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THE TREND AND PATTERN OF NATURAL RUBBER PRICE IN INDIA : AN EXPLORATORY ANALYSIS

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Annual average price of natural rubber (NR) in India during the 27 year period from 1968-69 to 1994-95 was analysed with the objectives of delineating the trend, identifying the different phases and direction of price movement and the contributing factors. NR price in India did not show any significant pattern of consistent movement towards a particular direction in the long run. Two broad phases (1968-69 to 1984-85 and 1985-86 to 1994-95) of NR price movement were identified based on the observed trend. Wide but less frequent fluctuations and mild but frequent fluctuations were the characteristics of the first and second phases respectively. Among the different economic variables, *viz.*, production, consumption, stock, import and world price of NR, the production of NR was found to be the most significant variable influencing the price. Significant statistical relations were not discernible with import and world price. Role of the non-quantifiable factors in price determination could not be ascertained, and therefore, a price forecasting based on the empirical modeling is less likely to approximate reality.

Key words : Natural rubber, Price trend, Import, India.
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INTRODUCTION

The vagaries of market arising from disequilibrium of supply and demand bear serious implications on the net income of the producers of perennial crops compared to annual crops. An important factor contributing to price fluctuations of perennial crops is borne out of its relatively inelastic supply in the short run. Studies on the price behaviour of perennial crops assume added significance due to higher investment, gestation period, span of economic life and secular trend in prices. Though there are substantial differences in the form and content of the international price stabilisation schemes evolved during the inter- war and post-war periods for the selected perennial crops exported from developing countries, the unique factor behind the schemes was a secular decline in real prices. Natural rubber (NR) is one among the perennial crops subjected to price stabilisation schemes (Corea,1992) under various historical contexts.

However, the political economy of change in the control over production, markets and consumption of NR and its implications on the international and country specific behavioural patterns of price movements are not subjected to detailed analysis both at the analytical and policy levels. The available studies on NR prices are broadly confined to empirical analysis of the secular trend rather than examining in detail the contributing factors encompassing inter-year and intra-year fluctuations. An analysis of the price behaviour of NR in the Singapore market showed a statistical regularity in its movement in the long run. However, forecasting based on

past price behaviour was rather difficult in the context of the variations in factors which determined the magnitude of the scatter (standard deviation) of the price from its mean (Allen, 1969). It was also observed that the important international markets for NR, *viz.*, London, Kuala Lumpur and Colombo were interlinked and the variables influencing the long run price movements in these three markets were found to be more or less the same. Moreover, a lead lag relationship was observed between Kuala Lumpur and London markets as any change effected in the market price of NR in Kuala Lumpur was transmitted to the London market after a lag of two weeks (Kanbur and Morris, 1980). Burger and Smit (1989) attempted a price forecasting of NR upto 2000 AD under two scenarios of projected supply of and demand for the commodity. Under the normal rate of growth of the supply and demand, the NR price forecasted was to register an upward movement after 1994. In the alternative scenario of augmented supply resulting from double replanting and new planting, the price was likely to decline after 1995. However, it was categorically admitted that the variations in NR price could not be explained by economic variables alone (Sooi,1992). The long run trend in NR price movement in the Kuala Lumpur market exhibited a pattern of parabolic shape, which supported the observed statistical regularity in NR price behaviour and explained in terms of the direct correlation between world economic growth and price of NR (Chew, 1994).

Compared to the major NR producing countries, India has been enjoying a protected price regime since 1942 either through statutory controls or price support under different historical contexts with varying forms of intervention. The price policy has been actively supplemented by a growing domestic market and as early as 1948 India became a net importer of NR. However, studies on the Indian context are mainly confined to government policy, price movements and the contributing factors rather than analysing the trend in NR price. An earlier study on NR price movement in India sought to explain the observed monthly variations in NR price in terms of the changes in production, consumption and the ratio of the manufacturers' stock to total stock of NR during 1970s. Imports of NR was presumed to have negligible impact on Indian price and, therefore, excluded from the model. The model revealed that though the NR price in India was influenced by the changes pertaining to import and export policies of the government particularly after 1973-74 period, production, consumption and stocks of NR were the crucial variables in determining its market price (Mani, 1984). The increase in NR output during peak production period was found pushing down the price and remained less responsive to fall in production during lean seasons. To a certain extent, this one-way relationship was found operating between NR price and its consumption. The uniqueness of the inverse and positive relationships of price with the supply and demand of NR was attributed to the oligopsony nature of the market (Ipe, 1988 and Jacob, 1994).

The major gap identified with the earlier studies on Indian NR prices was the absence of a scientific approach in analysing the trend in prices incorporating all variables likely to influence NR price such as production (supply), consumption (demand), imports, total stocks (held by manufactures and growers together)and international price of NR in the price determination process. Another missing link identified was the characterisation of the different phases in the NR price movements.

The main objectives of the study were to delineate the secular trend in NR

price and to identify the nature of different phases and direction of the price movement and to examine the price formation of NR in the domestic market in terms of supply, demand, stocks, imports and the world market price . The present study assumes added significance in the context of growing market integration process of Indian economy with the world market.

METHODOLOGY

The study covered the 27 year period from 1968-69 to 1994-95 and the analysis was based on the annual average price of ungraded sheet rubber reported at the Kottayam market. The choice of the period was influenced by the onset of a new phase in the price policy of the government characrterised by partial price decontrol since 1968-69. About 75 per cent of the smallholders' sheet rubber is traded in the primary market as ungraded sheet and therefore the price of ungraded sheet was taken as the representative price of NR. Further, the price of RSS IV grade sheet rubber was available only from the year 1976-77. The choice of the price for the analysis was further justified as the coefficient of variation of prices of different grades of NR was found to have moved rather consistently (Appendix 1). The trend in the price was examined using a 'random test' supplemented by an analysis of three year moving average intended to even out the seasonal fluctuations and to capture the secular trend in the price movements. Linear, semilog, Gompertz and logistic curve are the important functional forms to estimate growth rate. Quadratic function can be treated either as a second degree function or as a variable parameter form of log-linear function to test if the growth rate is accelerating, decelerating or growing at a constant rate (Pushpagadan,1992). Hence, a semi-log quadratic equation was fitted to detect the direction of the price movement. The relationship between price and its explanatory variables was analysed by fitting a linear regression model. Each variable was checked for stationarity employing Dicky-Fuller(DF) test and the variables were tested for co-integration. An error term was used to restore relevant information that can be lost due to differencing the data by employing Granger-representation theorem(error correction model).

RESULTS AND DISCUSSION

The results of the random test revealed the absence of any discernible trend in the long run NR price movement. The test statistic employed for random test was:

$$Z = \frac{R\text{-}E\,(R)}{SE\,(R)}$$

where $E(R) = N/2 + 1$

$SE(R) = \sqrt{N-1}/2$

R = number of runs

N = number of observations

The necessary condition of the null hypothesis is that it is accepted if the value of 'Z' lies within the range $-1.96 \leq Z \geq 1.96$. The first difference of NR price series was taken to derive the runs (Appendix-2). The value of 'Z' obtained by employing a two tailed test at 5 per cent level of significance was -0.588 rejecting the randomness in NR price movement. However, a three year moving average of NR price (Figure 1)

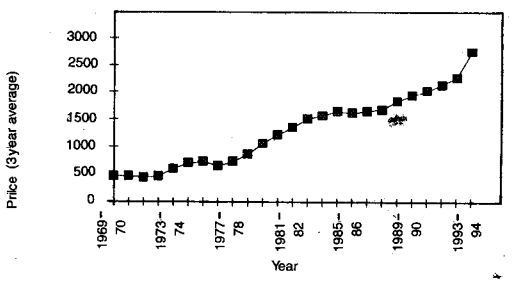

Fig. 1. NR price in India

Table 1. **Trend growth rates of NR price**

Period	t'	t'^2	R^2	DW
1968-69 to 1994-95	0.0759*	-0.00067	0.94	1.11
1968-69 to 1984-85	0.0911*	0.00346*	0.91	1.52
1968-69 to 1985-86	0.0902	0.00249	0.90	1.12
1968-69 to 1992-93	0.0760*	-0.0010*	0.93	1.08

* Significant at 5% level

showed relatively more frequent fluctuations in the 1980s and early 1990s than in 1970s. To recapitulate it, the trend growth rate for the entire period of the analysis and for different phases were worked out by fitting a semi-log quadratic equation of the form:

$$\ln NRP = a + bt' + ct'^2 + u_t \qquad (1)$$

where, ln NRP is the natural logarithm of NR price. As t' and t'^2 are orthogonal, the estimates are free from multicollenearity (Pushpangadan,1992). The NR price grew at a rate of 7.6 per cent during the 27 year period (Table 1). The growth rate for the first 17 years was 9.1 per cent with a positive and significant t'^2 coefficient indicating that NR price grew at an increasing rate during the period 1968-69 to 1984-85. The positive t'^2 coefficient became insingnificant as price in 1985-86 was added to the price series in the regression. It appears that there exists a discontunity in the trend growth rates from 1985-86 . A dummy variable, '0' for the period upto 1984-85 and '1' from 1985-86 to estimate the presence of a break, if any, in the trend growth rate, was used . The result obtained using dummy variables was of the form:

$$\ln Y = 5.85 + 0.0785\ t + 0.0118\ Dt \quad R^2 = 0.97 \quad DW = 1.31$$

t values (20.41) (2.3)

At the point 1984-85, a significant coefficient was obtained for 'Dt' which confirmed the presence of a break at that point. Boyce (1986) method of kinked exponential trend function was employed to estimate the period–wise growth rate (Kannan and Pushpangadan, 1988). The results of the function for the two sub-periods are shown in Table 2. Thus, two broad phases (1968-69 to 1984-85 and 1985-86 to 1994-95) of NR price movement were identified based on the analysis of the observed trend.

Table 2. **Period-wise growth rates of NR price**

	Coefficients		R^2	DW
	Period I	Period II		
ln Y =	0.8678	0.0546	0.94	1.21
	(13.08)	(4.78)		
CORC =	0.0920	0.0561	0.89	1.74
	(8.75)	(3.69)		

Growth rate is calculated using kinked exponential function; $\ln Y = a_1 + b_1 (d_1\ t+d_2\ k) + b_2 (d_2\ t-d_2\ k)$ and is adjusted for autocorrelation (corc.) using Cohrane-Orcutt method.
Values in parentheses indicate t values

The analysis of the trend in the NR price movement (Appendix 2) during the entire period also indicated that the 1980's and 1990's were more prone to fluctuations than the 1970's. The trends during the two broad phases were subjected to a detailed analysis to confirm the results obtained. The coefficient of variation of the price during the two phases showed a higher value for the first phase indicating relatively wider fluctuation compared to the second phase (Table 3). This observation was in sharp contrast to the result obtained

in appendix 2. A higher value of the coefficient of variation in the first phase was confirmed by an analysis of the quinquennial average price and its deviation from the minimum and maximum prices for the five sub-periods (Table 4). The results (Table 4, Appendix 2) showed that there were wide price fluctuations during the second and third sub-periods compared to the last two sub-periods which implies a less frequent but wide fluctuations in the first phase and more frequent but mild fluctuations in the second phase.

Theoretically, the trend in NR price movement could be explained in terms of quantifiable economic variables such as its supply, demand, stock and imports and, non-quantifiable policy inputs related to price support, tariff and non-tariff barriers to imports. Another plausible factor influencing the Indian NR price could be the price movement in the world market though the inter-relationship is yet to be analysed in detail. At this juncture, it is important to analyse the main features of NR imports into India and the trend in international price movements before incorporating these two variables (apart from supply, demand and stocks) into the price determination model. Hence, the quintessence of the model is its dynamic nature which incorporates imports of NR into India and the international market price as the influence of these two on Indian NR price were not hitherto analysed.

Table 3. **Phase-wise coefficient of variation* of NR price**

Period	Mean	S D	C V
1968-69 to 1994-95	1333.16	748.58	0.56
1968-69 to 1984-85	880.17	425.34	0.47
1985-86 to 1994-95	2103.24	513.41	0.25

* Estimated from *Indian Rubber Statistics*, relevant issues

Table 4. **Quinquennial deviation from the average NR price**

Period	Average	Deviation minimum (%)	Deviation maximum (%)
1968-69 to 1972-73	461.80	8.80	8.40
1973-74 to 1977-78	667.20	22.70	27.30
1978-79 to 1982-83	1204.50	20.80	18.80
1983-84 to 1987-88	1654.70	4.10	4.30
1988-89 to 1992-93	2044.00	14.00	18.00

NR price in India had been statutorily controlled from 1942 and was an essential ingredient of the policy oriented towards enhancing NR production in the country (George and Chandy, 1996). The year 1968 marks the beginning of a major policy shift characterized by price decontrol and market intervention. This modus operandi is being continued till date under various historical contexts with the main objective of stabilising the price at remunerative levels (Appendix 3). Subsequent policy changes in tariff and non-tariff barriers on imports of NR into India were also designed to stabilize the prices in the domestic market. The major tariff barrier has been import duty whereas the non-tariff barrier consisted of the regulations on the mode of imports (cannalized Vs direct imports). The quantity of NR imported has been based on the reported consumption-production gap and the import duty is assumed to protect the domestic market prices. Since 1968, the major share of the imported rubber was cannalized through State Trading Corporation (STC) and the balance was in the form of direct imports by the exporters of rubber products as an incentive to boost the exports. Therefore, technically, the tariff and

non-tariff measures on NR imports into India were expected to play the crucial role of stabilizing the domestic prices at desired levels from the instabilities of the world NR market.

An analysis of the quantity of rubber imported as percentage of consumption-production gap for the 27 year period indicated that the quantity of NR imported exceeded the reported gap for 16 years (Table 5). Among the years in which the quantity of imports exceeded the deficit, the year 1969-70 assumes special significance as more than four times of the required quantity of NR was imported. Consequently, there was accumulation of stock of NR and the price crashed in the early 1970s. The import policy during the three succeeding years (1970-71 to 1972-73) was also instrumental in depressing the prices as NR was imported during the three years inspite of a reported surplus. The 1969-70 price level was restored only in 1973-74 with the exports of NR by the STC. The policy on imports and its timing appeared to be equally important in generating speculative activity in the NR market, which exerts downward pressure on the price. The analysis of the timing of imports showed that (barring the four year period of no imports) more than 50 per cent of the quantity was imported during the peak season of NR production in the country for ten years and for the remaining 13 years, the share of peak season imports ranged from 6 to 50 per cent (Table 6). Another notable feature was that a major share of imports during the first five years beginning from 1968-69 was in the peak season supplementing the price crash.

Table 5. **NR imports* in relation to deficit and consumption**

Year	Imports as % of	
	consumption-production gap	consumption
1968-69	54.93	9.87
1969-70	418.33	20.67
1970-71	-50.04	2.83
1971-72	-9.18	0.45
1972-73	-3.59	0.29
1973-74	1.01	0.04
1974-75	0.00	0.00
1975-76	0.00	0.00
1976-77	0.00	0.00
1977-78	0.00	0.00
1978-79	50.46	8.97
1979-80	192.00	19.49
1980-81	45.05	5.33
1981-82	120.25	22.69
1982-83	112.48	17.08
1983-84	105.11	17.16
1984-85	120.61	17.22
1985-86	112.05	17.45
1986-87	120.04	17.63
1987-88	102.66	18.67
1988-89	109.47	19.07
1989-90	99.78	13.00
1990-91	149.71	14.26
1991-92	108.17	3.81
1992-93	80.03	3.98
1993-94	139.58	4.75
1994-95	60.78	1.76

* Computed from *Indian Rubber Statistics*, relevant issues.

An analysis of the trend in NR prices based on the available comparable data (1976-95) for sheet rubber in India vis-a-vis the world market price (Kuala Lumpur market) provided a few important results. The three year moving averages of the prices during the twenty year period between 1976-95 showed that departure from the initial convergence resulted in a widen-

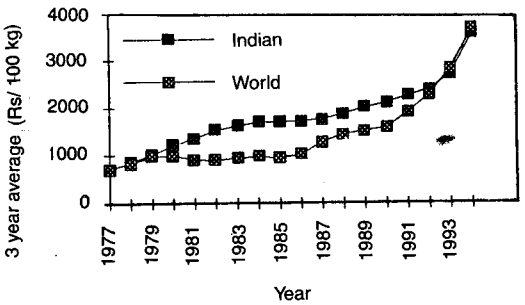

Fig. 2. Trend in Indian and world NR prices

Table 6. **Seasonwise imports of NR (Percentage share*)**

Year	Lean season	Peak season
1968-69	48	52
1969-70	45	55
1970-71	18	82
1971-72	43	57
1972-73	44	56
1973-74	100	0
1974-75	0	0
1975-76	0	0
1976-77	0	0
1977-78	0	0
1978-79	0	100
1979-80	50	50
1980-81	94	6
1981-82	74	26
1982-83	48	52
1983-84	22	78
1984-85	64	38
1985-86	65	35
1986-87	94	6
1987-88	71	29
1988-89	75	25
1989-90	94	15
1990-91	65	35
1991-92	62	38
1992-93	47	53
1993-94	61	39
1994-95	48	52

* Computed from *Indian Rubber Statistics*, relevant issues.

ing gap in the mid 1980s and the prices again converged in the early1990s (Fig. 2). Although the Indian and the World market prices recorded comparable growth rates during the 20 year period, substantial differences were observed in the two sub-periods, 1976-85 and 1986-95 (Table 7). During the first sub-period (1976-85) the Indian price recorded maximum growth rate (12.38 %) compared to the world price (2.73%) and the absolute difference between the two was the highest in the year 1985. Subsequently, the difference between Indian and world price narrowed down and

Table 7. **Trend growth rates of world and Indian NR price**

Year	World price	Indian price
1976-95	8.44	8.08
1976-85	2.73	12.38
1986-95	15.76	9.82

Growth rate is calculated using the formula log $y = a + bt$

in the second sub-period, growth rate of world price (15.76 %) was higher than that of the Indian price (9.82 %). The Indian NR price expressed as a ratio of world price also illustrated that the Indian price was relatively higher in 1980s and since 1990 the movement of the price was in tandem with the international price (Table 8).

Therefore, under the given specific features of the Indian NR market, annual fluctuations in prices are sought to be explained by the inelastic supply behaviour of the crop in relation to its demand cor-

Table 8. **Comparison of world and Indian NR price**

Year	World price RSS 3 (Rs/100kg)	Indian price RSS 4 (Rs/100kg)	Ratio of Indian to world price
1976	674	620	0.92
1977	692	630	0.91
1978	789	885	1.12
1979	1011	1024	1.01
1980	1083	1154	1.07
1981	872	1423	1.63
1982	739	1473	1.99
1983	1042	1672	1.60
1984	1040	1689	1.62
1985	890	1694	1.90
1986	988	1670	1.69
1987	1217	1760	1.45
1988	1600	1811	1.13
1989	1482	2040	1.38
1990	1425	2147	1.51
1991	1796	2128	1.18
1992	2457	2463	1.00
1993	2538	2546	1.00
1994	3455	3107	0.90
1995	5030	5059	1.01

Source: *Indian Rubber Statistics*, relevant issues

roborated by the direction of change in stock accumulation(variable taken as $stock_{t-1}$) the trend in world NR price and quantity imported (inclusive of years of no import) effected through the import policy. Given the above specification it was hypothesised that,

$$P_t = f(P_{dt}, C_t, S_{t-1}, I_t, P_{wt}) \quad (2)$$

where,

P_t = annual average price of NR_t

P_{dt} = the production of NR_t

C_t = consumption of NR_t

S_{t-1} = Stock of NR_{t-1}

I_t = Import of NR_t

P_{wt} = International price of NR_t (Grade-III, Kuala Lumpur)

Given the model, the relations expected are:

$$\frac{\partial P_t}{\partial P_{dt}} < 0, \quad \frac{\partial P_t}{\partial C_t} > 0, \quad \frac{\partial P_t}{\partial S_{t-1}} < 0, \quad \frac{\partial P_t}{\partial I_t} < 0, \quad \frac{\partial P_t}{\partial P_{wt}} > 0$$

The model is specified as a log-linear form:

$$\ln P_t = a + a_1 \ln P_{dt} + a_2 \ln C_t + a_3 \ln S_{t-1} + a_4 \ln I_t + a_5 \ln P_{wt} + e_t \quad (3)$$

where 'ln' indicates the natural logarithm and 'e_t' is the error term.

Macro economic variables remain integrated (non-stationary) when short-run movements deviate from its long run equilibrium path. However, two integrated variables can be 'co-integrated' when they converge in the long run despite short run divergence (Alexander and Wyeth, 1994). This notion of long run convergence has to be verified for price, production, consumption, stocks, import and world price. Moreover, the standard regression equation pre supposes that the time series data are stationary (integrated variable) and if not, they must be differenced enough to achieve stationarity and it can be checked using the unit root test. The unit root test involves a regression of the first difference of a series against its lagged value.

The null hypothesis of a unit root is rejected if the parameters are negative and significantly different from zero. The series achieved stationarity in the second order of integration for which the following form was used.

$$\partial^2 \ln P_t = a + a_{1\partial} \ln P_{t-1} + e_{t-1}t \quad (4)$$

where $\partial^2 \ln P_t$ is the second difference of the logarithmic value of NR price and $\partial \ln P_{t-1}$ is the one year lagged value of its first order change.

The results indicate that all the variables became stationary in the second difference; second order of integration (Table 9). Therefore, the long run movement of price and other explanatory variables in the analysis were influenced by short run fluctuations and the co-integration test revealed that the series could be co-integrated in a model eventhough the variables are individually non-stationary. The model was checked with and without world price for NR and obtained the best fit in the following form:

$$\ln P_t = a + a_1 \ln P_{dt} + a_2 \ln C_t + a_3 \ln S_{t-1} + a_4 \ln I_t + a_5 \ln P_{wt} + e_t \quad (5)$$

The term e_t refers to the deviation from equilibrium and this equilibrium error in the long run tends to become zero and this error term co-integrating equation has to be stationary in a model specification. Verification of the stationarity of the error

Table 9. **Results of unit root test**

Variable	D F Test values	Critical values
Price	-4.9629	1 % = 4.32
Production	-3.4769	5 % = 3.67
Consumption	-5.3058	10 % = 3.28
Stock	-7.0035	
Import	-4.2846	
World price	-4.9698	

term takes the following form:

$$e_t = a + a_1 e_{t-1} + u_t \quad (6)$$

The test implies that the deviation from the equilibrium are stationary, i.e., the error adjusts to the long run equilibrium.

The reported results showed that a model could be fitted using an error correction model (Engle and Granger,1987) which include an error correction term as an explanatory variable. This error term restores the relevant information that has been lost due to differencing data and represents the error from a model using non-differenced data. The error correction representation model is specified as:

$$\partial \ln P_t = a + a_1 \partial \ln P_{dt} + a_2 \partial \ln C_t + a_3 \partial \ln S_{t-1} + a_4 \partial \ln I_t + a_5 \partial \ln P_{wt} + a_6 e_{t-1} + u_t \quad (7)$$

The results of the analysis given in Table 10 showed a positive relationship between price and demand; given the supply, an increase in consumption led to rise in price. Conversely, an increase in supply of NR had a dampening effect on NR price confirming the findings of an earlier study (Mani, 1984). A significant inverse relationship was also observed between the stock and price. The impact of the volume of imports on the price was found to be statistically insignificant. Eventhough the movement of the domestic price of NR was expected to be positively related to the world price, the statistical relation obtained between the two variables was insignificant implying the extent of protection given to the Indian NR market through tariff and non-tariff barriers during the period under study.

Table 10. **Inter-relationship between price and explanatory variables (Error correction model)**

Variables	Coefficient	T-value
Production	-1.941	-3.410
Consumption	1.278	2.266
Stock	-0.248	-2.027
Import	-0.025	-1.875
World price	-0.039	-0.331
R^2	0.654	
DW	2.116	

CONCLUSION

Analysis of annual NR price in India did not show any statistically significant trend to move consistently towards a particular direction in the long run. However, two distinct phases could be identified in the NR price movement for the period 1968-69 to 1994-95. The important factors behind the mild and less frequent price fluctuations from 1985-86 to 1994-95 compared to 1968-69 to 1984-85 appeared to be on account of non-quantifiable variables pertaining to ad-hoc policy measures related to price support and imports of NR. The model fitted to gauge the degree of influence of different economic variables, *viz.*, production, consumption, stock, import and world price, on the price formation revealed that the production was the most important factor compared to consumption and other variables. Eventhough the volume of imports was thought to be a policy variable influencing NR price, no significant statistical relation could be obtained to prove that hypothesis. Nevertheless, policy inputs such as announcement, timing and channel of imports might have played a crucial role in determining the trend in prices. Despite the graphically observed synchronimous movement between international and Indian prices, the influence of the former on the latter was quite insignificant during the 27 year period.

The price determination model developed in this study has well defined limitations for evolving a price forecasting model as the non-quantifiable policy inputs related to the price support and imports play a significant role in determining the NR price in India. Nonetheless, the study underlines the need for a close perusal of various facets of the political economy of

the government policies to unearth the roles and means through which the contributing factors interact and influence the price determination process.

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Appendix 1. **Price ratio of different grades of NR**

Year	Grade-I	Grade-II	Grade-III	Ungraded	C.V.
1977-78	1.06	1.04	1.02	0.98	0.03
1978-79	1.05	1.04	1.01	0.98	0.03
1979-80	1.04	1.03	1.02	0.98	0.02
1981-81	1.05	1.03	1.02	0.98	0.03
1981-82	1.05	1.04	1.02	0.98	0.03
1982-83	1.06	1.04	1.02	0.99	0.03
1983-84	1.05	1.04	1.02	0.98	0.03
1984-85	1.04	1.03	1.01	0.97	0.03
1985-86	1.08	1.05	1.02	0.97	0.04
1986-87	1.07	1.05	1.03	0.97	0.04
1987-88	1.07	1.05	1.02	0.97	0.04
1988-89	1.06	1.03	1.01	0.97	0.03
1989-90	1.06	1.04	1.02	0.97	0.04
1990-91	1.07	1.05	1.02	0.96	0.04
1991-92	1.07	1.04	1.02	0.97	0.05
1992-93	1.07	1.05	1.03	0.96	0.04
1993-94	1.09	1.05	1.03	0.97	0.05
1994-95	1.09	0.96	1.05	0.97	0.05

Notes: Price of Grade -IV of NR is taken as the base.
Source: *Indian Rubber Statistics*, relevant issues.

Appendix 2. **Trend in NR price**

Year	Rs per 100 kg of ungraded NR	Runs	
1968-69	466		
1969-70	501	+	1
1970-71	464	-	
1971-72	421	-	2
PHASE 1			
1972-73	459	+	
1973-74	515	+	3
1974-75	849	+	
1975-76	744	-	
1976-77	596	-	4
1977-78	632	+	
1978-79	953	+	
1979-80	1017	+	5
1980-81	1212	+	
1981-82	1431	+	
1982-83	1410	-	6
1983-84	1708	+	7
1984-85	1587	-	8
1985-86	1661	+	9
1986-87	1592	-	10
1987-88	1726	+	
1988-89	1745	+	
1989-90	2058	+	11
PHASE 2			
1990-91	2023	-	
1991-92	1975	-	12
1992-93	2420	+	
1993-94	2437	+	
1994-95	3396	+	13

Source: *Indian Rubber Statistics*, relevant issues

Appendix 3. **Price policy regimes of NR in India**

Period	Policy		
	Min. price	Max. price	Others
May. 1942 - Sept. 1946	Yes	No	
Oct. 1946 - Nov. 1947	—		
Dec. 1947 - Dec. 1963	Yes	Yes	
Jan. 1964 - Sept. 1967	Yes	No	
Oct. 1967 - Nov. 1968	Yes	Yes	
Dec. 1968 -			Entry of STC in the market
Dec. 1968 - Aug. 1981	Yes	No	
Sept.1981 - Feb. 1986	No	No	
Feb. 1986 - Sept. 1988	Yes	Yes	Buffer stock scheme
Oct. 1988 - Jan. 1991	Yes	Yes	Buffer stock scheme
Jan. 1991 -	Yes		

Source: Burger *et al.* (1995)