TRENDS AND FLUCTUATIONS IN INDIAN NATURAI RUBBER PRICE : 1968 - 69 TO 1997 -98

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I hereby affirm that the research for this dissertation titled ***Trends and Fluctuations in Indian Natural Rubber Price: 1968–69 to 1997–98*** being submitted to Jawaharlal Nehru University for the award of Master of Philosophy in Applied Economics, was carried out entirely by me at the Centre for Development Studies, Thiruvananthapuram.

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Certified that this dissertation is the bona fide work of S. Veeraputhran, and has not been considered for the award of any other degree by any other University.

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Chapter I

Introduction

The movement of natural rubber price in India and the underlying demand and supply factors are being analysed in this study. Such an enquiry assumes significance in the background of the major changes that are currently taking place in the supply and demand conditions and government policies. Natural rubber production and rubber manufacturing have till recently been closely protected from foreign competition. The ongoing structural adjustment programme is steadily undermining this situation. The integration of the Indian rubber economy to the world market can have serious implications for the trend and fluctuations in the rubber prices. In the new situation many of the marginal lands that were brought under cultivation by the small producers in the protected environment may be rendered nonviable. The liberalisation may also strengthen the oligopolistic structure of the manufacturing industry and thus increase the collusive behaviour in the rubber market. It is in this context of above possible changes that our inquiry into the rubber prices becomes relevant.

The price analysis may focus on any of the following aspects: (1) trends in prices, (2) seasonal price variations, (3) spatial price variations, (4) market integration, and (5) marketing efficiency, i.e. costs and price spreads. In the context of world rubber economy the behaviour and functioning of market for NR have been well documented. Given the limitations of data and constraints of time, we shall attempt to look into only certain selected issues of price behaviour of natural rubber in India.

In the Indian context also, it has been confirmed that generally agricultural prices are flexible upward and downward while manufactured products are found to be sticky downwards. However, in the case of Indian rubber that has been characterised by minimum floor prices periodically revised by government for the last five decades the prices cannot be flexible downward. We shall attempt to periodise the trend in the NR prices on the basis of the observed fluctuations and their relation to the price regulatory policies of the government.

The average yearly prices of agricultural commodities may conceal wide month to month fluctuations. Therefore, seasonal price variations are calculated using monthly or weekly wholesale or retails or farm prices. Generally agricultural prices decline in post harvest period and rise in the pre-harvest period. The degree of these fluctuations depends generally upon the extent of seasonality of supply factors and also the countervailing factors. Thomasen and Foote (1952) and Shephered (1963) have reported that average seasonal variation represents merely a very general tendency which may or may not be followed by price in any given year because of changes in non-seasonal supply and demand factors. It is more or less true of farm products, especially of food grains, which follow a normal seasonal behaviour from one year to another. If the fluctuations render wide and recurrent over a series of years they give a firm indication of the incapacity of market forces to equate demand over time and so denote market imperfection. Alternatively, if there is successful balancing between demand and supply factors, the amplitude of seasonal fluctuations would be significantly reduced and the market would be near perfection. The rather predictable seasonal price fluctuations are common among storable agricultural commodities. It is, though not exclusively, due to the fluctuations in demand (Tschirley, 1995). It is observed that the government policy operations on storage, internal procurement and imports could narrow down the seasonal rise in prices. Nevertheless, according to Lele (1971) and Cummings (1967) seasonal price rise was not excessive in relation to the cost of carrying the stock. Kahlon and George (1985) are of the opinion that because of market imperfections and speculative element, prices exhibit wide intra-seasonal fluctuations often in excess of carrying cost of the commodity.

Ipe (1988) analysed the seasonal fluctuations in the price of NR for the period 1968-69 to 1983-84 by using the classical decomposition model. The study reveals that, unlike the behaviour of prices of annual crops, the seasonality of production did not get reflected in the price movement of NR. The impact of production on prices was mild and subdued. Such behaviour of price in relation to production is attributed to the oligopsony in the buying market. Based on the monthly price data during the seventies, Mani (1984) analysed the intra year variations in NR prices during the seventies taking production, consumption and

stock hold by manufacturers as explanatory variables. It is found that all these variables were significant in determining the price variations. The same conclusion was also drawn by Lekshmi et al, (1996) for the period 1968-69 to 1994-95 by using annual data and the cointegration technique.

The discussion on the relatively muted seasonality behaviour of prices has often led references to the stockholding behaviour and its resultant impact on prices. Allen (1969) argued that price instability of NR at international level is due to stockholding behaviour in the consuming regions. He also argued that stockholding pattern would be influenced by the extent of involvement or control of consuming countries over trade. Literature on markets and pricing of agricultural commodities are mostly confined to addressing question of price instability but studies inter linking the price movement with its structure is scanty. But such analysis has been undertaken with respect to some of the cash crops in developed countries. Wann and Sexton (1992) found that pear markets in California is characterised by oligopsonistic market behaviour. Interestingly, another study by Durham and Sexton (1992) on the market structure and pricing behaviour of tomato in California found that the industrial purchasers were unable to exercise their market power throughout the year.

The markets of primary commodities in agrarian economies are observed to be rather different where numerous marginal and small farmers constitute the major chunk of suppliers who are susceptible to seasonal price fluctuations emerging out of production cycles. The government policies and its intervention in the market restrict the role of market forces in setting the equilibrium price. In contrast to this commonly held notion, the study on cotton and ground nut market in Rajkot district of Gujarat was reported to have been functioning on a competitive market conditions (Jasdanwalla, 1966). It could be possible that the market would have fulfilled one or two of the general conditions of competitiveness, viz., numerous buyers and sellers. Interestingly case studies of the market characteristics of cash crops, viz., cotton, jute, tobacco and sugar cane reveal that the commodity market exhibits the behaviour of oligopsony market situation (Gupta, 1975., Kahlon and George, 1985).

Initially we had set out the objective to analyse in detail the relationship between the market structure of rubber and its influence on the price behaviour. However, severe constraints of data imposed by the unwillingness of the dealers and manufactures to co-operate to such an enquiry and constraints of time forced us to re-focus our study into a more traditional mould of price analysis.

Another set of issues that are taken up in the analysis of price is related to the market integration. It focuses at the spatial level, i.e. the extent of price variations among regions and factors responsible. An analysis of spatial price differentials will indicate the nature of price transmission between markets and the speed of market adjustment. Slow response from the markets will indicate structural inefficiencies inhibiting the free flow of information. Price correlation analysis is used to measure the market integration of agricultural commodities (Cummings, 1967; Harris, 1979; Jasdanwala, 1966; Jhala, 1984; Lele, 1971). The validity as well as utility of correlation coefficients as a measure of market integration was often questioned (Harris, 1980; Blyn, 1973). In some cases the correlation coefficient was found to be high even though there was no contact between these markets or periods.

Blyn (1973) and Harris (1980) argued that correlation coefficient is an inadequate measure of market or price integration. Tomek (1980) and computed price-pair differentials and constructed a first differential equation to assess the pricing behaviour of Alberta pork market over time. The dynamic bivariate regression model was used to estimate the short-run price adjustment. The long-run price adjustment was measured through error correction model (Palaskass and Harris, 1991). Ravallion (1986) tested the casual relations among prices by Granger causality test. The price linkage and price transmission were studied through Wolfram's asymmetry model (Ward, 1982). Temporal ordering between price series was computed by lead-lag relationship, which indicates the strong and weak causality. Koyck's distributed lag model was used to test market integration of groundnut (Narasimhan, 1983).

By using the spectral analysis based on covariance stationary time series for the period 1947 -79, Kanbur and Morris et al, (1980), attempted to investigate the evidence of existence of

cycles and lead-lag relationship pattern of NR prices in the leading international markets viz., Kuala Lumpur, London and Colombo. Their study shows that any change spurts in the Kuala Lumpur market gets reflected in the London market after a lag of two weeks. According to Suan Tan et al, (1984) the London spot price exerts ultimate influence over NR price formation in the producing areas in each period. Further, by using an econometric model they confirmed the fact that the Synthetic Rubber market exerted a strong influence on the instability of world NR price during the period 1956 to 1978.

In the case of natural rubber in India, Kottayam being the only market where prices are being quoted, it is not meaningful to attempt an analysis of integration of domestic markets. However, we shall be seeking to assess the extent of integration of domestic NR market and international market with special reference to the ongoing macro economic reforms.

According to Dantwala (1961) the marketing margins judged in terms of the percentage of consumers' rupee (going to middlemen) are not smaller in countries with more efficient marketing system than those countries where marketing is admittedly inefficient. Shepherd (1962) observed that the reason for higher price spread might be better services provided. Joshi and Sharma (1979) found that price-spread for rice had substantially increased during the post-green revolution period (1966-67 to 1973-74) compared to the earlier period, indicating that profits of the intermediaries and the cost of marketing had increased considerably. In 1979 Pandey, Gupta and Sing examined the price received by the producers and price paid by the ultimate consumers of rice, wheat and potato in Hayana for the year 1978-79 has been examined. From this it was observed that the net price received by the farmers had negative and significant relationship between distance and marketing cost but positive and significant relationship with the marketed surplus. It has been pointed out that as the firm level price increases the price spread between the wholesale and retail price declines (George, 1972).

In an attempt to analyse the price-spread of NR Sreekumar et al, (1990), based on a sample survey, concluded that producers share in the consumers price as 88 per cent based on weighted average price of sheet rubber and scrap rubber. In the case of sheet rubber, the

producer's share was found to be 94 per cent. Mani (1983) has argued that marketing margins are very narrow and therefore, the rubber market is efficient. George and Chandy (1996) have argued that it is the existence of the co-operative marketing network that has tended to peg the dealers' margin at a very low level.

Finally, there are a large number of studies that have attempted to analyse the supply response to price movements. Umadevi (1984) explored the short-run and long run supply response of NR in India to the prices during the period 1955 to 1980 by using Norlovian model. The study mainly deals with response of new planting in relation to price and concluded that new planting accelerates during the rising phase of price cycle and vice versa. Similarly, Jacob (1994) examined the response of replanting to price during the period 1964-65 to 1993-94. He found that replanting was high during declining phase of NR price and vice versa. Based on Koyck's model, Ipe and Prabhaharan (1988) analysed the short run and long run supply response of Indian NR to price and other related variables covering the period 1953-54 to 1983-84. They concluded that price, yield and lower price of other crops and Land Ceiling Act of Kerala Government might have been the reasons for rapid increase in the area under rubber plantation. We shall be referring to this literature while we examine the trends in production of natural rubber.

Objectives and Chapter Scheme

The present study intends to analyse the Indian NR market price with the following specific objectives.

* To analyse the following aspects of NR price movement in India
  a) trend in NR prices
  b) annual and seasonal fluctuations in the price
  c) extent of integration of the domestic and international prices of NR, and
  d) model the price behaviour to determine the relative importance of demand-supply factors
* To analyse the trend and fluctuations in production of NR with special reference to the production cycle and production structure.

* To analyse the nature of demand by delineating the structure and composition of rubber manufacturing industries.

Sources of Data

Until 1968, there had been a maximum and minimum price existed for NR in India. In 1968 the Government of India removed the maximum price ceiling to enable the growers to get the remunerative price. Therefore, the period of analysis is intended to be from 1968-69 to 1997-98. Though Kottayam and Kochi are the major markets for NR, the Kottayam, where the maximum marketing takes place, market price alone is being quoted throughout India. Hence, the Kottayam market price will be considered for analysis. Even though there are different grades of NR, only the price of ungraded rubber is intended to be considered as around 70% of NR is traded in ungraded form. The international price (Kuala Lumpur price) is taken for comparison. The required data are available from Indian Rubber Statistics of Rubber Board, publications of International Rubber Study Group (IRSG) and various publications of All India Rubber Goods Manufacturers Association and All India Tyre Manufacturers Association.

Chapter Scheme

The study has four more chapters apart from the present introductory chapter. In chapter 2 we examine the production conditions of NR and in chapter 3 the structure and composition of rubber manufacturing industry. The insights gained on the nature of the demand and supply factors from the analysis of the above chapters are brought together to shed light on the price movements of NR. The focus of the chapter 4 is the analysis of price behaviour. In the final chapter we shall try to summarise our findings.

Chapter II

Production of Natural Rubber in India

Natural Rubber (hereafter referred as NR) is a plantation tree crop[1] which is obtained from the bark of *Hevea Brasilians,* a tropical forest tree first found in Amazon forest of South America. Rubber tree is sturdy, quick growing and tall. It grows on many types of soils provided the soils are deep and well drained. A warm humid equitable climate (21^0 to 35^0 C) and a fairly distributed rainfall of not less than 200cm are necessary for the growth of this plant. In India these conditions are favourable traditionally in a narrow belt extending from Kanyakumary district in Tamil Nadu in the South to Dakshin Kannada and Kodagu districts of Karnataka State in the Western Ghats. Normally, the life span of NR is 35 years and starts yielding i.e. tapping[2] on an average after 6 to 7 years depending on clones. Unlike other crops, NR fetches yield throughout the year. On an average tapping is possible for 140 days in a year. However, NR has also a peak and lean production period in a year. In India November to January is considered as the peak and February and March as lean periods. The yield of rubber follows a cycle. During the initial 6 or 7 years it accelerates (Increasing Phase). For the next 10 years it remains more or less the same (Stabilisation Phase). And from thence the yield starts to decline until the tree becomes uneconomical (Decreasing Phase). These phases depend upon the clones, cultural operations, and agroclimatic conditions and growers' replanting[3] decision.

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[1] According to Barlow (1996) A plantation tree crop " is understood to be the one cultivated systematically in a plantation, as opposed to growing naturally in "native groves". Plantations can be established on family smallholdings of a few hectares or on commercial estates with hired managers and workforces.

[2] Latex is obtained from the bark of the rubber tree by tapping. Tapping is a process of "controlled wounding' during which thin shavings of bark are removed. The aim of tapping is to cut open the latex vessels in the case of trees tapped for the first time or to remove the coagulam which blocks the cut ends of the latex vessels in the case of trees under regular tapping.

Section 2.1

Early Expansion of Rubber Cultivation in India

India was the first country in the East to undertake commercial cultivation of rubber. Before the commercialisation of rubber cultivation in India, it was widely found in the forest of Assam during 1880-1890 and its annual production was around 200-400 tonnes. The commercial cultivation of rubber started in 1905 with the formation of Periyar Syndicate in the erstwhile Travancore State in Kerala by a group of British planters. In the same year rubber was also introduced in erstwhile Cochin State at Palappilly (Haridasan, 1975). The important reason for the choice of foothills of South-Western India for rubber planting was the ideal agroclimatic conditions. The favourable socio-economic factors also contributed to the rapid expansion of rubber cultivation in the region.

It was estimated that during 1905 to 1907, rubber was cultivated to the extent of 404.86 hectares, particularly in Mundakayam, which was the leading centre of rubber plantations. Travancore Rubber and Produce Company and Malayalam Rubber and Produce Company were the major large scale estates that were established during 1904-1910. The main motivation for the large scale cultivation came from the expectations of rapid expansion of demand for the new raw material in the world economy (Mani. 1983, George et al, 1988, Erick. 1997). Rubber was exported to London from India as many of the planters were London based. London was the leading marketing centre for major European countries.

The agricultural policies adopted by the Travancore and Cochin also encouraged plantation cultivation. The companies Act 1862 and other commercial laws including the making British India currency legal tender also facilitated rapid commercialisation of agriculture. There was also significant expansion of infrastructure facilities linking up plantation regions with market towns. The migration from neighbouring Tamil country and the development of labour market ensured availability of cheap labour.

The movement of relative price of different crops played a determining role in the rapid shifts of cropping pattern in the plantation agriculture of the region. Coffee was the earliest plantation crop

that dominates the scene until late 19th century. It gave way to cinchona, cardamom and tea. Rubber was the last major plantation crop to take root. With the invention of pneumatic tyres and the development of internal combustion engine by the end of the last century a tremendous increase in the requirement of NR was witnessed. In 1900 the world NR production was only 45000 tonnes whereas the consumption was 52500 tonnes. The persistence of demand and supply imbalance resulted in escalation of prices reaching an all time record in 1910. However, during the course of First World War, due to the restriction of export to Germany and other countries, the NR price registered a sharp fall in the early 1920's. But the voluntary restrictions on production in British Empire, popularly known as Stevension Scheme[4], helped to stabilise the prices.

Until the Second World War, almost the entire rubber production from India was being exported. Consequently, the onset of the Great Depression had a disastrous impact on Indian rubber economy. The world market price of NR reached its rock bottom in 1932. Subsequently, in 1934, The International Rubber Regulation Agreement (IRRA), consisting of 19 NR producing countries, was established. As the part of it, in 1934 the Indian Rubber Licensing Committee was established under the Rubber Control Act. The IRRA was terminated in 1944, during the Second World War, when the strategic policy objective underwent a sudden transformation. It became imperative to rapidly increase the rubber production with outbreak of war in the South-East Asia. For this purpose, the Rubber Control and Production Order under the Defence India Rules, was framed. The next major milestones in the history of government intervention was the formation of the Rubber Board under the Rubber production and Marketing Act, 1947 for the promotion of rubber cultivation. In 1957 Rubber Research Institute of India was constituted for promotion of scientific research to achieve increase in productivity. In the same year a subsidy scheme was also introduced to promote expansion of cultivation in to new areas and shift to High Yielding Varieties (HYVs). The response to these promotional activities in terms of increase in the number of holdings, expansion of area, improvement in productivity and growth in production are taken up below.

[4] Under this scheme exports from Briton were regulated.

Structure of NR Production:

Before we analyse the trend in the production of NR, we shall examine the size structure of the rubber holdings. An important feature of rubber cultivation, in contrast to other plantation crops such as coffee and tea, has been the significant presence of a small holder segment from the early days onwards. The size profile of holdings has tended to move dramatically in favour of the small holders[5] since independence partly due to the promotional measures undertaken by the Rubber Board.

Table 2. 1 illustrates the percentage share of area and holdings under different size classes[6] from 1955-56 to 1997-98. The table shows that around 30,033 growers were cultivating NR in an area of around 86067 hectares during the period 1955-56. After 40 years i.e., in 1997-98 it has increased to more than nine lakh growers cultivating in an area of more than 5 lakh hectares. In 1955-56, the estates constituted only 1.5 per cent of the total holdings but covered 55 per cent of total area under rubber[7]. However, the expansion of the rubber into new areas almost entirely accounted by small growers[8]. Therefore, by 1990-91 the share of estates in the total holdings had declined to 0.04 per cent and the area under estates to 16.33 per cent. By 1996-97 the area under estates further declined to 13.84 per cent of the total holdings.

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[5] According to the Rubber Board, small holder is a holder/grower having a single ownership of an area of 20.23 hectares. Estate holding is the one having area of more than 20.23 hectares.

[6] The Rubber Board classifies holding (growers) as smallholdings and estates. Smallholdings consists of three classification viz. 2 ha & below, above 2 ha. & upto and including 4 ha. and above 4 ha. Since the later two classes constitute small in number (see Table 2.1) we have consolidated them into one group. Estates too, are classified into 6 categories. But they also constitute small in number so that they are also grouped as one.

[7] Estates all over the main NR producing countries were able to acquire remarkable economies in achieving inputs and outputs, as well as in initial development, processing and output handling together with cheap capital and information, new techniques and unit cost in most operation. They likewise obtained vertical integration of economies of scale through being in conglomeration with central selling organisations, giving good access to information about technologies and buyers' requirements. They were insulated from incomplete markets facing small holders, while at least during colonialism their size gave them political influence on government. (Barlow, 1996,1997)

[8] According to Burger et. al (1995) the leniency of government towards the small growers and the presence of dominant trade unions and strict implementation of Plantation Labour Act led to the expansion of area under small holding and downfall of area under estates Kerala.

In 1955-56 holdings between 2–20 hectares constituted 11.4 per cent of the rubber growers and accounted for 20.91 per cent of the area. By 1975-76 the area under this middle category of rubber cultivators had increased to 32.35 per cent. Thereafter, the relative importance of this segment in terms of both numbers and area tended to decline sharply upto the end of 1980s. By 1990-91 its share in total number was only 2.25 per cent and in total area 13.70 per cent.

As a result, the rubber cultivation in India has come to be dominated by very small growers owning less than 2 hectares of land. In 1955-56 this very small holders accounted for 87.11 per cent of the total number of cultivators and 23.81 per cent of the total area. Their relative importance has steadily increased since then.

Table 2. 1

Percentage Share of Area & Holdings According to Size At the End of Each Year (Area in ha.) In India: 1955-56 to 1997-98

Year	Total		2 ha and below		>2 ha & Upto 20 ha		Estates	
	Holding	Area	Holding	Area	Holding	Area	Holding	Area
1955-56	30033	86067	87.11	23.81	11.40	20.91	1.49	55.28
1960-61	75921	143905	89.35	36.37	9.93	26.43	0.72	37.20
1965-66	107140	186713	90.05	38.79	9.36	27.09	0.59	34.12
1970-71	131088	217198	87.67	38.02	11.83	30.95	0.50	31.03
1975-76	151347	235876	87.84	39.17	11.76	32.35	0.40	28.48
1980-81	237021	284166	92.04	49.20	7.73	26.62	0.23	24.18
1985-86	412595	382831	95.73	62.21	4.18	18.82	0.09	18.97
1990-91	780919	475083	97.71	69.97	2.25	13.70	0.04	16.33
1991-92	815881	488514	97.74	70.01	2.22	14.05	0.04	15.94
1992-93	842839	499374	97.80	70.40	2.16	13.94	0.04	15.66
1993-94	864042	508420	97.84	70.70	2.12	13.89	0.04	15.41
1994-95	881743	815547	97.84	70.93	2.12	13.94	0.04	15.13
1995-96	911615	524075	97.86	71.74	2.10	14.03	0.04	14.23
1996-97	931960	533246	97.87	72.01	2.10	14.15	0.03	13.84
1997-98	957724	544534	**	**	**	**	**	**

** *break up is not available.*

Source: Indian Rubber Statistics, Vol.22, 1997.

The expansion of the tiny sector has been very rapid since 1975-76. Between 1975-76 and 1990-91 the share of these very smallholders in the total number of rubber holders increased from 87.84 percent to 97.71 per cent and the area covered by them from 39.17 per cent to 69.97 per cent.

Section 2.2

Trends in Area, Production and Yield

The rubber economy in the later half of the present century has been characterised by the steady expansion of area, improvement in yield and increase in production. The total area under rubber (i.e. total planted area including non-tappable fresh planted areas) increased from 86067 hectares in 1955-56 to 544534 hectares in 1997-98. (See table 2.1) The compound rate of growth of area under rubber has been 3.5 per cent during this period. The shift in the cropping pattern in favour of rubber has been subjected to analysis by scholars who have identified the relative price as an important factor (Ipe and Prabhaharan, 1988). Because of the policy of protection provided to the rubber growers from imports, the domestic prices have by and large remained above the international prices. We shall take this aspect in detail chapter 4. Compared to the prices of other competent crops such as cashew nut, tapioca and coconut, the rubber prices have shown improving trends. (Kannan and Pushpangadan, 1988). It has also been argued that rubber has achieved relatively higher growth in productivity compared to that of crops like coconut which has been debilitated by rootwilt disease and other non-perennial crops like paddy and tapioca.

The general tendency in Kerala during the past decades for the rural wages to rise faster than productivity has accelerated the shift from labour intensive crops characterised by slow productivity growth. (Unni. 1981,Pushpangadan. 1993). Besides, there are also a number of institutional factors that have come to the advantage of rubber. The exemption granted to the plantation sector from Land Reforms Acts has been an important factor that encouraged medium holders to take up plantation crops. The subsidy for newplanting (NP) and replanting (RP) and other credit and marketing support extended by the Rubber Board also made the crop attractive and, importantly, facilitated the entry of smaller holders[9]. The trend in the growth of area, production and yield during this period is examined with the help of figure 2.1.

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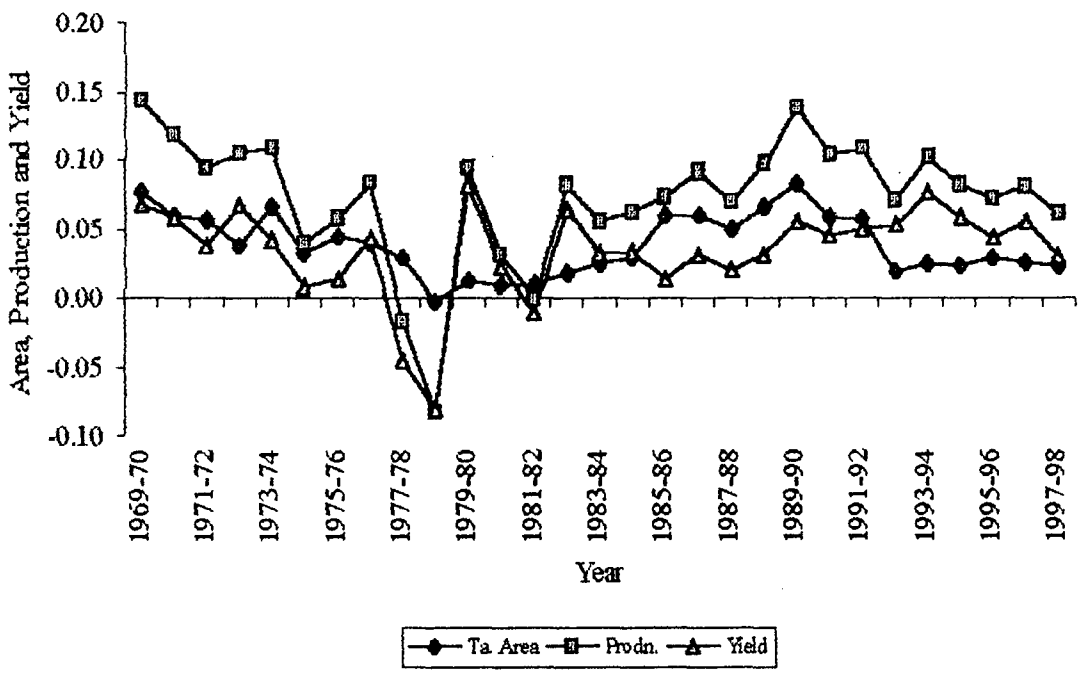
[9] In order to popularise the rubber plantation; the Rubber Board has been implementing a number of technical and financial assistance. From 1957 to 1979 subsidies were given only for replanting. From 1980 onwards subsidy has been given for new planting too, which has been implemented in the name of Rubber Plantation Development Schemes. The subsidy schemes which have been implemented so far can be listed as follows;In addition to financial assistance, the other incentive includes;(1) advisory and extension services (2) production and distribution of planting materials (3) sponsored nursery supply of cover crop seeds (4) scheme for promotion of growing leguminous ground cover in immature rubber plantation etc. (for a detailed information for the financial and technical assistance given by the Rubber Board. See the Rubber Growers' Companion, 1998, Rubber Board).

However the expansion of rubber cultivation during the 1950s, which were a result of many incentives, could not sustain the same momentum throughout to the later decades. The expansion in area, production and yield did not show a continuous trend of growth, instead showed an invasion of fluctuations. In order to analyse these fluctuations, we have used the logarithm ($\ln p_t - \ln p_{t-1}$) developed by Mohapatra (1993) of area under rubber. The 1950s were characterised by slow expansion and significant fluctuations in As can be seen from Figure 2.1 there are three broad phases that are clearly discernible in the expansion the area under rubber. The mid sixties was a period of relative stagnation. During the 1970s there was a deceleration in the expansion upto

Fig 2.1
Trend in Tappable Area, Production and Yield of NR (1968-69 to 1997-98)



1978-79 when the area shrunk absolutely. In contrast, the expansion of area under rubber accelerated during the 1980s reaching a peak in 1989-90. Since then, the area expansion has been relatively mute[10]. Another major reason for the deceleration in the expansion during the 1990s has been the exhaustion of suitable area for cultivation of rubber in Kerala. Given the land constraint in

[10] Uma Devi. (1984) newplanting takes place during the upward phase of the price. Jacob. (1994) replanting takes place during the downward phase of price.

Kerala, Rubber Board has been actively seeking and promoting rubber cultivation in other states, particularly the north-eastern states. In fact, the share of Kerala State in the total area under rubber cultivation in India has tended to decline from 94 per cent in 1955-56 to 85 per cent in 1996-97.

Coming to the trends in the yield of rubber which was 347 kg/hec. in 1955-56, tended to rise rapidly at an annual compound growth rate of 3.5 per cent reaching 1549 kg/hec. in 1997-98. The chief factor responsible for the increase in yield has been the shift to high yielding varieties (HYVs). During the initial periods, HYVs applications were confined only to estates. In 1955-56, out of 86067 hectares land under rubber cultivation, only 17718 hectares (20 per cent) was covered by HYV under both estate and smallholdings. While only 7 per cent of total land under smallholdings was covered by HYV, the coverage in the estate area was 31 per cent. Within 25 years, i.e., by 1980-81, HYVs covered the entire area under estates and HYVs covered 79 per cent of the area of the small growers. Currently, the coverage of HYVs in the smallholdings sector has increased to 96 per cent. The successful introduction of the high yielding variety of RRII 105 during late seventies and the incentives provided by the government were the important factors that contributed to rapid diffusion of HYVs even among the small growers.

The production of NR in India was only 2.4 lakh (MT) during 1968-69 and it increased to the level of around 5.8 lakh MT in 1997-98 at an annual average growth of 3.92 per cent. For obvious reasons, the trends in production have followed those of area and yield.

Table.2.2: *Trends in Tappable Area, Production and Yield of Rubber in India From 1968-69 to 1997-98*

Year	Ta. Area (Ha)	Prodn. (MT)	Yield (Kg/ha)	Ch. In Area (%)	Ch. In Prodn (%)	Ch. In Yield (%)
1968-69	123282	71054	576			
1969-70	133107	81953	616	7.97	15.34	6.94
1970-71	141176	92171	653	6.06	12.47	6.01
1971-72	149307	101210	678	5.76	9.81	3.83
1972-73	154962	112364	725	3.79	11.02	6.93
1973-74	165604	125153	756	6.87	11.38	4.28
1974-75	170879	130143	762	3.19	3.99	0.79
1975-76	178482	137750	772	4.45	5.85	1.31
1976-77	185594	149632	806	3.98	8.63	4.40
1977-78	191000	146987	770	2.91	-1.77	-4.47
1978-79	190300	135297	711	-0.37	-7.95	-7.66
1979-80	192554	148470	771	1.18	9.74	8.44
1980-81	194245	153100	788	0.88	3.12	2.20
1981-82	196211	152870	779	1.01	-0.15	-1.14
1982-83	199712	165850	830	1.78	8.49	6.55
1983-84	204520	175280	857	2.41	5.69	3.25
1984-85	210519	186450	886	2.93	6.37	3.38
1985-86	223347	200465	898	6.09	7.52	1.35
1986-87	237064	219520	926	6.14	9.51	3.12
1987-88	249100	235197	944	5.08	7.14	1.94
1988-89	266103	259172	974	6.83	10.19	3.18
1989-90	289060	297300	1029	8.63	14.71	5.65
1990-91	306413	329615	1076	6.00	10.87	4.57
1991-92	324540	366745	1130	5.92	11.26	5.02
1992-93	330500	393490	1191	1.84	7.29	5.40
1993-94	338550	435160	1285	2.44	10.59	7.89
1994-95	346265	471815	1362	2.28	8.42	5.99
1995-96	356444	506910	1422	2.94	7.44	4.41
1996-97	365580	549425	1503	2.56	8.39	5.70
1997-98	373830	583830	1549	2.26	6.26	3.06

Source. Indian Rubber Statistic, various issues.

However, it is the tappable area rather than the total area under cultivation that relevant in the determination of production. Therefore, we have presented in Table 2.2 the trends in tappable area

(-data in 2.1 includes also non-tappable area-) production and yield of rubber from 1968-69 onwards.

Given the nature of production,[11] to study the growth rate we fitted the folloowing exponential functional form[12];

$\ln Y = a + b_t + e$

Where "a" is the intercept term, "B" is the growth rate over the years, "t" is the time trend and "e" represents error term. It is found that area, production and yield were growing at a rate of 3.7, 6.7, 3.0 per cents respectively during the period 1968-69 to 1997-98.

Cyclical Movement:

This section analyses whether the growth of area, production and yield of rubber is characterised by the cyclical movement which analyses the movements in growth, whereas the trend analysis estimates the secular trend in the time series, which is a useful tool to identify shifts in the long-term trend in growth of any economic time series. This method uses an univariate approach, which was developed by Swinton and King (1991). In order to estimate the growth, the observed time series data was detrended by merely fitting the exponential trend stationarity model. Following Jan Timbergen's method (1950) of discerning cyclicality in growth, the detrended series is expressed as standard deviations. Then detrended series are smoothened by resorting to a three year moving average[13].

The Figure 2.2 illustrates the trend that from 1968-69 to 1973-74, area, production and yield were rising.And thereafter they had declined till the early 1980s. From 1983-84 onwards yet another

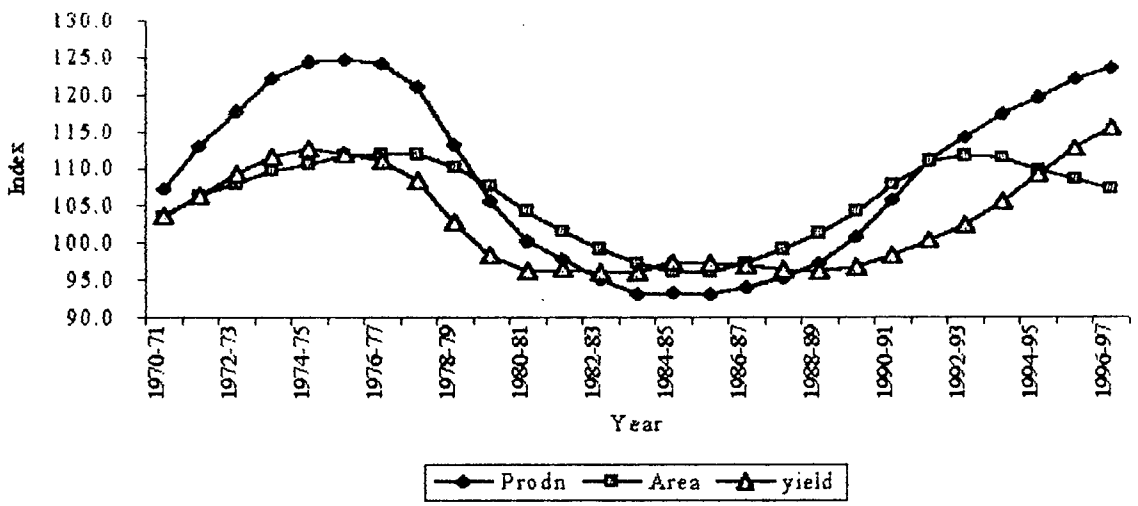
[11] Brown (1975I in the short run prdoduction of NR cannot be adjusted with price fluctuations.

[12] Regarding growth rates, the existing literature does not show a consistent agreement on which functional form fits best with regard to crop output Krishnaji. (1980), Alaghand Sharma (1980), Boyce (1987), and Pushpangadan, (1990)

[13] For a detailed discussion on theoretical and empirical validity see Anandaraj, 1998.

upward phase started for yield and production which continued till the mid 1990s, while the upswing continued only upto 1992-93 after which it started a declining trend.

Fig 2.2
Cyclical Trend of Production, Area & Yield



Since the current production trends is independent of the decisions of the farmers, the fluctuation in production cannot be attributed to that factor and could be traced to effect of NP and RP taken place at least six or seven years before the period under consideration. The reasons for the contradictory movement of price and production could be the following. Tremendous increase in New Planting (NP) and Replanting (RP) during the late fifties and early sixties led to an increase in production from 1968-69 onwards. However there was a decline in the NP and EP during 1960s to the mid seventies. The share of NP and RP declined to 35 per cent in 1973-74 of the NP and RP taken place during the 1960s and this decline caused the reduction in production in the 1970s. The growth of area NP & RP from 1975-76 together with higher governmental intervention and the introduction of HYV of RRII 105 helped to increase the production from 1982-83 onwards. However, from 1992-93 onwards area started declining due to the fall in NP & RP during eighties.

In this context the another question arises as to which factor contributed more in increasing the production in different phases. In order to know the relative contribution or area and yield in

increasing production, the decomposition model suggested by Minhas and Vaidyanathan (1971) is used. The model is outlined as follows;

Where Q_1 and Q_0 denote production during current and previous years respectively,

$$Q_1 - Q_0 = Y_0(A_1 - A_0) + A_0(Y_1 - Y_0) + 2(A_1 - A_0)(Y_1 - Y_0)$$

$$= \frac{Y_0(A_1 - A_0)}{Q_1 - Q_0} + \frac{A_0(Y_1 - Y_0)}{Q_1 - Q_0} + \frac{2(A_1 - A_0)(Y_1 - Y_0)}{Q_1 - Q_0}$$

$$\textit{Area Effect} = \frac{Y_0(A_1 - A_0)}{Q_1 - Q_0}$$

$$\textit{Yield Effect} = \frac{A_0(Y_1 - Y_0)}{Q_1 - Q_0}$$

$$\textit{Interraction Effect} = 1 - \left[\frac{Y_0(A_1 - A_0)}{Q_1 - Q_0} + \frac{A_0(Y_1 - Y_0)}{Q_1 - Q_0}\right]$$

A_1 and A_0 refer to trappable area under rubber cultivation during current and previous periods respectively,

Y_1 and Y_0 represent yield during current and previous periods respectively.

The obtained results are presented in Table 2.3

Table.2.3 Decomposition of Production

Year	Area Effect	Yield Effect	Interaction Effect
1968-69 to 1977-78	55.2	42.9	1.9
1978-79 to 1988-89	49.3	48.7	2.0
1989-90 to 1997-98	39.7	57.8	2.1

During the first phase (1968-69 to 1977-78) the expansion of area contributed relatively more to the increase in production. While the area effect was 55.2 per cent, yield effect was 42.9 per cent. In the second phase (1978-79 to 1988-89) contribution from both the factors to the increase in

production were nearly equal. In the third phase (1989-90 to 1997-98) the increase in yield contributed 57.8 per cent in the growth of production while the area effect declined to 39.7 per cent. This shift in importance from area to yield is mainly due to the awareness[14] of the small growers regarding scientific cultural operation Chandy.B. (1997) and active involvement of government from 1981-82 onwards to enhance the production. . Presently, 96 per cent of total area under smallholding is now covered by HYVs.

Given the smallholding size of farmers, and the lagged response[15] of the changes in output to the changes in price the investment decisions of the farmers will be adversely affected by violent price fluctuations[16]. Small rubber farmers cannot adjust their production behaviour in accordance with the movement of price as argued by Tan. (1984) by adjusting the tapping. The demand side factors that affect price are taken up in the next chapter.

[14] T.W.Schultz, (1964), says that the differences in land are least important, differences in quality of material capital are of substantial importance and differences in capabilities of farm people are most important in explaining the differences in the amount and rate of increase in agricultural production.

[15] Koyck says that a change in output in response to a change in price occures with a "Distributed Lag"

[16] W.W.Wilcox & W.W.Cochrane (1963), Farmers decisions depend on, in a large measure on their price expectation
of their product at a future date, in the ensuing season, next year and in the coming few years.

Chapter III

Structure of Rubber Manufacturing Industry and Consumption of Rubber

In this chapter we analyse the factors that influence the demand for natural rubber. The demand for NR is "derived" demand as it is used as an intermediate good in producing final consumer goods such as tyres, tubes, latex products etc. Thus, demand for rubber in general, and for specific types of rubbers in particular, depends on many factors influencing demand for final goods. For example, the demand for tyres as final goods is in turn influenced by demand for motor cars.

We may distinguish between short-run and long run factors that influence demand. The long run factors include level of national income, expectations of price and availability of substitutes and final goods, technology and consumer preferences. Increase in the general income level in the macro economy may stimulate the demand for rubber depending on the income elasticity of demand for final goods, using rubber as an intermediate input. For instance, increase in the demand for automobiles consequent upon improvement in per capita income would lead to an increase in the demand for rubber. The price of rubber should be considered in relation to price of substitutes. For example, if the price of natural rubber (NR) increases compared to the price of synthetic rubber (SR), the demand may shift from NR to SR. Technology is also a vital factor, which may facilitate the substitution of rubber by developing substitutes, like plastics. Technological change may reduce the demand by producing high quality, substantially modified or entirely new rubber goods, with greater efficiency and larger product life span. Consumer preference as the ultimate expression of choice is hard to pin down, but certainly end product manufacturers caters to the need of consumers by developing new products.

In the short run the demand is influenced by factors such as capacity utilisation of the rubber manufacturing industries. For example, in spite of the increase in demand, limits to the capacity utilisation levels can limit the output response of manufacturers to increased demand for a particular good having rubber content. Increased demand may be met by reducing the stock. The stock holding operations would also be an important short run factor that can influence the demand. The stock in

turn is influenced by a number of factors, particularly, the characteristics of the stockholders in terms of their capacity and trading practices such as presence or absence of collusion.

Section 3.1

Structure of Rubber Manufacturing Industries

Natural rubber is used for the production of more than 3500 kind of rubber products. The different types of NR and their typical end products are presented in the table 3.1.

Table 3.1

Major End Uses of the Different Forms of Processed Rubber

Forms of Processed Rubber	Major End Uses
Ribbed Smoke Sheets (RSS) Grades	Automotive tyres and tubes, camel back, beltings, hoses etc.
Crepe Grades:	
(a) Pale Latex Crepe	Surgical and pharmaceutical articles, adhesives, light coloured and transparent goods.
(b) Sole Crepe	Translucent shoe soling material
(c) Estate Brown Crepe	Tyre repair materials, footwear, camel back, bushes.
Crumb Rubber:	All kinds of tyres and tubes, beltings, hoses etc.
Centrifuged Latex:	Foam rubber goods, carpet backings, dipped goods such as gloves, catheters, rubber bands and latex thread etc.

Source: Handbook of Natural Rubber, 1981.

During 1996-97, more than 5000 licensed rubber goods manufacturers were operating in India. The rubber goods manufacturing industry is classified as tyre and non-tyre sectors. While the former comprises of well-organised big firms producing limited numbers of goods such as automotive tyres and tubes, and camel back. The latter, on the other hand, comprises thousands of unorganised small-scale units producing a wide range of industrial and consumer items like footwear, hoses, latex foam, cables and wires, battery boxes and dipped goods.

Size distribution of units

Table 3.2 and 3.3 depict the distribution of manufacturers according to their size group by consumption level and the percentage share of each group in the total consumption. The number of rubber manufactures and their total consumption of rubber have tended to rapidly rise. The number of manufactures increased more than four fold from 1281 in 1970-71 to 5588 in 1996-97. The total consumption of rubber by these units increased nearly six fold from 134745 MT to 771160 during the same period. The average consumption of natural rubber by an average manufacturing unit increased from 105 MT to 138 MT pointing to the fact that the average capacity of the manufacturing unit had been rising despite rapid increase in the numbers.

There were 11 manufactures who consumed more than 1000 MT per annum (category F) and 13 manufactures who consume between 500-1000 MT (category E) in 1970-71. The number of such large scale manufactures have increased to 49 each in both the categories by 1996-97. However, their share in the consumption of rubber has tend to decline. In the case of category F it declined from 70.57 per cent in 1970-71 to 62.03 per cent 1996-97. In the case of category E the share declined from 7.34 per cent to 4.37 per cent during the same period. Despite this decline the domination of the demand for rubber by a small number of large scale manufactures remain single most important aspect of the industrial profile.

Even though there has been a proliferation of small-scale units, the data also reveals that it has not been the tiny sector (category A) that registered the faster growth. The percentage share of category A in the umber of manufacturing units declined from 66.12 per cent in 1970-71 to 43.16 per cent in 1996-97. In fact, between 1990-91 and 1996-97 the number declined absolutely from 2686 to 2412. The share of the tiny category in the total consumption also declined from 3.04 per cent to 2.33 per cent during the same period.

The sharpest increase has been in category B (consuming between 10 to 50 MT) and category C (consuming between 50 to 100 MT). The share of these two categories in the manufacturing units increased from 26.7 per cent to 48.5 per cent and the share in the total consumption increased from 9.26 per cent to 15.61 per cent between 1970-71 to 1996-97. A similar improvement in the shares in category D (consuming between 100 to 500 MT) also occurred.

Table 3.2

Distribution of Manufacturers According to Their Consumption of All Rubbers

	1970-71		1980-81		1990-91		1996-97	
Consum Group	No.Manufacturers	Consum (MT)	No.Manufacturers	Consump (MT)	No.Manufacturers	Consump (MT)	No.Manu Facturers	Consmp. (MT)
A	847	2786	1696	5295	2686	15847	2412	17944
B	280	7487	817	21963	1639	55214	2206	74071
C	62	4979	159	15276	335	28375	504	46318
D	68	14513	112	27447	291	85700	368	120795
E	13	9893	18	14176	34	25463	49	33674
F	11	95087	24	163373	43	310946	49	478358
Total	1281	134745	2826	247530	5028	521545	5588	771160

Table 3.3

Percentage Shares of Manufacturers and Their Consumption

	1970-71		1980-81		1990-91		1996-97	
Consmp. Group	% Sh. Of Manufactrs	% Sh. Of Consmp.	% Sh. Of Manufactrs	% Sh. Of Consmp.	% Sh. Of Manufactrs	% Sh. Of Consmp.	% Sh. Of Manufactrs	% Sh. Of Consmp.
A	66.12	2.07	60.01	2.14	53.42	3.04	43.16	2.33
B	21.86	5.56	28.91	8.87	32.60	10.59	39.48	9.61
C	4.84	3.70	5.63	6.17	6.66	5.44	9.02	6.01
D	5.31	10.77	3.96	11.09	5.79	16.43	6.59	15.66
E	1.01	7.34	0.64	5.73	0.68	4.88	0.88	4.37
F	0.86	70.57	0.85	66.00	0.86	59.62	0.88	62.03
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note: A. 10 tonnes and below, B. >10 tonnes and upto and including 50, C.> 50 tonnes and upto and including 100,

D. > 100 tonnes and upto and including 500, E. > 500 tonnes and upto aand including 1000, F. > 1000 tonnes.

Source: Indian Rubber Statistics. Vol. 21.

Regional distribution of units

Table 4 gives the distribution of licensed manufacturers and their share of consumption of NR in different states. In 1970-71 majority of the units were concentrated in Maharashtra (18 %), Punjab (15.7), West Bengal (15.5 %), Delhi (12 %) and Kerala (9 %). These states together constituted 78 per cent of total units during the same period. During the last two decades there has been a tendency for the industry to get localised in regions that produced natural rubber like Tamil Nadu and Kerala

and away from traditional manufacturing centres, such as Maharashtra, Punjab West Bengal and Delhi. While the share of Kerala and Tamil Nadu in the number of manufacturing units increased from 14.27 per cent to 27.33 per cent between 1970-71and 1996-97, the share of traditional major production centres such as Maharashtra, Punjab, West Bengal and Delhi declined from 61.03 per cent to 37.56 per cent. Utter Predesh and Gujarat, two other major rubber-manufacturing states, have maintained their share.

Table3.4

Number of Licensed Manufacturers in Different States and Their Consumption of NR

	No. of units	% share	No.of units	% share	Consumption of NR	% share
State/UT	1970-71	1970-71	1996-97	1996-97	1996-97	1996-97
Kerala	119	9.28	994	17.79	67144	11.95
Maharashtra	230	17.95	627	11.22	62608	11.14
Punjab*	201	15.69	608	10.88	68750	12.24
Tamil Nadu	64	4.99	533	9.54	37884	6.74
West Bengal	198	15.45	531	9.50	42105	7.50
Uttar Pradesh	103	8.04	465	8.32	63860	11.37
Gujarat	78	6.08	427	7.64	30230	5.38
Delhi	153	11.94	333	5.96	17981	3.20
Haryana	65	5.07	298	5.33	31526	5.61
Karnataka	17	1.32	252	4.51	23268	4.14
Andhra Pradesh	15	1.17	173	3.10	18728	3.33
Madhya Pradesh	15	1.17	92	1.65	20914	3.72
Rajastan	9	0.70	105	1.88	30079	5.35
Bihar	7	0.54	38	0.68	1250	0.22
Goa	1	0.00	20	0.36	22682	4.04
Orissa	2	0.01	17	0.30	18137	3.23
Himachal Pradesh	0	0.00	12	0.21	**	**
Assam	4	0.03	4	0.07	**	**
Others	0	0.00	59	1.06	4619	0.82
Total	1281	100.00	5588	100.00	561765	100.00

*Note: * includes Chandigarh, ** included in others*

But it should be noted that even though Tamil Nadu and Kerala account for nearly 27 per cent of unit, they account for only 18 per cent of the total consumption of rubber. This indicates that most of the units that came up in these states are small scale in nature. In contrast in Punjab, Utter Predesh, Rajastan and Gujarat the share of consumption exceeds the share in manufacturing units. In

Maharashtra and West Bengal, the other two major players in rubber manufacturing, the two shares are nearly equal.

Nearly 73 per cent of the rubber manufacturing units in Kerala are manufacturing dry rubber products and the rest latex-based products. Interestingly, 75 per cent of the total latex produced in India is consumed in Kerala alone. Due to the cheap availability of latex, 90 per cent of total NR processing units in India are also located in Kerala. Latex contains only 60 per cent of rubber and the rest water. Water content can be removed only through the method of centrifuging which is possible only at factory level. Also, they cannot be preserved for a long time at field level as is possible in the case of other forms of rubber. It has to be packed in barrels, and transportation becomes uneconomical for those units in far away places. The natural rubber producing regions has a definite comparative locational advantage in the manufacture of latex-based products.

Type of Manufacturing Industries

The rubber manufacturing industries may be broadly classified into two- tyre and non-tyre sector. The tyre sector have three segments, i) automobile tyres and tubes, ii)cycle tyres and tubes and iii) camel back. The non-tyre sector has a large assortment of industries, most important of them being the following, i) footwear, ii) belt and hose, iii) latex foam products, iv) cable and wire, v) battery boxes and vi)dipped goods (gloves etc.). Table 3.5 gives the share of the different segments in the Indian rubber manufacturing industry between 1975-76 and 1997-98.

Table 3.5

Percentage Shares of Different End Products (1975-76 to 1997-98)

Year	Aut. Tyre &Tubes	CycleTyres&tubes	Camel back	Total tyre sector	Foot-Wear	Belt & hoses	Latex foam	Dipped Goods	Others
1975-76	49.42	12.71	4.41	66.54	9.86	7.12	1.62	2.77	12.10
1976-77	48.48	12.67	5.37	66.51	10.78	6.56	1.63	2.85	11.67
1977-78	47.90	12.74	5.06	65.70	11.02	6.40	1.83	2.87	12.18
1978-79	50.58	12.14	5.33	68.05	10.26	6.77	2.15	2.73	10.04
1979-80	48.65	12.34	5.48	66.46	11.19	6.86	2.80	2.73	9.96
1980-81	50.28	11.90	5.26	67.44	10.89	6.80	3.31	2.85	8.71
1981-82	51.50	11.81	4.97	68.27	10.24	6.71	3.62	2.89	8.27
1982-83	51.33	11.80	4.83	67.96	10.16	6.74	3.91	3.11	8.12
1983-84	51.63	11.58	4.95	68.15	9.90	6.52	4.09	3.21	8.12
1984-85	51.33	11.87	5.20	68.41	10.00	6.42	4.23	3.26	7.68
1985-86	47.52	12.60	6.34	66.46	10.19	6.56	5.22	4.02	7.55
1986-87	45.96	13.05	6.42	65.43	10.88	7.04	5.09	3.94	7.61
1987-88	45.02	13.31	6.97	65.29	10.84	7.07	5.01	4.03	7.76
1988-89	47.19	12.88	6.79	66.85	10.29	6.92	4.85	3.90	7.18
1989-90	45.12	13.28	7.06	65.46	10.36	6.94	5.20	4.11	7.92
1990-91	44.35	13.77	6.98	65.11	10.31	7.02	5.38	4.28	7.90
1991-92	43.61	13.85	7.04	64.49	10.50	7.13	5.46	4.49	7.93
1992-93	45.01	13.62	6.56	65.19	10.38	6.89	5.40	4.53	7.62
1993-94	44.34	13.67	6.53	64.54	10.37	6.92	5.60	4.96	7.61
1994-95	46.97	12.97	6.17	66.11	9.92	6.65	5.40	4.70	7.22
1995-96	46.75	12.63	6.15	65.53	9.90	6.82	5.45	4.75	7.56
1996-97	47.28	12.59	6.02	65.88	10.09	6.90	4.94	4.37	7.81
1997-98	45.62	12.44	5.81	63.87	10.21	6.78	5.10	4.58	9.47

The tyre sector accounts for around 65 per cent of the total consumption of rubber. As can be seen from table 3.5 the share of tyre & tube sector tended to fluctuate within a narrow range of 68.5 per cent to 64 per cent with a slight tendency to decline from mid eighties. Automotive tyre that includes truck and bus, tractors, jeeps and LCV, motor vehicles, scooters, moped, ADV, off the road, and aero tyres accounts for nearly two-thirds of total consumption of rubber. Though the number of truck and bus tyres is lower compared to other commercial vehicles, they consume larger quantities of NR, as they are bigger in size. Until 1984-85 the share of automotive tyre consumed on an average 50 per cent of the total NR and thereafter its share of consumption has tended to decline to around 45 per cent. In contrast, the share of camel back in consumption has tended to rise from around 5 per cent in the latter half of seventies to over 6 per cent during the nineties. The cycle and tyre and tube claim around 12 –13 per cent of the rubber consumption.

The demand for tyres can be divided onto two viz. original equipment (OE) fitted to new vehicles and replacement of tyres (REPL) used when new tyres are worn out. The distinction between OE and REPL is pertinent in assessing the demand for rubber, where the former is directly related to number of vehicles purchased. The average new passenger car may be estimated to have 5 tyres, each using an overall average of some 4-5 kg of rubber, while new trucks can have 5-23 tyres each using an average of 21 kg. Demand for REPL tyres is related to factors including intensity of vehicle use, nature of driving conditions, character and extent enforcement of minimum trade depth legislation, durability of tyres and cost of replacement. REPL accounts for 60-70 per cent of the currently used tyres in passenger cars and for 75 -85 per cent of the tyres in commercial vehicles. It should be noted here that the big tyres in heavy commercial vehicles commonly go through 3 or more retreads.

The share of non-tyre sector in the total consumption has also fluctuated within a narrow range with a slight tendency to increase from the mid eighties. More significant feature of the non-tyre sector has been the discernible changes in its composition in favour of latex-based products. The share of latex foam increases from around 1.6 per cent in the mid 1970s to over 5 per cent during the 1990s. Similarly the share of dipped goods rises from around 2.8 per cent to over 4.5 per cent during the same period. The share of the major components of non-tyre sector such as footwear (10-11 percent), belt and hose (6-7 per cent) have remained more or less stable. Therefore, the expansion of share of latex-based products has been at the expense of other minor industries.

The exponential rate of growth of tyre and non-tyre sectors shows that while the former grows at the rate of 6.9 per cent the later grows at 7.4 per cent during 1975-76 to 1997-98. Even though the share of consumption of automotive tyres is low since 1984-85 its rate of growth (based on Boyce kinked model) is high (7 %) during 1984-85 to 1997-98 compared to the earlier period (6 %). The growth of other end products also accelerated in the second period.

Before we conclude the section certain broad comments on the industrial organisational structure may be made. The tyre and tube sector is characterised by high degree of concentration right from its inception. At the time of independence few foreign companies dominated the industry. The top four companies controlled more than 75 per cent of the assets and around 90 per cent of the market in automobile tyres in 1960s (Mani, 1993). The subsequent period witnessed Indianisation of the industry mainly as a response to government policies. However, these changes did not have any

significant impact on the degree of concentration as the expansion of installed capacity took place through expansion of existing units rather than through new entry. According to Mani, (1993) the scale barriers to entry and government policies that could easily be manipulated by the entrenched interest have been mainly responsible for the persistence of ologopolistic structure. There was also no external competition as the industry was closely protected. Given the above market structure the price determination in the tyre industry has always been characterised by collusive behaviour. Despite the liberalisation during the 1990s' the market share of top ten companies in automobile tyres have increased from 92.46 in 1991-92 to 95.37 per cent in 1996-97. The share of the top four companies increased from 54.75 per cent to 61.47 per cent during the same period. In cases of automobiles tubes the share of the top ten increased from 87.53 to 95.06 and the top four from 58.1 per cent to 66.29 per cent between 1990-91 to 1996-97 (CMIE, 1998).

Compared to the tyre sector the non-tyre sector is much more competitive and characterised by the existence of large number of small-scale units. In foot wear industry the share of Bata, the leading company has tended to decline and the recent period witnessed large number of new entrants. It is only in latex-based contraceptive production and manufacture of belt and hoses that there exists any remarkable degree of concentration.

Section II

Consumption of Natural Rubber (NR) and Synthetic Rubber (SR)

Total consumption of rubber in the rubber goods manufacturing industry consists of natural rubber, and its substitutes such as synthetic rubber (SR) and reclaimed rubber (RR). While NR is produced from rubber tree, SR is a petroleum by-product. Reclaimed rubber is obtained by vulcanising the scrap rubber (dirt/ low quality natural rubber). It is produced by re-plastication (de-polymerisation) using heat or pressure or both. It gives shape and stability to the end product and its unit cost of production is very low compared to SR.

Table 3. 6

Consumption of rubber according to end products(1996-97)

Products	NR	SR	RR	Total
Tyre Sector:				
Auto tyres & tubes &Cycle tyres & tubes	73.3	20	6.7	100
Camel back	75.2	15.7	9.1	100
Non-Tyre Sector:				
Footwear	62.5	28	9.5	100
Belts and hoses	76.3	14.7	9	100
Latex foam	100	0	0	100
Cables and wires	40.5	36.8	22.7	100
Battery boxes	12.8	16.3	70.9	100
Dipped goods	100	0	0	100
Others	74	12.8	13.2	100

Source: Indian Rubber Statistics, Vol. 22, 1998.

Given the above characteristics of different types of rubber their consumption in the production of different rubber products can significantly vary. Table 3.6 presents the composition of different types of rubber according to end use. In the tyre sector more than 70 per cent of the rubber consumption consists of NR. The ratio varies significantly in the non-tyre sectors from 100 per cent for latex foam and dipped goods industries to 13 per cent in the case of battery boxes.

The table 3.7 presents the trend in the composition of consumption of different types of rubbers in India during 1968-69 to 1997-98. The data shows that overall NR, SR and RR are consumed in India in the ratio 70:20:10.

Table 3.7

Consumption, Share and Growth of NR, SR and RR During 1968-69 to 1997-98

Year	Total	%Sh. NR	% Sh. SR	% Sh. RR
1968-69	128022	67.66	21.28	11.07
1969-70	131104	65.76	23.37	10.87
1970-71	134745	64.74	24.61	10.65
1971-72	149435	64.55	24.90	10.55
1972-73	152607	68.17	22.22	9.61
1973-74	172007	75.75	13.91	10.34
1974-75	175076	75.74	13.92	10.34
1975-76	177486	70.82	18.28	10.90
1976-77	193535	71.11	18.06	10.83
1977-78	202798	71.48	17.83	10.69
1978-79	231324	71.12	17.49	11.38
1979-80	234143	70.57	18.47	10.96
1980-81	247530	70.15	19.01	10.85
1981-82	269230	69.98	19.56	10.46
1982-83	279985	69.84	19.73	10.43
1983-84	302470	69.26	20.60	10.15
1984-85	317535	68.50	20.60	10.90
1985-86	345690	68.69	20.26	11.05
1986-87	367725	69.97	19.52	10.51
1987-88	405030	70.98	18.87	10.16
1988-89	440430	71.26	19.11	9.64
1989-90	481690	70.97	19.42	9.61
1990-91	521545	69.85	20.08	10.07
1991-92	539815	70.42	19.57	10.01
1992-93	585265	70.76	18.57	10.67
1993-94	626985	71.85	18.09	10.07
1994-95	673215	72.17	18.23	9.60
1995-96	725325	72.45	18.49	9.07
1996-97	771160	72.85	18.52	8.63
1997-98	802820	71.23	20.04	8.73

The share of NR fluctuated between 65 to 76 per cent and SR between 14 to 25 per cent during the period 1968-69 to 1997-98. In contrast the share of RR remained more or less stable hovering around 10 per cent. As a result the movement of shares of NR and SR show that there has been inversely related to each other nearly throughout the period. However, it may be noted that the consumption of NR and SR grew almost at the same annual average rate of 6.8 per cent. The growth rate of RR was lower at the rate of 5.6 during this period. The data reveals a limited extent of

substitutability between NR and SR. But the ratio of consumption of NR and SR in India , 80:20, is widely different from the international ratio of 35:65. What accounts for the low consumption of SR in India?

Since the automotive tyre sector consumes the major share of NR, it is desirable to examine the factors, which limit the scope of substitutability of NR by SR in India. It has been argued that the diffusion of blending technology, instability of NR price and the divorce of its production and consumption centres resulted in the replacement of NR by SR at the world level (Tan, S 1988). In India because of high cost and lack of blending technologies SR could not make appreciable presence. After the oil crisis of mid seventies SR prices in India have generally been higher than NR prices. Further, it has also been argued that the government has been following a discriminatory policy against SR due to a number of socio-economic reasons[i]. In the tyre sector substitutability of NR by SR depends upon whether it produces radial/crossply tyres. Radial tyres are highly preferred to crosply tyres for various advantages[ii]. However, in India, while to a limited extent (35 %) the car and two wheeler tyres are radialised the giant, truck and bus tyres are of still cross ply in nature. The tyre production in other major countries has already been radialised between the range of 80 per cent (USA) and 98 per cent (European countries). High investment cost and non-availability of steel tyre cord in the domestic market are the important factors found to be limiting the radialisation in India.

To sum up we have analysed the nature of the derived demand for natural rubber. Discussion of the size distribution of units reveals that there has been a marginal decline in the share of large scale units and an increase in the share of medium scale units. There has been greater product diversification and regional distribution of units. But the rubber manufacturing industry has continued to be dominated by the tyre and tube-manufacturing sector accounting for nearly 65 per cent of the consumption. Our discussion indicates that the diversification and proliferation have been limited to the non-tyre sector. The tyre sector continues to be characterised by oligopolistic structures and collusive marketing behaviour. The concentration in the tyre and tube sector has tend to rise during the nineties. The collusive behaviour of the major consumers in the tyre sector could have important implications on the functioning of the rubber market. In the second section of the chapter we examined the trend in the consumption of NR and SR. Even though it was seen that the consumption of SR in India is much lower than the world average, within certain limits SR and NR are being used as substitutes by Indian manufacturers. However, this substitution possibility is

severely restrained by the demand conditions for tyre, tyre production technology employed and restricted supply of SR

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[i] Following arguments have been put forward for promoting NR vis-a-vis SR. **Capital Cost:** Compared to SR industry, the NR plantation sector is less capital intensive. No foreign exchange or import of know-how is involved in developing rubber plantations as are required in the case of establishing SR capacity. To establish a factory producing 50,000 tonnes of SBR (One of the mainly used grades of SR) it is estimated that a massive investment of Rs.500-600 crores will be needed. At least 25 per cent of this will be in hard currency. For producing 50,000 tonnes of SBR about 80,000 tonnes of naphtha will have to be imported and cracked to produce the monomers required for polymerisation. In contrast to this for producing 50,000 tonnes of NR the investment required is only around Rs.120 crores, on the assumption that the yield will be 1,500 kg/ha. And the planting and maintenance cost upto the tapping stage is Rs. 40,000/ha. **Production Costs:** The minimum economic size of a SR plant in Indian conditions is 100,000 tonnes according to the Government of India (Ministry of Industry in August, 1989). But the actual installed capacities of the existing factories are grossly inadequate leading to high cost of production. **Energy and environment:** Rubber plantation is ecologically favourable compared to SR plants and it is the source of supply of fuel wood, timber, vegetable oil, oil cake and honey as by-product. Rubber plantations are renewable and non-polluting. The SR production requires costly energy input while the rubber plantations produce rubber as a result of photosynthetic action in nature. **Employment:** SR plants generate much less employment opportunities that what NR plantations can generate. On hectare of rubber plantation gives employment to 0.7 person.

[ii] **Comparison of Crossply and Radial Tyres**

Crossply Tyres	Radial Tyres
❖ Reinforcing cords extend diagonally across the Tyre from bread to bread.	❖ Reinforcing cords extend transversely from bread to bread.
❖ Cords are at angle to centre line of the tyre	❖ Cords are 90^0 to the centre line of the tyre.
❖ Breakers (short lies) positioned between tread And casings	❖ Inextensible belts under the tread and top of carcass plies.
❖ Lower life mileage but higher retreadability Factor resulting in comparable cumulative mileage.	❖ Higher first life mileage but lower retreadability factor.
❖ Higher tyre weight	❖ Lower tyre weight
❖ More suitable for overload and bad roads	❖ More susceptible to failures or overloading and bad roads (harsh ride)
❖ Lower investment cost	❖ Higher investment cost
❖ Suitable for existing vehicle suspension	❖ Need improved vehicle suspension
❖ Lower cost (price)	❖ Higher cost(price)
❖ Less fuel efficiency	❖ Better fuel efficiency.
❖ Less safe at higher speed	❖ More safe at high speed
❖ Average sophistication precision in processing required	❖ High precision sophistication needed in processing

Source: BICP, 1982.

Chapter III

Structure of Rubber Manufacturing Industry and Consumption of Rubber

In this chapter we analyse the factors that influence the demand for natural rubber. The demand for NR is "derived" demand as it is used as an intermediate good in producing final consumer goods such as tyres, tubes, latex products etc. Thus, demand for rubber in general, and for specific types of rubbers in particular, depends on many factors influencing demand for final goods. For example, the demand for tyres as final goods is in turn influenced by demand for motor cars.

We may distinguish between short-run and long run factors that influence demand. The long run factors include level of national income, expectations of price and availability of substitutes and final goods, technology and consumer preferences. Increase in the general income level in the macro economy may stimulate the demand for rubber depending on the income elasticity of demand for final goods, using rubber as an intermediate input. For instance, increase in the demand for automobiles consequent upon improvement in per capita income would lead to an increase in the demand for rubber. The price of rubber should be considered in relation to price of substitutes. For example, if the price of natural rubber (NR) increases compared to the price of synthetic rubber (SR), the demand may shift from NR to SR. Technology is also a vital factor, which may facilitate the substitution of rubber by developing substitutes, like plastics. Technological change may reduce the demand by producing high quality, substantially modified or entirely new rubber goods, with greater efficiency and larger product life span. Consumer preference as the ultimate expression of choice is hard to pin down, but certainly end product manufacturers caters to the need of consumers by developing new products.

In the short run the demand is influenced by factors such as capacity utilisation of the rubber manufacturing industries. For example, in spite of the increase in demand, limits to the capacity utilisation levels can limit the output response of manufacturers to increased demand for a particular good having rubber content. Increased demand may be met by reducing the stock. The stock holding operations would also be an important short run factor that can influence the demand. The stock in

SECTION I

Evolution of Policy Regimes in the Rubber Economy:

The independent India inherited a highly regulated rubber economy (Mani, 1983, George, et al. 1988). The price of NR used to be determined by the rubber regulating authority. Apart from the determination of price, the government used to have other regulatory controls. These regulatory controls can be divided into two broad categories, viz., (i) qualitative controls and (ii) quantitative controls. The qualitative controls were in the form of imposition of minimum and maximum price and monopoly procurement of rubber by the government[2] and payment of price differential of imported NR and the domestic NR to the government. The quantitative controls were in the form of compulsory submission of stock returns by the manufacturers, dealers and estates and quota restrictions on import[3]. These sets of policies were aimed at protecting the domestic production from the competition from the world market[4]. Apart from the policy of protecting the domestic rubber economy from international competition, the set of regulatory policies that were introduced to control the domestic price of rubber is delineated in the Table 4.1.

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[2] The system of government procurement of rubber was in operation from 1947 to 1964.

[3] In order to avoid the dampening effect of stock piling on price and for proper estimates of demand supply gap, the promulgation of Government of India's Sock (Control) Order of 1942 made it mandatory for all the manufacturers, dealers and estates to submit the stock returns.

[4] As the part of controlling import, in 1956, the government announced that the manufacturers should pay the price difference of imported and indigenous rubber to the government. During sixties too the imports were controlled through frequent enhancement of import duties. The system of minimum statutory price notified by the Tariff Commission had been in existence till 1981. However, subsequent to the frequent request of growers to dismantle the maximum price in the late 1968 the maximum ceiling was removed. The supply and demand imbalance existed during this time encouraged the government to follow a system of monopoly procurement from 1942 to 1964.

Table 4.1: The Price Control Measures During Regulatory Regime

1. The Rubber Production and Marketing Act (1947) introduced the Statutory minimum rice for NR in 1947.

2. During the period from December 1947 to December 1963 and from October 1967 to November 1968 maximum ceiling price had also been put into operation.

3. The State Trading Corporation was permitted to enter the market as a price controlling mechanism. From 1970-71 to 1977-78, market regulations were operated through the STC and from 1978-79 onwards all the imports were canalised through it to control the variability in the price.

4. The Buffer Stock scheme came into operation from 1986 to act as an instrument to narrow down the production-consumption gap so that the upward pressure on price of NR arising out of higher demand could be controlled.

The introduction of structural adjustment programme largely dismantled these qualitative and quantitative restrictions. The duties on rubber and rubber product imports were cut down drastically. The policies as shown in Table 4.2 were not continued uninterruptedly till the process of liberalisation began in 1991. In fact, at various time points, government had altered these polices according to the changing situation in the rubber economy of India. For example, the maximum ceiling price was withdrawn in 1968 because the growers did not find it attractive to continue with the ceiling on the price of NR as the difference between the minimum statutory price and maximum ceiling price was narrowing down (Mani, 1983). Apart from this, substantial fluctuations in NR prices induced the government to change various policies to stabilise these prices. It can be seen from the Table 2, that minimum price support policy of the government had continued for most of the years. Where as maximum ceiling price policy of the government after the withdrawal in 1968, December, was reintroduced for a short period of time during the last half of 1980s'. The continuation of the minimum price support was aimed to prevent a sharp decline in prices and thereby provide a provision of an income-guarantee to the small holders and estates. In other words,

higher priority was attached to maintain the minimum price than the maximum price.

Moreover, with the increase in production during the early periods of seventies the STC was authorised as a market-regulating agency from 1972 to 1978 and onwards all the imports were canalised through the STC from 1978-79.

Table 4.2: Price Policy of the Government in the Natural Rubber Market

Period	Minimum Price	Maximum Price
1947.12-1963.12	Yes	Yes
1964.01-1967.09	Yes	No
1967.10-1968.11	Yes	Yes
1968.12-1981.08	Yes	No
1981.09-1986.02	No	No
1986.02-1988.09	Yes	Yes
1988.10-1991.01	Yes	Yes

Source: Compiled from Burger et al. 1995

It was authorised to import and distribute NR to manufacturers during lean production season when production would comparatively be lower than the consumption. Similarly the STC used to release stocks whenever the production and consumption gap widened.

Inspite of the fact that, from September 1981 onwards the statutory minimum price was removed and STC became the only price controlling mechanism from 1981 to 1986. There had been some fluctuations in the price during the first half of 1980s'. Subsequent to these fluctuations, from 1986 to February 1994 the Buffer Stock Scheme (here after BSS) was in operation (except 1987, 1989 and 1990). The BSS policy aimed at stabilising the price of NR at a level remunerative to rubber growers and fair to the producers of rubber products.

However, the behaviour of price movement and stabilisation mechanisms has got changed when the economy was opened up in 1991. Till 1990-91 the Indian NR price was insulated from the

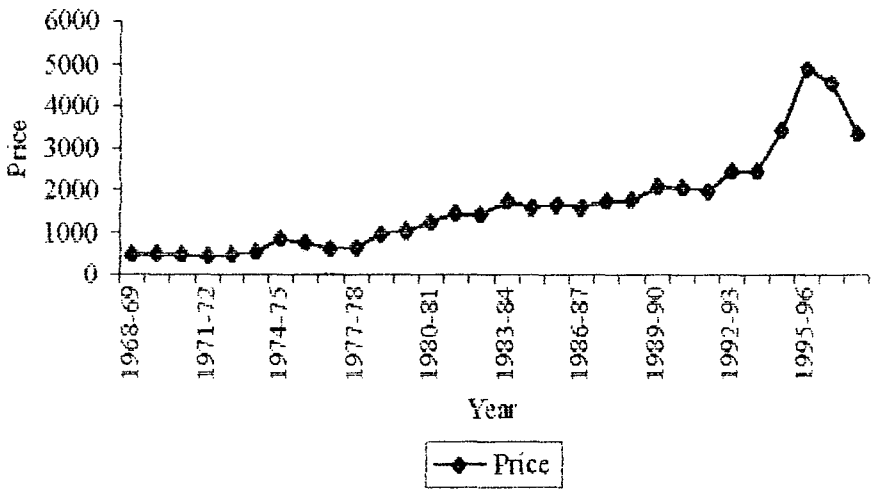
movement/influence of the price movement of NR in the world market. During the period of post liberalisation, though NR is still in the negative list, the import duties were cut down from 60 per cent in 1983 to 30 per cent in 1992 and 25 per cent in 1995 and 20 per cent from 1997 onwards. Import of rubber products, particularly used tyres, was also liberalised to an extent. Another factor is that from 1991 to 1997 no import was done through the STC and the stock with the STC too declined considerably. Further more from 1994 onwards no procurement by the STC was made except the commercial procurement.

SECTION II

Trends in NR Price:

Having discussed the government policy with regard to the stabilisation of NR price, in this section we discuss the trends in the price of NR. As seen in Figure 4.1, the NR price increases almost exponentially during the entire period of analysis except for the last two years (1996-97 and 1997-98). It is seen from the figure that, between 1968-69 and 1997-98, the absolute price of NR exhibited an increasing trend. Even though, there had been more than 5-fold increase in the NR price from Rs 466 in 1968-69 to Rs. 4531 in 1996-97, the rate of increase in the price was different in different sub periods. For example, between 1968-69 and 1973-74, the absolute price of NR remained more or less stagnant. However, from 1974-75 to 1995-96, there had been a steady upsurge in the price of NR from Rs. 849 to Rs 4531. The point to be noted here is that compared to the 1980s', the price of NR showed a sharper increase during 1990s'. Between 1991-92 and 1995-96, the increase in the price was from Rs. 1975 to Rs.4531.

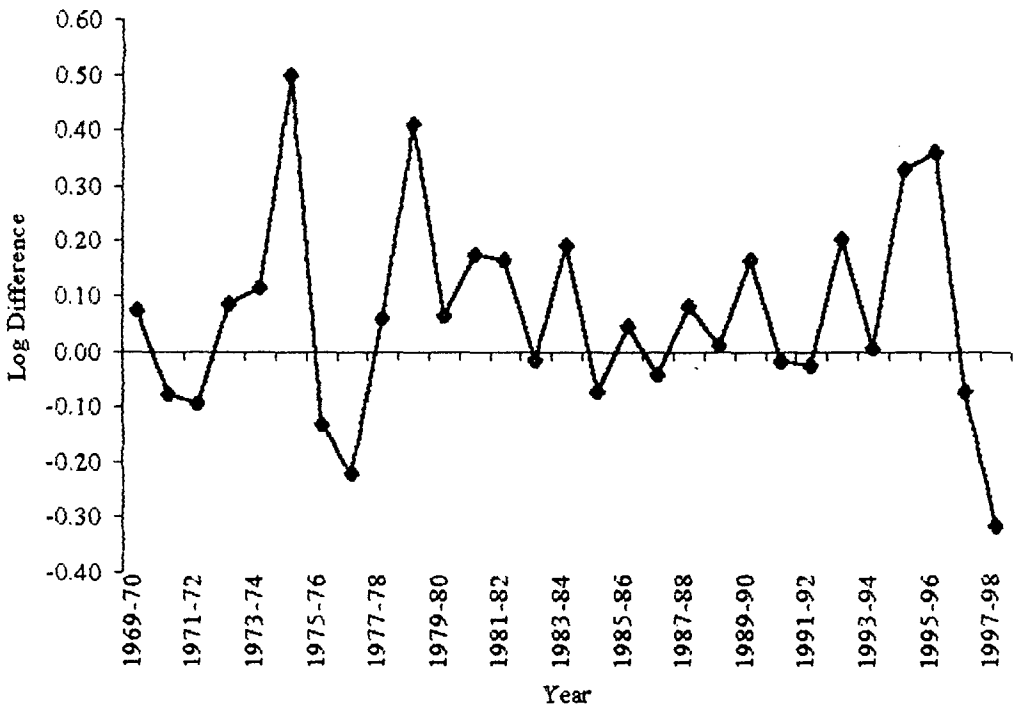
Figure 4.1
Movement of NR Price (Absolute)



The seventies, broadly coincides with the partial decontrol characterised by the removal of maximum price restriction and the permission of imports by the manufacturers. The introduction of the STC as a shock absorber of the NR price volatility due to the removal of maximum price restriction and the allowance for import during this period, could be the reason attributed to the moderate increase in the rubber price during the 1970s compared to the 1980s and 1990s. During the first half of the 1980s', the mechanism of statutory minimum price was withdrawn and was later reintroduced for few years during the late 1980s. During the second half of the 1980s' also, the STC undertook the Buffer Stock Scheme operation implying determination of upper and lower limits for the price. We have noted in Figure 4.1, that there had been a near secular increase in the price of NR from 1968-69. To examine whether the fluctuations in the NR price during this period, the series of absolute price of NR was detrended by taking the first difference of logarithm, i.e., $\ln p_t - \ln p_{t-1}$).

It can be observed from the detrended series in Figure 4.2 that there were wide fluctuations in the

Figure 4.2
Movement of Average Price (1968-69 to 1997-98)



NR price movement during 1968-69 to 1997-98. On the basis of observed fluctuation, the whole period of analysis can be divided into three sub-periods. The first, second and third sub-periods are the period from 1968-69 to 1979-80, from 1980-81 to 1989-90 and from 1990-91 to 1997-98 respectively.

The first phase (1968-69 to 1979-80) is characterised by much wider annual upward and downward movements of price. While in the second phase (1980-81 to 1989-90) fluctuations are much smaller in magnitude. However, again in phase III (1990-91 to 1997-98) price showed sharp upward and downward movements. The coefficient of variation in price was highest in phase III (35.6), followed by phase I (32.7) and phase II (14.3). In order to understand the observed behaviour of

price in different sub-periods, we examine the growth of production, consumption, stock, imports, and exports as these factors mainly influence the prices.

Phase I (1968-69 to 1979-80):

It is already mentioned that this phase is characterised by wider fluctuations in the NR price. It can be seen from Table 4.3 that during this period, the NR price grew at an annual rate of 9.8 per cent. In this period, the consumption grew at a slower rate than the production. Despite the relatively slower growth of consumption, the production was not sufficient to meet the consumption requirements. It is evident from Table 4.4 that in phase I, that only 98.47 per cent of the total consumption were met through domestic production. The export as a percentage of total production was only 1.52 per cent. On the other hand, the import as a percentage of total production was 5.82 per cent.

Table 4.3 Average Annual Growth

	Average Price	Produc-tion.	Stock	Import	Export	Consum-ption
I Phase	9.80	7.10	12.50	-3.70	-8.80	6.30
II Phase	6.51	7.72	8.53	41.81	0.00	7.85
III Phase	9.91	8.52	9.97	60.92	122.75	6.68
All	8.75	7.64	9.75	20.72	15.94	6.85

However, this import was not sufficient enough to cover the gap between production and consumption. It can be seen from Table 4.4 that import could cover only 54 per cent of the gap between production and consumption. Thus, the rest of the consumption requirement was possibly met through the depletion of stock. On average around 35 percent of the production was being held as stock during this period. This period also witnessed a restrictive import policy by the government to protect the domestic growers through the active involvement of the STC in the NR market.

Phase II (1980-81 to 1980-90):

Compared to phase I, the Phase II did not experience much of fluctuations in the NR price. The rate of growth of average price was 6.51 per cent during this period. In this period, both production and consumption grew at a rate of around 8 per cent. However, in phase II, the domestic production was substantially lower than that of consumption requirement. It can be seen from the Table 4.4 that the production could only meet around 85 per cent of the consumption. During this phase, the import was relatively higher than that of previous phase. During this period, import expanded at 41.81 per cent per annum. On an average, imports constituted 19.69 per cent of the domestic production. Unlike the first phase, the imports covered more than the production-consumption gap. Imports were 104 per cent of the production-consumption gap[5]. Another important feature of this phase was that the level of stock holding was 9 percentage point lower than the phase I.

Table.4.4 Annual Average Percentage Shares

	Pdn as % of Cons	Sto.as % of Prodn	Imp. As % Of Prodn	Exp as % of Prodn	Imp as % of Gap
I Phase	98.47	35.24	5.82	1.52	54.36
II Phase	84.46	26.11	19.69	0.00	104.75
III Phase	96.51	20.50	6.08	0.51	151.43
All	93.28	28.27	10.51	0.74	97.06

As the international NR price was lower than that of domestic price of NR during this period (see Figure 4.3), import was less costlier which prompted the STC to import more than the production-consumption gap. In fact, upto 1988, direct imports by manufactures were negligible compared to imports by STC (Burger, et al., 1995).

The rate of growth of annual average price for this phase had declined to 6.5 percent compared to 10 per cent in the first phase. This has happened when the rate of growth of production was marginally higher (at 7.72 per cent) than that of in the first phase. However, during the second phase

[5] Releasing of imported natural rubber by the STC presumably occurs whenever the price of natural rubber rises and the gap between production and consumption becomes very big (Burger, et al., 1995).

consumption increased by around 2 percentage points from the first phase. The imports were an important factor that helped the authorities to rein the price rise. There were no exports during this phase.

Phase III (1990-91 to 1997-98):

This phase is completely different from the earlier phases. In earlier phases, high import duties, both for synthetic and natural rubber, import licensing, foreign exchange shortages and the presence of the STC, have effectively isolated the Indian rubber economy from the world market (Burger, et al., 1995). The remarkable feature of this phase is that no institutional intervention was there to stabilise the price. Also, from 1991 onwards no import was made through the STC (see Table 4.5).

As mentioned earlier, the era of trade liberalisation initiated in 1991 has made an attempt to integrate Indian NR market with the global economy through a cut in import duty of NR. Not only the reduction in the import duty but various other policy initiatives by the government, viz., advance licensing for export promotion, special import licensing scheme. Duty Entitlement Pass Book (DEPB) scheme, and Public Notice was meant to encourage the import of NR during the liberalised regime.

Table 4.5: Import of NR Through Different Channels

	(1986-87 to 1997-98)			
Year	AL(wd*)	STC	Pub Notice	Total
1986-87	5128	40228	0	45356
1987-88	NA	NA	0	53685
1988-89	8472	51363	0	59835
1989-90	17896	26549	0	44445
1990-91	17314	31699	0	49013
1991-92	15070	0.00	0.00	15070
1992-93	17884	0.00	0.00	17884
1993-94	15884	0.00	4131*	20015
1994-95	8093	0.00	0.00	8093
1995-96	13185	0.00	38450*	51635
1996-97	19770	0.00	0.00	19770
1997-98	29389	0.00	0.00	29389

Note:AD=Advance Licensing, PUB= By manufacture through Public Notice, STC=State Trading Corporation WD=Without Duty, *denotes without duty

During this phase, production-consumption gap had narrowed down compared to phase II because of a rise in domestic production of rubber. This was mainly due to the increase in yields coupled with marginal decline in the rate of growth of rubber consumption due to the industrial recession of the mid nineties. Because of this, the domestic production could cover 96.51 per cent of the total consumption. The total import was 151.43 per cent of the production-consumption gap.

It can be seen from Table 4.6 that between 1968-69 and 1997-98, total import showed 6.65 fold increase. However, periodic movement of import does not exhibit a specific trend. After an initial spurt, the volume of import declined steadily from 1970-71 to 1977-78. Between 1978-79 and 1990-91, the volume of import though fluctuated; the total volume of import was quite larger than that of 1970s. The increase in the volume of import was from 51041.85 MT in 1990-91 to 64198.51 MT in 1995-96.

However, there were years of exceptions, when the import went below 1990-91 level. Another point to be noted here is that during the 1990s', the share of finished products import in total import

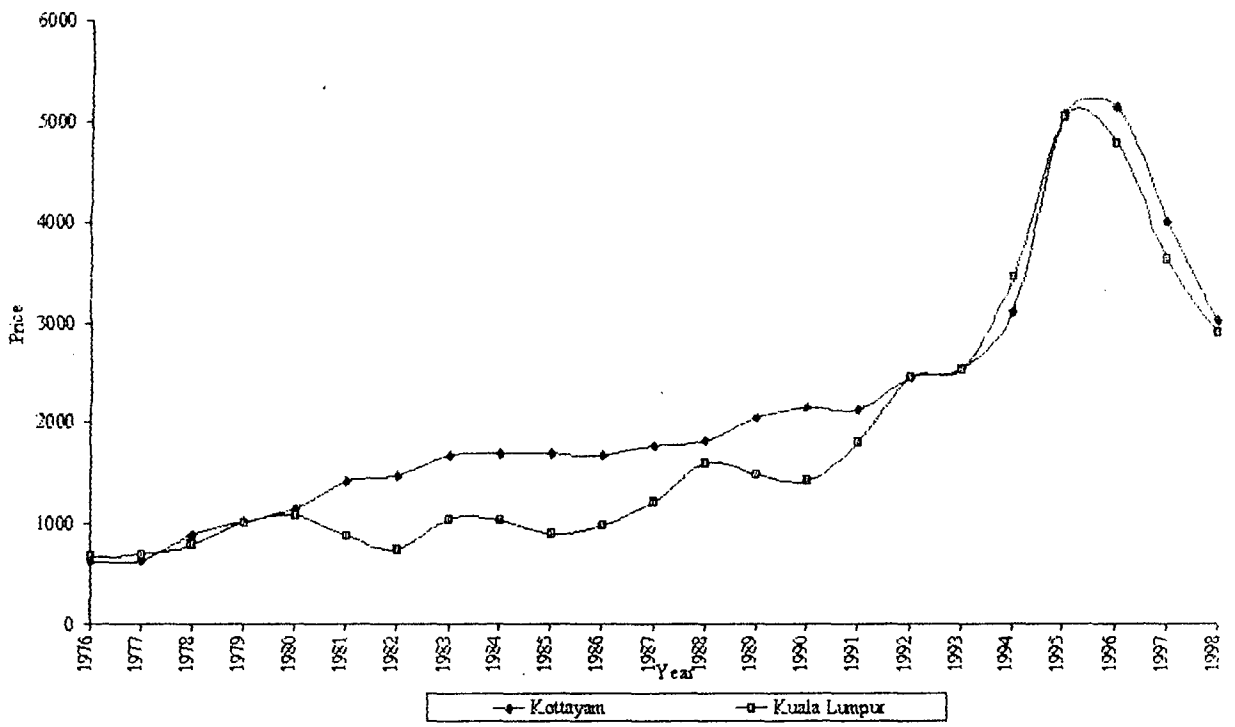
showed a significant increase. The share of finished product in total import increased form 3.97 per cent in 1990-91 to 26.51 per cent in 1996-97.

Table 4.6: Import of NR and Finished Products

Year	NR Import	Import of Finished Products	Total Import
1968-69	8548	1104.38	9652.38
1969-70	17821	1313.08	19134.08
1970-71	2469	1019.82	3488.82
1971-72	437	1921.36	2358.36
1972-73	380	1324.50	1704.50
1973-74	52	1883.13	1935.13
1974-75	0	1628.81	1628.81
1975-76	0	1889.35	1889.35
1976-77	0	1984.00	1984.20
1977-78	0	629.81	629.82
1978-79	14750	1201.28	15951.28
1979-80	32200	5409.53	37609.53
1980-81	9250	3649.75	12899.75
1981-82	42750	17478.34	60228.34
1982-83	33401	206.88	33607.88
1983-84	35940	1024.67	36964.67
1984-85	37461	1021.36	38482.36
1985-86	41431	380.281	41811.28
1986-87	45356	478.33	45834.33
1987-88	53685	2470.165	56155.17
1988-89	59835	884.42	60719.42
1989-90	44445	18725.55	63170.55
1990-91	49013	2028.85	51041.85
1991-92	15070	672.22	15742.22
1992-93	17884	3144.55	21028.55
1993-94	19940	10860.64	30800.64
1994-95	8093	16837.35	24930.35
1995-96	51635	12563.51	64198.51
1996-97	19770	7133.462	26903.46

Note: 1. Finished product import considers only the tyre import (excluding by-cycle tyres)
2. Because of the adding up problem, other finished products Import is not considered.

Figure:4.3 Movement of World and Indian NR Price, 1976 to 1998
(Absolute price for RSS 4& RSS 3)



As import became easier during this phase, the stock level declined further to 18 per cent of production compared to 21 per cent in the previous phase. During this phase average price grew at a rate of 9.91 per cent per annum. During the phase III, there had been an increase in the import of rubber products as well.

The post 1990's price behaviour can be explained with reference to the international price movement. As we noted earlier, the post 1990s', the period of trade liberalisation led to a drastic cut in the import duty of NR, which in turn put the Indian NR price almost at per with the international price of NR (see Figure 4.3). From 1990 onwards both international and domestic NR prices registered a sharp increase till 1995. However, during 1996 to 1997 they have registered a

sharp fall. The estimated correlation coefficient between domestic and international NR price for the period between 1982 and 1991 and 1992 and 1998 were 0.86 and 0.97 respectively (at 1 per cent level of significance). In other words, the correlation between domestic and international price of NR became stronger in the post liberalisation period. The rise in price from 1993 to 1995 was an indication of the recovery of the world automobile sector after a recession during the earlier period. The reason for the declining trend in price from 1996 onwards could be attributed to the onset of South-East Asian crisis. The emergence of the South-East Asian crisis and the consequent devaluation of the currency made the import of NR costlier to these nations and hence their demand has slackened (Rubber Trends, 1997, Mathew, 1998).

Having compared the growth of production, consumption, stock, import and exports during theses different phases, it is not possible to arrive at a definite conclusion on the factors that have influenced the fluctuation in the prices in different sub-periods. Of course, the varied growth of these factors has definitely affected the supply and demand conditions of NR and thereby the price. Thus, there is a need to have close look at the supply demand condition in the NR market during these different sub periods. The point to be noted here is that supply demand conditions in a year gets considerably influenced by the seasonality. In the next section, we examine the supply demand condition in the NR and also the seasonality factor which affects the market condition and thereby the price.

Section III

An Analysis of Supply Demand Conditions in NR Market

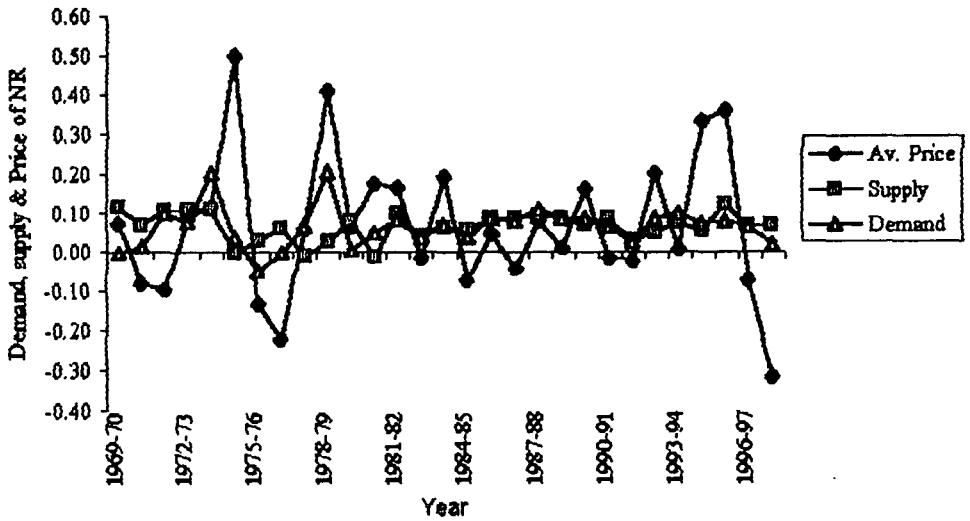
The basic micro economic formulation of price theory argues that, other things remaining constant, price is determined by the interaction between demand for and supply of a particular commodity. In other words, the non-distortionary market mechanism free from government intervention is the key factor in the determination of price. However, in this context, the behaviour of NR price was not only influenced by the demand and supply factors. As mentioned earlier, the price policy of the

government played a vital role in the structure and behaviour of the NR price. The point to be noted here is that, given the nature of the commodity with significant seasonality of production, but evenly distributed demand, accompanied by uncertainty of imports and oligopsonistic nature of buyers, stock holding also plays an important role in the determination of the price.

As mentioned, the total rubber supply in a particular year depends on three factors, viz., production, import of both the NR and manufactured products and stock of rubber. The total demand depends on the volume of consumption by various industries and export. It can be seen from Figure 4.4 that the movement of average prices of NR (de-trended price) has broadly followed the expected functional relationship of price with demand and supply of NR.

The movements of supply and demand showed wider fluctuations during 1970s'. During 1981-82 to 1991-92, the total demand and total supply broadly matched with each other. Between 1992-93 and 1994-95, demand exceeded supply marginally. However, during 1995-96 to 1997-98, supply exceeded the demand, which led to a fall in the rubber price in 1997-98.

Figure 4.4
Trend in the Demand, Supply & Price (1968-69 to 1997-98)



Seasonality of Production, Consumption Stock, Import:

Apart from supply and demand factors, the seasonal factors could have also affected the price of NR[6]. The NR, being an agricultural product characterised by seasonalities of production and also being storable; the monthly prices can be influenced by the seasonality of production, consumption, stock and import. In order to understand the seasonal movement of price, the monthly data of price, production, consumption, stock and import for the period from 1968-69 to 1996-97 has been analysed. The seasonal indices of price, production, consumption, stock (of both manufacturers, and dealers and growers) and import were analysed seperately for the three different phases.

To examine the seasonality, we have used the methodology adopted by Tscherley (1995). The advantage of this method is that the trend is completely excluded as the original data gets deflated by another nominal series (the centered moving average for 12 months)[i]. It can be seen from the Table 4.7 that the seasonal indices of price in the three different phases have moved differently. In the first two phases, the price was maximum during July where as in the third phase it was in the months of May and June. Similarly, the lowest price registered in June in the first phase. However, in the second phase price pushed down to the lowest level for two months namely, November and December.

The seasonal indices of production also revealed that, the highest production in all the phases were in the month of December. The NR production generally starts peaking up from August and reaches its peak in December. The lean season is considered to be February and March. The lowest production was in these two month during the three different phases.

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[6] Seasonality is defined as a systematic movement that repeats itself every 12 months. Seasonal nature of production affects price in two ways (Thomsen and Foote, 1952). One is, when the production of commodities of perishable and semi-perishable nature increase, price falls and vice versa. Secondly, non-perishable commodities, which can be stored throughout the season, are lowest in price at harvest time. When the season's supply is relatively uniform through out the months in a year, price also, on the average, remains uniform throughout the year. The rather predictable price fluctuations of this type are common among agricultural products, mainly, though not, exclusively among products that may be stored (Tschirley, 1995).

Table 4.7

Seasonal Indices (1968-69 to 1979-80)

	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	GIS
Price	101.3	102.8	102.73	105.03	102.45	100.65	95.32	96.06	95.65	99.39	99.21	99.39	1200
Prdn	85.8	100.4	93.38	78.65	81.87	107.38	115.93	129.69	152.02	128.30	52.38	74.23	1200
Consm	97.10	92.55	100.50	104.33	102.11	100.31	88.74	102.40	107.91	101.97	99.64	102.45	1200
Import	140.2	53.0	54.37	91.93	157.71	182.17	214.98	66.48	85.81	53.98	39.86	59.48	1200
Stock	95.48	100.97	101.29	95.37	88.37	86.50	92.75	98.28	109.85	115.48	111.06	104.60	1200

Seasonal Indices (1980-81 to 1989-90)

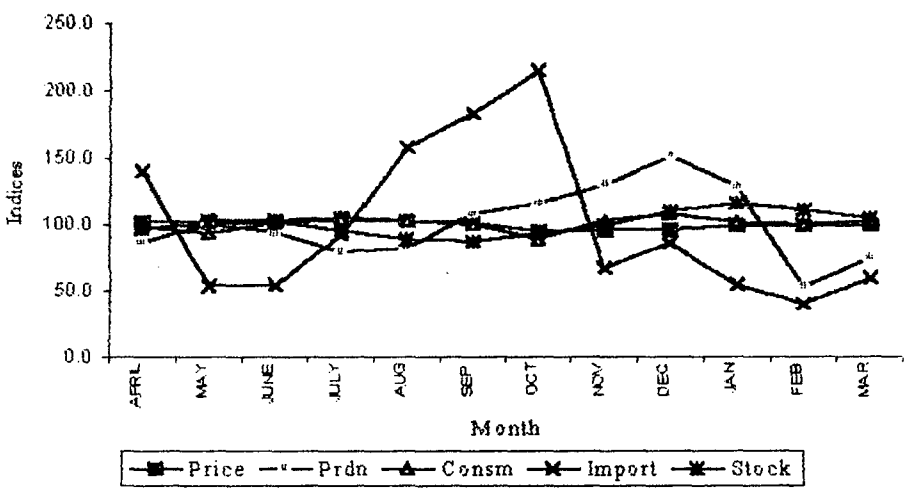
	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	GIS
Price	102.2	104.2	104.5	104.8	104.4	99.0	97.3	94.7	94.8	96.9	97.9	99.1	1200
Prdn	79.2	115.6	69.8	67.6	81.9	103.3	139.5	145.0	153.2	127.5	53.0	64.5	1200
Consm	98.3	98.5	99.3	100.3	98.2	98.0	95.3	101.3	107.6	102.6	99.3	101.3	1200
Import	146.5	149.6	139.5	189.8	160.2	116.9	9.3	12.8	25.4	72.4	87.7	90.0	1200
Stock	96.7	102.4	102.9	95.5	94.0	95.1	91.2	94.9	104.3	107.8	108.8	106.3	1200

Seasonal Indices (1990-91 to 199-97)

	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	GIS
Price	102.7	106.8	106.9	101.6	100.6	100.0	96.0	91.4	95.8	97.1	99.5	101.5	1200
Prdn	86.2	99.7	72.0	74.0	91.4	118.5	126.8	134.7	144.4	127.8	58.3	66.3	1200
Consm	97.9	97.5	98.7	101.1	99.7	97.4	98.4	101.6	104.8	102.4	99.5	101.1	1200
Import	97.6	92.4	111.9	177.9	169.1	147.8	80.1	64.3	45.3	42.7	47.9	123.0	1200
Stock	110.4	105.1	102.4	88.9	77.7	78.9	84.7	90.4	104.4	116.8	119.7	120.6	1200

In all the three phases, consumption reached its maximum in December. But the lowest consumption was in October in the first and second phase. Whereas in the third phase it was in September. The volume of import in the first phase was very high during the August to October. This period largely coincided with the peak season of production. The lowest import in the first phase was made in February. In the second phase import was higher during the period April to September. During this period, the production increased only moderately. But in the third phase, maximum import was made from June to September, the period in which production was lower than the peak period. In the second phase and third phase, the lowest import was recorded in the month of October and January respectively.

Figure 4.5.a
Seasonality (1968-69 to 1979-80)

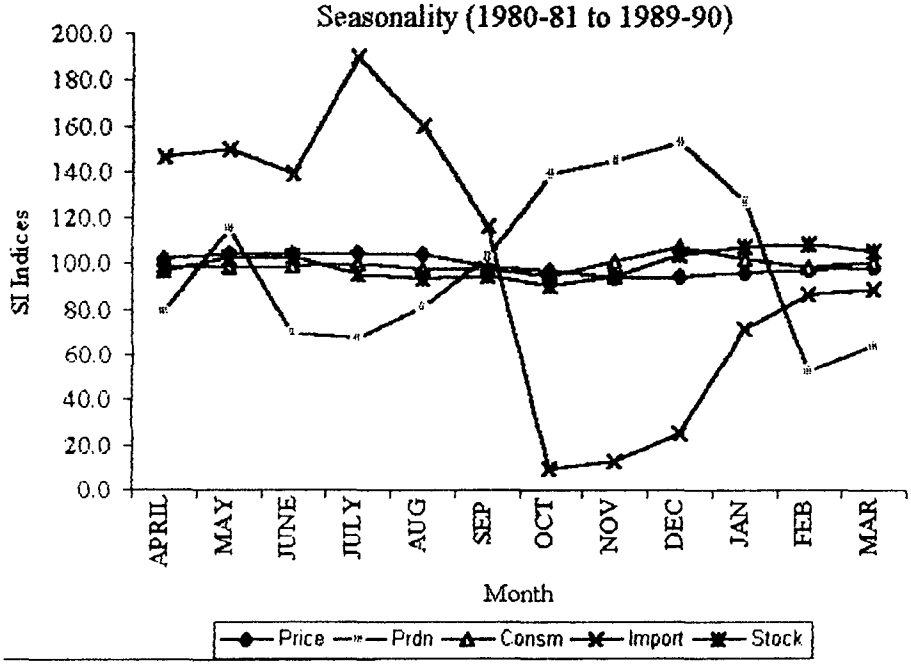


With regard to the movement of SI of production and price, one would expect an inverse relationship because increase in production and the corresponding increase in the 'market arrivals' should reduce the price. However, the observation of data does not provide any kind of relationship between the two. The study of Ipe (1988) also argued that the impact of production on price was

mild and subdued in one direction. The market imperfection, especially, oligopsony in the buying market could be the reason (Ipe, 1988 and 1986; Wharton, 1962; George, 1978). From Figure 4.5a, 4.5b, and 4.5c it was also observed that SI of consumption and price moved together in all the three phases.

It can be seen from the Table 4.8 that the seasonal accumulation of stock by the manufacturers dealers and growers was highest in January in all the phases. The seasonal index of monthly stock holding by the manufacturer[7] was found to be moving along with that of production, consumption and price in all the three phases. Conceptually a fall in price should induce greater stock holding and vice-versa. The bi-directional movement of price and stock could be attributed to two reasons (Hwa, 1984 and Tan, 1988).

Figure 4. 5.b
Seasonality (1980-81 to 1989-90)

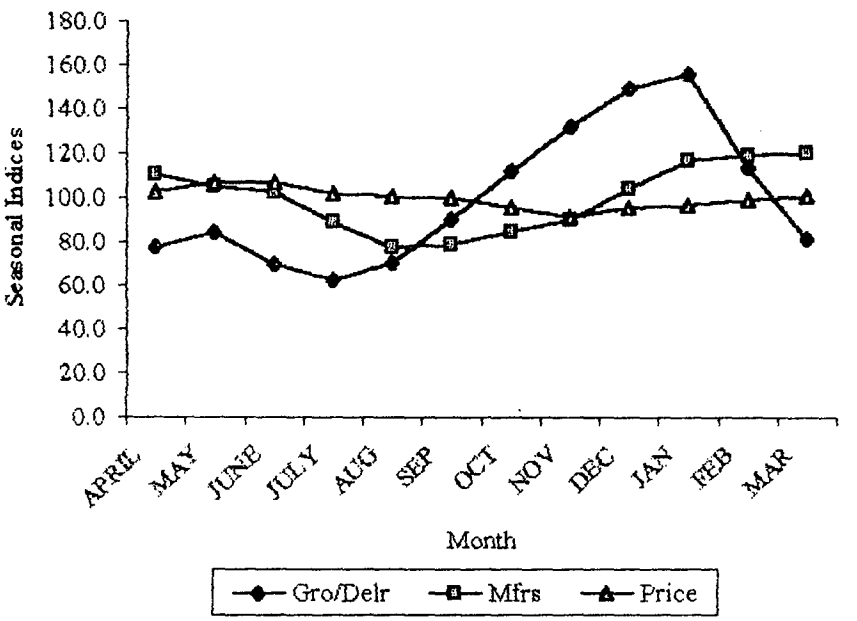


[7] The stockholders comprise of manufacturers, growers and dealers. While the manufacturers hold stock as an inventory adjustment (precautionary motive) to sustain the glut in the market, the dealers and growers hold stocks for speculative purposes.

Table 4.8 Seasonality of Stock of Growers/Dealers and Manufacturers

I Phase	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	GIS
Gro/Delr	96.4	98.0	95.0	87.2	85.1	91.2	99.5	107.2	117.7	122.2	102.7	97.7	1200
Price	101.3	102.8	102.73	105.03	102.45	100.65	95.32	96.06	95.65	99.39	99.21	99.39	1200
Mfrs	95.48	100.97	101.29	95.37	88.37	86.50	92.75	98.28	109.85	115.48	111.06	104.60	1200
II Phase													
Gro/Delr	85.1	93.9	82.6	75.2	78.3	90.8	112.2	125.2	133.6	134.9	103.8	84.4	1200
Price	102.2	104.2	104.5	104.8	104.4	99.0	97.3	94.7	94.8	96.9	97.9	99.1	1200
Mfrs	96.7	102.4	102.9	95.5	94.0	95.1	91.2	94.9	104.3	107.8	108.8	106.3	1200
III Phase													
Gro/Delr	77.7	84.4	69.5	62.7	70.0	90.1	111.9	131.9	149.9	156.2	114.1	81.6	1200
Prtice	102.7	106.8	106.9	101.6	100.6	100.0	96.0	91.4	95.8	97.1	99.5	101.5	1200
Mfrs	110.4	105.1	102.4	88.9	77.7	78.9	84.7	90.4	104.4	116.8	119.7	120.6	1200

Figure 4.5.c
Seasonality (1990-91 to 1996-97)



(1) As a transaction and precautionary motive, consumers may intend to increase stock by offering higher price/lower price if they anticipate that market availability will be lower/higher in the near future.

(2) If they procure NR at a slight higher price when availability is relatively moderate, they can escape from giving higher price when the availability is lower during the lean months.

Section IV

Determinants of the Price of Natural Rubber: An Econometric Analysis

Having discussed the supply-demand conditions and the seasonality factors that influences the price of NR, this section specifies an econometric model for the formal verification of the factors that determine the price of NR using yearly time series data from 1968-69 to 1996-97.

On the supply side there are three factors to be considered, (1) domestic production (2) stock and (3) import and export. The increase in domestic production leads to an increase in the total supply. Thus, we expect a negative association between price and domestic production. The relationship between the stock and price is also expected to be negative as the stock holding increases when the price falls.

Another factor that affects the price is import and export. Since export is very minimal, only import is considered for the analysis. Import is normally resorted when the domestic production is inadequate to meet the consumption. As import increases domestic availability, it should also have a negative association with the price.

Apart from the supply factors, demand factors also influence the price. The demand factor ideally should include both total domestic consumption and exports. However, as export is ignored because of its negligible share in the total production, only domestic consumption is considered as the total demand. One would expect that high demand pulls up the price. Particularly, if the percentage of consumption as a proportion of total availability is going up one would expect an increase in excess demand resulting in higher price. On the other hand, if the ratio comes down lower excess demand will put downward pressure on the price.

Definition of Variables

1. Price of Natural Rubber (PNR):

Rubber price varies across different grades of rubber. We have considered only the price of ungraded rubber (the annual average price per 100 Kg quoted in Kottayam market-the leading centre for rubber trade in the Country). Since more than 70 per cent of the natural rubber traded, constitutes

the ungraded variety (Mani, 1983), its price is considered. Moreover, it is documented that the prices of different grades of rubber do not vary substantially (Lekshmi et al, 1996).

2. Price of Synthetic Rubber (PSR):

The price (the annual average price per 100 Kg) of the variety 1500/1502 is taken as this variety constitutes major share of consumption. The data on PSR is collected from the Indian Rubber Statistics (vol 22, no. 27).

3.Domestic Production (O):

Domestic production is defined as the total production of NR (in metric tons) in a particular year.

4.Import (I):

Total import of rubber includes import of natural rubber and the import of finished rubber products. Since the study is concerned with the price of natural rubber we have estimated the natural rubber content of the finished products. The NR content in finished products is estimated following the procedure adopted by Burger et al (1995).

5. Stock (K):

The stock represents opening stock at the beginning of the year. In other words it is the volume of stock carried forward from the last year.

6. Domestic Demand (T):

It is well known that the demand for NR is derived demand, which comes mainly from the automobile sector (60 per cent). This would mean that the demand for NR is very closely related to the consumption of the automobile sector. Thus, we have taken the value of total production of the automobile tyres (excluding bicycle tyres) as a proxy for the domestic demand for NR.

Model Specification

Having discussed the various supply and demand factors determining the price level, we now turn to the specification of the model.

$S = f(PNR, I, K, O)$.....(1)

$D = f(PNR, PSR, T)$.....(2)

where S is the total availability and D is the total demand.

In equilibrium S = D

PNR= f(PSR,T, I, O, K)

Specifying a linear log function form we have

$$\log PNR = a + \alpha \log PSR + \beta \log T + \delta \log I + \gamma \log O + \eta \log K + \varepsilon$$

The effect of government intervention on price level is measured by using a dummy variable, D, which takes the value 0 for the period 1968-69 to 1989-90 and 1 otherwise.

Now the final model used is:

$$\log PNR = a + \alpha \log PSR + \beta \log T + \delta \log I + \gamma \log O + \eta \log K + a_1 D + \varepsilon$$

The estimated regression is

$$\log PNR = 1.3 - 0.31\, D + 0.52 \log PSR + 0.37 \log T - 0.05 \log I + 0.54 \log O - 0.55 \log K$$

(0.5) (-2.7)* (3.1)* (2.1)* (-0.8) (1.6) (-2.5)*

n =29; Adj. $R^2 = 0.96$; D–W = 1.6

* implies significant at least at 5 per cent level.

All variables, except production and imports are significantly related to the price of NR. The government intervention and price level is found to be negatively related during this period. Though apparently, this seems to be surprising, one has to borne in mind that in the controlled regime active government intervention helped in stabilising the price level. The STC actively intervened in the NR market to cover the mismatch between production and consumption and thereby to keep the price from wide fluctuation. STC's intervention in the market has possibly prevented a likely price increase in the face of excess demand and import restrictions during this period. The negative association between price and government intervention could be a reflection of this aspect.

Undermining of STC's role as a price regulator through quantity adjustment has led to a wider fluctuation in the price in the post liberalised period. This has been highlight by the highest CV of price at the liberalised phase compared to the earlier two phases (mentioned in section II).

The estimated regression equation revealed that SR price is positively related to the price of NR, which confirms that these two commodities are substitutes. The most significant factors that affect the price of NR are the stock which has maximum elasticity (0.55) followed by price of SR (0.52).

Summing UP:

The analysis of trends and fluctuations of NR price revealed that there were three distinct phases of price movement from 1968-69 to 1997-98. During the second phase, the production-consumption disparity was significantly higher compared to the first and third phase. In the first phase, total import could cover only 54 per cent of the total production-consumption gap. However, during the second and third phases, import was higher than the production-consumption gap. As the accessibility of import became easier during the 1980s and 1990s, the levels of stock holding came down to a considerable extent. In the first phase, the stock holding was 35 per cent of the total production. However, in the second and third phase, stock holding was 21 and 18 per cent of the total production respectively.

The econometric estimation of the model for price determination showed that price of natural rubber gets determined by the levels of stock holdings, synthetic rubber price, levels of consumption and the government policy interventions.

Endnote

[i] To estimate the seasonal index of a time-series, the centered moving average (CMA) is first calculated. The technique of using the CMA (for any number of periods-n) substitutes the observed value in the time series with the average of that value and a given number of observation taken immediately before and after it. Consequently, the CMA^n eliminates random variations and systematic movements of a duration equal to "n'. The CMA^{12} is estimated using the following formula;

$$CMAt^{12} = \sum_{i=t-6}^{i=t+5} P_i + \sum_{i=t-5}^{i=t+6} P_i \Big/ 24$$

CMA^{12} represents the trend and cyclical components of the original series and eliminates the seasonality and randomness. Therefore, the Seasonal Index (SI) can be calculated as division of the original price by CMA^{12} multiplied by 100. Thus,

$$SI_i = (TCSE_i / TC_i) = SE_i = (P_i / CMA^{12})\ 100$$

The terms T, C, S and E represent trend, cyclical, seasonal and error terms as commonly explained in the classical decomposition model. Since the index is calculated by dividing a nominal series (the original price) by another nominal series (the CMA^{12}), the SI can be considered as deflated. Thus, seasonal fluctuations (S), randomness (E) and trend (as indicated for the CMA^{12} and the SI formula) are eliminated. Finally the grand seasonal index (G I S) is useful to explain the typical seasonal behaviour of a time series. It is calculated by obtaining the average seasonal index for each month of a given year and then adjusting this 12 figure series in such a way that it adds upto 1200. Specifically,

$$GSI_I = \bar{SI} * 1200 / \sum_i \bar{SI}_I$$

Where $\bar{SI}$ is the average seasonal index for month for month " i "

Chapter 5

Conclusion

We attempted to analyse production and consumption of NR in India in order to explain the behaviour of NR prices from 1968-69 to 1996-97. The domestic production along with imports and net stock constitutes the supply of and consumption by domestic industries and exports constitutes the demand for NR. By way of conclusion we shall attempt to summarise the major findings of our analysis.

Chapter 2 focussed on production of natural rubber in India. The localisation of rubber cultivation in south-western India was largely determined by agro-climatic conditions. The rapid expansion of rubber as the premier plantation crop of the region during the post independence period was due to a number of favourable factors such as relative prices, technological diffusion leading to productivity growth, legal exemption given from land ceiling and institutional support from Rubber Board.

The production of rubber followed a cyclical pattern and on the basis of which three broad phases were identified, viz., 1968-69 to 1977-78, 1978-79 to 1988-89 and 1989-90 to 1997-98. During the first phase, production, area and yield tended to increase, during the second phase they tended to decline and in the third phase both production and yield increased upto 1992-93 and thereafter showed a declining trend. During this phase, area under rubber production showed a sharp decline. The decomposition analysis showed that the effect of area on production has decline from 55.2 per cent in the first phase to 39.7 per cent in the third phase. However, the yield effect increased from 42.9 to 57.8 per cent during this period. Apart from the full HYVs coverage of estates, significant increase in the HYVs coverage of small holdings from a meagre 7 per cent to 96 per cent have contributed to the increase production despite the decline in the area.

An important charecteristic of NR cultivation is the presence of numerous small and marginal farmers (less than two hecters of holdings), whose area under the crop constitutes more than 70 per cent of total area under rubber. These farmers stand unorganised in the supply side and the situation is made further vulnerable by the fact that the crop constitutes the main source of income for a considerable section of the NR growing community.

In sharp contrast to the scenario observed in the supply side of NR market, the quantity demanded by automotive and cycle tyre segment of the rubber goods producing sectors forms about 60 per cent of the total NR traded in the domestic market. It is important to note that the number of firms operating in the tyre sector is less than a dozen. The non tyre sector comprising thousands of tiny rubber goods manufacturing units incapable of influencing the market price on account of their negligible individual share in demand. The geographical concentration of NR production and the limited size of the market is argued to have facilitated the market participants in the tyre sector to interact and chart out strategies to control the market price of NR.

In the chaper 3 the demand analysis of rubber was undertaken. As the demand for rubber is a derived demand, a discussion of the size distribution of units using NR as an intermediate input becomes relevant. The analysis revealed that even though the share of large scale units consumption of NR in total consumption marginally declined , they still consume more than 60 per cent of the total NR. Despite the greater product diversification and regional distribution of units, the rubber manufacturing industry still continues to be dominated by the tyre and tube manufacturing sector.

The concentration in the tyre and tube sector has tend to rise during the nineties. The collusive behaviour of the major consumers in the tyre sector could have important implications on the functioning of the rubber market. An examination of the NR and SR indicated that the consumption of SR in India is much lower than the world average. However, some degree of substitution between SR and NR is taking place in Indian rubber manufacturing.

Having discussed the factors that could have possible influence on demand and supply of NR, we analysed the price behaviour of NR in chapter 4. On the basis of the observed fluctuation of price, we have periodised the price movement into three distinct phases, viz., 1968-69 to 1979-80, 1980–81 to 1989-90 and 1990-91 to 1997-98. It was observed that, price behaviour in general was more fluctuating in nature during the first and third phase compared to the second phase. The observed behaviour of data on the seasonality of price and production revealed that expected functional relationship between the two does not hold good. In other words, the increase in the supply during the peak seasons does not lead to a corresponding fall in the prices. The behaviour of stock movement revealed that during the first phase, in relation to production, the stock holding was highest. But during the next two phases stock holding declined. The analysis of the movement of domestic and international price of NR revealed that, during the third phase, with the initiation of the process of liberalisation, domestic price of NR started moving at per with the international price. During this period, total import was significantly higher than the production-consumption gap. The share of import of finished products in total import of rubber also increased sharply during this period.

The econometric model of price determination revealed that the levels of stock holdings, synthetic rubber price, levels of consumption and the government policy intervention determine the price of natural rubber. The dummy variable used to capture the policy intervention effect of the government found to be negatively related to the price. The relationship between the price of SR and NR are found to be positive and significant which implies that they are close substitutes. The relationship between stock holding and price was also found to be negative and significant.

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