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COTTON ACREAGE RESPONSE TO PRICE IN THE PRE AND POST REFORM PERIOD IN THIRUPPUR MARKET CENTER OF TAMIL NADU STATE (PART B)

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ABSTRACT

Quantitative assessment of the contribution of the various factors to the growth of cotton is helpful in reorienting the programmes and priorities of cotton growth so as to achieve higher rates of growth. The factors which essentially determine the growth of cotton are the rate of growth in land area, area sown more than once, the yield per hectare, rainfall and substitute crop acreage to name a few. Acreage response to relative price for cotton in Thiruppur market center in the pre reform period reveals that this district takes two years and six months for full adjustment to bring about acreage allocation when there is change in price of cotton crop and in the post reform period this market center takes nearly three years for full adjustment due to rigidities in cotton acreage allocation.

KEYWORDS: *cotton, crop process, crop yields, crop acreage, cotton market*

INTRODUCTION

The major focus of the study is on the cotton market area of Thiruppur where the price pertaining to cotton is available in this market center of the state. The requirements of basic statistical series for this cotton market area fall into four categories namely crop areas, crop process, crop yields and rainfall.

THE DATA

The study covers pre reform period (1971–72 TO 1989–90) and post reform period (1990 – 91 TO 2014 – 15) for which continuous time series data have been made available from the various issues of Government of Tamil Nadu. The estimating model included prices, lagged acreage, yield, rainfall, time trend and substitute crop acreage as independent variables with acreage considered as a dependent variable. The effect of the above six independent variables on cotton acreage in this select region has been examined individually because it is not only the price but the quantum of other variables which are important for acreage allocation of cotton.

The results and interpretations of this analysis are based on two models, the adjustment lag model and the traditional model to obtain the response relation. Non-linear (logarithmic) regression equations have been fitted to the absolute values of the variables. The logarithmic functions gave consistently better fit and therefore for the study area, they were selected for discussion in this paper.

For Thiruppur cotton market region a set of sixteen equations are presented. The first eight relate to the adjustment lag model using the first four price specifications namely, (a) Twelve - month annual average price in previous year (p_1), (b) Three - month post-harvest average price in previous year (p_2), (c) Three - month pre-sowing average price in current year (p_3), and (d) Average of previous year's post harvest and current year's pre-sowing prices (p_4) with and without a trend value. The remaining eight are the equations based on the traditional model. In the traditional model with no recognition to past acreage,

the first four prices are the same as used in the adjustment lag equations and the last four involve three year average price specifications namely (e) Three - year average of twelve - month annual average price (p_5), (f) Three - year average of three - month post harvest average price (P_6), (g) Three - year average of three - month pre sowing average price (p_7) and (h) Three year average of three - month post harvest and three month pre sowing average prices (p_8). On the basis of these sixteen functions the best price expectation has been chosen for analysis.

FINDINGS OF THE STUDY

As a preliminary analysis simple zero order and first order partial correlations were worked out for Thiruppur region for the variables used in this study and are given below.

TABLE – 1

ESTIMATION OF ZERO-ORDER AND FIRST-ORDER CORRELATIONS IN PRE-REFORM PERIOD (1971–72 TO 1989–90) AND POST REFORM PERIOD (1990 – 91 TO 2014 – 15) THIRUPPUR

PRE-REFORM PERIOD

	At	At_1	Yt_1	Wt	Tt	St
At	1.000	.817(**)	-.148	-.036	.776 (**)	-.104
At_1		1.000	-.061	-.126	.840(**)	-.147
Yt_1			1.000	-.204	-.210	.376
Wt				1.000	-.244	-.265
Tt					1.000	-.020
St						1.000

POST REFORM PERIOD

	At	At_1	Yt_1	Wt	Tt	St
At	1.000	.842(**)	.067	-.542(*)	.807(**)	.603(**)
At_1		1.000	.110	-.476(*)	.685(**)	.569(**)
Yt_1			1.000	.056	.184	-.200
Wt				1.000	-.619(**)	-.273
Tt					1.000	.479(*)
St						1.000

** Correlation is significant at 0.01 level. * Correlation is significant at 0.05 level.

TABLE – 2

ESTIMATION OF SIMPLE PRICE CORRELATION COEFFICIENTS IN PRE-REFORM PERIOD (1971–72 TO 1989–90) AND POST REFORM PERIOD (1990 – 91 TO 2014 – 15) THIRUPPUR

PRE-REFORM PERIOD

	P1	P2	P3	P4	P5	P6	P7	P8
P1	1.000	.952 (**)	.926 (**)	.941(**)	.882 (**)	.832 (**)	.918 (**)	.876 (**)
P2		1.000	.991(**)	.998 (**)	.934 (**)	.898 (**)	.953 (**)	.929 (**)
P3			1.000	.998 (**)	.934 (**)	.899 (**)	.954 (**)	.931 (**)
P4				1.000	.936 (**)	.901(**)	.956 (**)	.933 (**)
P5					1.000	.991(**)	.988 (**)	.998 (**)
P6						1.000	.963 (**)	.993 (**)
P7							1.000	.987 (**)
P8								1.000

POST REFORM PERIOD

	P1	P2	P3	P4	P5	P6	P7	P8
P1	1.000	.860 (**)	.803 (**)	.846 (**)	.934 (**)	.806 (**)	.922(**)	.888(**)
P2		1.000	.936 (**)	.984 (**)	.842 (**)	.835 (**)	.840(**)	.856(**)
P3			1.000	.984 (**)	.849 (**)	.838 (**)	.860(**)	.868(**)
P4				1.000	.860 (**)	.851 (**)	.865(**)	.877(**)
P5					1.000	.928 (**)	.984(**)	.979(**)
P6						1.000	.915(**)	.975(**)
P7							1.000	.982(**)
P8								1.000

** Correlation is significant at 0.01 level. * Correlation is significant at 0.05 level.

In pre reform period the correlation between area and lagged area were positive in the study area. This association reveals that a substantial portion of acreage allocation in cotton flows from past behaviour. Equally surprising is the positive correlation found between area and trend in the study region. It was really unique, variables like rainfall and substitute crop acreage emerged with negative signs in Thiruppur region. The relationship between area and time trend was positive in this market region.

In the post reform period, there was positive association between area and lagged area, area and yield, and area and trend value in Thiruppur study region. Cotton acreage and rainfall emerged with a negative sign in this select region taken for the study. The relationship of area with substitute crop acreage had a mixture of positive and negative signs.

It may be mentioned that no definite indication could be obtained from the zero order correlations worked out for the acreage and non price variables as the association between them in the study area came to be neither uniform nor powerful, not significant enough to suggest any definite choice.

The extent and direction of association between the relative prices was attempted with the help of simple correlation coefficients. P_1 price showed a very good significant association with P_3 price in Thiruppur, in pre and post reform periods. All values are positively correlated in the study area. Out of the eight price variables P_3 emerges significantly correlated with

remaining price variables in this study area of Tamil Nadu.

Regressions were run for Thiruppur district and the estimated acreage response function based on the selection of price for this district is given below.

TABLE – 3

ESTIMATED ACREAGE RESPONSE FUNCTIONS WITH DIFFERENT PRICE EXPECTATIONS USED FOR COTTON LINT PRICES IN THIRUPPUR IN PRE-REFORM PERIOD (1971–72 TO 1989–90) - LOGARITHMIC

Equation No.	Price Expectation used	Constant	Pt_1	At_1	Yt_1	Wt	Tt	St	R^2	Adj. R^2
3.01	P1	9.762	-0.571 (0.54)	0.374 (0.387)	0.388 (0.635)	0.327 (0.402)	0.147 (0.815)	-0.346 (0.56)	0.636	0.418
3.02	P2	5.088	-0.0695 (0.558)	0.299 (0.41)	0.487 (0.662)	0.26 (0.44)	0.671 (0.873)	-0.362 (0.598)	0.596	0.353
3.03	P3	3.798	0.0177 (0.534)	0.312 (0.36)	0.449 (0.631)	0.261 (0.419)	0.759 (0.767)	-0.327 (0.581)	0.655	0.466
3.04	P4	4.528	-0.0139 (0.574)	0.289 (0.404)	0.488 (0.666)	0.246 (0.454)	0.735 (0.848)	-0.353 (0.605)	0.595	0.352
3.05	P1	10.196	-0.639 * (0.369)	0.426 * (0.247)	0.322 (0.495)	0.325 (0.384)		-0.308 (0.496)	0.635	0.469
3.06	P2	7.227	-0.374 (0.385)	0.534 ** (0.268)	0.246 (0.572)	0.289 (0.43)		-0.254 (0.57)	0.572	0.377
3.07	P3	6.081	-0.323 (0.409)	0.561 *** (0.258)	0.234 (0.592)	0.307 (0.416)		-0.217 (0.57)	0.624	0.467
3.08	P4	6.801	-0.356 (0.411)	0.541 ** (0.278)	0.253 (0.601)	0.298 (0.445)		-0.244 (0.585)	0.565	0.367
3.09	P1	11.776	-0.46 (0.526)		0.819 ** (0.451)	0.314 (0.401)	0.732 * (0.543)	-0.639 (0.469)*	0.602	0.421
3.10	P2	6.573	0.0241 (0.531)		0.813 * (0.478)	0.239 (0.429)	1.147 ** (0.569)	-0.577 (0.51)	0.574	0.381
3.11	P3	5.997	0.0332 (0.528)		0.797 * (0.482)	0.297 (0.413)	1.223*** (0.543)	-0.581 (0.496)	0.631	0.478
3.12	P4	6.299	0.0514 (0.554)		0.804 * (0.487)	0.228 (0.443)	1.17 ** (0.577)	-0.568 (0.513)	0.575	0.381
3.13	P5	6.319	0.0516 (1.101)		0.809 * (0.500)	0.228 (0.541)	1.169 (0.974)	-0.572 (0.556)	0.574	0.381
3.14	P6	-2.620	0.936 (0.92)		0.735 * (0.453)	-0.101 (0.516)	1.962 *** (0.876)	-0.391 (0.498)	0.611	0.434
3.15	P7	6.460	0.0403 (1.002)		0.807 * (0.532)	0.232 (0.515)	1.16 (0.911)	-0.575 (0.539)	0.574	0.381
3.16	P8	-0.414	0.736 (1.035)		0.7 * (0.485)	0.004 (0.522)	1.777 ** (0.967)	-0.434 (0.516)	0.593	0.408

** - Significant at 20% level* *** - Significant at 10% level* **** - Significant at 5% level* ***** - Significant at 1% level*

Figures in the Parenthesis are standard errors

P1 – Twelve – month annual average price in previous year. *P5 – Three – year average of twelve – month annual average price.*

P2 – Three – month post harvest average price in previous year. *P6 – Three – year average of three – month post harvest average price.*

P3 – Three – month pre sowing average price in current year. *P7 – Three – year average of three – month pre sowing average price.*

P4 – Average of previous years post harvest and current year pre sowing prices. P8 – Three – year average of three – month post harvest and three-month pre sowing average price

TABLE – 4

FINALLY ESTIMATED COTTON ACREAGE RESPONSE FUNCTIONS – THIRUPPUR IN PRE REFORM PERIOD

Equation No.	Price Expectation Selected	Constant	Regression Coefficients						Coefficient of Multiple Determination R^2	Adjusted Coefficient of Multiple Determination $\bar{R}^2$
			Relative Price P_{t-1}	Cotton Acreage in A_{t-1}	Yield Y_{t-1}	Rainfall W_t	T_t	Substitute Crop S_t		
3.03	P3	3.798	0.0177 (0.534)	0.312 (0.36)	0.449 (0.631)	0.261 (0.419)	0.759 (0.767)	-0.327 (0.581)	0.655	0.466
3.11	P3	5.997	0.0332 (0.528)		0.797 * (0.482)	0.297 (0.413)	1.223*** (0.543)	-0.581 (0.496)	0.631	0.478

** - Significant at 20% level* *** - Significant at 10% level* **** - Significant at 5% level*

***** - Significant at 1% level*

Figures in the Parenthesis are standard errors

TABLE – 5
ACREAGE ELASTICIES AND COEFFICIENT OF ADJUSTMENT FOR COTTON LINT PRICES IN THIRUPPUR PRE-REFORM PERIOD (1971-72 TO 1989-90)

Equation No.	Elasticity with respect to prices		Elasticity with respect to yield	Elasticity with respect to weather	Elasticity with respect to substitute crop	~		Coefficient of adjustment (¥)	Years required for 95 percent effect of price
	Short run elasticity	Long run elasticity							
3.03	0.012	0.018	0.015	0.016	0.030	5.52	0.0258	0.6880	2.572
3.11	0.023	0.023	0.019	0.021	0.039	6.00	0.0332	-	-

PRE REFORM PERIOD

Thiruppur district is the second major market area for cotton in Tamil Nadu state. Table 3 gives the logarithmic functions obtained for this district. Equations 3.01 to 3.04 give the regression coefficients obtained by the adjustment lag model using the four prices other than the three year averages with relative yield, rainfall, trend and substitute crop acreage. The price coefficients have negative signs in all cases but only P_3 emerges positively significant. Among other variables, lagged area, lagged yield, rainfall and trend are positively significant. The S_t variable has negative sign for all the four equations. Between these equations R^2 is the highest for one using P_3 price as the expected price (equation 3.03) thereby suggesting its superiority over other prices.

In the next four equations 3.05 to 3.08 where the above same model is used for the first four specifications, no difference is observed in past acreage, past yield and rainfall. The removal of the effect of time makes the coefficient of correlation among acreage, P_{t-1} and $S_t$negative. P_3 price specification emerges as the best price specification with a high level of R^2 value.

In the traditional model the only negative price variable is P_1. The coefficients for lagged yield and trend are found to be positive varying from 20% level to 1% level of significance. With regard to rainfall one equation 3.14 gives a negative value. It is observed that the coefficient for substitute crop acreage is negative and not significant even under this model. Equation 3.03 and 3.11 are picked up for estimating acreage response under the selected price given in traditional and adjustment lag models (Table 4) for the simple reason of highest R^2 value. But the value of coefficient has come down from .66 to .63 in the prediction equation in this district. The short run and long run elasticities are .012 and .018 respectively in adjustment lag model and .023 (same value for short run and long run acreage elasticity with respect to price) in the traditional model (Table 5). In order to effectively bring about adjustment in acreage allocation, the study indicates that this district takes two years and 6 months for full adjustment in pre reform period (Table 5).

POST REFORM PERIOD

The estimated acreage response function based on the selection of price in the post reform period for Thiruppur district is given below.

TABLE – 6
ESTIMATED ACREAGE RESPONSE FUNCTIONS WITH DIFFERENT PRICE EXPECTATIONS USED FOR COTTON LINT PRICES IN THIRUPPUR IN POST-REFORM PERIOD (1990-91 TO 2014 - 15) - LOGARITHMIC

Equation No.	Price Expectation used	Constant	Pt_1	At_1	Yt_1	Wt	Tt	St	R^2	Adj. R^2
4.01	P1	-3.113	0.142 (0.629)	0.493 * (0.292)	-0.439 (0.364)	0.143 (0.441)	0.697 * (0.444)	0.462 (0.78)	0.904	0.856
4.02	P2	-4.061	0.455 (0.554)	0.393 * (0.265)	-0.598 * (0.409)	0.101 (0.433)	0.852 *** (0.375)	0.44 (0.751)	0.909	0.863
4.03	P3	-3.844	0.791 * (0.503)	0.366 * (0.214)	-0.715 ** (0.376)	0.133 (0.401)	1.018 *** (0.34)	0.162 (0.724)	0.92	0.88
4.04	P4	-4.356	0.675 (0.545)	0.358 * (0.24)	-0.674 * (0.394)	0.107 (0.416)	0.963 *** (0.364)	0.321 (0.732)	0.915	0.872
4.05	P1	2.666	-0.684 ** (0.365)	0.861 **** (0.183)	-0.26 (0.365)	-0.004879 (0.455)		0.531 (0.821)	0.884	0.84
4.06	P2	-2.181	-0.518 (0.404)	0.854 **** (0.196)	-0.05612 (0.381)	-0.122 (0.484)		0.8 (0.843)	0.87	0.819
4.07	P3	-4.646	-0.347 (0.418)	0.803 **** (0.198)	-0.07697 (0.394)	-0.264 (0.48)		1.026 (0.842)	0.86	0.807
4.08	P4	-3.447	-0.441 (0.417)	0.824 **** (0.196)	-0.06745 (0.388)	-0.193 (0.484)		0.927 (0.841)	0.865	0.813
4.09	P1	-12.699	0.915 ** (0.461)		-0.465 (0.389)	0.05935 (0.468)	1.3 **** (0.282)	0.968 (0.769)	0.881	0.836
4.10	P2	-9.090	1.012 *** (0.426)		-0.772 ** (0.409)	0.009379 (0.448)	1.279 **** (0.252)	0.773 (0.749)	0.892	0.851
4.11	P3	-7.864	1.239 *** (0.461)		-0.832 ** (0.397)	0.08813 (0.429)	1.417 **** (0.267)	0.42 (0.759)	0.9	0.862
4.12	P4	-8.623	1.176 *** (0.449)		-0.82 ** (0.4)	0.04369 (0.433)	1.363 **** (0.258)	0.578 (0.745)	0.899	0.86
4.13	P5	-16.569	1.959 **** (0.666)		-0.61 * (0.352)	-0.03458 (0.416)	1.543 **** (0.28)	0.541 (0.711)	0.907	0.871
4.14	P6	-12.988	1.327 * (0.969)		-0.583 (0.448)	-0.05273 (0.51)	1.236 **** (0.313)	0.828 (0.866)	0.865	0.813
4.15	P7	-14.292	1.601 *** (0.605)		-0.604 * (0.367)	0.05248 (0.431)	1.437 **** (0.274)	0.607 (0.738)	0.899	0.861
4.16	P8	-14.649	1.705 *** (0.787)		-0.638 * (0.4)	-0.02179 (0.461)	1.389 **** (0.296)	0.638 (0.793)	0.886	0.842

** - Significant at 20% level ** - Significant at 10% level *** - Significant at 5% level **** - Significant at 1% level*

Figures in the Parenthesis are standard errors

P1 – Twelve – month annual average price in previous year.
P2 – Three – month post harvest average price in previous year.
P3 – Three – month pre sowing average price in current year.
P4 – Average of previous years post harvest and current year pre sowing prices.
P5 – Three – year average of twelve – month annual average price.
P6 – Three – year average of three – month post harvest average price.
P7 – Three – year average of three – month pre sowing average price.
P8 – Three – year average of three – month post harvest and three-month pre sowing average price

TABLE – 7
FINALLY ESTIMATED COTTON ACREAGE RESPONSE FUNCTIONS – THIRUPPUR IN POST REFORM PERIOD

Equation No.	Price Expectation Selected	Constant	Regression Coefficients						Coefficient of Multiple Determination R^2	Adjusted Coefficient of Multiple Determination $\bar{R}^2$
			Relative Price P_{t-1}	Cotton Acreage in A_{t-1}	Yield Y_{t-1}	Rainfall W_t	T_t	Substitute Crop S_t		
4.03	P3	-3.844	0.791 * (0.503)	0.366 * (0.214)	-0.715 ** (0.376)	0.133 (0.401)	1.018 *** (0.34)	0.162 (0.724)	0.92	0.88
4.11	P3	-7.864	1.239 *** (0.461)		-0.832 ** (0.397)	0.08813 (0.429)	1.417 **** (0.267)	0.42 (0.759)	0.9	0.862

** - Significant at 20% level ** - Significant at 10% level *** - Significant at 5% level **** - Significant at 1% level Figures in the Parenthesis are standard errors*

TABLE – 8
ACREAGE ELASTICITIES AND COEFFICIENT OF ADJUSTMENT FOR COTTON LINT PRICES IN THIRUPPUR
IN POST-REFORM PERIOD (1990-91 TO 2014 - 15)

Equation No.	Elasticity with respect to prices		Elasticity with respect to yield	Elasticity with respect to weather	Elasticity with respect to substitute crop	~		Coefficient of adjustment (¥)	Years required for 95 percent effect of price
	Short run elasticity	Long run elasticity							
4.03	0.711	1.121	0.761	0.852	1.474	-6.06	1.2476	0.6340	2.980
4.11	1.113	1.113	0.756	0.846	1.463	-7.86	1.2390	-	-

Table 6 gives the regressions relating acreage and other variables with alternative price specifications in Thiruppur region in post reform period. It is found that P_{t-1}, A_{t-1}, W_t, T_t and S_t are positively significant in all equations from 4.01 to 4.04 with varying level of significance. Only yield coefficients are negative from 20% to 10% level of significance. In the adjustment lag model without the trend variable equations 4.05 to 4.09 reveal that farmers are influenced by past cotton acreage and substitute crop acreage. Other factors did not do well in the acreage allocation decisions. P_3 price is substantially significant in both the models because of the highest R^2 value. In the finally estimated cotton acreage response function (Table 7), regression coefficients are highly positive for past price and the level of significance varies from 20 percent to 5 percent level.

The long run elasticities are 1.121 and 1.113 for both the models. What is surprising is that both the short run and long run elasticities are the same for the traditional model. In this market center, it takes nearly 3 years for full adjustment due to rigidities as shown in Table 8.

CONCLUSION

The present study provides us with substantive evidence in support of the objective that price along with other factors do influence farmers' decisions to increase the area under cotton.

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