and profit margins in the industrial sector are not responsive to demand. Thus, the relative price rises only through an increase in the absolute or the money price of agricultural goods. This will lead to a rise in labour costs because workers will bargain for higher money wages to compensate the rise in food prices. This increase in labour costs coupled with the increase in material input cost will raise the industrial costs. As industrial prices are cost determined, the rise in the prices of agricultural commodities is passed through various stages of production into the final prices with an exaggerated effect as noted by Kaldor (1976). Thus, the general price level rises. A rise in the prices of agricultural goods, especially food grains, may well result in a wage/price spiral type of inflation in the industrial sector. It follows therefore, that both the industrial and primary sectors an be potential sources of inflation. Hence, an analysis of the role of industrial sector in the inflationary process becomes imperative in understanding the dynamics of general price formation.

I.2.2 Industrial pricing - some theoretical issues

A departure from the Marshallian demand-supply equation framework for analysing prices can be seen in Hicks (1965). Hicks discusses

a 'new method' of determining prices, that is, exogenously determined prices. The determination of prices is taken outside the model. The Marshallian temporary equilibrium method has been referred to as flex-price method and the new model as the fix-price model as prices are fixed exogenously (which permits them to be constant). It should be noted that prices do change in the fix-price method, though, not necessarily whenever there is a demand supply imbalance as in the case of industrial products where changes in costs lead to changes in prices.

Empirical evidence shows that the pricing of industrial goods is cost oriented. Blanchard and Fisher (1989) argue that prices of produced goods are set as fixed mark-ups over unit labour cost with demand shifts having little effect on the mark-up. Further, in this connection, Kaldor observes: "in the field of primary production the market price is given to the individual producer or consumer and prices move in direct response to market pressures in the classical manner described by Adam Smith. Changes in prices act as 'signals' for adjustment. In the modern industrial society where greater part of production is concentrated in the hands of large corporations - prices are 'administered', i.e., fixed by producers themselves and the adjustment of production to changes in demand takes place independently of price changes through a stock adjustment mechanism: production is reduced in response to accumulation of unsold goods and raised in face of a depletion. Industrial prices are not 'market clearing'"[3].

[3] Kaldor, 1976: 705.

Econometric exercises also reveal that demand influences price outside auction markets to a limited extent. The inclusion of measures of demand pressure such as the degree of capacity utilisation and capital-output ratio in the price equation has not yielded significant results. Although these equations have been questioned regarding the sensitivity of their results to simultaneity, no evidence is found in favour of the effects of demand shifts on non-auction market prices (Blanchard and Fisher, 1989; Nishimura, 1992).

The failure of demand shifts having impact on the prices in non-auction markets has been well argued by Okun. To quote Okun, "The picture that emerges is that non-auction markets are mainly a transmission belt in the inflationary process. They are not a source of inflation. They do not magnify it nor do they damp it down. Rise in wages and increases in input prices that stem from the auction markets and imports are reflected in prices rather fully or more or less promptly depending on the precise nature of cost standards applied in pricing"[4]. However, it should be noted that industrial sector acts as a transmission belt in the inflationary process only when the mark-up is constant over the cycle. Hence, in case of pro-cyclical or counter-cyclical mark-up, the industrial sector could become a source of inflation.

Coming back to the question of price determination in industry, theories of price determination are closely linked to theories of firm behaviour and market structure. Malcom Sawyer (1982) makes a

[4] Okun, 1981: 166.

basic distinction amongst theories of firm behaviour, namely, theories in which firms are essentially price takers and those theories in which firms are price makers. The first set of theories consists mainly of the theories of perfect competition. The second set of theories includes theories of monopoly and oligopoly.

The distinction between prices determined in competitive markets and those determined in oligopolistic ones is similar to the distinction which Kalecki (1971) made between 'demand determined' and 'cost determined' prices. To quote Kalecki, "short term price changes may be classified into two broad groups: those determined mainly by changes in the cost of production and those determined mainly by changes in demand. Generally speaking, changes in prices of raw materials inclusive of primary food stuffs are 'demand-determined', while changes in the prices of finished goods are `cost determined'. The prices of finished goods are affected of course by `demand determined' changes in the prices of raw materials but it is through the channel of costs that this influence is transmitted. It is clear that these two types of price formation arise out of different conditions of supply"[5].

However, the phenomenon of cost based prices is inconsistent with perfect competition except in the trivial case of a flat supply curve (Nishimura, 1992). As the prices are determined at the intersection of demand and supply curves under perfect competition,

[5] Kalecki, 1971: 43.

a shift in demand as well as the supply curve affects prices unlike under cost-oriented pricing.

The generally accepted theory of firms were based on the models of imperfect or monopolistic competition put forward by Robinson (1933) and Chamberlain (1933)[6]. In these models, firms were assumed to be atomistic and pursuing a short run profit maximising strategy which implies the equalisation of marginal revenue with marginal cost. This view of marginal cost pricing was challenged by Hall and Hitch (1939).

On the basis of an empirical survey of pricing rules adopted by firms, Hall and Hitch argued that firms do not attempt to maximise profits. Their survey revealed that firms use the `full cost', that is, average direct costs, average overhead costs and a margin for profit, in their pricing policy. They argue that a price change comes about as a result of a general change in costs. As they observed a stickiness of prices, they ruled out the effect of changes in demand on the changes in price[7]. Their findings suggested widespread prevalence of oligopoly. The findings of Hall and Hitch implied that in actual practice, firms use a cost-plus pricing principle where price is based on a percentage margin over average costs which has a tendency to remain stable.

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[6] While Robinson's concern was monopoly and the 'large-group' and dealt little with non-price competition and the 'small group', Chamberlain's concern was something like the middle ground between pure competition and monopoly characterised by product differentiations.

[7] Hall and Hitch had explained this with the concept of a kinked demand-curve, which was later on developed by Sweezy (Sweezy, 1939).

The theory of oligopoly was also being developed simultaneously. As the competition is among a few, the problems of interdependence is inevitable. As a move by one firm provokes other firms to react and that this reaction is quite unpredictable, it is often said that to understand oligopoly one needs to understand the rules of war (Rothschild, 1947). Often, oligopoly is approached via the theory of duopoly models. These models assume standard reactions by competitors. Cournot developed a model in which it was assumed that each firm would set its own output with the belief that other firms' output will not change. Bertrand on the other hand, was of the view that a firm would set its price rather than output with the belief that other firms' price would remain unchanged. Stackleberg developed a model of leadership in which the follower behaved as in the Cournot model[8]. This makes the analysis of price determination in the oligolopolstic markets all the more complicated.

In the 'limit pricing' theory, firms are seen as being concerned with the long-run rather than the short-term, and view the prevention of entry into the industry as serving their long-term interest best. In the theory of limit pricing, Modigliani (1958), Bain (1956), Sylos-labini (1962) and Spence (1977) focus on the conditions of entry into an industry as the key determinant of the mark-up of price over costs. While Modigialni argues for economies of scale as the major barrier, Bain discusses absolute cost advantage, product differentiation and economies of scale as

[8] Shapiro (1989) an extensive exposition of the theories of oligopoly behaviour.

important entry barriers. Spence stresses the rate of excess capacity in determining entry.

A common thread that knits all these theories on oligopolistic markets is the responsiveness of one firm to the other firms' move. It implies that the firm, while pricing, takes into account the price of other firms. This has been well brought out in the Kaleckian framework. Kalecki assumes that supply is elastic in the short run and that due to uncertainty, firms do not attempt to maximise profits in any precise sort of manner. In fixing the price, the firm takes into account its average prime cost and the price of other firms producing similar products. He argues that firms must make sure that price is not too high in relation to that of other firms as it would reduce sales and not too low as well, since that would reduce the profit margin.

Kalecki uses this framework of firms' behaviour in price-fixing to analyse the price formation at the industry level. To quote Kalecki, "Each firm in an industry arrives at the price of product by 'marking up' its average direct cost in order to cover overheads and achieve profits. But this mark-up is dependent on competition, i.e., on (the) relation of the ensuing price to the weighted average price of this product for the industry as a whole"[9]. Thus, it can be seen that for Kalecki, the average (prime) cost is the basis on which pricing decisions are made.

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[9] Kalecki, 1971: 160.

The essence of Kalecki's view on pricing is that the price-cost relation depends upon the competitiveness in industry , that is the degree of monopoly. Althogh, pricing is dependent on the degree of monopoly in Kalecki's analysis, it remains a vague concept. Hence, Kriesler argues that price determination in Kalecki's analysis starts from a weak foundation because the concept of industry is not developed satisfactorily and looses its generality as it is limited to differentiated oligopoly (Kriesler, 1987). However, Kalecki's work on pricing did have a strong influence on subsequent developments on price analysis[10].

There exist substantial empirical studies about the behaviour of industrial prices which is too large to summarise adequately here[11]. All these studies necessarily pertain to the developed western countries. A review of these studies both at micro-level studies and at macro level using industry-wide data points to cost-oriented pricing. The works of Balkin (1956), Godley (1959), Neild (1963), Solow (1969), Coutts, Godley and Nordhaus (1978), Sylos-labini (1979) and Okun (1981) too arrive at a similar conclusion.

I.2.3 Business fluctuations and mark-ups

Traditional economic theory postulates that a firm, when prices are given, sets its level of production to maximise profits within constraints imposed by the demand for its product, the available production technology and the price of factors of production. An

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[10] Sweezy (1939), Steindl (1945), Sylos-labini (1962), Robinson (1950) and Cowling (1985).

[11] A survey of literature on the behaviour of industrial prices is provided by Nordhaus (1972).

oligopolistic firm attempts to attain a target rate of profit by adjusting both its price and the level of output, rather than try to maximise profits by adapting its level of output to a variety of parameters.

An important decision to be taken by an oligopolistic firm is the percentage of mark-up to be added to labour and material costs. However, the determination of this percentage becomes difficult due to three main reasons: firstly, costs, especially average variable costs, change with the level of output making it difficult to know in advance what those costs will be; secondly, the sales volume depends on the behaviour of the rival firms within the same industry; and thirdly, sales volume also depend on the level of industrial and aggregate demand (Skinner, 1970).

Larger mark-up would reduce sales whereas smaller mark-up, though would stimulate demand, would reduce total profits. Hence, while fixing the mark-up rate, a firm has to have information on the factors that affect demand for the product. Strength of the industry demand which is determined by the purchasing power of the buyer is one of the most important factors. The purchasing power will be large in an expansionary phase of business fluctuation and small in the recessionary phase. The strength of industry demand depends also on the market structure such as concentration, entry barriers, extent of imports and product differentiation.

Responses of prices and margins to demand fluctuations have occupied a focal spot in the search for micro-foundations of Macro

Economics[12]. This has lead to the controversy over variability of the mark-up which has been primarily empirical in nature and hence, the debatable point has been the demand sensitivity of mark-up. The advocates of cyclical mark-ups differ in their stance regarding cyclical fluctuations of mark-up. One argument relies on the elasticity of demand to explain the behaviour of mark-up by taking into account both cost and demand determinants. Other set of arguments rely on cost-dominated theories which argue that mark-up is constant over the cycle.

Although the question of the determination of mark-up is left unaddressed in the works of Kalecki, he argues that firms do not attempt to maximize profits due to uncertainty. According to him, the price-cost relation is unaffected by short-run variations in demand as the existence of excess capacity and constant marginal costs enable firms to expand output without a change in price. But he is of the view that extreme variations in demand will affect the mark-up as in booms where cut throat competition leads to decline in mark-up and in recession, firms adopt tacit collusion not to reduce prices, to keep their profit margins in tact.

I.2.4 Concentration and mark-ups over the cycle

Concentration in the industrial sector is a major determinant of mark-up. The relationship between concentration and mark-up is well documented in Shapiro (1989). Consider a Cournot oligopolist producing homogeneous product. In the Cournot model, all firms choose their output simultaneously. In other words, the Cournot

[12] See Gordon (1981).

equilibrium is a Nash equilibrium in quantities. Given a set of choices, $[x_i]$ price adjusts to clear the market, that is, $P = P(X)$. The Cournout equilibrium output vector $(x_1 \ldots . x_n)$, is determined by the equations, $\delta\pi_i / \delta x_i = 0$, $i = 1 \ldots . . n$. The i^{th} equation is called firm i's reaction curve.

Consider the problem of a Cournot oligopolist.

$$\text{Max } \pi_i = P\ (X).x_i - C\ (x_i)$$

where P = price of the product

X = industry output, and x_i = firm's output

Now maximising π_i with respect to x_i, firm i's reaction curve is given by the first-order condition $P\ (X) + x_i\ P'(X) = C'_{i\ (x}i)$ which can be rewritten as

$$P(X) - C'_i = x_i\ P(X) \text{ or}$$

$$\frac{P(X) - C'_i}{P(X)} = \frac{S_i}{\varepsilon},\ i = 1 \ldots . \ n \qquad \ldots \ldots \ldots \ (1)$$

where $S_i = x_i / X$ is the i^{th} firm's market share, and $\varepsilon > 0$ is the market elasticity of demand, at X, $\varepsilon = - P(X) / XP(X)$. The above equation (1) is the basic Cournout oligopoly pricing formula.

In the case where all firms have identical cost function, (1) will become

$$\frac{P - C'}{P} = \frac{1}{n\varepsilon} \qquad \ldots \ldots \ldots (2)$$

where C' is the marginal cost, common to all firms. When $n = 1$, (2) becomes $(P - C') / P = 1 / \varepsilon$, which is generally known as monopoly mark-up formula in the literature.

When the cost functions vary across the firms, the industry-wide average mark-up becomes the average of the firms' mark-up weighted by their market shares, that is,

$$\frac{P - \bar{e}}{P} = \sum_{i=1}^{n} s_i \frac{P - C'_i}{P} \quad \ldots\ldots\ldots (3)$$

Substituting for firm i's mark-up from equation (1)

$$\frac{P - \bar{C}}{P} = \sum_{i=1}^{n} \frac{S_i^2}{\varepsilon} \text{ or} \quad \ldots\ldots\ldots (4)$$

$$\frac{P - \bar{e}}{P} = \frac{H}{\varepsilon} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where $H = \sum_{i=1}^{n} (S_i^2)$ is the Herfindahl index of concentration. From equation (3), it can be seen that the mark-up is directly related to the degree of concentration in the industry and inversely to the elasticity of demand. It implies that when the number of firms is one, the expression for mark-up is the same as that for the monopoly case and when the number of firms tends to infinity the mark-up tends to zero.

Opinions vary with regard to the elasticity of demand. Harrod[13] was of view that the elasticity of demand behave inversely over the trade cycle. Drawing conclusions from this, he was of the opinion that mark-up will be pro cyclical. Contradicting this, Nickell and Kong[14] argue that elasticity of demand rise in the upswing due to the search for new products by unattached customers. Recent evidences by Bils[15] show that prices do not reflect marginal cost variations in US industry and that the mark-up of price over

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[13] Harrod (1936).

[14] See Nickell and Kong (1987).

[15] Bils (1987).

marginal cost is counter cyclical. The explanation given is that elasticity of demand faced by imperfectly competitive firms is pro-cyclical.

Of recent developments regarding the behaviour of mark-up, two studies need special mention, both pointing to counter-cyclical mark-up. Stiglitz[16] using the 'entry limit' pricing framework shows that the price-cost ratio rises relative to the boom as capacity utilisation nears the limit. As excess capacity exists the threat of entry is warded off. Rotemberg and Saloner[17] explore optimal collusive pricing when demand is subject to shocks. According to them, the gain from cheating on a collusive agreement is highest when the market demand is also high, that is, during booms. In other words, firms will have a tendency to undercut prices during booms. They argue that the ratio of actual to monopoly price is lower in booms. This implies a counter-cyclical behaviour of price-cost ratio too. They conclude that it is generally more difficult for firms to collude in booms, resulting in price wars[18].

Counter-cyclical mark-ups point to the fact that recession feeds inflation. Wachtel and Adelsheim (1977) and Cowling (1983) are of the view that firms tend to increase mark-up in a recession.

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[16] See Stiglitz (1984).

[17] See Rotemberg and Saloner (1986).

[18] Haltiwanger and Harrington Jr. (1991) are of a different view. According to them, firms find it more difficult to collude in recessions as the foregone profits from inducing a price war are low. They find a greater tendency for firms to price counter-cyclically during recession than during booms.

Wachtel and Adelsheim also give an account of how recession feeds inflation in a concentrated economy. To quote "firms operating in concentrated industries will increase their price mark-up during recession to the extent they can, in order to recapture revenues lost from declining sales"[19]. The evidence pertain to the US economy.

Contrary to this view, Qualls (1979) showed that the price-cost margin is positively correlated with concentration in the peak year of a business cycles and negatively correlated in the trough years. Domowitz and others (1986) also find results inconsistent with Wachtel and Adelsheim. They found that the positive effect of concentration on price-cost margins increases when the percentage change in industry output increase or the economy-wide unemployment decreases. However, their findings at a diaggregate level agree with the findings of Wachtel and Adelsheim.

I.2.5 Studies in the Indian context

In the Indian context, inflation has been empirically examined in a number of studies. These investigations have followed two approaches basically, namely, monetarist and structuralist[20].

Independent investigation of industrial price behaviour and inflation is hard to find for the seventies and early eighties. Most studies are in line with the then existing large macro-

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[19] Wachtel and Adelsheim, 1977: 7.

[20] An extensive survey of these studies is provided by Bhattacharya and Lodh (1990).

econometric model building. Broadly, these studies followed a mixed monetarist-structuralist framework.

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It should be noted that demand plays a vital role in most of these studies. Marwah (1972) reports procyclical behaviour with industrial prices being determined by food import prices and capacity utilization. Chakrabarti (1977), Bhattacharya (1984), Krishnamurti and Pandit (1984), along the lines of monetarists, include m1 and the role of credit in their exercises[21]. Krishnamurti (1984) depicts a relationship between money supply growth, mark-up factor and inflation. According to him, industrial sector reacts favourably to increase in inflation with mark-up factor increasing with excess demand pressure.

The latter part of 80s witnessed a number of studies on inflation, industrial price behaviour and its relation with demand using mark-up models[22]. Madhur and roy (1986), in a disaggregative analysis, estimate the pricing equations for four types of manufacturing industry over a period 1961-77 and find that excepting the capital goods industry, in all other industries of their sample (consumer goods, intermediate goods and basic goods), capacity utilisation index exerts a direct impact on the mark up.

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[21] Even a recent study by Ray and Kanagasapathy (1992) uses credit as an explanatory variable. The model used in the study is similar to that of Balakrishnan (1991), but uses credit as an additional variable and establish credit as a determinant of industrial inflation with a direct relationship.

[22] Lahiri et. al. (1984) have reviewed some of these earlier studies. They present a model Keynesian in spirits, emphasising the role of demand factors in contrast to the view of supply bottlenecks as the dominant factor for price and output fluctuations. According to them variations in demand leads to variations in prices in the long run.

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In an important study on industrial price behaviour, Chatterji (1989) shows that prices are almost entirely cost determined and demand plays no significant role. In case of individual industries over the period 1947-1977, activity is shown to affect only two, namely, sugar and textiles, out of six chosen industries. The dependence of these industries on agriculture which constrains industrial output is given as an explanation for this. Her study was, however, restricted to the census sector of the Indian industry.

Balakrishnan (1991) analyses industrial inflation indicating the role of demand factors. It is found that the rate of industrial inflation is positively related to changes in labour and raw material costs. Activity has an inverse relation with industrial inflation indicating the presence of a counter cyclical mark up[23]. The study presents the first error correction mechanism (ecm) model of price behavior in the Indian economy.

As discussed above, all these studies report different results necessitating a fresh look at the behaviour of industrial prices.

I.3. Outline of the study:

Empirical excercises begin by examining the behaviour of industrial prices and mark-up at the aggregate industry level. This is further substantiated by a disaggregated analysis. The core of the analysis is given in two chapters. A brief outline of these are given below.

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[23] Some recent studies also report counter-cyclical mark-up, for example, Goyal (1993).

Chapter II: Price, cost, activity relation at the aggregate industry level:

As behaviour of prices and mark-up over the cycle is crucially dependent on the market structure, a brief section is devoted to market structure and concentration and their impact on mark-up in Indian industry.

Econometric exercises begin with a test of the mark-up pricing rule for Indian industry. Estimates reveal 'cost plus' pricing in Indian industry with demand not affecting the price-cost ratio. The technique of co-integration is used here. As a forerunner to the analysis, the underlying theory of technique is also discussed. The results suggest that activity does not affect the price cost ratio.

Chapter III: Price, cost and activity relation at the individual industry level:

Six industries, namely, Textiles, Paper and Paper products, Chemicals, Basic Metals and Alloys, Machinery, and Transport equipment and parts are examined at the disaggregate level. The rationale of having a further scrutiny on these industries is also given. The results substantiate the findings at the aggregate level with activity not affecting the price-cost ratio in any of the six industries chosen.

Chapter IV: The role of the industrial sector in Indian inflation:

The role of the industrial sector in the inflationary process in India and a summary of the entire project brings this dissertation

to a conclusion. The essential conclusion is that prices are set in Indian industry by marking-up costs. Demand appears to have no influence on price setting as well as on the mark-up. With mark-up being constant over the cycle, the industrial sector acts as a 'transmission belt' of price increases originating from outside the industrial sector.

Chapter II

PRICE-COST-ACTIVITY RELATION AT THE AGGREGATE INDUSTRY LEVEL IN INDIA

This chapter analyses the behaviour of the mark-up and the determinants of industrial prices in India. An econometric model of industrial price behaviour is presented in order to analyse the price, cost and activity relation in the Indian industry. The chapter is divided into 4 sections. As a forerunner to the proceeding analysis some basic stylized facts are presented in the first section. The second section discusses the relation between mark-up and concentration in the Indian industry. This is followed by a note on the theory underlying, the technique used for modelling price behaviour, that is, the theory of cointegrated variables. Specification, estimation and interpretation of the results brings up the rest of this chapter.

II. 1 Some stylized facts

Variations in Wholesale Price Index (WPI) and industrial prices[1] are presented in Fig. II.1. It can be inferred that the inflation rate and industrial inflation portray similar trend. This close movement of both the variables makes it all the more difficult to analyse the role of the industrial sector in the whole inflationary process. This leaves three possible explanations. The industrial sector can be a catalyst adding to the price increases originating from outside, it can dampen the price rise tendencies or it can even be a transmission belt in the overall inflationary process. A closer scrutiny is warranted before any conclusion can be drawn.

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[1] Wholesale Price Index of manufactured products are used as industrial prices.

Figure II.1

Variations in WPI and Industrial Prices

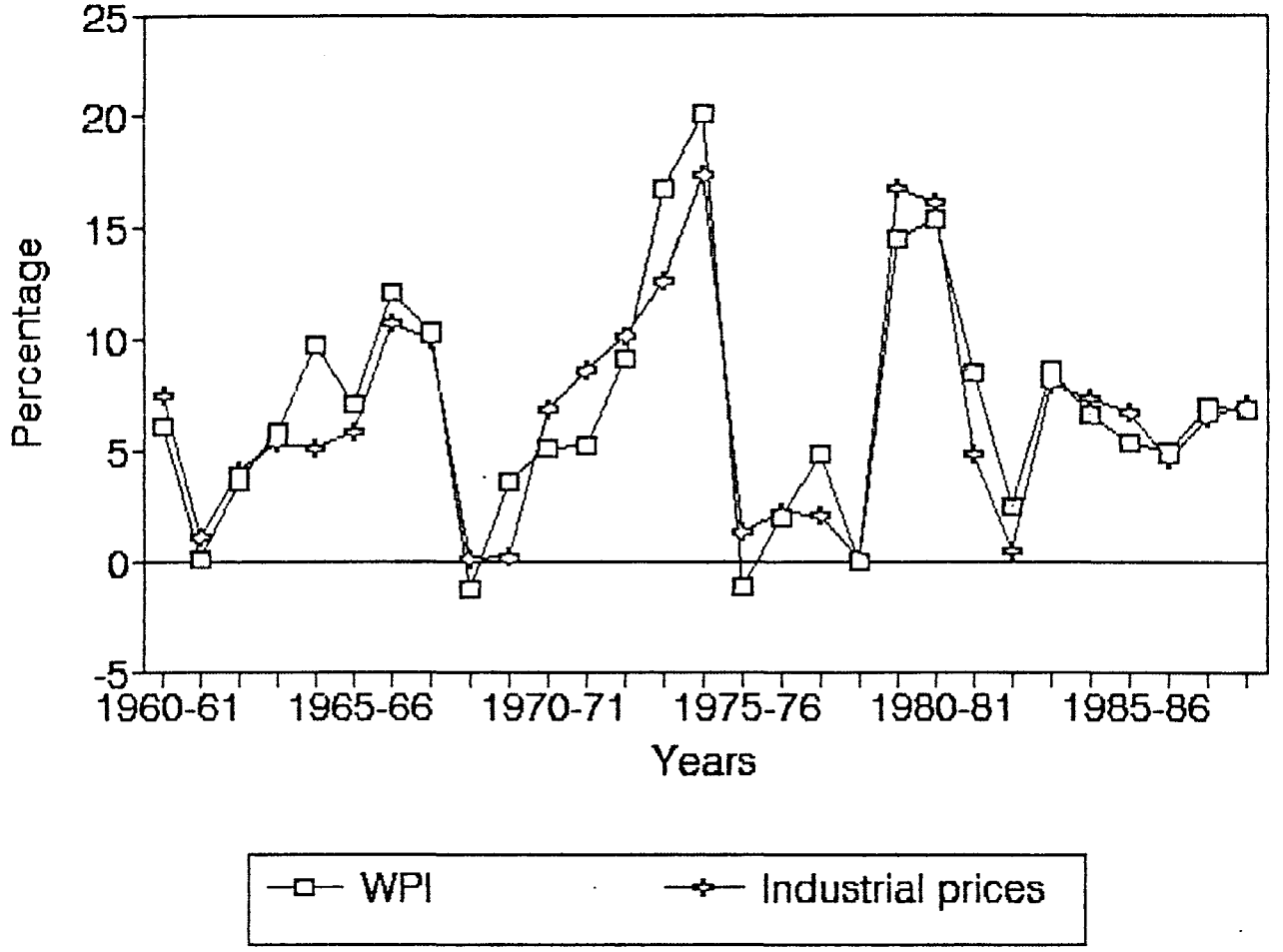

Table II.1
Output, Mark-up and Industrial Price Variation

Year	Output (1)	Mark-up (2)	Variation in Prices (3)
1960/61	39.5	13.07	2.24
1961/62	42.8	13.94	0.91
1962/63	46.7	12.39	4.50
1963/64	51.1	12.69	5.60
1964/65	55.7	15.26	5.71
1965/66	57.3	10.57	6.18
1966/67	58.0	9.67	12.00
1967/68	57.7	14.25	11.36
1968/69	61.2	8.25	0.00
1969/70	65.1	14.13	0.29
1970/71	67.9	13.77	7.56
1971/72	71.6	13.33	9.46
1972/73	74.3	13.61	11.11
1973/74	74.8	13.82	14.67
1974/75	76.2	14.40	20.93
1975/76	80.5	12.24	1.44
1976/77	87.9	13.18	2.21
1977/78	91.5	12.33	2.32
1978/79	98.5	13.18	0.15
1979/80	96.4	12.68	20.21
1980/81	100.0	11.91	19.32
1981/82	107.9	11.99	5.15
1982/83	109.4	11.65	3.50
1983/84	115.6	13.41	6.09
1984/85	124.8	12.77	7.01
1985/86	136.9	13.13	5.87
1986/87	149.7	12.32	3.86
1987/88	162.0	12.70	7.20
1988/89	175.6	13.67	9.39

Note: 1. Output is the Index of Industrial Production - manufacturing.
2. For details on the computation of mark-up, see Appendix 1.
3. Price is the Wholesale Price Index - manufacturing

Source: 1. Column (1) National Accounts Statistics, various issues.
2. Column (3) RBI Bulletins, various issues.

Table II.1 depicts the output, mark-up and the rate of change of industrial prices. It should be noted that during the decade of 1965 to 1975 when Indian industrial sector output was growing at a slow pace the mark-up rates were high. Contrary to this in the 80s when the output grew faster, a steady mark-up or even decline in

mark-up is noticed. This suggests an inverse relation between output and mark-up pointing to a likely counter-cyclical behaviour of the later. As the information provided is far from adequate to confirm the behaviour of mark-up over the cycle we need an econometric investigation. This is taken up in a later section.

II.2 Market structure and mark-up in Indian industry

There has been a substantial widening of the industrial base in India enabling the production of a very broad range of industrial products. At the time of independence industry was dominated by textiles which alone accounted for approximately 53 per cent of total industrial output in 1951. By 1970 its weight in the Index of Industrial Production (IIP) came down to 21.5 per cent and by 1980 it came down still further to 18.27. The traditional consumer goods industries which was the leading sector has been replaced by the modern industries in the basic and capital goods sector, such as chemicals and engineering which have recorded impressive growth rates. The diversification within the industrial sector is brought out by Table II.2.

Table II.2
Diversification Within The Industrial Sector

	1956 (1)	1960 (2)	1970 (3)	1980 (4)
A. Weights of Use-based sectors in Index of Industrial Production				
Basic goods	22.3	25.1	32.3	33.2
Intermediate goods	24.6	25.9	20.9	21.3
Consumer goods	48.4	37.2	31.5	30.5
Non-durables	-	(31.6)	(28.1)	(26.6)
Durables	-	(05.7)	(03.4)	(03.8)
Capital goods	4.7	11.8	15.2	15.0
B. Weights of Use-based Sectors in Value Added in Manufacturing				
Intermediate goods		34.0	38.3	40.2
Consumer goods		49.6	40.4	36.3
Non-durables		(46.9)	(37.1)	(32.5)
Durables		(02.7)	(03.3)	(03.8)
Capital goods		12.5	16.7	21.0
Unclassified		3.9	4.6	2.5

Source: For Columns (1), (2) and (3), Annual Survey of Industries, Factory Sector Summary Results, various issues. For Column (4), Sandesara (1992).

One of the striking feature that the Table II.2 brings out is the decline in the weights of consumer goods. In 1956 the weights of consumer goods 48.4 per cent which came down to 30 per cent by 1980. The decline in consumer goods weight is due to the increase in the weights of capital goods and basic goods. In terms of value added also the same pattern is discernible.

This diversification and structural change in industry has contributed to high degree of concentration of industry as it is evident from Table II.3.

Table II.3
Product-wise Concentration Across Industry Group

Product group	Number of products enquired into	Products with a 3-firm CR > 75 %	of which, products produced by 1 firm
Food, drink, tobacco & textiles	55	19	2
Machinery,tools & engineering equipment	415	368	133
Metallurgical products	102	91	27
Chemicals & Petro-chemical products	520	496	217
Other Products	167	135	37
All Products	1259	1109	416

Source: Report of the Monopolies Enquiry Commission, 1965, Vols. I and II.

Table II.3 shows that concentration is highest in the newer industries such as chemicals and machines[2]. One possible reason for this is that India being late in the industrialization process has been forced to depend on developed countries for acquiring frontier technology. The optimal scale of new technology geared to the larger markets of developed economies has often been large relative to the size of domestic market. In such a situation only few firms can sustain.

Barriers to entry is one of the reasons for concentration. Barriers to entry can be technological barriers like minimum size of plant necessary for production unit to remain viable and commercial barriers like promotional expenditure. In the Indian context, it can be seen that technological barriers arise in the

[2] A recent study, Vijayabhaskar (1992), also reveals that concentration has not come down significantly in these industries.

case of capital goods and commercial barriers arise in the case of consumer goods. Planned industrialization strategy, of which licensing in the sectors earmarked for private enterprises, was an important aspect which added some institutionalized barriers in India. This coupled with a number of restrictions and protection reared the industry along the lines which do not confirm what can be called as 'perfect competition' and 'monopoly'. These facts help to characterize the aggregated industrial sector as oligopolistic, although the concentration measures understate the degree of monopoly power.

Table II.4
Concentration and Mark-up

Years	Average 3 firm Concentration Ratio	Mark-up
1978-79	63.0	13.18
1981-82	60.1	11.99
1983-84	62.4	13.41
1987-88	60.5	12.7

Note: Mark-up is computed from ASI Volumes. For details see Appendix I.
Source: Concentration Ratios are from Vijayabhaskar (1992).

Examining concentration and mark-up in the Indian economy from Table II.4, it can be seen that years when the average 3 firm concentration ratio are high have higher mark-ups and decline in concentration results in a decline in mark-ups. Even though a number of works[3] have suggested that high concentration may pave way for higher mark-ups, Katrak (1981) present evidence of a 'U' shaped behaviour of concentration and mark-ups from the Indian

[3] See Strickland and Weiss (1976).

industry[4]. This was attributed to the fear of government action like monopoly regulation leading to a restraint by large firms on the margins.

Before going for an econometric investigation of the behaviour of mark-up in Indian industry, the prices costs and activity of industrial sector in India are examined.

II.2.1 Prices, costs and activity

The annual rates of change of output, manufacturing prices, raw material costs and labour cost are presented in Table II.5. Three phases of rapid increases in industrial prices can be identified ie 1966-67, 1972-75 and 1979-81.

The first phase is due to a abrupt end of the growth of industrial output coupled with increase in the cost. This is also a phase soon after the 1965 war which was followed by a break in the five year plans and the subsequent devaluation of 1966. The second phase of price rise can be attributed to rise in costs especially the costs of raw materials. These were the succeeding years of recessionary trends in output generated around mid-sixties. Another major reason for this inflationary phase is the first oil shock. This has led to tremendous increase in the price of raw material which registered almost 37 per cent variation in 1973-74. It can also be seen that the year 1974-75 witnessed 20.9 per cent variation in industrial prices as it was year in which both raw material and labour cost shot up.

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[4] An earlier study by Sawhney and Sawhney (1973) also presents similar results.

Table II.5
Variation in Prices, Costs and Activity

Years	A	P	RM	L
1961/62	7.65	0.91	-1.91	3.76
1962/63	8.62	4.50	-1.26	3.63
1963/64	8.53	5.60	4.50	0.66
1964/65	8.04	5.71	13.33	12.94
1965/66	5.20	6.18	11.40	11.46
1966/67	0.55	12.00	15.58	10.82
1967/68	1.10	11.36	1.34	6.46
1968/69	6.50	0.00	3.68	6.07
1969/70	7.00	0.29	9.63	-5.85
1970/71	3.82	7.56	6.52	8.44
1971/72	5.35	9.46	0.84	6.19
1972/73	3.76	11.11	8.25	11.98
1973/74	0.83	14.67	37.06	10.70
1974/75	3.08	20.93	24.95	18.28
1975/76	6.16	1.44	-7.76	4.93
1976/77	8.82	2.21	13.27	-5.24
1977/78	3.64	2.32	5.67	9.10
1978/79	7.08	0.15	-1.62	2.95
1979/80	-1.35	20.21	21.80	19.88
1980/81	3.80	19.32	20.67	7.81
1981/82	8.51	5.15	10.82	0.98
1982/83	3.10	3.50	2.68	14.97
1983/84	6.31	6.09	6.94	7.04
1984/85	7.88	7.01	8.07	5.74
1985/86	8.02	5.87	0.23	-5.37
1986/87	8.20	3.86	7.46	0.92
1987/88	7.31	7.20	12.66	5.65
1988/89	7.68	9.39	-0.16	2.13

Note: For sources and computation, see Appendix 1. Here, 'A' denotes industrial output, 'P' price, 'RM' raw material costs and 'L' is labour costs.

The third phase of inflation in industrial prices coincides with the year in which industry registered negative variation in output, that is 1979-80, incidently material costs as well as labour cost also shot up in that year. A possible reason for this price rise could be the fall in agricultural output in 1979-80[5].

[5] Index of agricultural production came down from 97.4 in 1978/79 to 80.4 in 1979-80.

One striking feature of price behaviour that is brought out in Table II.5 is that the prices appear to have a close relation with variation in raw material prices rather than the labour cost. And also the degree to which firms pass on increases in costs does not seem to be influenced by the growth of output and thus demand[6].

In light of the above discussion follows an econometric investigation of the behaviour of prices and the price/cost/activity relation. In order to analyse the long run relationship between prices/costs/activity, the technique of co-integration has been used. This technique is useful for estimating and testing the existence of long run economic relationships suggested by theory.

II. 3 Co-integration - An overview

The assumption of stationarity around which most of econometric theory is built upon was not challenged until recently. Econometric analysis proceeded as if all the economic time series variables are stationary. A series is said to be stationary, in a strict sense, if the joint and conditional probability distributions of the series are unchanged if displaced in time. Stationary variables should have constant unconditional mean and variance overtime (which is very rare in economics). Thus, a stochastic process[7] $[X_t]$ is said to be stationary if

$$E[X_t] = \text{constant} = \mu$$
$$\text{Var}[X_t] = \text{constant} = \sigma^2$$
$$\text{Cov}[X_t, X_{t+j}] = \sigma_j$$

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[6] It is evident for the year 1979-80.

[7] A stochastic process is defined as a family of real valued random variables indexed by time. X, a stochastic process is denoted as set $[X_t]$. So each element $X_1, X_2 \ldots X_t$ of the stochastic process $[X_t]$ is a random variable.

To put it in other words a Stochastic Process is stationary if the means and variances are constant over time and the value of the Co-variance and between two periods depends only on the gap between the periods and not the actual time at which this co-variance is considered. If any one of the above condition is not fulfilled then the process is nonstationary. The works of Granger and Newbold (1974) and Nelson and Plosser (1992) have highlighted econometric implications of non-stationarity.

Coming to integrated variables, they are a specific class of non-stationary variables with important economic and statistical properties. These are derived from the presence of stochastic trends and not from deterministic trends. Innovations to an integrated process are permanent, not transient[8]. A simplest example of an integrated series is the random walk:

$$X_t = X_{t-1} + e_t$$

where`e' has zero mean, constant variance, and zero covariance. The series is called an integrated series because X_t can be regarded as the sum of the differences in X upto time t and the base value X_0. As the implied coefficient on X_{t-1} then time series of X is said to have a 'unit root'.

Non-stationary time series are often de-trended before further analysis is carried out. De-trending can be done in two way (1) by regressing on time (2) by successive differencing. An example will clearly exposit the difference between the two. Suppose a series

[8] See Dolado and Jenkinson (1987).

Y_t has the following relationship:

$$Y_t = \alpha + ß_t + U_t \qquad \ldots\ldots\ldots(1)$$

where U_t is a stationary series then (1) is trend stationary process (TSP). Contrary to this if U_t is generated by

$$Y_t = Y_{t-1} = ß + e_t \qquad \ldots\ldots\ldots(2)$$

where e_t is a stationary series then (2) is difference stationary process (DSP). The number of times a series must be differenced before it may be rendered stationary is called the 'order of integration'. In the above case (equation 2) U_t is integrated of order one or Y_t is I(1). A stationary series is intergrated of order zero.

Dickey and Fuller (1979) shows that the DSP hypothesis is valid if $\alpha_1 = 1$ in the following equation.

$$Y_t = U + ß_t + \alpha_1 Y_{t-1} + \sum_{i=1}^{m} \alpha_i A Y_{t-1} + e_t \qquad \ldots\ldots\ldots (3)$$

The whole question of testing whether $\alpha 1 = 1$ or not is called the `testing for unit root'. The most widely applied unit root tests are (1) the Durbin-Watson test of Sargan and Bhargawa (1983) CRDW (2) Dickey-Fuller test (DF) of Dickey and Fuller (1979, 1981) and (3) the Augmented Dickey-Fuller test (ADF) test (Engle and Granger 1987). The process of testing for unit roots are discussed at length by Banerjee et al (1993) and Campbell and Perron (1991).

The analysis of co-integration developed out of the work on testing for and implications of unit roots. The possibility of estimating and testing of the existence of long run economic relationships suggested by theory made the concept of co-integration attractive to economic modellers. Many economic time series appear to be non-stationary requiring differencing at least once to induce stationarity. But these variables linked by some theoretical economic relationship should not diverge from each other in the long run. To put it differently there should be stationary equilibria in the long run. In the short run because of seasonal effect these variables might drift apart. But if they were to drift apart without bound one cannot postulate equilibrium relationship among such variables. So there may exist some fundamental economic forces which makes them move together over time. 'In other words, whereas the individual economic variables involved in a theory may all be non-stationary the deviations from a given equilibrium may be bonded'[9]. Co-integration is nothing but the statistical expression of such equilibrium relationships.

One of the major problems associated with non-stationary series is the problem of non-sense regression termed by Yule (1926) or spurious regression as Granger and Newbold (1974) called it. Hendry (1986) gives an account of problems associated with static regressions. The realisation of these problems led many economists to transformations to induce stationarity. Most of them used the Box-Jenkins (1970) methodology of transformation. But these models

[9] Dolado and Jenkinson, 1987: 21.

were difficult to interpret as it did not allow for the existence of any long run relationships which economic theory postulate.

In order to overcome these problems the error correction mechanisms (ECM) were used in models[10]. The ECMs retains the information about levels of variables and hence only long run relationships between variables.[11] Engle and Granger (1987) establishes that ECMs produce cointegrated sets of variables and if a cointegrated set of variables is found it must have an ECM. Co-integration provides the formal statistical support for the use of error correcting models.

Co-integration analysis in time series econometrics originating with Granger (1981)[12] has a number of attractions for empirical model builders. The fact that only the method of ordinary least squares need to be applied makes co-integration analysis simple to understand the use[13] especially modelling series with strong trends. Moreover spurious regressions can be identified and avoided using Co-integration techniques. At the same time long-run information regarding relationships between economic variables can be retained in regression equation using the 'error correction' mechanisms[14].

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[10] The ECMs have been in use since Sargan (1964).

[11] An excellent example is Davidson et al (1978).

[12] Hendry (1986) gives a review of the origin and development of co-integration.

[13] Although the underlying theory is not so straight forward.

[14] See Davidson et al (1978).

Definition: Engle and Granger (1987) introduces a definition of co-integration. They define co-integration as,"The components of the vector X_t is said to be cointegrated of order d, b, denoted X_t C (d,b) if (1) all components of X_t are I(d), (2) there exists a vector α # 0 so that $Z_t = \alpha^1 X_t$, I (d - b), b > 0. The vector α is called the co-integrating vector."[15] cointegrated then each variable in x_t would be I (1), but some linear combinations of them would be I(0). Suppose such a linear combination can be found, then α is the co-integrating vector. The seminal paper of Engle and Granger (1987) elucidates the important properties of cointegrated variables and their representations apart from the testing and estimation procedures involved.

The two step procedure advocated by Engle and Granger is used here. The two step procedure is as follows. First a prior levels regression is run which allows the hypothesis of co-integration to be tested. Then the residuals from this regression are entered into the ECM model in place of the level terms. This has the effect of imposing a set of parameter values on the level terms which give minimum least squares in the equation. Imposing this restriction is the explanation of increased convergence speed of the two stage estimators. Granger and Engle (1985) is of the view that "these estimates converge even faster to the true value than standard econometric estimates"[16]. According to Hall (1986), "The advantage of the Granger Engle two step procedure is that the Z_t errors may be tested for stationarity and α the co-integrating

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[15] See Engle and Granger, 1987: 253.

[16] From Granger and Engle, 1985: 14.

vector, can be imposed on the ECM estimated equation. Thus, not only do we know that X_t is a properly co-integrating vector but we also know that the final equation is based on a consistent estimate of α"[17].

II.4 Estimation

The first step in co-integration modelling is to investigate whether the variables display similar time series properties. This is done by the standard unit root tests, the Dickey-Fuller and the Augmented Dickey-Fuller tests[18]. The results are presented in Table II.6. It is seen that the price and cost variables need to be differenced twice to induce stationarity.

Table II.6
Time series properties of prices and costs

Var	I	II
	ADF	ADF
p	1.96	-5.97*
rm	1.53	-4.04*
l	1.25	-5.21*

Note: N=29 under I & 28 under II. I dependent variable is the first difference of the variable, II dependent variable is the second difference. ADF = Augmented Dickey-Fuller Statistic, p = price, rm = raw material cost, l = labour cost, * indicates significance at 5 per cent level. The critical value for both DF and ADF is 3.33 (Fuller, 1976).

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[17] Hall, 1986: 230.

[18] Widely accepted method of implementing the Dickey Fuller procedure in a test of stationarity of a series involves running the regression $X_t = a0 + a1x_t - 1 + u$. If a1 = 0 is defined as a unit root in the series X implying then it is non stationary. This has been criticised for low powers.

Proceeding on to the co-integrating regression. As ambiguity is often raised on the reliability of co-integrating regression Durbin-Watson test because it could well be in the inconclusive region the Augmented Dickey Fuller test is also carried out. The Augmented Dickey-Fuller test results are reported in Table II.7.

Table II.7
Tests of Co-integration[19]

CRDW	ADF
1.50	-5.33

These results validates the existence of an equilibrium relationship between prices and costs by rejecting the null of non-stationarity of the residuals in the co-integrating regression.

Before getting down to the second step of the Granger-Engle Two Step method an explanation of the variables used and the rationale for its choice. In the price equation estimated the cost term is decomposed into labour and raw material costs. Labour costs are represented by wages adjusted for labour productivity. Regarding cost of raw material inputs an index of raw material prices is used[20]. This assumes that the material input-output coefficients remain constant which implies that there is no variation in the efficiency of material input use. This can be subjected to

[19] The regression P = a0 + a11 + a2m + u was run. CRDW is co-integrating regression Durbin-Watson statistic and CRADF is co-integrating regression Augmented Dickey-Fuller statistic.

[20] See Appendix I for the methodology of the calculation of this index.

criticism. The raw material price index thus constructed includes oil as well as imported raw materials.

Measurement of demand is the most important question. The ideal way to measure demand is from the orders in the firms's books. But this information is not available. Another alternative is to use some output based measures. Although this measure is widely used in studies regarding price behaviour in industrialised nations in the Indian context this is not free from problems. This is because it is often argued that the industrial capacity utilisation is often supply constraint in India. So the demand term used is the deviation of industrial production from its trend value.

Regarding some aspects of the external sector, no allowance has been made for international demand or for the role of international competition via prices in the specification. International demand to some extent will be captured by the capacity utilisation index. This should not lead to the conclusion that aspects of external sector is completely ignored. The very fact that price of oil and raw material imports are included in raw material price index itself speaks of the due importance given to the external sector.

An aggregate industry price equation is presented in the following equation.

$$\underset{}{\Delta p_t} = \underset{(-0.18)}{-0.032} + \underset{(3.67)*}{0.388}\ \Delta l_t + \underset{(4.11)*}{0.343}\ \Delta rm_t - \underset{(-0.10)}{0.010}\ d_{t-1} - \underset{(-3.31)*}{0.64}\ z_{t-1}$$

$R^2 = .77$; SEE = .0283; DW = 1.58; t = 1960 - 1988

* indicates significant at 1 per cent level.

All variables except activity is entered in rate of change. Activity is not entered in rate of change[21] based on two considerations. Firstly considering the time series properties of the variables as the level of activity is I(0) it corresponds with the dependent variable, that is, the rate of change of price implying that there is no need for further differencing of the activity term. Secondly based on theoretical consideration it would be ideal to use the lagged level of activity as price equations associated with market clearing models usually portray relationship between price changes and the level of excess demand at the beginning of the period. This makes the lagged level of activity more relevant. Moreover almost all the theoretical formulations relate mark-up to the level of capacity utilisation rate of change. This justifies the use of level of activity in the specification.

Turning to the interpretation of these results, firstly it should be noted that the sign of the error correction term (the term Z_{t-1}) is negative and significant. This points to the fact that there exist a valid error correction mechanism between prices and costs suggesting a long-run equilibrium relationship. As our objective is to analyse the behaviour of mark-up over the cycle attention should be paid to the activity terms. Notice that both the activity terms are insignificant leading to the conclusion that aggregate industry mark-ups do not respond to demand conditions. This also validates the argument of cost plus pricing in Indian industry. With the demand variations not affecting the mark-up,

[21] Chatterji (1989) does it in some of her equations, so does Balakrishnan (1991).

the mark-up is constant over the cycle. This makes us possible to set right the apprehensions regarding the behaviour of mark-up in Indian industry and conclude unambiguously that the mark-up is constant over the cycle.

Though the above equation is well determined the possibility of simultaneous equation bias[22] cannot be ruled out. So the equation

Table II.8
Instrument Variables and Money Equations

Var\ Coeff.	IV	M1	M3
lt	0.62 (3.55)	0.42 (4.32)	0.38 (4.43)
rmt	0.22 (1.99)	0.32 (4.46)	0.33 (4.44)
dt-1	-0.01 (-0.25)	-0.09 (-0.91)	-0.09 (-0.09)
zt-1	-0.58 (-2.42)	-0.57 (-3.22)	-0.61 (-3.48)
d.w.	1.71	1.56	1.58
s.e.e.	0.033	0.027	0.028
R^2		0.78	0.77
Chow	(9,14) 1.45		

was re-estimated by the method of instrumental variables. The results are reported in Table II.8. The instruments used wereprice of food grains the principal wage good, productivity and the lagged value of rate of change of industrial price. Coefficient maintain their sign and significance when estimated using instrumental

[22] Due to the influence of prices on labour costs via money wages.

'variables method. The parameter stability is not rejected in a split sample test (Chow test). It is often argued that the growth of money stock is a determinant of industrial price behaviour. As sectoral prices are specified as price relatives the inclusion of money in equations for sectoral prices is difficult to justify[23]. To set at right these speculations the above equation was re-estimated with the rate of growth of money stock in place of demand terms. Two measures of money stock M1 and M3 were used. But both were statistically insignificant as reported in the above Table II.8.

II.5 Conclusion

This chapter has argued that in the industrial sector in India, which is oligopolistic in nature, the prices are set by marking on costs. This has been validated by the results of the econometric exercises. As the results show that activity does not affect mark-up, it is argued that the mark-up behaves constantly over the cycle.

[23] Of course money could affect capacity utilisation as argued by Rowthorn (1978).

Chapter III

PRICES, COST AND ACTIVITY RELATION AT THE INDIVIDUAL INDUSTRY LEVEL

As the possibility of contradictory results between the aggregate and individual industry level cannot be ruled out, an analysis at the disaggregate level has been carried out in this chapter. Six industries are chosen for the purpose of analysis, namely, textiles, paper and paper products, chemicals, basic metals and alloys, machinery and transport equipment and parts. The technique of co-integration, as discussed in Chapter 2, has been used. The chapter is divided into three sections. The first section provides a rationale for choosing these industries and discusses the growth performance and capacity utilisation in these industries. The second section elucidates market concentration, price controls and its impact on mark-up for the six industries. Third section provides price equations for each of the industries.

III. 1 Growth performance and capacity utilisation

Before examining the growth performance of the individual industries, some considerations that prevailed upon the choice of these industries are discussed[1].

As mentioned earlier, the focus of the study was to analyse the role of industrial sector in price increases originating from outside. Price increases can originate either from the

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[1] A discussion of the problems and prospects of these individual industries is deliberately avoided as a number of studies have dealt with it in detail. For example, see Shastry (1984) with regard to cotton textile industry.

agricultural sector or it could be a case of imported inflation[2]. Thus the main consideration for the selection of the individual industries have been their linkage with the agricultural sector and the import intensity. Comparing the data of census and sample sector till 1970 with factory sector from 70 onwards acted as the major constraint, though appropriate price series were available for most of these industries.

The six industries, chosen for the purpose of analysis, contribute nearly 70 per cent of the total output. In terms of their characteristics these industries cover a wide spectrum. They vary not only in growth rates but also in concentration, mark-ups and ownership. In terms of output some produce consumption goods, some intermediate goods while some others are capital goods industries. Regarding inputs diversity exists as certain industries rely on agricultural inputs while some other industries on chemicals and metals. Despite the diversity in industry characteristics the behaviour of mark-up could be similar.

The Table III.1 provides the changing structure with these industries and their growth rate for the study period. It portrays the changing relative weights at different base years. This clearly shows that a structural change has come about in Indian industry. As these weights are allotted on the basis of value added by manufacture, this subtly points to the growth of these industries over the period of time. Higher growth rate of

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[2] In the Indian context, studies have proved that price increases originate from the agricultural sector especially from the food grains and not from variations in money supply or imported from outside (see Balakrishnan, 1991).

Table III.1
Changes in Structure and Growth rate

Industry	Changes in weights in the index of industrial production			Output growth 1960 to 1988
	1960	1970	1980	
Textiles	31.9	21.5	18.5	3.29
Paper	1.9	2.8	4.2	6.37
Chemicals	8.6	13.4	16.2	9.07
Basic metals	8.7	10.9	12.7	7.43
Machinery	7.6	13.4	15.6	10.49
Transport equipment	9.2	9.1	8.28	7.54
Total Manufacturing	100	100	100	

Source: National Accounts Statistics and Annual Survey of Industries, Various issues.

industries like chemicals and machinery points to the broad direction of industrial development taking place in India. Low rates of capacity utilisation is believed to be one of the factors behind the low growth of output. Certain amount of excess capacity is retained by firms in order to maximise their profits, to limit the entry of new firms and tackle the upswings and downswings in demand. Capacity utilisation levels points to the growth in factor productivity also. An analysis of capacity utilisation becomes imperative in order to discern demand conditions.

A World Bank (1989) study provides capacity utilisation ratios from 1970 to 1984 for four broad groups, namely, basic, capital, intermediate and consumer goods. This study observed that the capacity utilisation ratios of consumer and intermediate goods are consistently higher than that of basic and capital goods industries. Further, another study[3] shows that around 35 per cent

[3] See Centre for Monitoring Indian Economy, 1987.

of industries in India operate below a capacity utilisation rate of 60 per cent in 1986. The capacity utilisation rate of the selected industries of this study is given in Table III.2.

Table. III.2
Capacity Utilisation (CU) in 1986
(per cent)

Industries	CU
Textiles*	60
Paper	46
Chemicals	85
Ferrous Metals	61
Non Ferrous Metals	94
Non-elec. Machinery	85
Electrical Machinery	68
Transport Equipment	70

Note: * for cotton mill cloth in 1984.
Source: Srinivasan (1992 a) and World Bank (1989)

It is evident from Table III.2 that industries like chemicals, metals and machinery have higher capacity utilisation raios. This partly explains the higher outputs of these industries in the 80s. Srinivasan (1992 a) finds a positive correlation between capital intensity and capacity utilisation. He attributes this to the high rental costs of unused capital. It is also evident from Table III.2 that there exits excess capacity in Indian industry. Srinivasan (1992 b) argues that the excess capacities is due to demand constraints which could have been generated by some supply constraints.

The examination of structural change and capacity utilisation of the selected industries raises the question of their concentration and mark-ups which is addressed in the following section.

III. 2 Price controls, concentration and mark-up

Mark-up is affected by various controls on the industry and by the type of ownership. A discussion of these becomes relevant to gauge the concentration and mark-up. During the study period, the Indian industries were operating under a regulated regime. As the mark-up is influenced by price setting, the control over prices becomes crucial in the analysis of mark-up. It is seen that such price control was prevalent for industries like paper and iron and steel which forms a part of basic metals and alloys. The industries, namely, fertilizers and pesticides which were the major industries within the chemicals industry, were also subject to price control. Textile industry had to face quantity controls not price control. Abiding a scheme of controlled cloth production, certain minimum quantity of cloth required for mass consumption had to be produced by the large scale mill sector at a controlled price. Price controls on this group had very little impact on the overall prices of textiles as these controls has been accompanied by subsidies. Moreover, this constitutes a small proportion of the total output of textile industry.

Besides price controls, there had been some quantitative controls on output and investment of some these industries. For textile industry, such controls were more important than price control. Although these controls were aimed at encouraging the growth of production in the decentralised industry, they had led to lower productivity and the generation of sick units[4]. However, a number

[4] Ahluwalia (1985) discusses how government policies had affected industrial performance in India.

of these controls were removed in a phased manner by the mid-80s, their immediate impact is not pronounced in the study, as it covers the period only up to 1988-89. It may be said that the industrial performance had improved in the 1980s which, according to Ahluwalia (1989), may be attributed to the unshackling of the industry.

The impact of controls especially price controls differ between industries in the public sector and in the private sector. The impact of price controls on paper industry dominated by private corporates is different from that of iron and steel (Basic metals) industry dominated by public sector units. The paper industry, which is highly capital intensive[5], had registered shortage of supply in relation to demand consistently. The low capacity utilisation, as seen in Table III.2, may be cited to explain the inadequate supply, entailing a tendency for the prices to rise. This is, further, aggravated by the existence of high degree of concentration in the industry[6]. Thus, it can be said that the price control in this industry, with the existence of high concentration, had little impact on the prices which had been steadily rising, more so in the eighties. The iron and steel industry, mostly comprising of public sector units, also shows an

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[5] Capital intensity is the productive capital employed per person engaged. For paper industry, the capital intensity has accounted for Rs. 0.955 Lakhs in 1986.

[6] Chatterji (1989) has observed that paper industry is characterised by high degree of concentration with nearly 75 per cent of the installed capacity controlled by seven large industrial houses until recently.

increase in the prices[7], however, the increase of the prices of non controlled items was faster than those of controlled items.

As mentioned earlier, the price controls have an impact on the mark-up. The trends in mark-up of the six industries has been analysed. The Figure III.1 gives the trends in the mark-up of chemical and machinery industries. It is seen from the figure that the mark-up in these industries has remained almost constant for machinery and has been declining for chemicals since the mid-seventies. Figure III.2 shows different level of mark-up for paper and basic metals industries. And the mark-up for textiles and transport equipments, as evident from Figure III.3, has been fluctuating over the years.

Concentration and mark-ups: In the earlier chapter, a positive relationship between concentration and mark-up was observed at the aggregate level. The relationship between concentration and mark-up at the disaggregate level is given in Table III.3.

[7] Report of the Committee on Controls and Subsidies (1979) has observed the increase in the prices of this industry, though the price has been administered by taking costs and a reasonable profit.

Table III.3
Industry-wise Concentration and Mark-up

Industries	1978-79		1981-82		1983-84		1987-88	
	Concen-tration Ratio	Mark-up	Concen-tration Ratio	Mark-up	Concen-tration Ratio	Mark-up	Concen-tration Ratio	Mark-up
Cotton Textiles	6.50	11.77	7.80	9.72	11.04	9.46	2.60	7.70
Transport	85.73	17.00	76.81	14.55	86.40	15.42	83.90	11.70
Paper	91.75	16.56	25.40	15.34	95.55	13.77	73.28	14.00
Basic metals and alloys	43.5	13.87	23.97	14.08	39.74	13.70	40.78	11.00
Chemicals	64.72	19.31	74.87	15.45	62.28	18.40	54.87	16.11
Machinery		15.74		15.50		17.44		15.83
1. Machinery & machine tools	59.95		58.60		60.56		65.46	
2. Electrical machinery & appliances	55.35		54.08		63.28		52.77	

Note: Concentration ratio was not available for machinery as a whole. For the computation of mark-up, see Appendix I.
Source: 3 firm concentration ratios from Vijayabhaskar (1992), Annual Survey of Industries, various issues.

Figure III.1
Mark-up in Chemicals and Machinery

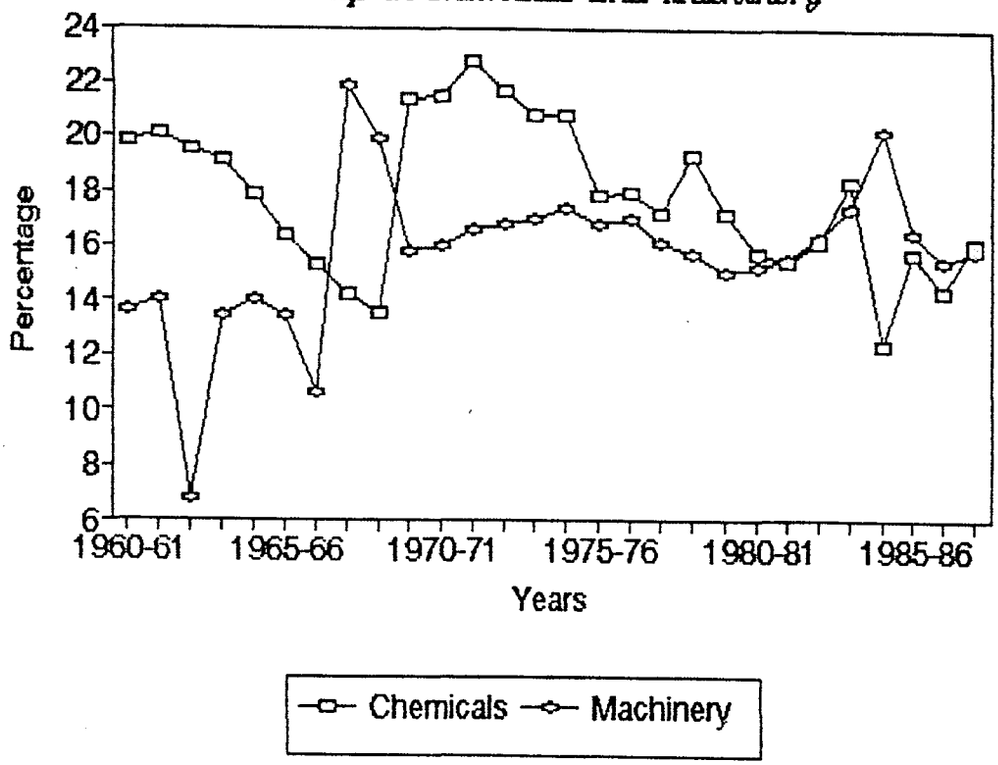


Figure III.2
Mark-up in Paper and Basic metals

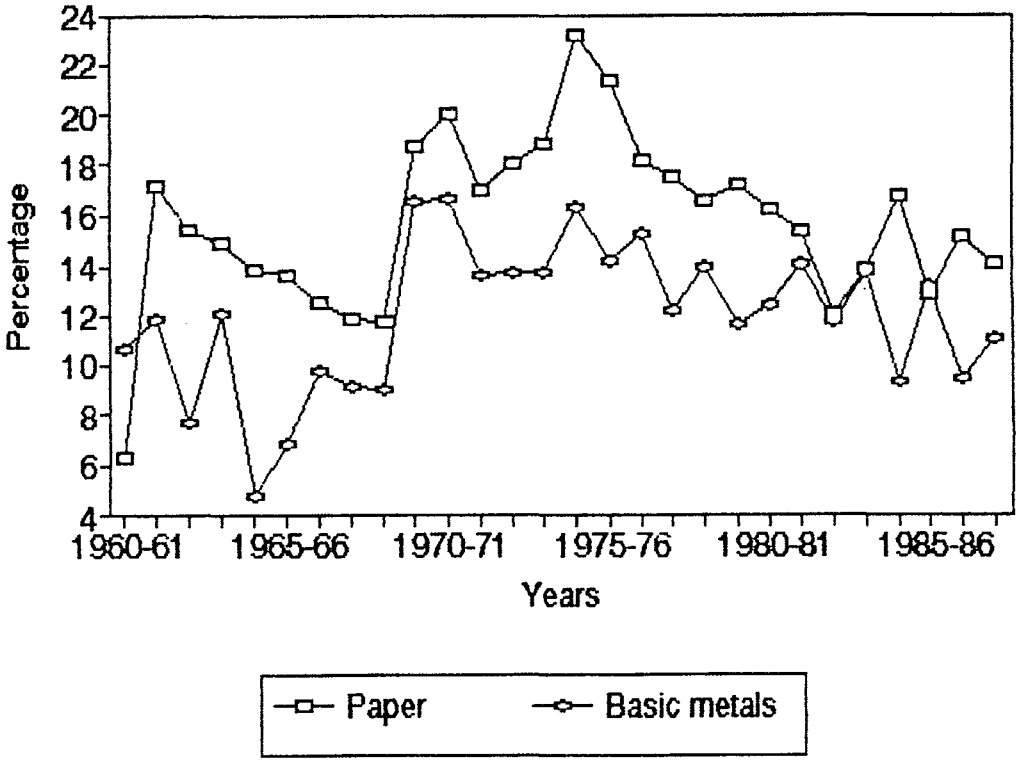
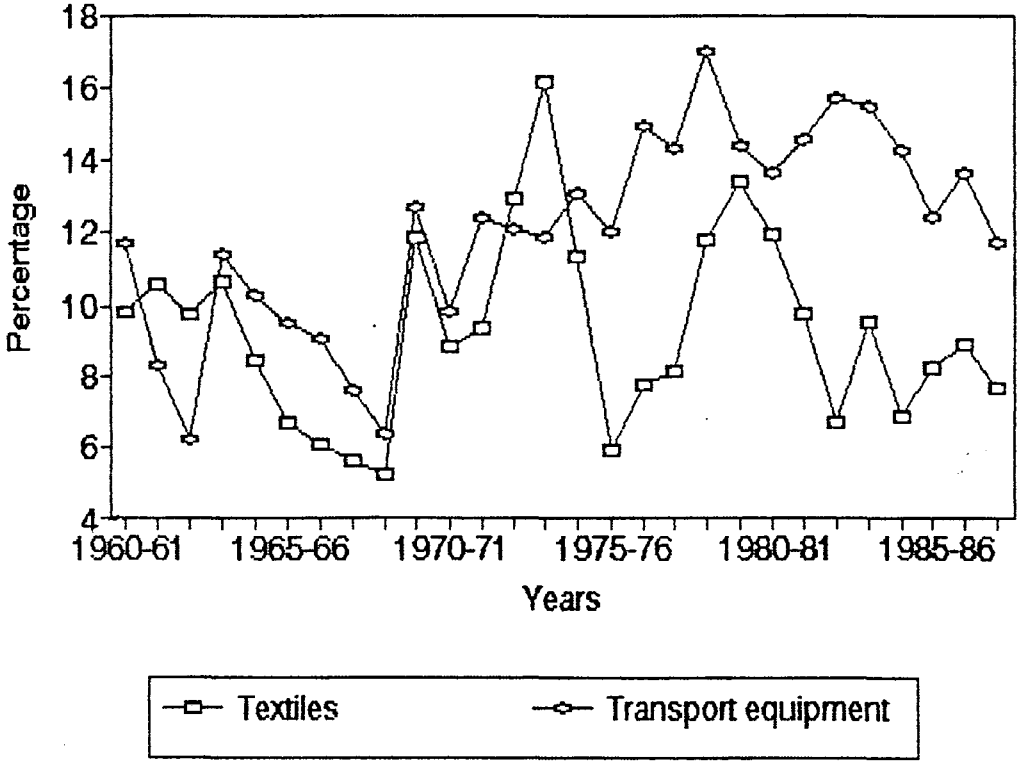


Figure III.3
Mark-up in Textiles and Transport



It seen from Table III.3 that all industries, excepting machinery, witnessed decline in both concentration and mark-up. The machinery industry consists of two groups, namely, machinery and machine tools (non-electrical) and electrical machinery and appliances. The Table III.3 evinces that while the concentration has increased in the case of machinery and machine tools, it has declined in the case of electrical machinery and appliances. This has rendered the mark-up more or less steady in the case of machinery industry. Thus, it may be said that there exist a positive relationship between concentration and mark-up in the Indian Industry at the disaggregate level.

III. 3 Relation between prices, costs and activity: An econometric investigation

Having looked into the trends in concentration and mark-up, it is decided to look at the of behaviour of mark-up over the cycle. The specifications of the equation to test the price/cost/activity relation at the individual industry level are the same as that of at the aggregate level. The technique of co-integration and Engle-Granger two step method is also the same as employed at the aggregate level. The variables used, raw material cost and labour costs and activity are constructed also along the similar lines[8].

The Augmented Dickey Fuller test was conducted to test the stationarity of the variables. The test suggest that all the variables are stationary in the second differences. The results, are reported below.

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[8] See Section II. 3 and Section II. 4.

Table III. 4
Time Series properties of Prices and Costs

Variables	Textiles	Chemicals	Paper	Basic metals& alloys	Machinery	Transport equipment
First Difference						
Price	-0.12	-0.28	0.86	0.36	1.42	0.43
Labour cost	-0.57	-0.60	0.85	-1.08	-0.32	-0.69
Raw material cost	0.41	1.82	0.14	0.58	1.16	1.56
Second Difference						
Price	-4.41	-4.67	-3.97	-4.56	-4.48	-4.24
Labour cost	-3.92	-5.85	-5.12	-5.08	-4.73	-5.52
Raw material cost	-3.73	-5.22	-3.53	-6.44	-5.82	-4.89

Notes: Critical value of ADF test statistic at 5 per cent level of significance with 25 observations is 3.33 (Fuller, 1976:Table 8.52)

Thus, having established the time series properties of the variables, the co-integrating regression was run. The values of Dickey-Fuller statistic implies the existence of an equilibrium relationship between prices and costs in all industries. The results are reported in Table III.5.

Table III. 5
The Co-integrating Regression Test Statistic

Industry	CRDW	ADF
Textiles	1.25	-4.93
Paper	0.93	-4.73
Chemicals	1.07	-3.99
Basic metals & alloys	1.04	-7.76
Machinery	1.32	-5.22
Transport	1.17	-4.87

Note: Critical values at 5 per cent level: CRDW=n=3 T=31 bounds are 0.70 and 1.74 and for ADF=n=2, T=50 is 3.67 (Engle and Yoo, 1987)

An industry-wise estimates of price equations is presented in Table III. 6.

Table III. 6
A price equation for individual industries

Industry	Coeff L	Coeff rm	Coeff d_{t-1}	Coeff $_{zt-1}$	d.w.	s.e.e.	R^2
Textiles	0.103	0.460	-0.037	-0.542	1.59	0.0306	0.72
	(2.42)	(5.14)	(-1.85)	-(2.75)			
Paper	0.140	0.837	0.130	-0.298	1.54	0.0399	0.77
	(2.99)	(5.62)	(0.83)	-(2.09)			
Chemicals	0.538	0.421	-0.071	-0.576	1.78	0.0390	0.85
	(4.56)	(4.18)	(-1.25)	(2.64)			
Metals	0.334	0.531	0.037	-0.840	1.66	0.0270	0.80
	(5.38)	(7.09)	(0.82)	-(4.82)			
Machinery	0.281	0.622	-0.110	-0.14	1.72	0.0329	0.68
	(2.14)	(5.40)	(-1.22)	(-3.22)			
Transport	0.321	0.514	0.041	-0.410	1.83	0.0410	0.77
	(2.21)	(4.39)	(-1.60)	(-2.17)			

Note: N = 29 and the figures in parentheses are 't' values.

The results are in line with the findings at the aggregate industry which suggested that activity term is not significant, implying that there is no evidence of demand directly affecting the mark-up[9]. Thus, it can be inferred that the mark-up is constant over the cycle even at the disaggregate level. This leads to conclude that the cost-plus pricing model appears to hold good in the Indian industries. This, in turn, leads to an examination of the role of the industrial sector in inflation, which is addressed in the subsequent chapter.

[9] These regressions were re-run using instrumental variables as in the case of aggregate industry. The coefficients maintain their respective signs and levels of significance. The results are reported in Appendix II.

Chapter IV

THE ROLE OF THE INDUSTRIAL SECTOR IN INDIAN INFLATION

What follows in this chapter is an interpretation of the role played by industrial sector in the inflationary process in the Indian economy over the period 1960 to 1988. The interpretation is based on the nature and pattern of wage and price determination in the industrial sector which influences the mark-up.

Role of Industrial Sector

With emphasis on the behaviour of mark-up over the cycle, the role of industrial sector in the inflationary process could be analysed in three ways.

First, the case of mark-up being procyclical. The theoretical exposition showed that when mark-up is procyclical, industrial sector becomes an independent source of inflation. The industrial sector exacerbates the price increase originating from outside, during the boom period and dampens the price increases during recession. Contrary to this, if mark-up is countercyclical, the recession feeds inflation. The problem becomes more severe in the case of a negative agricultural supply shock in a concentrated economy. In the event of a negative agricultural supply shock, the general price level rises due to two reasons: first, due to increase in food prices and second, due to increase in industrial prices caused by increases in both costs and mark-up.

In the event of the mark-up being constant over the cycle, the industrial sector acts as a transmission belt of the price increases originating from outside. This implies that industrial sector is passive in the inflationary process. Even, when mark-up remains constant over the cycle, the industrial sector could be a source of inflation if the wage rise is faster than the rise in food prices. This is due to autonomous increases in the wages as result of higher bargaining power of the workers. However, this possibility is not considered by the present study.

The analysis of behaviour of mark-up of the industrial sector of the Indian economy showed that the mark-up remained constant over the cycle. It can therefore, be said that the industrial sector acts as a transmission belt in the inflationary process. This is a corrolary to the argument of Okun (1981) that non-auction customer markets are mainly a transmission belt in the inflationary process. Hence, the industrial sector, by acting as a transmission belt for inflation, accentuates quantity variations over the cycle, and thereby shifts the burden of price responsiveness to the labour markets and auction sector of the product markets.

To sum up

This study was set out to analyse the nature of price/cost/activity relation over the cycle in Indian industry and thereby, examine the role of industrial sector in the inflationary process. The study assumes significance in view of its attempt to test a mark-up pricing model for Indian industry and the behaviour of mark-up over the cycle.

A characterisation of industrial sector revealed that it is oligopolistic in nature and follows cost plus pricing. The findings suggest that prices and costs in the industrial sector, both at the aggregate and disaggregate level, are co-integrated, moving together in the long run. It is also observed that industrial prices in India are cost determined. The findings also suggest that the influence of activity over the mark-up is insignificant, leading to infer that the mark-up is constant over the cycle. Hence, it may be said that, the role of industrial sector in Indian inflation is that of a transmission belt of price increases originating outside this sector.

The insignificant influence of activity on the mark-up suggests the insignificant role of demand factors on the mark-up of Indian industry. An enquiry into the role of non-demand factors such as the investment decision of firms, though the present study failed to explore, is therefore called for to understand better the role of industrial sector in inflationary process in the Indian economy.

Appendix I

DATA SOURCES AND COMPUTATIONS

Factory sector data on manufacturing

For the sample period 1960 to 1988, the single comprehensive source of industrial statistics in the Indian economy is the Annual survey of Industries (ASI). This survey was introduced in 1959 to take care of the drawbacks of the then prevailing sample survey of manufacturing industries[1] (SSMI).

The Annual Survey of Industries (ASI) covers the entire registered factory sector (excluding factories under the Defence Ministry, Oil Storage depots and training institutes). A factory is defined as any premise where 10 or more workers with the aid of power, or 20 or more without the aid of power are engaged in a manufacturing process. It should be noted that the section of industry which employs less than ten workers in a manufacturing process is outside the purview of this survey.

The survey is carried out at two different levels. ASI divides the registered factories into two groups. Units operated on power employing 50 or more workers and these employing 100 or more workers operating without power, that is, the larger establishments are covered on a complete enumeration basis. This is known as the census sector. The remaining units of the smaller factories are surveyed on a sample basis and known by the sample sector. The Census and Sample sector combined gives the total 'Factory Sector'

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[1] For a detailed discussion of the problems of SSMI see Chatterji (1989) and Balakrishnan (1991). As the present study does not make use of this data a discussion of SSMI is not provided.

data. The present study has made use of this Factory sector data. For a period 1960 to 1969 both Census and Sample sector data was added to get the Factory sector data which is readily available from 1970 till 1988.

Comparability between Factory, Census and Sample sectors constraints the choice of industries for the disaggregate analysis. Within this constraint effort was made to ensure that the industries chosen covered a range of industries in terms of final use as well as in terms of inputs. The industries chosen were textiles, paper, chemicals, metals, machinery and transport equipments. The comparable factory sector, census sector and sample sector industry groups are given in Table A1.

Table A1
Equivalent Factory Sector, Census Sector and Sample Sector Industry Groups.

	Industry Description		
Industry	Factory Classification Sector	Census Sector Classification	Sample Sector Classification
Textiles	Cotton Textiles (23)	Spinning,weaving & Finishing of Textiles (231)	Cotton & Other Textiles (231)
Paper	Manufacture of Paper & Paper Products, Printing and Publishing and Allied activities (28)	Manufacture of Pulp, Paper and Paper board (271) Printing, Publishing and Allied Industries (280)	Paper and Boards (271) Printing and Book Binding(280)
Chemicals	Manufacture of Chemicals and chemical products (except products of Petroleum and coal)(31)	Basic Industrial chemicals, including fertilisers(311) Vegetable and animal oils and fats (except edible oils) (312) Manufacture of paints, varnishes and lacquers and manufacture of miscellaneous chemical products (313 & 319).	Basic Chemicals (311) Vegetable and animal oil and fats (312) Miscellaneous chemicals (319)

(contd.....)

Industry Description			
Industry	Factory Classification Sector	Census Sector Classification	Sample Sector Classification
Metals	Basic metal and alloy Industries (33)	Iron & Steel basic Basic Industries (341) Non-ferrous basic metal industries (342)	Ferrous metals (341) Non-ferrous metals (342)
Machinery	Manufacture of Machinery, machine tools & parts except electrical machinery (35)	Manufacture of machinery except electrical machinery (360)	Machinery except electricals (360)
	Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and parts(36)	Manufacture of electrical machinery, apparatus, appliances and supplies (370)	Electrical machinery etc. (370)
Transport equipment	Manufacture of Transport equipment and parts (37)	Ship building and repairing (381) Manufacture of rail road equipment (382) Manufacture of motor vehicles (383) Manufacture of motor cycles and bicycles (385) Manufacture of aircraft (386) Manufacture of Transport equipment not elsewhere classified (389)	Ship Building (381) Rail road equipment (382) Manufacture of Motor Vehicles(383) Manufacture of bicycles (385) Aircraft (386) Transport not elsewhere classified (389)

Note:Figures in brackets indicate the National Industrial Classification (NIC-70) Codes for the factory sector and serial number of the industry in ASI classification for the others.

Even though the ASI provides data on number of factories, capital, persons employed, emoluments, total inputs, total output and value added the present study has used only data on total emoluments, output and total employment. The data on inputs was also used for the computation of mark-up which is discussed later.

Prices: 'Wholesale Price Index for Manufacturing Products' base 1981-82 = 100 represents the price of manufactured goods. To maintain uniformity the various price series in this study even though with different bases have the same source. These are drawn from the 'India Data Base', Vol.I by H. L. Chandok and The Policy Group for the entire period, 1960 to 1988. The series used for the estimation of industrial price equation are presented from Table A III.1 onwards.

Labour Cost: 'L' = [E/O], where E stands for total emoluments, ie. wages plus salaries plus benefits and O is output. As discussed both these are drawn from various issues of ASI. As ASI was not published for the year 1972, a simple average of the labour cost calculated for the years 1971 and 1973 was used.

Raw Material Costs: The raw material costs are represented by a price index. In the construction of this price index the value of manufactured inputs entering industry have been excluded as the representation of materials cost in a price equation for aggregate industry should not contain them. This index was constructed as follows. The value of primary inputs into manufacturing output was used to construct shares of individual items in total materials costs. These values were taken from "Input-Output Transactions Table (commodity into Industry Absorption Matrix) for the Indian economy for 1983-84 published by the Central Statistical Organisation. The inputs were classified into groups that could be represented by price indices. The shares of individual items were aggregated to yield the weight assigned in the composite index.

The following are the four groups and their weights.

Food Crops	2.54
Non-food agricultural products	55.13
Minerals	24.81
Fuel and power	17.51

The price indices corresponding to each group were drawn from the classification adopted in the index number series base 1981-82=100 drawn from the 'Indian Data Base'. These are 'primary: food articles', 'primary: non-food articles', 'minerals and fuel, power, light and lubricants'.

For disaggregate industry the same exercise was repeated by taking relative weights of manufactured and non-manufactured inputs, but excluding own industry input to each industry. Table A2 provides the weights used at disaggregate level.

Table A2

Weights of Raw Material Inputs into Industry - Inter-Industry

Industry	Inputs																	
	Cotton (raw)	Jute (raw)	Wool (raw)	Electricity	Chemicals	Machinery	Logs etc.	Coal	Petrol	Textiles	Other minerals	Metals	Food manufacture	Paper	Non-ferrous metals	Metal products	Transport equipments	Miscellaneous mfg.
Textiles	57.43	0.67	9.20	24.30	5.41	2.97												
Paper	-	-	-	27.54	21.65	2.01	20.67	15.89	8.04	4.16								
Chemicals	-	-	-	24.81	-	1.98	-	-	31.52	10.70	4.34	0.29	9.99	10.74	4.61			
Metals	-	-	-	.59	-	47.27	-	-	-	-	-	-	-	-	-	22.07	21.18	8.69
Machinery	-	-	-	38.90	5.62	-	-	22.41	-	-	-	4.20	-	-	-	-	19.60	9.27
Transport equipment	-	-	-	1.27	-	12.42	73.64	-	-	-	-	-	-	-	-	-	-	12.67

Activity: The deviation of industrial output from its trend has been taken as activity. The data for this is from the same ASI volumes. The series on labour cost, raw material cost and activity used in the econometric exercises are presented in Appendix III.

Procedure on Mark-up:

$$\text{Mark up (M)} = \frac{\text{Value of output-Total Emoluments (Wages \& Salaries)} - \text{Material Cost}}{\text{Value of output.}}$$

This measure of mark-up could well be an underestimate or overestimate. The problem arises due to material costs. As ASI don't provide information on material costs alone, data for total inputs has to be made use of. As total inputs contain inputs from within the industrial sector as well, the mark-up of these too will enter in the computation. Thus this is not a true measure of mark-up. As the data was not available on material costs we limited ourselves to this measure of mark-up.

Appendix II

Regression results of instrument variables estimation for individual industry data

Industry/ Variable	L_t	rm_t	z_{t-1}	a_{t-1}	Constant	d.w.	s.e.e.	Chow
Textiles	0.63	0.29	-0.90	-0.04	0.18	1.97	0.034	(9,14)=1.03
	(4.2)	(4.0)	(-3.5)	(-0.44)	(0.45)			(2.65)
Paper	0.34	0.39	-0.30	-0.01	0.11	1.52	0.043	(11,13)=1.62
	(2.5)	(3.5)	(-2.0)	(-1.0)	(0.93)			(2.63)
Chemicals	0.69	0.28	-0.40	-0.05	0.04	2.10	0.042	(10,13)=1.55
	(2.8)	(2.5)	(-2.8)	(-0.1)	(0.2)			(2.67)
Metals	0.38	0.66	-0.75	-0.03	0.16	2.02	0.037	(9,14)=2.01
	(2.0)	(5.1)	(-2.9)	(-0.70)	(0.65)			(2.65)
Machinery	0.31	0.59	-0.20	-0.02	0.61	1.61	0.029	(9,9)=1.05
	(2.9)	(4.8)	(-2.9)	(-0.46)	(0.30)			(3.18)
Transport Equipments	0.46	0.30	-0.46	-0.20	0.13	1.73	0.041	(9,12)=1.27
	(2.2)	(2.3)	(-2.4)	(-0.72)	(0.41)			(2.80)

$$P_t = L_t + rm_t + a_{t-1} + z_{t-1} + U_t$$

Where P = Price

L = Labour cost

rm = raw material cost

a = activity

z = ecm.

The instruments used are Pf_t, Pr_t and P_{t-1}. Where Pf = Price of foodgrains, Pr=Productivity and P=Price of industrial products. Labour cost was treated as endogenous. Figures in parentheses are t-statistics except for chow test which is the F value.

Appendix III

DATA SERIES

The data series used in the econometric exercises are presented in the following tables. First for aggregate industry and then for each of the individual industries. Data are presented for four variables, they are price, labour cost(l), raw material cost (rm) and activity (a).

Table A III.1: Aggregate Industry 1960-1988

Year	Price	Lab.cost	Raw.cost	Activity
1960/61	22.00	32.43	16.69	219.9
1961/62	22.20	31.62	16.37	183.2
1962/63	23.20	33.71	16.16	153.3
1963/64	24.50	34.76	16.89	134.3
1964/65	25.90	37.53	19.14	129.2
1965/66	27.50	43.63	21.32	114.0
1966/67	30.80	47.33	24.64	103.7
1967/68	34.30	52.10	24.97	93.8
1968/69	34.30	53.82	25.89	90.2
1969/70	34.40	47.61	28.38	94.4
1970/71	37.00	50.75	30.23	91.9
1971/72	40.50	56.11	30.49	86.4
1972/73	45.00	63.04	33.00	82.4
1973/74	51.60	72.91	45.23	75.4
1974/75	62.40	80.24	56.52	78.5
1975/76	63.30	80.48	52.13	82.5
1976/77	64.70	75.29	59.05	86.9
1977/78	66.20	76.31	62.39	92.0
1978/79	66.30	74.82	61.38	98.9
1979/80	79.70	89.55	74.77	93.3
1980/81	95.10	103.04	90.22	86.8
1981/82	100.00	100.00	100.00	94.6
1982/83	103.50	105.08	102.67	102.5
1983/84	109.80	119.04	109.79	99.3
1984/85	117.50	127.87	118.65	102.1
1985/86	124.40	122.40	118.93	105.8
1986/87	129.20	128.42	127.80	107.0
1987/88	138.50	135.44	143.98	111.7
1988/89	151.50	135.42	143.75	119.6

Table A III.2: Textiles, 1960 to 1988

Year	Price	Lab.cost	Raw.cost	Activity
1960/61	29.3	41.0	23.0	86.4
1961/62	29.6	38.8	22.9	98.1
1962/63	30.0	41.2	23.9	101.2
1963/64	30.3	39.8	25.7	107.1
1964/65	31.1	41.9	26.7	111.2
1965/66	33.6	46.4	27.3	108.3
1966/67	35.9	48.1	29.4	105.9
1967/68	36.2	48.4	30.8	109.3
1968/69	38.0	49.7	32.7	111.0
1969/70	40.5	47.0	35.1	108.3
1970/71	44.7	54.7	40.3	97.2
1971/72	49.0	58.7	44.0	91.4
1972/73	50.3	58.0	42.3	93.1
1973/74	60.2	67.0	56.4	81.2
1974/75	71.4	80.3	66.6	89.1
1975/76	65.8	79.4	59.8	92.6
1976/77	69.4	70.6	77.0	97.0
1977/78	77.2	76.8	77.6	101.6
1978/79	79.9	77.0	74.9	108.9
1979/80	90.8	95.2	77.5	96.9
1980/81	95.0	99.0	84.5	97.7
1981/82	100.0	100.0	100.0	93.9
1982/83	104.8	107.7	95.0	97.1
1983/84	109.5	119.3	105.4	102.4
1984/85	120.0	127.4	117.2	96.7
1985/86	119.5	118.6	108.4	101.2
1986/87	116.0	125.5	111.6	105.4
1987/88	126.6	129.7	144.1	101.2
1988/89	139.6	124.7	151.1	109.1

Table A III.3: Paper, 1960 to 1988

Year	Prices	Lab.cost	Raw.cost	Activity
1960/61	29.0	35.8	16.9	123.1
1961/62	29.0	39.7	17.5	114.0
1962/63	29.9	40.8	18.2	105.5
1963/64	31.2	41.0	19.2	104.3
1964/65	31.0	42.5	19.8	100.2
1965/66	30.7	42.3	20.9	103.5
1966/67	30.7	44.2	22.8	102.1
1967/68	31.0	45.1	23.8	99.5
1968/69	32.4	46.8	25.0	97.8
1969/70	34.9	47.4	26.5	102.5
1970/71	35.4	45.5	27.4	110.6
1971/72	39.1	52.2	28.9	98.8
1972/73	40.5	52.6	30.3	102.3
1973/74	45.8	58.2	34.3	95.9
1974/75	65.5	67.2	45.1	91.0
1975/76	65.1	71.8	49.0	86.1
1976/77	63.8	69.8	50.0	92.4
1977/78	65.4	71.8	54.1	96.6
1978/79	69.5	76.3	61.8	92.6
1979/80	84.1	84.8	74.7	94.0
1980/81	92.9	88.7	84.6	96.1
1981/82	100.0	100.0	100.0	104.0
1982/83	108.5	109.8	113.8	98.1
1983/84	118.2	118.6	121.1	98.4
1984/85	131.4	116.7	132.9	106.7
1985/86	142.4	125.8	139.6	98.8
1986/87	154.3	127.1	148.3	103.6
1987/88	170.2	139.2	154.2	104.3
1988/89	180.9	140.4	162.7	106.2

Table A III.4: Chemicals, 1960 to 1988

Year	Prices	Lab.cost	Raw.Cost	Activity
1960/61	16.5	25.8	19.2	144.7
1961/62	17.7	26.0	19.4	195.2
1962/63	18.2	25.5	20.2	147.0
1963/64	18.4	26.3	21.9	123.6
1964/65	19.1	27.6	22.8	116.8
1965/66	20.3	29.9	24.1	106.7
1966/67	23.3	34.9	26.1	89.1
1967/68	24.3	36.7	27.4	90.5
1968/69	24.2	36.8	28.1	96.3
1969/70	26.9	37.4	29.0	92.3
1970-71	27.5	38.3	30.9	100.1
1971-72	29.4	41.4	33.7	97.2
1972-73	30.8	42.8	35.9	100.2
1973-74	35.1	48.4	43.7	93.2
1974-75	53.4	60.9	57.2	82.4
1975-76	55.1	65.4	59.3	85.5
1976-77	52.3	58.7	61.0	95.5
1977-78	52.8	58.3	63.0	104.8
1978-79	58.2	66.0	66.4	102.8
1979-80	74.1	81.9	77.4	92.4
1980-81	94.3	101.9	88.6	81.4
1981-82	100.0	100.0	100.0	89.0
1982-83	103.5	105.2	103.7	91.9
1983-84	107.3	114.7	109.3	96.5
1984-85	112.0	126.7	115.4	95.6
1985-86	118.3	125.1	126.8	103.7
1986-87	124.6	129.3	134.9	107.0
1987-88	131.9	139.8	145.3	110.9
1988-89	135.8	133.7	159.1	120.6

Table A III.5: Metals, 1960 to 1988

Year	Prices	Lab.cost	Raw. Cost	Activity
1960/61	16.5	29.5	21.7	158.6
1961/62	16.9	29.3	25.4	133.2
1962/63	17.7	30.8	26.3	144.8
1963/64	18.5	29.1	27.5	147.2
1964/65	19.8	35.7	28.2	123.3
1965/66	22.2	41.5	29.8	107.8
1966/67	23.6	41.7	32.3	106.9
1967/68	25.4	46.6	33.5	97.6
1968/69	26.2	49.8	33.7	93.5
1969/70	28.1	49.0	34.7	92.3
1970-71	30.7	52.5	37.7	91.3
1971-72	32.0	55.2	39.6	91.2
1972-73	35.1	61.7	42.2	90.5
1973-74	43.7	77.9	46.5	78.1
1974-75	53.3	87.0	60.5	78.6
1975-76	57.4	89.1	65.1	84.2
1976-77	59.0	85.3	64.9	86.8
1977-78	59.5	85.7	66.9	86.2
1978-79	65.6	82.7	70.8	96.0
1979-80	78.7	97.1	82.6	92.5
1980-81	84.5	94.9	91.4	99.9
1981-82	100.0	100.0	100.0	104.2
1982-83	105.2	105.8	103.4	109.8
1983-84	112.4	129.2	107.1	99.8
1984-85	123.2	154.2	113.9	104.8
1985-86	145.2	144.8	122.2	95.5
1986-87	145.3	146.3	128.2	102.2
1987-88	151.4	150.6	133.3	106.2
1988-89	174.4	148.7	151.4	118.5

Table A III.6: Machinery, 1960 to 1988

Year	Prices	Lab.cost	Raw. cost	Activity
1960/61	25.2	42.2	18.5	157.6
1961/62	26.0	43.0	22.1	190.7
1962/63	27.1	63.2	23.0	232.4
1963/64	28.1	46.7	24.6	152.0
1964/65	29.3	48.7	25.3	128.5
1965/66	30.8	50.0	26.4	115.3
1966/67	33.0	54.7	29.1	102.9
1967/68	34.3	50.4	30.1	109.1
1968/69	34.6	51.7	31.2	99.1
1969/70	35.6	54.3	31.8	88.2
1970-71	39.3	55.1	32.7	87.6
1971-72	41.1	57.0	33.9	87.3
1972-73	43.5	61.0	36.0	88.4
1973-74	48.1	68.0	38.8	84.5
1974-75	61.4	81.2	49.3	81.4
1975-76	68.1	85.5	55.4	80.2
1976-77	67.2	77.7	57.6	88.6
1977-78	68.0	82.7	60.0	89.6
1978-79	72.0	83.7	66.2	89.9
1979-80	83.2	92.2	78.2	90.4
1980-81	91.1	93.9	86.9	94.7
1981-82	100.0	100.0	100.0	93.1
1982-83	102.8	108.1	109.3	100.8
1983-84	106.7	125.2	116.5	97.8
1984-85	112.2	131.1	126.1	101.7
1985-86	121.4	135.5	136.1	103.5
1986-87	127.3	137.6	147.2	101.2
1987-88	132.3	137.7	156.4	116.5
1988-89	150.8	141.9	170.9	119.7

Table A III.7: Transport Equipment, 1960 to 1988

Year	Prices	Lab.cost	Raw.cost	Activity
1960/61	24.5	33.9	11.1	206.2
1961/62	24.6	31.0	15.9	178.1
1962/63	25.1	37.6	16.3	130.6
1963/64	26.7	36.3	16.6	122.2
1964/65	27.2	37.4	16.9	124.8
1965/66	28.2	38.9	17.6	124.7
1966/67	30.7	43.0	19.5	113.6
1967/68	31.9	46.2	20.6	101.4
1968/69	32.1	47.3	22.0	95.5
1969/70	32.8	45.7	23.8	92.7
1970-71	33.6	48.2	24.3	95.0
1971-72	36.1	48.9	25.5	93.8
1972-73	39.1	51.2	27.4	92.4
1973-74	41.6	53.0	31.0	91.6
1974-75	52.6	66.7	40.4	82.4
1975-76	57.3	70.8	40.7	75.3
1976-77	56.4	60.8	39.3	82.7
1977-78	57.7	66.7	48.8	79.8
1978-79	62.7	69.5	60.8	87.1
1979-80	77.1	84.5	74.0	88.2
1980-81	88.3	92.5	79.1	89.4
1981-82	100.0	100.0	100.0	95.1
1982-83	103.6	104.7	125.4	98.9
1983-84	105.6	113.1	132.0	98.1
1984-85	111.9	119.4	149.5	103.7
1985-86	123.1	122.7	147.6	99.2
1986-87	129.6	123.9	162.3	108.6
1987-88	135.5	126.7	182.9	112.8
1988-89	148.9	123.2	215.1	128.8

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