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TRENDS IN FARM INCOME AND WAGES IN THE ERA OF MARKET UNCERTAINTY: AN EXPLORATORY ANALYSIS OF NATURAL RUBBER SECTOR IN KERALA

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ABSTRACT

This paper has been contextualised to capture the long-term trends in the real values of price, farm income and wages in Kerala's natural rubber sector in the era of market uncertainty. The analysis succinctly revealed that despite the pivotal role of the rate of growth in productivity in sustaining the tempo of growth in farm income during the 28 year period under review, the outcome during the post-reforms phase had been influenced more by the trends in unstable prices. The emergence of unstable prices as the major determinant of farm income in the post-reforms phase poses serious policy challenges to the rubber plantation sector in the state.

Background

The achievements of Kerala's natural rubber (NR) sector have been widely recognised for the unique features. The distinctive features of the sector are: a near monopoly position in India's NR production during the past one century, progressive responses of a highly receptive farming community to research and development initiatives and the concomitant performance of the sector surpassing the gains elsewhere. The most glittering element among the achievements has been a sustained increase in productivity despite the smallest average operational size of the holdings in the state compared to other major rubber growing regions in India and abroad.[1] The explicit contributory factors for the sustained growth of the sector are reported to be a comparatively stable and remunerative price and a higher net farm income vis-a vis other crops in the state (George *et al*., 1988; George, 1999; Lekshmi and George, 2003). The pro-active policy level interventions during the five decades from 1942 to 1991 had been effective in insulating the domestic market from external competition and ensured a comparatively stable and remunerative price (George and Chandy, 1996; Lekshmi *et al.*, 1996; Mohanakumar and Chandy, 2005). However, the hitherto unperturbed profile of the price policy has been seriously challenged by a host of

external trade policy reforms initiated since 1991. The subsequent integration of national and international markets and the transmission of world market price instabilities to the domestic market posed serious questions on the sustainability of the state's NR sector for three important reasons: (i) inherent limitations of the market intervention schemes to contain the market uncertainties since the 1990s; (ii) dilution of the prescribed agro-management practices by the planting community to reduce costs in the era of market uncertainty; and (iii) the growing shortage of tapping labour and steady increases in tapping wages in the dominant smallholdings sector[2] .

In this backdrop, it is imperative to explore the trends in the selected variables so as to capture the varied dimensions of potential challenges of the integration process. Accordingly, the long-term trends in productivity, price, farm income and wages in rubber smallholdings and estate sectors in the state are analysed from a policy perspective.

Objectives

The major objectives of the study are:

1. to understand the trends in productivity, prices, farm income and wages during the pre and post-reforms phases
2. to analyse the comparative stability of productivity, prices, farm income and wages
3. to examine the relative contributions of productivity and price in the observed trends in farm income and
4. to highlight the policy implications

Methodology

The database consists of documented field level time series data on wages from primary sources and published official data on productivity and price during the 28 year period from 1980-81 to 2007-

08. The choice of the base year 1980-81 was guided by two factors: (i) it corresponds to the official release of the indigenously developed high yielding clone RRII 105 which has revolutionised commercial cultivation of NR in Kerala[3]; and (ii) the year also coincided with the launching of integrated Rubber Plantation Development (RPD) Scheme targeted to improve productivity and enhance production through the adoption of high yielding varieties of planting materials. The trends in statutory basic daily wages plus dearness allowance in the estate sector and the rate of tapping wages in the smallholdings sector were considered for the analysis of wages[4]. Since time series data on net farm income based on reliable cost of production are not readily available, the trends in total annual farm income per hectare was estimated by multiplying the reported annual average productivity in Kerala with the annual average price of RSS 4. In order to remove the inherent ambiguities of prices and wages and to contain the effect of inflation, the real values of price and wages were estimated by using appropriate deflators (Reserve Bank of India, various issues)[5]. Table 1 shows the reconstructed WPI and CPI with 1980-81 as the base year.

The long–term trends in the selected variables were analysed by estimating the growth rate which was estimated by fitting exponential trend of the type

$$Y=ab^t \quad \text{(Gulati, } \textit{et al.}\text{, 1994)}$$

The stability of the different variables was measured by using Instability Index (Cuddy-Della Valle index) which is used as a suitable measure of variability in time series data characterised by long-term trends[6].

The relative influence of real price and productivity on the observed trends in real farm income was estimated by employing the Standardised Partial Regression Coefficient β_k for the different variables.[7]

Table 1: Reconstructed Consumer Price Index (CPI) and Wholesale Price Index (WPI)

Year	CPI for agricultural workers in Kerala	WPI for all commodities (All India)
1980-81	100	100
1981-82	111	109
1982-83	126	115
1983-84	154	123
1984-85	157	131
1985-86	159	137
1986-87	175	145
1987-88	186	157
1988-89	208	169
1989-90	223	181
1990-91	248	200
1991-92	275	227
1992-93	308	250
1993-94	347	271
1994-95	386	305
1995-96	448	330
1996-97	486	345
1997-98	505	360
1998-99	524	382
1999-2000	540	394
2000-01	556	422
2001-02	556	438
2002-03	571	452
2003-04	592	477
2004-05	608	508
2005-06	616	530
2006-07	647	559
2007-08	698	586

Table 2: Nominal values of price, productivity, farm income and wages

Year	Price (Rs/kg)	Producti-vity (kg/ha)	Farm income (Rs/ha)	Wages (Estates-Basic wage + DA) (Rs/day)	Tapping wages (Small holdings) (Rs/100 trees)
1980-81	12.41	780	9679.80	10.98	4.00
1981-82	14.60	770	11242.00	13.66	4.50
1982-83	14.40	828	11923.20	14.11	5.66
1983-84	17.52	864	15137.28	16.85	6.66
1984-85	16.65	890	14818.50	18.20	7.66
1985-86	17.32	897	15536.04	18.47	8.00
1986-87	16.60	924	15338.40	21.38	8.50
1987-88	17.91	942	16871.22	22.93	8.75
1988-89	18.15	967	17551.05	24.48	8.94
1989-90	21.31	1025	21842.75	27.14	10.00
1990-91	21.29	1079	22971.91	28.24	10.31
1991-92	21.41	1139	24385.99	31.59	11.00
1992-93	25.50	1203	30676.50	37.00	12.43
1993-94	25.69	1304	33499.76	39.40	14.25
1994-95	36.38	1389	50531.82	43.40	16.50
1995-96	52.04	1443	75093.72	53.09	18.25
1996-97	49.01	1529	74936.29	59.39	21.69
1997-98	35.80	1583	56671.40	62.39	24.50
1998-99	29.94	1599	47874.06	66.65	28.89
1999-00	30.99	1612	49955.88	71.65	30.25
2000-01	30.36	1612	48940.32	79.67	31.13
2001-02	32.28	1612	52035.36	81.83	33.25
2002-03	39.19	1635	64075.65	81.83	34.25
2003-04	50.40	1715	86436.00	84.00	35.00
2004-05	55.71	1765	98328.15	87.47	35.00
2005-06	66.99	1865	124936.35	90.89	40.25
2006-07	92.04	1960	180398.40	106.64	47.43
2007-08	90.85	1876	170434.60	108.80	58.75
Mean	34.03	1314.54	51504.37	50.08	20.56
Growth rate (%)	6.51	3.71	10.45	8.89	9.62

Trends in nominal values

The nominal values of the selected variables are useful indicators on the comparative trends and form the basis for detailed analysis. Table 2 indicates the trends in nominal values of price, productivity, farm income and wages in estates and smallholdings. During the 28 year period, farm income exhibited the highest growth rate (10.45%) followed by tapping wages in the smallholdings (9.62%), wages in the estates (8.89%), price (6.51%) and productivity (3.71%). Apparently, a higher growth rate of farm income compared to the wages is indicative of the higher returns to the planting community.

Nevertheless, the time series data on nominal values and growth rates of the same are circumscribed by varying degrees of inflationary contents. Therefore, real values of price, farm income and wages were estimated for a comparative analysis.

Trends in real values

The comparative trends in the real (deflated) values of price, farm income and wages form the basis for a critical assessment on the performance of the sector from a policy angle. Table 3 provides the details.

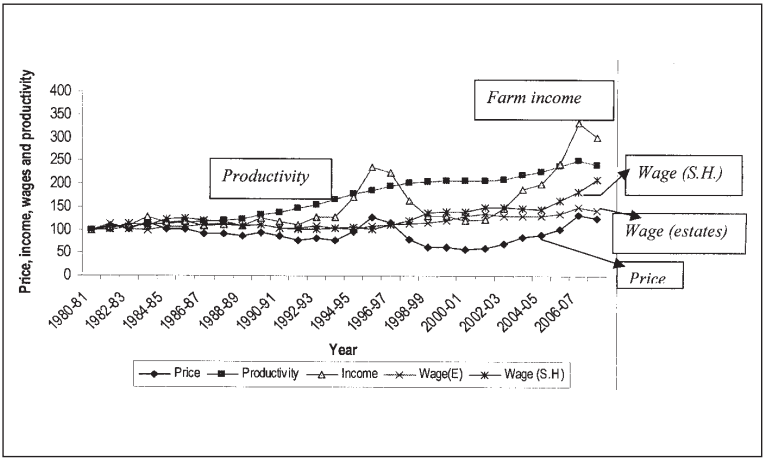
During the period under review, the farm income in real terms grew at a rate of 3.13 per cent despite a negative growth rate of price (-0.55). Prima facie, the positive growth rate in farm income has been singularly contributed by a higher growth rate in productivity (3.71%). The sustained growth in productivity had been effective in containing wide fluctuations in price during the period under review. Therefore, it is plausible to surmise that the interactive relationships evolved among rubber research, extension network and the planting community had been instrumental in maintaining the tempo of growth in farm income over the past three decades. The wages in both smallholdings (1.88 %) and estate sectors (1.20%) also have registered positive growth rates.

Table 3: Real values of price, farm income and wages

Year	Price (Rs/kg)	Producti-vity(kg/ha)	Farm income (Rs/ha)	Wages (Estates-Basic wage + DA) (Rs/day)	Tapping wages (Small-holdings) (Rs/100 trees)
1980-81	12.40	780	9668.51	10.98	4.00
1981-82	13.34	770	10270.86	12.36	4.07
1982-83	12.54	828	10384.38	11.19	4.49
1983-84	14.19	864	12260.33	10.92	4.31
1984-85	12.67	890	11272.61	11.59	4.88
1985-86	12.62	897	11318.95	11.65	5.04
1986-87	11.43	924	10560.21	12.18	4.84
1987-88	11.40	942	10741.33	12.31	4.70
1988-89	10.75	967	10398.77	11.77	4.30
1989-90	11.75	1025	12043.37	12.16	4.48
1990-91	10.65	1079	11487.41	11.40	4.16
1991-92	9.41	1139	10721.57	11.49	4.00
1992-93	10.19	1203	12254.71	12.03	4.04
1993-94	9.47	1304	12351.05	11.35	4.10
1994-95	11.91	1389	16544.92	11.24	4.27
1995-96	15.78	1443	22767.12	11.84	4.07
1996-97	14.20	1529	21719.16	12.21	4.46
1997-98	9.94	1583	15732.72	12.34	4.85
1998-99	7.85	1599	12544.24	12.71	5.51
1999-2000	7.86	1612	12675.32	13.27	5.60
2000-01	7.19	1612	11588.21	14.34	5.60
2001-02	7.38	1612	11893.30	14.73	5.98
2002-03	8.66	1635	14162.34	14.33	6.00
2003-04	10.56	1715	18116.19	14.19	5.91
2004-05	10.97	1765	19354.33	14.40	5.76
2005-06	12.63	1865	23560.26	14.75	6.53
2006-07	16.46	1960	32263.32	16.47	7.33
2007-08	15.51	1876	29104.11	15.60	8.42
Mean	11.42	1314.54	14919.58	12.71	5.06
Growth rate (%)	-0.55	3.71	3.13	1.20	1.88

However, higher values in the wages were observed only since the turn of this century. The higher growth rates in productivity and farm income compared to wages had been effective in containing the cumulative effect of a rise in wages[8] and a negative growth rate in prices during the 28 year period. Fig. 1 shows the indices of the prices, productivity, farm income and wages.

Fig. 1: Indices of real price, income, wages and productivity



The trends in price, productivity, farm income and the wages in both smallholdings and estates exhibit disparate trends and higher levels of volatility since the mid 1990s. Hence, it is imperative to capture the trends in the selected variables over the pre and post- reforms phases to draw relevant inputs for a comparative assessment.

Trends over phases

Apart from desirable rates of growth, comparative stability of selected variables is also vital for the sustenance of a perennial crop like NR. Table 4 shows the comparative growth rates and instability indices of the price, productivity, farm income and wages during pre and post-reforms phases.

Table 4: Comparative growth rates and instability indices

Variables	Growth rate (%)			Instability index		
	Pre-reforms phase	Post - reforms phase	Total period	Pre-reforms phase	Post - reforms phase	Total period
Price	(-) 2.04	1.21	(-) 0.55	5.97	27.84	21.95
Productivity	3.18	2.91	3.71	1.99	4.44	5.08
Farm income	1.07	4.15	3.13	6.71	30.52	17.94
Wages (S.H.)	0.56	4.31	1.88	7.97	6.77	14.15
Wages (Estates)	0.52	2.26	1.20	4.38	3.93	6.44

Though price recorded a negative rate of growth (-2.04%) during the pre-reforms phase farm income grew at a rate of 1.07 per cent due to the higher growth rate in productivity (3.18%). Conversely, a comparatively higher growth rate in farm income during post-reforms phase (4.15%) was mainly due to a positive growth rate in price (1.21%) in spite of a lower growth rate in productivity (2.91%). The growth rate of wages in the smallholdings (4.31%) and estates (2.26%) were higher during the post-reforms phase compared to the pre-reforms phase.

The analysis of instability indices revealed that compared to pre-reforms phase, price, productivity and farm income were unstable during the post-reforms phase. Among the three variables, the highest instability was observed in farm income (30.52) followed by price (27.84). Though growth rate in price was higher during the post-reforms phase it was highly unstable. Contrary to the trends in prices, the wage rates of both smallholdings and estates exhibited comparatively higher growth rates and stability during post-reforms phase.

Genesis of farm income

The analysis of relative contributions of price and productivity in sustaining the tempo of growth in farm income revealed varied roles of the selected variables over the phases. Table 5 shows the relative

contributions of price and productivity in farm income during the entire 28 year period and the pre and post - reforms phases.[9]

Table 5: Relative contributions of price and productivity in farm income

Variable	Standard deviation (σ)	Regression coefficient (b)	β	Relative contribution (%)
Total period:				
Price	2.50	1585.69	0.66	45
Productivity	382.90	12.59	0.80	55
Farm income	5964.54			
Pre-reforms phase				
Price	1.08	899.89	1.22	46
Productivity	95.91	11.83	1.42	54
Farm income	797.74			
Post-reforms phase				
Price	3.03	1659.61	0.78	65
Productivity	229.51	11.69	0.42	35
Farm income	6461.75			

The trends in real farm income during the 28 year period had been influenced more by productivity (55%) compared to that of real price (45%). The pre-eminence of the trends in NR productivity in sustaining the tempo of growth in farm income during the 28 year period has been a negation of the view "falling prices are problematic for primary-producing developing countries because, with inelastic demand and inelastic supply, the incidence of productivity advance is very largely on consumers, typically in developed countries" (Gilbert, 2006). More precisely, the rubber farming community in Kerala had been able to capitalise the positive growth rate in productivity due to the reported higher share of farm gate price realisation (Sreekumar *et al*., 1990) during the period under review.

Disaggregate level analysis of the trends in the relative contribution of price and productivity during the pre and post-reforms phases revealed that during the pre-reforms phase the movements in farm income was influenced more by productivity (54%) compared to that of price (46%). But the explicit shift in the comparative influence of price (65%) vis-à-vis productivity (35%) during the post- reforms phase is indicative of the prominence attained by uncertain prices in determining farm income in the context of market integration. Technically, this observation is in tandem with the results on the comparative growth rates and instability indices given in Table 4.

Conclusion

The results of the study provide a few valuable insights on the unique growth path of Kerala's NR sector in retrospect and raise a few questions in prospect. First of all, the pivotal role of sustained growth in productivity leading to commensurate increases in farm income in a smallholder dominated crop underline the unique features of the stakeholders, institutional arrangements and the positive outcomes of the interactive relationships. Secondly, the realised productivity gains and farm income set out benchmarks for research and development efforts, innovations, systems of diffusion conducive to technological shifts as well as interventions in the market. Thirdly, the process of structural devolution of rubber holdings in Kerala and its attendant issues in the context of market uncertainty deserve detailed investigations. Notwithstanding the unique gains reported, the results of the study also indicate potential limits to the sustenance of the growth path traversed. The decline in growth rate of productivity, notable increase in the instability indices of price and farm income and higher growth rates in wages are indicative of challenges posed by developments in the post-reforms phase. Despite a higher growth rate of farm income during the post-reforms phase, the decline in growth rates of productivity signal the underlying contradictions between the responses of the farming

community and policy perspectives. This is amply demonstrated by the postponement of replanting and the growing share of area under uneconomic age group (Jacob and George, 2008). Therefore, future trends in farm income will tend to be dictated by the trends in real values of farm gate prices rather than productivity improvements. The gravity of the emerging issues is confounded by a higher growth rate in tapping wages in the dominant smallholdings sector which has been primarily dependant on hired labour after more than three generations of gainful rubber planting in Kerala.

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NOTES

1 The average productivity of NR in Kerala was 1876 kg/ha during the year 2007-08. It was the highest reported productivity despite a less than 0.50 ha average size of small rubber holdings in the state. This is in sharp contrast to an average size of more than 1.49 ha in North -Eastern states in India (Viswanathan, 2006) and in other producing countries.

Mean size of smallholdings in major NR producing countries

Country	Mean size of holding (ha)
India	0.51
Malaysia	1.91
Papua New Guinea	1.68
Sri Lanka	0.66

Sources: (1) ANRPC (2006)
(2) Rubber Board (2009)

2 The average wage rate for tapping 100 trees for the tapping labourers in the smallholding sector was Rs 21.00 during 1996 and Rs 26 during 1998-99 (Viswanathan *et al*., 2003; Mohanakumar and Chandy, 2005). It has more than doubled to Rs 59.00 during 2007-08. The shortage of tapping labourers has been leading to a shift to multiple grower dependence in the smallholdings sector.

3 The difference in average yield per ha between the clones RRII 105, which now accounts for more than 85 per cent of the rubber cultivated area in Kerala (Veeraputhran et al., 1998) and RRIM 600, which was the most popular clone till the release of RRII 105, is 359 kg, during the 1-20 year phase of tapping (Chandy and Sreelekshmi, 2008).

4 Time series data of statutory wages are available in the public domain whereas the tapping wages in the smallholdings sector were collected from members of two selected Model Rubber Producing Societies (Janatha Model RPS, Aimcombu, Pala and Chirakkadavu Model RPS, Kanjirappally) in Central Kerala.

5 The price of NR is deflated with the Wholesale Price Index (WPI) for all commodities,

ie., *Nominal price of RSS 4 / WPI for the corresponding year*

The WPI during the 28 year period had three different base years, *ie*., 1970-71 was the base year for WPI data from 1980-81 to 1981-82; 1981-82 for WPI from 1981-82 to 1993-94 and 1993-94 for WPI from 1993-94 to

2007-08. The WPI values for all these years were corrected to the base year 1980-81 using the estimated linking factors (2.81 for WPI with 1981-82 as base year and 6.97 for WPI with 1993-94 as base year). The nominal values for wages of both estates and small growers were deflated with Consumer Price Index (CPI) for agricultural labourers in Kerala,

i*e., Nominal wage/CPI for agricultural labourers in Kerala for the corresponding year*

The CPI during the 28 year period had two different base years *i*.e., 1960-61 was the base year for data from 1980-81 to 1994-95 and 1986-87 for data from 1995-96 to 2007-08. As was done in the case of WPI, the values for CPI for all these years were also corrected to the base 1980-81 using the linking factor: 5.89 for CPI with 1986-87 as base year.

6 Since the simple coefficient of variation (CV) over estimates the level of instability in time series data characterised by long-term trends, the Cuddy-Della Valle index corrects the coefficient of variation by

$$CV = (CV^*)\,(1-R^2)^{0.5}$$

where CV* is the simple estimate of the coefficient of variation (in per cent) and R^2 is coefficient of determination from a time-trend regression adjusted by the number of degrees of freedom (Lekshmi and George, 2003).

7 β is the regression coefficient computed for standardized data which is estimated as:

$$\beta_k = \frac{S_k}{S_y} \times b_k \qquad \ldots\ldots (1)$$

where:

Sk - Standard deviation (σ) of the k^{th} independent variable
S_y - Standard deviation (σ) of the dependent variable 'y', and
b_k - Regression coefficient of k^{th} variable

Here, β is the rate of change in y over the observed range of x. It is the number of standard deviations (σ) that y change for each one σ in x.

Regression coefficient 'b' for the different independent variables was estimated using multiple regression equation of the form:

$$Y = b_0 + b_1X_1 + b_2X_2 \qquad \text{————} \quad (2)$$

where:

Y	-	dependent variable
X_1 and X_2	-	independent variables, and
b_1 and b_2	-	regression coefficients

The relative importance or relative contribution of the independent variables viz., price and productivity were worked out by estimating the ratio of their β coefficients as:

Relative contribution of independent variable price

$$= \frac{\beta_1}{\beta_1 + \beta_2} \times 100 \quad \text{(3)}$$ and

Relative contribution of independent variable productivity

$$= \frac{\beta_2}{\beta_1 + \beta_2} \times 100 \quad \text{(4)}$$

8. The estimated share of wages in total operational cost in the NR smallholdings sector in Kerala is in the range of 55 to 60 per cent out of which the major share is accounted for by the tapping wages (unpublished results of the survey on operational efficiency of rubber plantations under the smallholdings sector conducted during the year 2000, Rubber Research Institute of India)

9. The statistical significance of the analysis is evident from the results given in the following table.

Variable	Coefficient of X variable	R^2
Farm income (y) and price (x)	$1397.46_{(3.67)}$	0.34
Farm income (y) and productivity (x)	$11.58_{(5.67)}$	0.55

Figures in parentheses are the respective t-values

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