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Assessment of Prices and Profitability in Chilli – A Study in Guntur District of Andhra Pradesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was undertaken in Guntur district of Andhra Pradesh to assess the prices and profitability of chilli marketing. The study used both primary and secondary data collection. The elasticity coefficients for area (1.177) and material costs (3.699) were positively significant in Cobb-Douglas production function. In multiple regression analysis area, expenses on production material and expenses on marketing services were found significantly influencing the income of the farmers. In ARDL model for factors influencing market arrivals of commodities analysis R^2 showed that 73 percent of variation and current prices were found significantly influencing the arrivals of the farmers. In ARDL model factors influencing current prices of commodities analysis R^2 showed that 84 percent of variation and lagged prices (P_{t-1} and $P_{t-2)}$ were found significantly influencing the current price of the farmers. Also price spread analysis of data indicated that majority of farm produce was routed through two marketing channels, Channel-I (producer-trader-wholesaler-retailer-consumer) and Channel-II (producer-processor-retailer-consumer). Producer's share in consumer's rupee was found to be 80.51%, 76.72% and price spread was `1500.67, `1971.92 for

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Channel-I and Channel-II respectively. Marketing efficiency in channel I and channel II were 3.53, 14.11 and 2.93, 16.87 respectively in Acharya's and Shepherd's methods. Low price for the produce at the time of harvest and lack of transportation with scores 78.26 and 63.13 was the most important constraint faced by the farmers.

Keywords: ARDL model; garrett ranking; marketing efficiency; prices and profitability; resource use efficiency.

1. INTRODUCTION

Chilli is one of the most important commercial crops of India [1]. Chilli is used in number of activities such as vegetables, spice, condiments, sauce, pickles. Chilli occupies an important place in Indian diet and it is indispensable item in the kitchen as it is consumed daily as condiment in one or the other form. India ranks second among world chilli exporters and has showed a steady decline in chilli trade due to domestic consumption [2]. Area under chilli cultivation in 2018-19 was 7.39 Lakh hectares and production was 21.7 lakh MT [3]. In Andhra Pradesh, area under Chilli was 69.8 thousand hectares in 2018. In Guntur area under chilli was 36.6 thousand hectares [4]. The income from chilli is not only depends on the production but also on its efficient marketing. The chilli growers of Guntur district have been using different marketing channels for its disposal and feel that the intermediaries enjoy the undue share of consumers rupee which affect their margin. A dynamic and vibrant marketing system with adequate supply chain infrastructure has been felt necessary to keep pace with the changing agricultural production and growing marketable surplus [5]. The market for chillies is affected by seasonal price fluctuations. Thus there is an enormous increase in the cost of marketing and the farmer end up getting a low price for his produce. The market for chillies is affected by seasonal price fluctuations. Hence there is a need to study the price fluctuations and profitability of chilli. Therefore present study was undertaken to work out with following objectives (a) to study the resource productivity and income determinants of chilli farmers. (b) factors influencing current prices and arrivals in chilli (c) to study about different marketing channels marketing efficiency and constrains faced by farmers in chilli production.

2. METHODOLOGY

Combinations of both purposive and random sampling techniques were used for selection of Guntur Agricultural Market committees (AMCs) because of the large volume of arrivals from different parts of the country. Primary data were collected from the selected farmers, Traders, processors, wholesalers and retailers in the study area through survey method with the help of pre-tested schedules designed for the purpose. Secondary data collected regarding the arrival and prices of the regulated market selected for the study. A sample of 15 farmers, 15 traders, 15 Processors, 15 wholesalers and 15 retailers were selected at random to a total of 75.

2.1 Cobb-Douglas Production Function

Cobb-Douglas production function was selected for the present study because of its relative advantage over other production functions that is the input coefficients constituted the respective elasticities [6]. Elasticities of production of inputs can be obtained directly and the sum of elasticities of production provides the estimates of returns to scale. The marginal productivity of factors, marginal rate of substitution, factor intensity and the efficiency of production can be calculated directly from the parameters in Cobb-Douglas type of production function [7]. Thus, Cobb-Douglas type production function of the following form was fitted to examine the factors affecting the resource productivity.

$$Y = a\ X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} \ldots e^u$$

Where Y denotes output

$X_1, X_2, X_3, X_4 \ldots X_n$ indicate input factors
b_1, b_2, b_3, b_4 denote production elasticities.
e' Napier base
'u' is the random error

The Cobb-Douglas type of production function in the form expressed above was linearised into a logarithmic function with a view to getting a form amenable to practical purposes as expressed below.

$$\text{Log } Y = \log A + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + \log u$$

Y = Gross income in rupees per farm
A = Intercept
x_1 = Area in hectares
x_2 = Material costs in rupees per hectare
x_3 = Labour charges rupees per hectare
x_4 = Productivity Qt per hectare
b_1 to b_4 = Production elasticities of factors x_1 to x_4

For testing the regression co-efficients or production elasticities 't' value was calculated using the formula.

$$t = \frac{bi}{S.E \text{ of } bi}$$

Where

b_i = Production co-efficient or production elasticity of input x_i
S.E of b_i = Standard error of b_i
t- test was used to know whether Σ b_i is significantly deviating from unity or not.

$$t = \frac{\Sigma bi - 1}{S.E \text{ of } \Sigma bi}$$

The estimated coefficients of the relevant independent variables were used to compute the marginal value products (MVP) and their corresponding marginal factor costs (MFC). The ratio of the MVP to MFC was used to determine the resources efficiency as shown in the following equation [8].

r = MVP/MFC
here,

r = Efficiency ratio (ratio of the MVP of an input and unit price of the input)
MVP = Marginal value product of a variable input.
MFC = Marginal factor cost (price per unit input)
MVP = MPPi × Py
MPPi = Marginal physical product of the ith input
Py = Price of output

MPPi = bi Y/ Xi

Where,

bi = Elasticity coefficient of the ith independent variable
Y = Geometric mean of the output, and
Xi = Geometric mean of the ith input

The MVP was obtained by multiplying the marginal physical product (MPP) with the product price per unit. The most reliable and most useful estimate of MVP is obtained by taking resources (Xi) as well as gross income (Y) at their geometric means [9]. As the MFC is price of input per unit, the MFCs of all the inputs will vary while calculating the ratio of MVP to MFC. However, the denominator will always be one, and therefore, the ratio will be equal to their respective MVP [10,11,12].

2.2 Multiple Linear Regression Model

Multiple linear regression model was carried out for factors determining the income of the farmers. The model included one dependent variable and five explanatory variables. The following linear model was used to determine the income of the farmer for individual crops.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + u_i$$

Where,

Y= Net income of the farmer (Rs)
X_1 (ACROP) = Area of the crop under consideration (ha)
X_2(MCCROP) = Material costs (Rs)
X_3 (LCCROP) = Labour costs (Rs)
X_4 (MRCCROP) = Marketing costs (Rs)
X_5 (PCROP) = price (Rs)
u_i = disturbance term

Here β_0 is the intercept term, giving average effect of Y when all the included variables were absent. The stochastic term u_i reflect intrinsic randomness in the data. β_1 to β_5 are partial regression coefficients. The partial regression coefficient, (β_1 to β_5) measures change in the mean value of Y per unit change in X_i holding other variables constant.

2.3 Autoregressive Distributed Lag Models (ARDL)

Autoregressive Distributed lag Models (ARDL) was used to determine factors effecting arrivals and prices. For chilli 133 observations are took from April 2001 to June 2012 on monthly basis. In regression analysis involving time series data, the regression model includes not only the current but also the lagged (past) values of the explanatory variables (the *X*'s), it is called a Distributed-lag model. If the model includes one or more lagged values of the dependent variable among its explanatory variables, it is called an Autoregressive model.

Thus,

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + u_t \quad (1)$$

Equation (1) represents a distributed-lag model.

$$Y_t = \alpha + \beta Xt + \gamma Y_{t-1} + u_t \quad (2)$$

Equation (2) represents an autoregressive model.

ARDL model is an econometric dynamic model in which the independent variables influence the dependent variable with a time lag and at the same time the dependent variable is correlated with lag(s) of itself. The simplest form of an ARDL model is [13].

$$Y_t = \alpha + \lambda Y_{t-1} + \beta_0 X_t + \beta_1 X_t + u_t \quad (3)$$

Equation (3) represents an autoregressive distributed lag model.

The estimation of ARDL model may result in residuals that violate the assumption of normality of the error term. This is a simplifying assumption of the classical normal linear regression model, and must be satisfied for the method of ordinary least squares to the best linear unbiased estimator (BLUE) [14].

In our study autoregressive distributed lag model was formulated to study the factors determining the prices of the farmers. An ARDL (2,1) model would have 2 lags on dependent variable and one lag on independent variables. The model included one dependent variable and four explanatory variables (two lagged dependent variables, one lagged independent variable). The model was lagged once and the lag length of the model was determined by the Akaike Information Criteria (AIC) [15].

The model was estimated using least squares method as presented below:

$$P_t = \alpha + \lambda_0 P_{t-1} + \lambda_1 P_{t-2} + \beta_0 A_t + \beta_1 A_{t-1} + u_t \quad (4)$$

Where,
P_t = prices of the crop (Rs/q)
P_{t-1} = Lagged price with one month period
P_{t-2} = Lagged price with two months period
A_t = Arrivals (q)
A_{t-1} = Lagged arrivals of produce (q)

The model was estimated using least squares method as presented below:

$$A_t = \alpha + \beta_0 P_t + \beta_1 P_{t-1} + \beta_2 P_{t-2} + \lambda_0 A_{t-1} + u_t \quad (5)$$

Where,
A_t = Arrivals of the crop (Rs/q)
P_t = prices of the crop (Rs/q)
P_{t-1} = Lagged price with one month period
P_{t-2} = Lagged price with two months period
A_{t-1} = Lagged arrivals of produce (q)

Validity of the estimated coefficients need to be done with the help of't' test and 'F' test. Durbin-Watson statistic, d test for autocorrelation was employed to allow a decision to be made regarding the presence of autocorrelation among the residuals.

2.4 Marketing Channels

The predominant supply chains/ marketing channels identified in the sale of chilli are:

Channel-I: Producer-Trader - Wholesaler - Retailer - Consumer
Channel-II: Producer- Processor - Retailer – Consumer

2.4.1 Total marketing cost

Total cost incurred on marketing either in cash or in kind by the producer and the various intermediaries involved in the sale and purchase of the commodity till the commodity reaches the ultimate consumer.

This is computed as follows

$$C = C_f + Cm_1 + Cm_2 + Cm_3 + Cm_4 + \ldots\ldots\ldots\ldots C_{mm}$$

C = Total cost of marketing of the commodity.
C_f = Cost paid by the producer form the time the produce leaves the farm till he sells it; and
Cm_1 = Cost incurred by ith middleman in the process of buying and selling the product.

2.4.2 Price spread

Price spread is the difference between the process paid by the consumer and price received by the producer for an equivalent quantity of farm produce.

2.4.3 Marketing margin of a middle men

This is the difference between the total payments (cost+ purchase price) and receipts (sale price) of the middle men (ith agency). The percentage margin of ith middle men Pmi was calculated.

$$Pmi = P_r – (P_{pi} + Cmi) / P_m$$

Where,

Pmi = Percentage margin of ith meddle men.
Pri= Total value receipt per unit (sale price)
Ppi= Purchase price of goods (purchase price)
Pmi= Cost incurred in marketing per unit.

2.4.4 Producer's share in consumer's rupee

It is the price received by the producer as a percentage in the consumer's price. If P_c is a consumer's price and P_F is the producer's price then the producer's share in consumer's rupee (P_s) may be expressed as follows.

$$Ps = \frac{PF}{Pc} X\ 100$$

2.4.5 Analysis of marketing efficiency under different marketing channels

For this Shepherd's formula can be used to draw appropriate conclusions. Shepherd has suggested that the ratio of the total value of goods marketed to the marketing cost may be used as a measure of efficiency. Higher value of Marketing Efficiency (ME) indicates higher efficiency.

$$ME = \left[\frac{V}{I} - 1 \right] X\ 100$$

Where

ME = Index of marketing efficiency
V = Value of the goods sold or price paid by the consumer (retail price)
I = Total marketing cost or input of marketing

2.5 Garret's Ranking Technique

To examine the relative importance of each constraint of farmers in marketing of their produce in regulated markets, we prioritize the constraints by using Garret's ranking technique.

Percent position = $100(R_{ij} – 0.50) / N_{ij}$

Where,

R_{ij} is the rank given by i^{th} item by j^{th} individual
N_{ij} is the number of items ranked by the j^{th} individual

The percentage position of each rank was converted into scores using Garret's table. For each constraint, scores of individual respondents were added together and were divided by total number of respondents for whom scores were added. Thus mean score for each constraint was ranked by arranging them in descending order.

3. RESULTS AND DISCUSSION

The results of Cobb- Douglas production function was presented in Table 1.The production function analysis for chilli producing farmers revealed that the regression coefficients for area (1.177) and material costs (3.699) were positively significant. Every one percent increase in area and productivity would contribute to the income to an extent of 1.177 and 3.699 per cent remaining things are constant. These results are corroborated with a similar study where income was increased with increased in area in their study on Paddy Cultivation in Peechi Command Area of Thrissur District of Kerala [6]. Labour costs (-2.830) showed negative significant effect indicating their excessive usage of these inputs of which increase in further quantity decreases the gross income. The results of increased labour costs will decrease the income was reported in resource use efficiency and economics of marketing of green chilli [16].

R^2 value showed that 79 percent of variation was explained by independent variables included in the production function. Returns to scale was 0.707 which indicated decreasing returns to scale.

The allocative efficiency i.e the MVP to MFC ratios indicated the price response of the farmers. The allocative efficiency of 1 indicated that the farmers were price efficient in allocating that particular resource in chilli cultivation. The allocative efficiency of more than 1 indicated the under-utilization of that particular resource and scope to increase in its application till the ratio is reached to 1. The results indicated that the MVP to MFC ratio was highest in the case of area (13.66) followed by productivity (4.57). This indicated that bringing in more land under paddy cultivation would bring out the economies of scale and would result in higher productivity. While the MVP to MFC ratio turned to be negative on expenditure towards labour (-3.60) implying uneconomic and excessive use of labour. Hence there is need to reduce the use of labour to produce the same level of production, will increase the efficiency of labour and will increase the income.

Table 1. Cobb - Douglas production function estimates for Chilli

S.no	Variables	Chilli	
		Coefficients	**MVP to MFC**
	Intercept	7.057	
1	Area (ha)	1.177***(0.362)	13.66
2	Material costs(Rs)	-1.338(0.808)	--
3	Labour costs(Rs)	-2.830**(1.142)	-3.60
4	Productivity(qt)	3.699**(1.471)	4.57
	Returns to scale	0.707	
	R^2	0.79	
	N	15	

*Note: 1) Material costs include seed, FYM, fertilizers, plant protection chemicals.2)Labour costs include ploughing, sowing, manures, fertilizers and plant protection chemical application and harvesting costs. 3) Figures in parenthesis are standard errors 4) **Significant at 5 % level, ***Significant at 1% level*

The results of multiple linear regression function was presented in Table 2. It was observed from the table that the coefficient of multiple determination R^2 showed that 83 percent of variation in income was explained by the variables in the model. Area, expenses on production material and expenses on marketing services were found significantly influencing the income of the farmers. One unit increase in area will increase the income of farmers by `62965. Similarly one rupee increase in expenses on production material and expenses on marketing services will increase income of the farmer by Rs. 0.30 and Rs. 0.21respectively. Large quantity of material is required for producing more quantity of produce which increases the income of the farmer. Expenses on marketing services will increase when quantity of produce was more which increases the income of the farmers.

From Table 3 it was observed that the coefficient of multiple determination R^2 showed that 73 percent of variation in arrivals was explained by the variables in the model. Current prices were found significantly influencing the arrivals of the farmers. One rupee increase in current price will increase arrivals of the farmer by 0.595 quintal. Durbin- Watson'd' statistic was employed to detect the presence of autocorrelation. It was 1.85 for sample data pertaining to chilli crop and concluded that there is no evidence of first order serial correlation.

Table 4. Reveals that the coefficient of multiple determination R^2 showed that 84 percent of variation in current prices was explained by the variables in the model. Lagged prices were found significantly influencing the current price of the farmers. One rupee increase in lagged prices P_{t-1} and P_{t-2} would increase current price of the farmer by `0.77 and `0.15 respectively. The Durbin-Watson 'd' statistic for autocorrelation is 1.88 and the presence of autocorrelation is ruled out.

Table 2. Multiple linear regression for factors effecting income of the farmer

S.no	Variables	Chilli	
		Coefficients	**t - stat**
	Intercept	39501	
1	Area (ha)	62964.93**(29924.07)	2.104
2	Expenses on production material	0.304**(0.151)	2.015
3	Labour costs	1.011(1.563)	0.646
4	Expenses on marketing services	0.21490***(0.055)	3.861
5	Price (Rs)	1.435(1.284)	1.117
	R^2	0.83	
	Adj. R^2	0.73	
	F- table	8.83	
	N	15	

*Note: 1) Expenses on production material include seed, FYM, fertilizers, plant protection chemicals.2)Labour costs include ploughing, sowing, manures, fertilizers and plant protection chemical application and harvesting costs. 3) Expenses on marketing services consists of bagging, hamali, chatavali, weighing, storage and commission charges.4) Figures in parenthesis are standard errors 5) **Significant at 5 % level, ***Significant at 1% level*

Table 3. Autoregressive distributed lag models for factors effecting arrivals of commodities

S.no	Variables	Chilli	
		Coefficients	**t - stat**
	Intercept	946.36	
1	Prices (Rs/q)	0.595***(0.071)	8.33
2	Lagged prices P_{t-1} (Rs/q)	20.276(17.75)	1.14
3	Lagged prices P_{t-2} (Rs/q)	-7.757(22.38)	-0.34
4	Lagged arrivals A_{t-1} (q)	-12.13(17.71)	-0.68
	R^2	0.73	
	Adj. R^2	0.73	
	F- ratio calculated	17.13	
	N	133	
	Period	April 2001 to June 2012	
	Durbin –Watson 'd' statistic	1.85	
		1.85	

*Note: 1) .P_{t-1} : Lagged price (one month lag); P_{t-2}:Lagged price (two months lags); A_{t-1}:Lagged arrivals (one month lag) 2) Figures in parenthesis are standard errors 3) ***Significant at 1% level*

Table 4. Autoregressive distributed lag models for factors effecting current price of commodities

S.no	Variables	Chilli	
		Coefficients	**t - stat**
	Intercept	326.068	
1	Lagged prices P_{t-1} (Rs/q)	0.775***(0.08)	8.887
2	Lagged prices P_{t-2} (Rs/q)	0.150*(0.08)	1.725
3	Arrival A_t (q)	0.00049(0.0004)	1.142
4	Lagged arrivals A_{t-1} (q)	-0.0005(0.0004)	-1.26238
	R^2	0.84	
	Adj. R^2	0.84	
	F- ratio calculated	176.75	
	N	133	
	Period	April 2001 to June 2012	
	Durbin –Watson 'd' statistic	1.88	

*Note:. 1) P_{t-1} : Lagged price (one month lag); P_{t-2}:Lagged price (two months lags); A_{t-1}:Lagged arrivals (one month lag) 2) Figures in parentheses are standard error 3) **Significant at 10 % level, ***Significant at 1% level*

Regarding marketing costs In channel I the movement of the produce from producer is through trader, wholesaler, retailer and finally to the consumer. The trader purchase chillies through open auction at APMC, Guntur. In channel II the produce is purchased from producer by the processor in APMC, Guntur through open auction method. The processor adds value to the raw chillies by different value addition processing and change the produce in to ready to use products like chilli powder and is attractively packed in small quantities as per the consumer choice then their value added products are distributed to retailers as per their orders and they are finally reach consumer through retailers. The costs incurred by producer and intermediaries in handling chilli were worked out and presented in Table 5. The total costs of `545.50 and `1094.44 per quintal of chilli was incurred towards marketing in channel I and channel II respectively. On an average, the producers incurred a cost of `254.28 per quintal of chilli towards labour charges, gunny bag, weighing charges, transportation and miscellaneous in channel I. Trader incurred a marketing cost of `156.71 per quintal of chillies towards labour charges, transportation, market fee, commission charges and miscellaneous. Wholesaler incurred major on transportation `52.82. The other costs come to `15.90 which includes hamali and weighing charges. Retailer incurred major on transportation `35.76. The other costs come to `30.03 which includes weighing charges, packing and miscellaneous. Producer marketing cost was worked out to `243.47 per quintal of chillies in channel II. Producer marketing cost was worked out to

`243.47 per quintal of chillies in channel II. Producer incurred maximum on commission charges ` 76.50 followed by transportation `69.26, gunnybags `64.46, labour charges `17.34, miscellaneous `10.64 and weighing charges `5.25. Processors costs includes taxes `95.54, market fee `52.43, transportation `45.38, commission charges `45.25, weighing charges `10.58 and loading and unloading `8.64. Marketing costs incurred by retailers were `82.65. Processors costs includes taxes `95.54, market fee `52.43, transportation `45.38, commission charges `45.25, weighing charges `10.58 and loading and unloading `8.64. Marketing costs incurred by retailers were `82.65.

From Table 6 results reveal that total marketing costs incurred in the supply chain 46.61% by producer, 28.72% by trader, 12.59% by wholesaler and 12.06% by retailer in channel I. The trader secured a margin of `350.50 (29.98%) per quintal of chillies in channel I. The processor incurred `510.50 per quintal of chilli towards processing. Marketing margin realized by the processors was `685.67 (61.10%) in channel II. The wholesalers secured a margin of `390.45 (32.28%). Margin obtained by retailers

Table 5. Marketing costs for Chilli (Rs/q)

S.no	Particular	Channel 1 (Rs / q)	Channel II (Rs/q)
1	**Producer**		
	a)Labour charges	21.68 (3.97)	17.34 (1.58)
	b) Gunny bag	60.83 (11.15)	64.46 (5.88)
	c) Transportation	72.89 (13.36)	69.26 (6.32)
	d) Weighing charges	6.25 (1.14)	5.25 (0.47)
	e) Commission charges	80.25 (14.71)	76.50 (6.98)
	e)Miscellaneous	12.38 (2.26)	10.64 (0.97)
	Total	**254.28 (46.61)**	**243.47 (22.24)**
2	**Trader**		
	a)Labour charges	10.26 (1.88)	--
	b) Transportation	55.28 (10.13)	--
	c) Market fee	35.28 (6.46)	--
	e) Commission charges	40.50 (7.420	--
	d) Miscellaneous	15.39 (2.82)	--
	Total	**156.71 (28.72)**	--
3	**Processors**		
	a)Loading and unloading	--	8.64 (0.78)
	b)Transportation	--	45.38 (4.14)
	c)Weighing charges		10.58 (0.96)
	d)Commission Charges	--	45.25 (4.13)
	c)Market fee	--	52.43 (4.79)
	e) VAT	--	95.54 (8.72)
	Total		**257.82 (23.55)**
	Processing costs	**--**	**510.50 (46.64)**
4	**Wholesaler**		
	a)Transportation	52.82 (9.68)	--
	b)Hamali	6.96 (1.27)	--
	c) Weighing charges	8.94 (1.63)	--
	Total	**68.72 (12.59)**	--
5	**Retailer**		
	a)Transportation	35.76 (6.55)	49.38 (4.51)
	b)Weighing	6.50 (1.19)	6.00 (0.54)
	c)Packing	10.94 (2.00)	15.36 (1.40)
	d)Miscellaneous	12.59 (2.30)	11.91 (1.08)
	Total	**65.79 (12.06)**	**82.65 (7.55)**
	Total marketing cost	**545.50 (100.00)**	**1094.44 (100.00)**

Note: Channel-I: Producer-Trader - Wholesaler - Retailer- consumer; Channel-II: Producer- processor - Retailer Consumer

Table 6. Price spread and marketing margins for Chilli (Rs/q)

S.no	Particulars	Channel 1 (Rs/q)	Channel II (Rs/q)
1	**Producer**		
	Gross price received	6200.00	6500.00
	Marketing costs	254.28	243.47
	Percent share of costs (%)	46.61	22.24
	Net price received	5945.72	6256.53
2	**Trader**		
	Purchase price	6200.00	**--**
	Marketing costs	156.71	--
	Percent share of costs (%)	28.72	--
	Margin	350.50	--
	Percent share of margins (%)	28.98	
3	**Processor**	**--**	
	Purchase price	--	6500.00
	Marketing costs	--	257.82
	Processing costs	--	510.50
	Percent share of costs (%)	--	70.19
	Margin	--	685.67
	Percent share of margins (%)		61.10
	Selling price		7953.99
4	**Wholesaler**		
	Purchase price	6707.21	--
	Marketing costs	68.72	--
	Percent share of costs (%)	12.59	--
	Margin	390.45	--
	Percent share of margins (%)	32.28	--
	Selling price	7166.38	--
5	**Retailer**		
	Purchase price	7166.38	7953.99
	Marketing costs	65.79	82.65
	Percent share of costs (%)	12.06	7.55
	Margin	468.50	435.28
	Percent share of margins (%)	38.73	38.83
6	retailer selling price per quintal rice/ consumer Purchase price	7700.67	8471.92
7	Total cost incurred	545.50	1094.44
	Percent share in consumers price	7.08	12.91
8	Total profit margin	1209.45	1120.95
	Percent share in consumers price	15.70	13.23
9	Price spread (CP-PP)	1500.67	1971.92
	Producer share in consumer price	80.51	76.72

Note: Channel-I: Producer-Trader - Wholesaler - Retailer- consumer; Channel-II: Producer- processor - Retailer – Consumer

in channel I and channel II were `468.50 (38.73%) and ` 435.28 (38.83%).

Farmers received a net price of `5945.72 and `6256.53 per quintal of chilli in channel I and channel II respectively. It was evident that the consumers purchasing price or retailers selling price of one quintal of chillies was `7700.67 and chilli a powder was `8471.92 in channel I and channel II respectively. Price spread in channel I and channel II were `1500.67 and `1971.92 while producer share in consumer rupee was 80.51% in channel I and 76.72 % in channel II. These resulted were corroborated with the similar study Price spread, marketing costs and margins of chilli in Karnataka state done where the producer share in consumers rupee was81.95%, 83.23% and 85.08%, in Gulbarga, Raichur and Bijapur respectively [17].

Table 7. Marketing efficiency of chilli

S.no	Particulars	Chilli (Rs/q)	
		Channel I	Channel II
1	Consumer purchase price	7700.67	8471.92
2	Total marketing cost (Rs/q)	545.50	1094.44
3	Marketing margins	1209.45	1120.95
4	Price received by farmer	6200.00	6500.00
5	Value added by marketing system (Rs/q) (1-4)	1500.67	1971.92
6	Conventional method (5/2)	2.75	1.80
7	Shephered's method (1/2)	14.11	16.87
8	Acharya's method (4/2+3)	3.53	2.93

Table 8. Garrett's ranking for the constraints perceived by farmers

S.no	Constraints	Chilli	
		Mean score	Rank
1	High marketing cost	52.20	4
2	Untimely payment	46.73	5
3	Defective and faulty weighing	43.53	7
4	Low price for the produce at the time of harvest	78.26	1
5	Lack of transportation	63.13	2
6	Lack of adequate storage facilities	60.04	3
7	Lack of adequate processing units	41.86	8
8	Forced sale	44.00	6
9	Main market is far away	22.8	9

Table 7 reveals that Marketing efficiency calculated by Acharya's approach and Shepherd's method in channel I and channel II for chilli were 3.53, 14.11 and 2.93, 16.87 respectively. Channel II were more efficient compared to channel I. In channel II marketing costs were more because processing cost of chilli powder were very high. In channel I marketing margins were more because of the involvement of more number of intermediaries.

3.1 Constraints Perceived by Farmers in Marketing of Chilli

From Table 8 it was observed that low price for the produce at the time of harvest and lack of transportation with scores 78.26 and 63.13 was the most important constraint faced by the farmers. Lack of transportation, lack of adequate storage facilities, high marketing cost and untimely payment are the other important constraints face by chilli farmers. These resulted were corroborated with the similar study Sustainable economic analysis and constraints faced by the king chilli growers in Nagaland where High price fluctuation in market, Lack of transportation facilities, lack of storage facilities are the major constraints faced by farmers [18].

4. CONCLUSIONS

From the study it was concluded that regression coefficients for area and material costs were positively significant in Cobb-Douglas production function. Area, expenses on production material and expenses on marketing services were found significantly influencing the income of the farmers in multiple regression analysis. In ARDL model arrivals and current prices were found significantly influencing the arrivals of the farmers and current prices of commodities analysis current prices and Lagged prices were found significantly influencing the current price of the farmers. Channel II were more efficient compared to channel I in Acharya and Shepherd's methods. The most important constraints faced by farmers was Low price for the produce at the time of harvest, Lack of transportation, Lack of adequate storage facilities and High marketing costs. Production and marketing techniques have to be integrated to reduce postharvest losses and the government should provide a good support price for the produce. Proper market information should be made available to the farmers. For that, the extension agency should be strengthened.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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