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Research Note

IMPACT OF TECHNICAL CHANGE ON FACTOR SHARES IN THE PRODUCTION OF BIDI TOBACCO IN KARNATAKA*

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I. Introduction

The modern inputs under new technology have had their impact upon output, employment and income distribution in the countryside. Technical change influences the pattern of distribution of income among various factors of production (functional income distribution), and also in the division of income by size of holding (personal income distribution). Technical change leads to the production of greater output with the given capacity of inputs, (Ruttan, 1960). The analytical tools used in evaluating the effects of technical change are based on the assumptions of neoclassical theory of functional income distribution. It assumes that factor shares depend on marginal productivity. Secondly, the assumption of perfect competition in a factor and product market is built into the functional income distribution.

Tobacco is an important commercial crop in India. Bidi tobacco formed the biggest chunk (36 percent) followed by Virginia tobacco (26 percent) in the total production of tobacco in India during 1986. In Karnataka, during 1986-87 bidi tobacco formed fifty per cent of tobacco grown in the State and is largely confined to Belgaum district (58 per cent of the total tobacco area in the State). Most of the bidi manufacturers are concentrated in the bidi manufacturing centres of Nipani, Mangalore, Mysore, Bangalore and Sira in Karnataka State.

Some bidi varieties like A-2 and A-119 were evolved as improvements over the S-20 variety and performing better on the yield front than S-20 variety in the tobacco belt of Karnataka. S-20 variety is localised in the area over two decades and its yield is low. Hence, its cultivation is being substituted for by the superior varieties, A-2 and A-119. In this study, S-20 variety is considered as an old variety while A-2 and A-119 varieties were considered as new varieties.

The focus of the present study is to evaluate the changes in factor shares with

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the introduction of new production technology. The specific objectives of the study are to :

1. Compare and evaluate the estimated factor shares wlth actual factor shares under both the old and new technology.
2. Determine the direction and magnitude of shifts in actual factor shares with the introduction of new technology.
3. Analyse the shifts in the direction and the magnitude of change in absolute factor shares.

II. Methodology

Sampling

Multistage sampling technique was employed in the selection of district, taluka and villages for the study based on the area and production of bidi tobacco in the State. Maximum area and production was concentrated under bidi tobacco in Belgaum district (86 percent of bidi area in the State) and Chikodi taluka (77 percent of the district). Bidi tobacco is the principal crop of farmers in Chikodi taluka, and it decides the economy of the farmers in the area. Two hundred and seventy farmers were selected in 1985-86 period based on the probability proportional to the total number of farmers growing each variety of bidi tobacco spread over 15 randomly selected villages of Chikodi taluka. The number of farmers selected under each variety were 87 in S-20, 101 in A-2 and 82 in A-119.

(*ii*) *Analytical Techniques*

To compare the estimated and actual factor shares due to technical change, the following Cobb-Douglas type production function was used and its parameters were estimated through the Unit Output Price Profit function (UOP).

$$Y = ALa_1\ Na_2\ Fa_3\ Ka_4\ Ma_5\ e^u \qquad \ldots (1)$$

where L=land, N=labour, F=fertilizer, M=manure, K=capital, u=random disturbance term and a_1, a_2 a_3, a_4, a_5 represent output elasticities of the respective and coefficients.

Estimated Factor Share

Estimated factor share accrued to a given factor is equal to the ratio of the estimated output elasticity of the factor to the returns to scale.

$$E\,F\,S_i = \frac{a_i}{\sum_{i=1}^{s} a_i} \qquad (i=1, \ldots s) \qquad \ldots (2)$$

where the numerator is the output elasticity of the factor and denominator indicates sum of the output elasticites (returns to scale).

Actual Factor Share

Actual factor shares under old and new technology are calculated as

$$S_i = \frac{(FB)_{ij}}{\sum_{j=1}^{N} P_j Y_j} \quad \ldots (3)$$

Where, $(FB)_{ij}$ = Total factor bill of ith factor on j^{th} farm

$P_j Y_j$ = Gross income of jth farm

S_i = Average actual factor share of ith factor

$$\text{Degree of Deviation (DD)} = \frac{\text{Actual Factor Share—Estimated factor share}}{\text{Standard error of estimated factor share}} \quad \ldots (4)$$

The change of ith factor share due to technical change was measured as :

$$Di = \frac{(Si)_N - (Si)_O}{(Si)_O} \quad \ldots (5)$$

where,

Di = Measure of percentage change in i^{th} factor

N, O are subscripts of new and old technology, respectively

If,

$Di > 0$, The actual factor share increases,

$Di = 0$, The actual factor share remains unchanged

$Di < 0$, The actual factor share decreases.

Absolute Factor Share

Absolute factor shares per acre under old and new technology are derived as :

$$Ai = (Si)\ (R) \quad \ldots (6)$$

where,

Ai = Absolute factor Share.

R = Mean value of gross income under respective technology.

Changes in Absolute Factor Share

Changes in absolute factor shares with the introduction of new technology are worked as :

$$(CAF)_i = \frac{(Ai)_N - (Ai)_O}{(Ai)_O} \times 100 \quad \ldots (7)$$

Where $(CAF)_i$ = Change in absolute factor share of ith factor.

III. Results and Discussion

Table 1 depicts the estimates of production elasticities for different factors derived from the Cobb-Douglas Production function through Unit Output Price (UOP) Profit function. The estimated and actual factor shares are worked out from the expressions 2 and 3, while the degree of deviation of the actual factor shares from the estimated ones are derived from the expressions 4, and are presented in Table 2.

The actual factor shares under old technology variety S 20 for land, labour, fertilizer, capital and manure were 0.5641, 0.01708, 0.0511, 0.1360 and 0.0437, respectively, and were not significantly different from the estimated factor shares of the corresponding factors which implied that all the inputs were paid their due share under old technology. Similar pattern was evident under new technology varieties like A-2 and A-119. Thus, it was concluded that actual shares accrued to all factors were found to approximate their contribution to the total output even under new technology varieties (Table 2).

Table 1. Per farm production function estimated through UOP profit function for bidi tobacco, 1985-86

Sl. No.	Factors of production	Parameter	Indirect estimates of production elasticities for bidi tobacco varieties		
			S-20	Anand-2	Anand-119
1.	Land (L)	a_1	0.6314	0.5710	0.6318
2.	Labour (N)	a_2	0.1961	0.2032	0.1291
3.	Fertilizer (F)	a_3	0.1059	0.1389	0.1389
4.	Capital (K)	a_4	0.0675	0.1108	0.1071
5.	Manure (M)	a_5	0.0457	0.0692	0.0787
6.	Returns to scale	—	1.0666	1.0931	1.0856

Table 2. Estimated and actual factor shares

Sl. No.	Factors of production	Factor Shares								
		S-20			A-2			A-119		
		Estimated	Actual	D.D.	Estimated	Actual	D.D.	Estimated	Actual	D.D.
1.	Land	0.6033	0.5641	—0.5132 NS	0.5224	0.5761	0.0239 NS	0.6865	0.5641	—0.4563SN
2.	Labour	0.1874	0.1708	—0.02673 NS	0.1859	0.1577	—0.0837 NS	0.1155	0.1708	0.5321 NS
3.	Fertilizer	0.1012	0.0511	—0.01456 NS	0.1271	0.0745	—0.0278 NS	0.0524	0.0511	—0.0235 NS
4.	Capital	0.0645	0.1360	0.1711 NS	0.1014	0.1308	0.0813 NS	0.1013	0.1360	0.2635 NS
5.	Manure	0.0437	0.0780	0.05346 NS	0.0633	0.0609	0.0124 NS	0.0445	0.0780	0.0356 NS

E=Estimated, A=Actual

D.D. =Extent of Deviation of Actuals from the estimated factor shares

NS=Non significant.

The direction of change in actual factor shares due to new technology varieties are presented in Table 3 using the expression 5. Land and fertilizer inputs were found to gain on account of introduction of new technology varieties A-2 (0.0213 and 0.4579) and A-119 (0.2169 and 0.0254).

The direction of change in the magnitude of absolute factor shares under new technology varieties of bidi tobacco are presented in Table 4 using the expression 6 and 7. All inputs stood to benefit under new technology varieties of A-2 and A-119 in absolute terms with varying degrees. The absolute shares of all inputs were higher for A-119 in relation to A-2 as well as in relation to S-20. The percentage rise in absolute factor share was as high as 154 percent for fertilizer followed by 78 per cent for land, 68 per cent for capital between S-20 and A-2 varieties. Similarly between S-20 and A-119, the percentage increase in absolute factor shares was as high as 204 percent for land, followed by fertilizer (156 percent) and capital (86 percent). The percentage gain accrued to was the highest for fertilizer in A-2 while it was the highest for land in A-119. This rise in absolute factor shares of land and fertilizer was the reflection of the responsiveness of the better quality seeds (A-119 and A-2) and their vast genetic potential. The rise in absolute share of labour was attribu-

Table 3. Changes in actual factor shares in different varieties of bidi tobacco in Karnataka, 1985-86

Crop group	Factor of production	Actual factor share in new technology	Actual factor share in old technology	Di
S-20 vs A-2	Land	0.5761	0.5641	+0.0213
	Labour	0.1577	0.1708	—0.0767
	Fertilizer	0.0745	0.0511	+0.4579
	Capital	0.1308	0.1360	—0.0382
	Manure	0.0609	0.0780	—0.2192
S-20 vs A-119*	Land	0.6865	0.5641	+0.2169
	Labour	0.1155	0.1708	—0.3238
	Fertilizer	0.0524	0.0511	+0.0254
	Capital	0.1013	0.1360	—0.2551
	Manure	0.0443	0.0780	—0.4321

Di=See expression 5.

Table 4. Change in the magnitude of absolute factor shares in the production of different varieties of bidi tobaeco in Karnataka during 1985-86

Group	Factor	Absolute share per acre		Per cent change in absolute factor share
		New technology Rs.	Old technology Rs.	
		(A-2)	(S-20)	
S-20 vs A-2	Land	2864.05	1608.93	78.00
	Labour	784.00	487.16	60.93
	Fertilizer	370.37	145.75	154.11
	Manure	302.76	222.47	36.09
	Capital	650.27	387.90	67.64
		(A-119)	*(S-20)*	
S-20 vs A-119	Land	4889.31	1608.93	203.89
	Labour	822.60	487.16	68.86
	Fertilizer	373.20	145.75	156.05
	Manure	315.51	222.47	41.82
	Capital	721.47	387.90	86.00

table to an increase in the level of employment potential per acre (161 man days in A-119, 132 in A-2 and 100 in S—20), in A-119 and A-2 varieties over that in S—20 variety. Thus, the effect of technical change on functional income distribution of new technology was biased in favour of land and fertilizer and biased against labour, manure and capital.

Implications

The per acre absolute actual income has increased by 78 and 204 per cent under new technology varieties (A-2 and A-119). This had made great impact on personal income distribution. In the regions where land distribution is skewed, the new varieties may lead to inequitable distribution of personal income. Also the land values have risen very high on account of these developments.

Reference

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