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Trend Analysis for Rubber Monthly Production and its Instability in India

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Abstract: This study will indubitably benefit the farmers, policymakers and stakeholders by delivering accurate forecast information of India.One essential method for locating trends, changes, and patterns in big data sets over a given time frame is trend analysis. Organizations can identify new opportunities, predict future events, and make well-informed strategic decisions by looking at historical data. Knowing trends offers important insights into consumer behavior, market dynamics, and industry changes in a variety of domains, from marketing and finance to technology and healthcare. This analytical method improves competitive advantage, optimizes resource allocation, and aids in change prediction. Trend analysis is a potent tool for anticipating and navigating future issues in a fast changing environment. Trend analysis and instability we are carried out monthly Rubber production data from 1990-2021 this trend model we are selected on the basis of minimum standard error, Significance ,b1,b2 and maximum R^2 further more the instability research related that will India had overall low instability in the term of production period in 1990 to 2021.This research will add in formulating effective policies regarding Rubber production.

Keyword: Rubber Production ,Trend ,Instability, Descriptive Statistics.

INTRODUCTION

The single most significant activity in the world is agriculture. Typically, agricultural advancement is seen as a prerequisite for economic growth. Any agricultural activity must be evaluated in terms of the net returns to the farmer. Natural rubber (Hevea brasiliensis) production has a long history and has been contributing as one of the most important economic sector. Other than natural rubber, nature has not produced any other industrial raw material. Developing nations frequently rely on the profits from their manufacturing through a few goods, the vast majority of which are primary in nature. As a result, the economy of these countries is significantly impacted by the price volatility of primary commodities. Rubber, one of the few production-oriented commodities, is crucial to the Indian economy and can be used as a raw material or as a product with added value. In addition to seasonal price fluctuations, price volatility and shifts in the long-term price trend are also strongly linked to price instability. Furthermore, the risk premium linked to the prices is determined to be stochastic volatility in price returns. There are many studies carried out to investigate the Natural rubber production instability with respect to changes in the conditional mean and the variance of Natural rubber production.

METHODOLOGY

The study is based on secondary data. This data has been collected from Rubber Board (From 1990-2021 the data regarding production in India.

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Descriptive Statistics

Numerical data is presented rationally and intelligibly using descriptive statistics. Descriptive statistics are used to predict the series for the upcoming years so that appropriate action can be taken. Descriptive statistics, including maximum, minimum, mean, median, skewness, kurtosis, and others, were used to explain the series' trend and reach a consensus.

Trend models

One definition of a model is a way to illustrate a system or process. Generally speaking, statistical models show the process's trajectory along with its statistical characteristics and ramifications. We are interested in applying a number of models, which are outlined below, to examine the nature and trajectory of the series in question in the present context:

Model Name	*Equation*	*Description*
Linear	$Y_t = b_0 + b_1 x_i + e$	Y and x_i's are yield and weather parameters respectively. b_0 and b_i's are constants to be estimated and e is the residual term
Quadratic	$Y_t = b_0 + b_1 x_1 + b_2 x_2^2 + e$	Y and x_i's are yield and weather parameters respectively. b_0 and b_i's are constants to be estimated and e is the residual term
Cubic	$Y_t = b_0 + b_1 x_1 + b_2 x_2^2 + b_3 x_3^3 + e$	Y and x_i's are yield and weather parameters respectively. b_0 and b_i's are constants to be estimated and e is the residual term
Compound	$Y_t = b_0\, x^{b_1} + e$ or $\ln(Y) = \ln(b_0) + b_1 \ln(x)$	Y and x_i's are yield and weather parameters respectively. b_0 and b_i's are constants to be estimated and ln is Natural Log and e is the residual term
Exponential	$Y = b_0 * \exp^{(b_1 x)} * e$	Y and x_i's are yield and weather parameters respectively. b_0 and b_i's are constants to be estimated, and e is the residual term
Multiple regression model	$Y_t = b_0 + b_1 x_1 + b_2 x_2 + \ldots + b_n x_n + e$	Y and x_i's are yield and weather parameters respectively. b_0 and b_i's are constants to be estimated, and e is the residual term

Instability and Its Measure

Utilizing the index developed by Cuddy and Della (1978) and Srivastava et al. (2022), instability, production, were evaluated:

$$CV_t = (CV) \times \sqrt{1 - R^2} \;\; where, \;\; C.V. = \frac{\sigma}{\overline{X}} \text{x} 100$$

Where σ = Standard Deviation

$\overline{X} = Mean$

R^2 = coefficient of determination of the linear trend model of the variable concerned.CV_t = CV around trend.

RESULT AND DISCUSSION

Performance of Rubber India The perusal of Table 1 showed that Rubber cultivation in India increased by approximately production from year 1990 to 2022.Rubber production in India increased by nearly 107 to 208 per cent, from just 329615 thousand tonnes in 1990-91 to 715000and thousand tonnes in 2020-21The average Rubber production in India was 55285 thousand tonnes per year.The negative skewness (-0.033 and -0.613) and kurtosis values suggested that output increased at the beginning of the study and remained nearly constant throughout the study period. The measure of central tendency, namely, mean > median > mode, confirmed the positive skewness criterion, implying that the data were asymmetric.The Rubber yield trend in India improved marginally, rising two times from 329615 thousand tonnes in 1990 to 715000 thousand tonnes in 2020-21.

Table 1: Performance of Rubber production in India 1990-2021

	April	*May*	*June*	*July*	*August*	*Sep*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*March*
Mean	41920	415156	43819	46089	52802	60614	65776	73713	79987	74226	41194	38445
Standard Error	0.414	0.414	0.414	0.141	0.421	0.421	0.421	0.421	0.421	0.421	0.421	0.421
Standard Deviation	10497.52	9900.26	11854.58	13272.11	14398.83	13091.33	15720.82	18744.01	20376.06	19760.17	14810.50	10379.84
Kurtosis	-0.013	-0.026	-0.169	-0.656	-0.639	-0639	-0.926	-0.864	-0.879	-0.922	-0.315	-0867
Skewness	-0.613	-0.510	-0.399	-0.360	-0.226	-0.226	-0.053	-0.155	-0.193	-0.253	-0.030	-0.033

Trends

A model can be defined as a method of showing a process or system. In general, statistical models trace the path of the process as well as its statistical features and implications. In the current context, we are interested in investigating the course and nature of the series under consideration using several models.

Trend analysis for monthly Rubber production in India

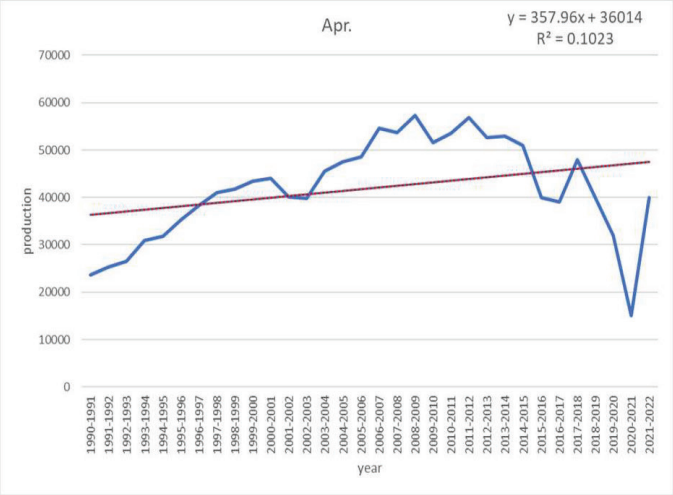
To workout the trends in production different parametric model like Polynomial, Logarithmic, Quadratic, Cubic, Compound, growth, and Exponential model were attempted. Among the competitive models the best model was selected on the basis of the maximum R2 value, significance of the model and its coefficient. In the following section present (table 2) the result of these exercises.

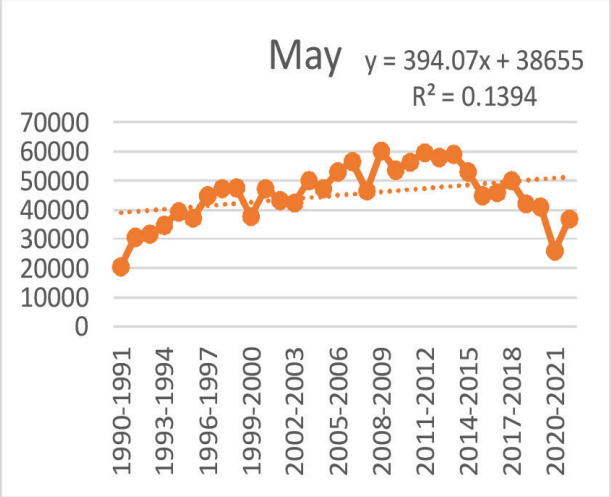
Table 2

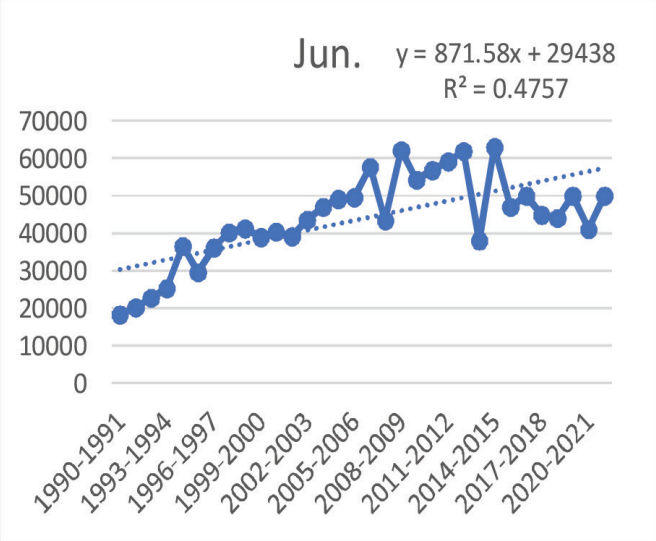
Months	*Model*	*R^2*	*Significance*	*Constant*	*b 1*	*b 2*
April	Quadratic	0.737	0	3046.868	4574.314	-108.112
May	Quadratic	0.743	0	8151.177	4270.448	-99.394
June	Quadratic	0.785	0	1693.695	4193.828	-85.186
July	Quadratic	0.799	0	3372.703	3876.2	-70.61
August	Quadratic	0.791	0	-559.715	5598.531	-120.204
September	Quadratic	0.76	0	13879.93	4817.148	-101.568
Oct	Quadratic	0.714	0	9175.948	6099.517	-134.445
November	Quadratic	0.699	0	5339.149	7675.782	-175.659
December	Quadratic	0.683	0	8804.985	7591.507	-165.661
Jan	Quadratic	0.695	0	6282.136	7053.114	-149.807
Feb	Quadratic	0.817	0	1183.044	3172.449	-45.954
March	Quadratic	0.725	0	2810.532	3619.302	-75.13

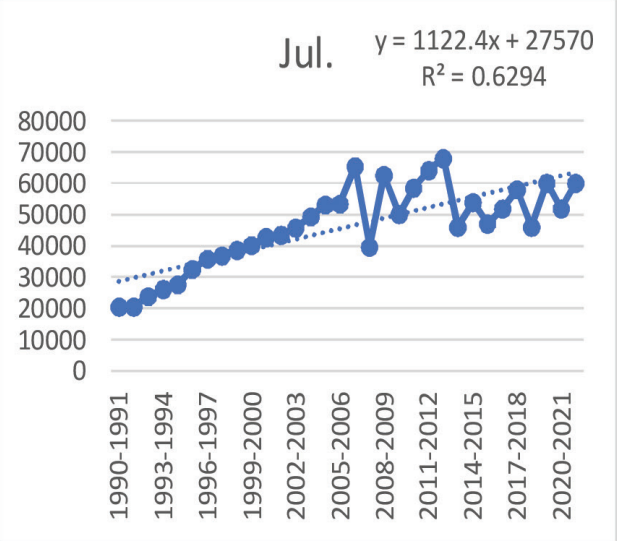
Instability Analysis

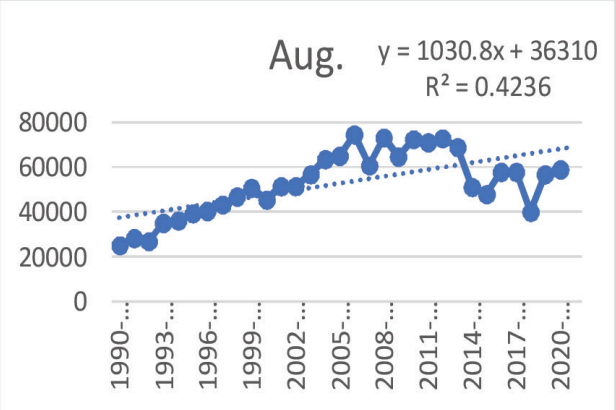
In this analysis, integrated non-linearity into the trend model, and the coefficient of determination was obtained from such a best-fitting model to calculate the CV value for various sequences, which we call modified Cuddy &Della measure, thus the R used in Cuddy & 2 Della model and the present study modified Cuddy & Della. The research used the Cuddy & Della (1978) measure for nonlinearity in the trend model against

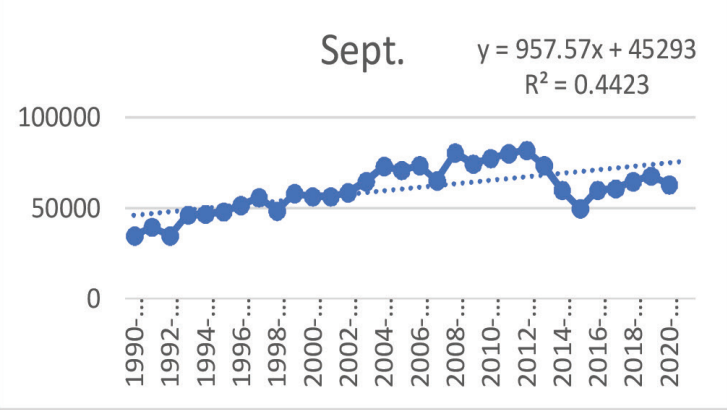

Apr.
y = 357.96x + 36014
R² = 0.1023
production
year

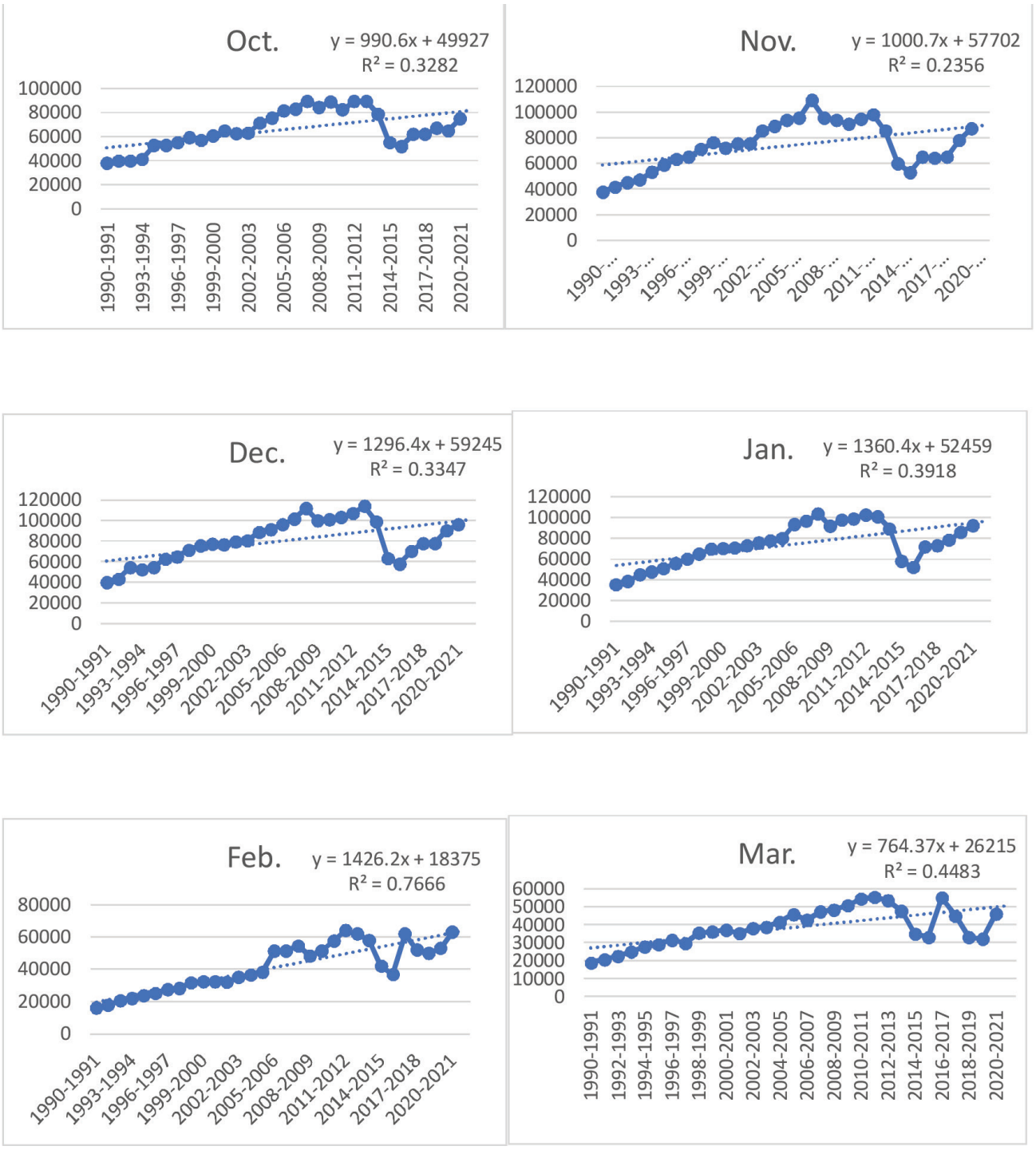

May
y = 394.07x + 38655
R² = 0.1394


Jun.
y = 871.58x + 29438
R² = 0.4757


Jul.
y = 1122.4x + 27570
R² = 0.6294


Aug.
y = 1030.8x + 36310
R² = 0.4236


Sept.
y = 957.57x + 45293
R² = 0.4423



only the Cuddy and Della model's linearity assumption. As a result, the R in the Cuddy and Della model and the modified Cuddy andDella model can differ. During the instability analysis, the trend coefficient of variation was measured in 1960-2021.

Instability of Rubber

Rubber production was given in table 3 for India. The results clearly showed that the coefficient variant around trend (CV) in the Monthly Production of Rubber has decreased from 0.2372 (19990) to 0.19728(2021).Indicate that the highest instability was sown in April monthIndia and lowest instability sown in march month from 1990 to 2021 in India.

As a result of the analysis of the Rubber production instability, it can be concluded that while production experienced minimal instability in recent years in India, the yield

Table 3: Instability in production of Rubber in India

	April	*May*	*June*	*July*	*August*	*Sep*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*March*
R^2	0.1023	0.1394	0.4757	0.6294	0.4236	0.4423	0.3282	0.2356	0.3347	0.3918	0.7666	0.4483
CV	0.250418144	0.216749	0.266272	0.283429	0.268259	0.212465	0.235117	0.250148	0.250562	0.261886	0.353684	0.265602
CV*1-R2 SQRT (Instability)	0.237263758	0.201075	0.192804	0.172543	0.203665	0.158668	0.19271	0.218704	0.204373	0.204238	0.17087	0.19728

experienced slightly increased instability, implying that greater emphasis was placed on reducing volatility and optimising processes in Rubber production. On the other hand, the adoption of new technologies increased Rubber production insecurity. It raised agricultural production risks and influenced farmer income and the decision to invest in high-paying crops.

CONCLUSION

The farmers, policymakers, and other stakeholders in India will unquestionably benefit from this study's accurate trending information. Additionally, this research will contribute to the rapidly expanding literature on agriculturaltrend analysis adaptation. Due to this, accurate crop production trend were crucial for everyone with a vested financial interest in the agriculture industry. Furthermore, the instability research for Rubber production low in India.Thus, the major source of this increase in production was mainly expansion in the area followed by a slightly increase in monthly production from 1990 to 2021.

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