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Impact of change in market prices on expansion of new planting area of natural rubber: a study on rubber plantations in Tripura

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Abstract
Tripura is the second-largest contributor to the total production of natural rubber in India. The natural rubber is the second-largest agricultural crop in Tripura after rice and area under natural rubber has registered a phenomenal increase during last one decade. The income from rubber plantation is basically a function of price and yield. The yield from natural rubber trees is available only after six years from the year of commencement of cultivation. Hence the impact of a price change on the growth of new plantation area and re-plantation of natural rubber can be practised only after six or more years. The sharp decline in market price of natural rubber in recent times has some negative effect over the profitability of small rubber growers. But a sudden response from the rubber growers for a change in the price of rubber can be noticed in the care given to rubber trees rather than on new planting area. The study examines the impact of change in market prices on new planting area of rubber plantations. Log-Linear Regression Model has been used for this purpose to estimate the elasticity of change in market price on new planting area. The result shows that for 1% increase in market prices of natural rubber, the new plantation area of rubber increased by 0.39% i.e. it is inelastic in nature. Natural rubber is a perennial crop and investment in rubber plantation is a matter of long term decision making. Therefore, price induced effect does not immediately reflect in the expansion of area under rubber plantation.

Keywords: natural rubber phenomenal increase, rubber growers, inelastic

Introduction
Rubber is the most premier commercial plantation crop of Tripura. Rubber Plantation Industry in Tripura is one of the largest industries in the north-eastern states. The state is closely followed by Kerala in rubber production and is credited to be the nation's second-largest producer of rubber.

Rubber was first introduced in Tripura in 1963 as a part of the afforestation programme by the State Forest Department as an experiment (Debnath, 1986). At the initial stage, the people of Tripura, especially, the *jhumias* (shifting cultivators) had no clear conception regarding rubber plantation. Due to lack of awareness on the prospect of rubber, the people of Tripura were not interested in a rubber plantation. Apart from this, a major portion of *jhumias* apprehended that *jhum* cultivation which was the only means of their livelihood would vanish forever if they start rubber plantation once (Bhattacharya 1992) [3]. Tripura Forest Development and Plantation Corporation Limited (TFDPC), a State Government Undertaking, initiated serious effort to develop rubber plantation in the State. Consequently, the other agencies were actively participated in rubber plantation (Bhowmik, 2006) [4]. Although at the initial stage the rate of expansion was very slow with the passage of time, the rate of expansion of rubber plantation in the state was accelerated very fast.

Rubber Board has started its activities in the state as a one-man office (Jr. Field Officer) in 1967. This office was upgraded to a Regional Office in 1979 for undertaking development and extension activities of rubber plantation in the state. It provides technical and financial support to the planters and engaged in research activities also (Paribalan, 2006) [8]. The State Government extends all kinds of co-operation for promoting rubber cultivation of the state. The National Bureau of Soil Survey and Land Use Planning have estimated that approximately 100000 hectare of land is available for rubber cultivation in Tripura. In the year 2015-16, the state of Tripura has reached 74,335 hectares of rubber plantations. The commercial exploitation has been started in 41,620 hectares. In the financial year 2015-16, total production of rubber was 52,025 MT which has a market value of about Rs 600 crore, at the prevailing market price. No doubt it occupies the lion share of state GDP among agricultural and others plantations crops of the state.

Rubber plantation has become a much-talked phenomenon in the state of Tripura. People at the market, tea stall and bus stands interact that rubber plantation is a highly profitable economic activity and the tale is that at the prevailing market price of Rs 200 and above per kg, the planters had been earning huge profit. Naturally, new planters are attracted by this huge profit. At the beginning of the financial year 2012-2013, the market price of natural rubber was Rs 230 per kg, whereas at the end of financial year 2012-2013 the market price of natural rubber has come down to below Rs 160 per kg and in the year 2015-16 the average price of sheet rubber is Rs 113.06 per kg. In recent years the cost of almost all elements of the production of natural rubber-like material cost and labour cost has been

increased heavily. On the other hand, the market price of natural rubber is decreasing continuously. The declining trend of natural rubber price has disappointed the small and marginal rubber growers of the state very much. (Paul, 2013) [7]. It may be remarked that the rubber plantation industry is not risk-free.

An unexpected decline in market price cannot be ruled out at all. Rubber prices are also linked with the international market as well as the production of synthetic rubber (John, 2002) [6]. Any adverse situation may change the present scenario and decline profitability which will hamper the sustainability of the industry.

Statement of the problem

Natural rubber is an agricultural commodity and is used as an industrial raw material. It has been argued that prices of the agricultural commodity are volatile because the short supply and demand elasticity is low (Ardeni and Wright, 1990) [1]. High volatility in natural rubber prices is the result of international trade policies, fluctuation in demand and supply of natural rubber, exchange rate in currencies, crude oil prices, changes in weather condition and political environment. There are no adequate measures to regulate crude oil prices mechanism to reduce or manage the risk associated with changes of natural rubber price to the growers in most of the producing countries including India (Dowling, 1977) [5]. The price of rubber is tied to the production of rubber, the demand for the end products and the price of substitutes for natural rubber (Raju K.V., 2016) [9].

The income from rubber plantation is basically a function of price and yield. Profit is a function of price and for rubber plantation, it has no exception. The yield from natural rubber trees is available only after seven years from the year of commencement of cultivation. Hence the impact of a price change on the growth of new plantation and re-plantation of natural rubber can be experienced only after seven or more years. But a sudden response from the rubber growers for a change in the price of rubber can be noticed in the care given to rubber trees. The impact of change in rubber price may directly be reflected on the expansion of new planting area as well as rubber cultivation.

Objectives of the Study

The specific objective of the study is;

1. To estimate the impact of the instability of natural rubber prices on the expansion of new planting area in Tripura.

Methods and Materials

The study was mainly based on secondary data on various aspects of rubber plantations such as the area under cultivation, production and productivity etc. Secondary data and information have been collected from various sources like Journals, Annual Reports, The Economic Review of Tripura, Reports of Newspaper, internet, journals, e-journals, and periodicals etc.

To estimate the impact of the instability of natural rubber prices on the expansion of new planting area data were analysed using descriptive statistics such as a table, percentage, and line graph etc. Log-Linear Regression Model has been used to estimate the elasticity of the new planting area of rubber plantations with respect to the market price of natural rubber. Due to the dearth of uniformity in state level market price data, the market price of RSS-4 was taken for present study purpose.

The data and information so collected from different secondary sources have been processed, analysed and interpreted with the help of MS-Excel and SPSS.

Hypotheses

1. Wide fluctuation in the market price of natural rubber has an impact on the expansion of a new planting area.

Result and Discussion

Market Price and Cultivation of Natural Rubber in Tripura

The area under rubber plantation has been increasing year after year. Till the end of the year 2005-06, the total area of rubber plantation in the state was 36536 hectares whereas in the year 2015-16 total area of rubber plantations in the state become 74335 hectares. Between the years 2005-06 to 2015-16 there has been an increase 37799 hectare of the area under rubber plantation showing a growth rate of more than 103 per cent over the last one decade. There had been a rapid expansion on the cultivated area of rubber plantation. The main reason for such rapid growth of expansion in rubber plantation was an abnormal hike in the market price of rubber. The price of natural rubber from 1985-86 to 2015-16 is shown in Table 1 below. From the year 2012-13, the market price of rubber shows a declining trend. It has an effect in the future growth rate of area under rubber plantation in the state. Natural rubber is a perennial crop and investment in rubber plantation is a matter of long term decision making. Therefore, price induced effect does not immediately reflect in the expansion of area under rubber plantation. Another trend is also noticed here that although the cumulative area of rubber plantation is increasing year after year, there is ascending or descending rate of increase in new plantation area during the year 1985-86 to 2015-16. It may be concluded that there has been no uniform trend in the growth of the new planting area.

This can be examined with the help of table 1 which shows the new planting area of natural rubber in Tripura with respect to price.

Table 1: Market price of Natural Rubber and Area under cultivation of Natural Rubber in Tripura

Year	Market Price (RSS-4) (Rs/ Kg)	Area of New plantation (ha)	Cumulative Area (Ha)
1985-86	17.32	1197	7742
1986-87	16.60	2343	10085
1987-88	17.91	2586	12670
1988-89	18.15	1656	14326
1989-90	21.31	2294	16620
1990-91	21.29	700	17320
1991-92	21.41	540	17860
1992-93	25.50	390	18250

1993-94	25.69	1076	19326
1994-95	36.38	1627	20953
1995-96	52.04	1323	22276
1996-97	49.01	1660	23936
1997-98	35.80	1844	25780
1998-99	29.94	1384	27164
1999-00	30.99	1211	28375
2000-01	30.36	1362	29737
2001-02	32.28	1567	31304
2002-03	39.19	806	32110
2003-04	50.40	1337	33447
2004-05	55.71	1257	34701
2005-06	66.99	1835	36536
2006-07	92.04	3794	40330
2007-08	90.85	4041	44371
2008-09	101.12	5099	49393
2009-10	114.98	283	52376
2010-11	190.03	1292	53668
2011-12	208.05	3952	57620
2012-13	176.82	3610	61230
2013-14	166.02	2563	63793
2014-15	132.57	6502	70295
2015-16	113.06	4040	74335

***Source*:** Indian Rubber Statistics, Kottayam, Various Volume & Rubber Board, Tripura (compiled)

From the table 1, it is seen that the price of natural rubber which stood at Rs 21.29 per kg in 1990-91, consistently increased to Rs 52.04/kg in 1995-96, the percentage of increase is being 144.3 per cent over the five years of time. In later years it comes down and reaches to Rs 30.36 in 2000-01. Again from the year 2001-02 the price of natural rubber consistently increases up to the year 2011-12 except for some minor exception. The price of natural rubber starts to decrease again from the year 2012-13.

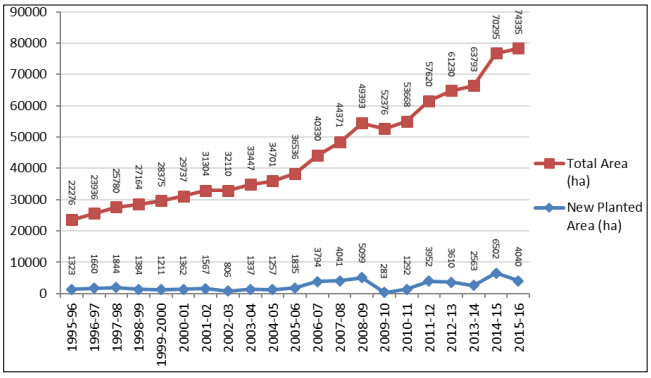


Fig 1: New Planting Area & Total Area Rubber Plantation in Tripura

The worldwide depression had affected the Indian rubber sector also and Tripura could not be insulated against the market fluctuation. The trend indicates that there is definitely a cycle operating in the price of natural rubber. The impact of a high price is definitely being reflected in the new planting area. The price of natural rubber from 1985-86 to 2015-16 is shown in Table 2.13 above. As the price of natural rubber reaches in a peak hike 37.4 per cent in 2006-07 and 65.27 per cent in 2010-11 the impact of this price hike is reflected in the area of new plantations in 2007-08 and 2011-12. In later years 2012-13 onwards, the price of rubber declines. As it is stated earlier that Log-Linear Regression Model has been used to estimate the elasticity of change in market prices on new planting area and the result is given below.

Summary Output
Regression Statistics

Multiple R	**0.431104056**
R Square	0.185850707
Adjusted R Square	0.157776593
Standard Error	0.666855633
Observations	31

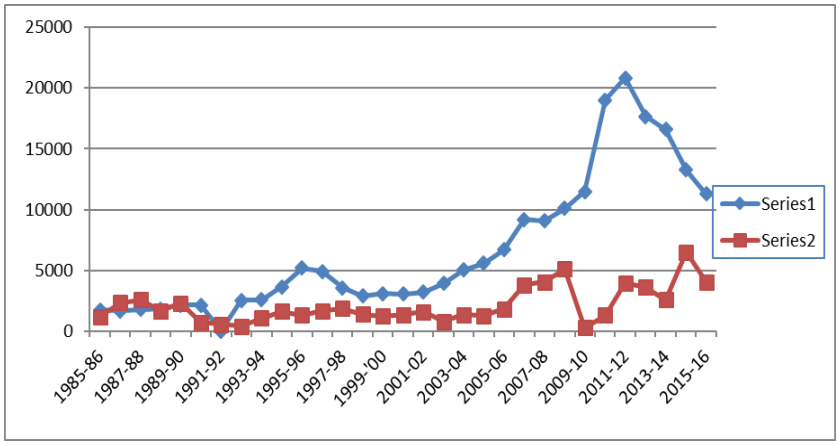
ANOVA

Regression	**df**	**SS**	**MS**	**F**	**Significance F**
Residual	1	2.943892	2.943892	6.620003	0.015466
Total	29	12.8962	0.444696		
	30	15.84009			

	Coefficients	**Standard Error**	**t Stat**	**P-value**	
Intercept	5.892365295	0.604291	9.750869	1.17E-10	<0.05
Ln_Price	0.391923482	0.152325	2.572937	0.015466	<0.05

The value of multiple R is 0.4311 and the value of R square is 0.18589 with adjusted R is 0.1578. The estimated equation is Ln_New_Prod=5.89*+0.39Ln_Price.

Interpretation of the result: The result shows that for 1% increase in market price of natural rubber price, the new planting area of rubber increases by 0.39% i.e. it is inelastic in nature. Hence the relation between the price of natural rubber and the area under new plantations is insignificant.



Series-1=> Price
Series-2=> New Planting Area

Fig 2: Market Price and New Planting Area

The Implication of Reduction in Market Prices

In the month of May-June of the year 2015- 2016, the prices of natural rubber have been come down to Rs 80-90 per kg of dry rubber sheet in local markets of different parts of Tripura. Whereas the national annual average price of natural rubber RSS-4 come down to Rs 113.06. The livelihood of rural rubber grower is dependent on the rubber plantation. The prevailing market price of natural rubber is very volatile rather than it is deteriorating in every passing day. Many rubber growers who are basically dependent on hired tappers have been temporarily postponed the tapping of latex to evade the market glut and those who have been continued tapping activity, many of them have been suffered a huge loss. The problem was more prominent to the rubber growers who have been just started tapping latex initially. During the initial stage of tapping, the yield from latex is less than from potential yield. In such a situation returns from rubber plantations may mismatch with the cost of production of marketable rubber sheets. The declining trend of rubber prices and the increasing trend of input costs sometimes make tapping activity commercially unviable. It has made helpless to many rubber growers of the state. Many rubber growers now remembering their golden memories of old good days when they would sell their products in almost double the existing rate in the local market. The annual average price of natural rubber has shown high instability in the last thirty years. In the case of natural rubber, the domestic market is highly integrated with the international market. The instability in the prices in the international market has significantly affected the prices in the domestic market.

The annual average price of rubber sheet in Indian rubber market shows the merely average price of one year. The prices prevailing in different local markets of the country during the year is far different from the annual average price (RSS). There is a variation in prices of natural rubber from one local market to another depending on the quality of grade of rubber sheet and local market environment and some other factors. Majority of the small growers generally have no bargaining power and sells their product to local traders at the prevailing local market prices. It is seen from table 1 that during the year 2011-12 the market price of natural rubber (RSS-4) was the highest Rs 208.05 and lowest Rs 113.06 in the year 2015-16. If we consider the cash flow analysis of rubber growers from rubber plantations and compare it only with recurring expenses (other than considering capital expenditure) of plantations in these two years, then it will show how rubber growers are affected in the recent period due to a sudden decline in rubber prices.

Table 2: Cash flow analysis from rubber plantation in the year 2011-12 and 2015-16(per/hectare)

Particulars	2011-2012			2015-2016			Increase (+)/ Decrease (-)	Per- centage
	Unit	Rate (RS)	Amount	Unit	Rate	Amount		
(A)Revenue from sale of rubber sheet	1200 kg	208.05	249660	1200kg	113.06	135672	(-)113988	45.67
(B)Recurring or maintenance cost			86000			103200	(+)17200	20.0
(C) Surplus (A-B)			163660			32472	(-)131188	80.16

***Source*:** Author's own computation

Table 2 shows that revenue generation from per hectare of rubber plantation has reduced to Rs 135672 in the year 2015-2016 from Rs 249660 in the year 2011-2012. There is clearly a 45.67 per cent decrease in revenue whereas the generation of surplus from per hectare of rubber plantation has been reduced by 80.16 per cent during this period of time. On the other hand, the recurring cost of production of natural rubber has been increased by 20.0 per cent.

The implication of price reduction of natural rubber on the income of the rubber growers is huge and remarkable. No doubt, further reduction in prices of natural rubber will widen the gap of income. Production of natural rubber in recent time especially is affected by unfavourable prices. A decrease in prices coupled with high labour cost and shortage of skilled labourers compelled growers to cut-off tapping days, reduce the application of fertilizers and other inputs and stay away from proper maintenance of trees.

It is to be mentioned that natural rubber price has declined to a level that renders the natural rubber sector become unprofitable as a viable income-generating activity, especially for small growers. As a direct consequence, there is a possibility to switch over of natural rubber growers, especially small growers to other more profitable alternatives in the long run and the sustainability of rubber

production in the state will face challenges.

Suggestions

A few suggestions which may useful to combat the situation arises during period of instability of market prices.

1. Natural rubber is an agricultural commodity and ups and down in price is a common phenomenon. This trend had been continuing for a long period ago. Unfavourable changes in price may be overcome by the growers improving production and productivity and reducing the cost of production of natural rubber. Programmes have been conducted for creating awareness for the adoption of cost-effective practices towards sustainability of the production of rubber in the context of instability in natural rubber prices and other challenges. Massive skill Development Programmes under the Prime Minister Kaushal Vikas Yojana (PMKVY) sponsored by the Ministry of Skill Development and Entrepreneurship (MSDE) may be very much effective as remedial measures in tapping and processing. This scheme has been introduced in Kerala, Tripura and Assam. The authorities should take care of the proper implementation of these schemes in different parts of the state with the help of RPSs.
2. Better quality of rubber sheet brings higher prices. The quality of the rubber sheet produced in Tripura is not good compared to other rubber producing state in India. In most cases, the rubber sheet produced by the growers in the state does not show any grade specified by the Rubber Board of India. Quality up-gradation programmes may be undertaken to train up the growers regarding the process of latex collection, preservation, sheet processing, grading and effluent treatment. Rubber Board has been continued this effort and conducted programmes in this regard seriously. Recently, Rubber Board has organised two programmes at Santarampara RPS and Hrishi Das colony RPS of Tripura for this purpose. Through the training programme, proper lessons were given to the growers to improve the quality of the rubber sheet but achievement not reached at the desired level. The realisation of higher prices for better grades may make the small growers 'grade conscious' leading to improvement in the quality of sheets. During the last one decade, rubber plantations of Tripura have achieved quantity both in production and productivity to some extent but now the time has come to make an attempt to achieve quality.
3. From past experience, it would not be wise to expect a stable price for natural rubber in India. Several internal and external uncontrollable factors are responsible for this. Fluctuation in crude oil prices is an important factor. Similarly, the demands supply mismatch can sparkle up the prices at any moment. Rubber Production Incentive Scheme (RPIS) may be introduced as precautionary measures by the state government to facilitate to small growers during the period when the market price of sheet rubber per kg comes down below the recurring cost of production per kg of rubber sheet. Under the scheme the state government may declares a support price and the difference between the support price and the daily reference price of RSS-4 grade published by the Board would be credited to the bank account of the small growers on the basis of purchase bills furnished by them through RPS and duly certified by the extension officers of the Board. This incentive is offered as a part of an intervention to support rubber farmers in Kerala during low price period and to encourage rubber production. Farmers of Kerala enjoy the benefit of this scheme having a total area of 5 hectares of plantation, but the assistance is limited to 2 hectares with a production ceiling of 1800 kg per ha /annum. Assistance is being provided for RSS 4 and high grades of latex.
4. A good number of small growers prefer homestead processing of sheet rubber rather than group processing which is one of the main hindrances of up-gradation of quality rubber sheets. If homestead processing is shifted to group processing through Group Processing Centres or RPS maintaining all modern technology then it may bring about remarkable improvements in the quality of rubber sheets. Group Processing Centres or RPS is the best centre where the small growers can avail all the facilities of modern technologies and latest development. The improvement in quality is conspicuous as the small rubber growers are not able to produce superior grades of rubber sheet without adopting a group approach. In this regard, the Board has been providing an incentive to RPS for quality sheet production by way of transportation subsidy for the produce transacted through the RPS. Group Processing Centres or RPS not only supports the small growers to improve the quality of the produce but it also promotes group marketing approach to achieve market competition. In this regards more new units of Group Processing Centres or RPS to be formed and the existing sick units should be rejuvenated to accelerate the programme.
5. When natural rubber price starts to go down and tapping also becomes commercially unviable, rubber growers of the state may start tapping the nectar out of honey bees for alternative livelihood. The rubber tree is a prolific source of honey which is obtained from the extra floral nectarines at the tip of the petiole when the leaflets join. Honey flow period is between the months of January and March. In Tripura honey collection from the rubber tree is yet to start. The forage plants identified by the Rubber Research Institute of India (RRII).To make the rubber honey collection commercially viable, it is necessary to take up plantation of these species also in forest land.
6. Online trading in other commodities has started operation in different parts of the country. But growers reside in the rural areas of the state are not conversant with this new trading system. This has to be popularized to the benefit of the growers. Even though there is talk about soft loan to the farming sector, this has not been the practice in the actual field. When big house construction firms and builders and rich persons get housing loan and vehicle loan at 7 to 9 per cent interest, the grower is deprived of this benefit and he can avail a crop loan at 10 to 11 per cent interest only. And even this facility is not in his easy each. He still has to depend on the local moneylender for his immediate needs.

Conclusion

Fluctuations in rubber prices are common phenomena. Several internal and external uncontrollable factors are responsible for this. Natural rubber is a perennial crop and investment in rubber plantation is a matter of long term investment decision. Therefore, price induced effect does

not instantaneously reflect in the expansion of area under rubber plantation. As a result, there is no immediate possibility of expansion of area under rubber plantation with the increase of market prices and vice versa. Unfavourable changes in price may be overcome by the growers improving production and productivity and reducing the cost of production of natural rubber. Authorities should take more care to accelerate the ongoing programmes which have been conducted for creating awareness to increase production and productivity as well as the adoption of cost-effective practices towards sustainability of rubber production in the context of instability in rubber prices.

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