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PERFORMANCE, LEVEL OF PROTECTION AND COMPARATIVE ADVANTAGE OF AGRICULTURE IN TAMIL NADU, INDIA

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ABSTRACT

The paper analyses the performance of agriculture in Tamil Nadu using the exponential growth rates, level of protection and comparative advantage by estimating net protection coefficient, efficient protection coefficient, effective rate of protection and domestic resource cost. Productivity trends in Tamil Nadu have been positive irrespective of food and non-food crops. The potential loss in area of some crops was more than compensated by productivity. Rice and coton have comparative advantage justifying further protection. The factors of production for rice and cotton can be paid more than the present level under free trade and still remain competitive with imports. The protection coefficients and domestic resource cost showed that sugarcane and groundnut are highly protected and have comparative disadvantage domestically as compared to world trade. Given the premise that sugarcane in the state has productivity advantage in the country as a whole, what disturbs one is unit cost of production. The question is now to convert the comparative advantage into competitive advantage globally? The answer lies in diversification of sugar industry. Groundnut is the second largest crop in the state next to rice, which is being grown mainly in rainfed and low fertility soils. Tamil Nadu has comparative advantage in terms of productivity at national level. The strategy lies in reducing the unit cost of production and makes the crop economically viable.

1. INTRODUCTION

Agriculture in India has undergone various changes due to frantic efforts taken by the government. These changes brought out both individual and social gains (Haque, 1996) and mainly attributed to technical improvements (Alshi. 1983; Kumar, 1983; Mathur, 1983; Ahluwalia, 1996) and protection extended to agriculture by way of subsidising the cost of farm credit and important agricultural inputs like fertilizers with better product prices (Gulati, 1987; Gupta 1989; Prakash, 1989).

A number of empirical studies (Balassa and Associates 1971; Bale and Lutz, 1981; Lutz and Scandizzo, 1980) have also shown cross sectional evidences that there is positive relationship between degree of agricultural protection and economic development. Betrand (1987) argues that the domestic market failures in developing countries lead to an inefficient

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adjustment to development in world markets. Moreover, agricultural protection in developing countries is to countervail the adverse effect, which the agricultural policies of highly protected countries have on them via world markets. It is also observed that within agriculture, levels of protection are found uneven among the crops (World Bank, 1991).

In the context of liberalisation and globalisation, an analysis of comparative advantage and level of protection could throw light on the implications of government policies including subsidies (product and non-product) and the export-import adjustments of the agricultural commodities. An analysis of effective protection provides a more complete picture of the impact of domestic pricing and trade policies on efficient resource allocation in agriculture (World Bank, 1991). Levels of protection in agriculture were measured by various studies (Appleyard, 1987; World Bank, 1991; Hermann, *et al.*, 1991; Masters, 1993; Bhatia, 1994) by comparing domestic prices with international prices, which shows the extent to which the commodities are protected or disprotected and the degree of price distortion.

The study is an attempt to address the performance of agriculture in Tamil Nadu, the levels of protection and comparative advantage of selected agricultural commodities. The paper is organised into five major sections *viz.*, setting, source of data, method of analysis, findings and conclusion with policy implications.

2. SOURCES OF DATA

For the present study,data were heavily drawn from published sources *viz.*, Season and Crop Report for Tamil Nadu, Tamil Nadu – An Economic Appraisal, Statistical Abstract of Tamil Nadu, Economic Survey of India and FAO Bulletin. In addition, cross sectional time series data were collected from the scheme on "Cost of Cultivation of Principal Crops" operated in the Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore.

3. METHODS OF ANALYSIS

Growth Pattern

The pattern of growth in terms of area, production and productivity over the years was examined by fitting non-linear growth curves[1] (Gujarati, 1992).

Level of Protection and Comparative Advantage

Net Protection Coefficient: Following Byerlee and Sain (1986), Net Protection Coefficient (NPC)[2] was calculated, which is given as NPC = P_d/P_w^* where, P_d is the domestic producer price of a commodity and P_w^* is a normal world commodity price, which was measured by a linear time trend regression[3]. P_w^* is the estimated world prices over a period of time. Herrmann (1991) argued that normal-world prices are the indicator of expected world

prices, whereas actual world prices include a stochastic component 'u'. The approach of Byerlee and Sain (1986) takes care of price uncertainty, while the traditional approach (Bhatia, 1994; World Bank, 1991; Herrmann, *et al.,* 1991) assumes price uncertainity and uses actual world price ie. NPC = P_d/P_w. Where P_d is the domestic producer price and P_w is the actual world price.

Following Herrmann, *et al.* (1991), a reduced form of econometric model was formulated to incorporate normal rather than actual world prices. Econometric model is a representation of both import demand and export supply of agricultural commodities. From the estimated equation, the world price was estimated and introduced as normal price into the calculation of nominal protection coefficient. The following econometric model was specified and estimated.

The export supply function is

$$E_{it} = a_0+a_1 P_{bit}+a_2GDP_t+a_3PR_t+a_4PR_{t-1}+a_5POP_t+u_t \quad (1)$$

and the import demand function is

$$I_{it} = b_0+b_1 P_{bit}+b_2 GDP_t+b_3 PR_t+b_4 PR_{t-1}+b_5POP_t+u_t \quad (2)$$

$$t = 1, ... n$$

$$i = 1, ... m$$

where, E_t is export of agricultural commodities, P_{bit} denotes border price, GDP is gross domestic product (included in the model as income variable), PR_t is production of agricultural commodities, PR_{t-1} refers to lagged production and POP_t is population. In an equilibrium situation, exports are equal to imports, such that

$$E_{it} = I_{it} \quad (3)$$

By introducing (1) and (2) into (3), the following reduced form was derived

$$P_{bit} = \frac{a_0-b_0}{a_1-b_1} + \frac{a_2-b_2}{a_1-b_1} GDP_t + \frac{a_3-b_3}{a_1-b_1} Pr_t + \frac{a_4-b_4}{a_1-b_1} Pr_{t-1} + \frac{a_5-b_5}{a_1-b_1} POP_t \quad (4)$$

The equation (4) was estimated using OLS method. The influence of inflation was eliminated by converting both the price series and income series into real terms.

From the econometric model, world price was estimated and the same was used as normal price in calculating NPC.

$$NPC = P_d/P_w^{**}$$

where, P_d is the domestic producer price and P_w^{**} is a normal world commodity price derived from the import demand and export supply model.

To examine the accuracy of econometric model with that of linear time trend model in determining normal world price, the following error measurements were made.

a. Root Mean Square Simulation Error (RMSE)

$RMSE = (1/n)\ E\ e_t^2$

b. Mean Absolute Error (MAE)

$MAE = (1/n)\ E/et$

c. Mean Absolute Percentage Error (MAPE)

$MAPE = (100/n)\ E(/et/P_{bt})$

d. Theil's Inequality Coefficient (TIC)

$TIC = Ee_t^2 / E(P_{bt} - P_{bt-1})^2$

where et (simulation error) $= P_{bt} - \hat{P}_{bt}$

P_{bt} is the estimated and $\hat{P}_{bt}$ is the actual world price in period t.

In the study, state's wholesale prices of selected agricultural commodities such as paddy, sugarcane, cotton and groundnut were used for domestic price and international prices converted to domestic currency both at official exchange rate and shadow exchange rate[5], were used for world price.

Effective Protection Coefficient (EPC) : Effective Protection Coefficients measure the whole structure of incentives/disincentives that exist with respect to given production process. To construct EPC the data from Cost of Cultivation of Principal Crops (CCPC) scheme sponsored by Government of India, operated in the Department of Agricultural Economics were used, which included both tradable and non-tradable inputs. Since non-traded goods can be treated as inputs with zero tariffs and also could be subtracted from the final good's value, Appleyard (1987) suggested 'Corden' method, where inputs are multiplied by the ratio of world prices to domestic prices.

$$EPC = \frac{VA'}{VA}$$

$$EPC = \frac{\text{Value added in domestic prices}}{\text{Value added in world prices}}$$

$$EPC = \frac{\text{domestic price per unit of output} - \text{cost of all inputs per unit of output}}{\text{world price per unit of output} - \text{cost of all inputs per unit of output measured at the ratio of world prices to domestic prices}}$$

The analysis was carried out per quintal of output. The multiplication of ratio of world prices to domestic prices of the output brings the tradable inputs in terms of world price per unit of output. In the present study, since state's wholesale price was used, no explicit marketing cost was incorporated for domestic price in the estimation.

Effective Rate of Protection (ERP) : Effective Rate of Protection was worked out to find out to what extent the factors of production of particular commodity can be paid more than under free trade to make the commodity still competitive with imports. The Effective Protection Coefficient (EPC) is given as:

$$EPC = \frac{VAD_p}{VAB_p}$$

where VAD_p is value added in domestic currency, VAB_p indicates value added in world price.

$$\text{Effective Rate of Protection (ERP)} = \frac{VAD_p - VAB_p}{VAB_P} = \frac{VAD_p}{VAB_p} - 1$$

$$ERP = EPC-1 \text{ or } EPC = ERP+1$$

Domestic Resource Cost (DRC) : Domestic resource cost is the ratio of value added domestically in terms of opportunity cost or scarcity price or shadow price to value added in world price.

In the DRC estimation, the tradable inputs and the tradable components of non-tradable inputs are not taken into consideration; rather, the direct estimates of value added by the primary factors (land, labour and capital) employed was measured at the true scarcity price (opportunity cost or shadow price)[6]. The stock of physical assets owned was also considered for the analysis, as the apportioned cost of fixed capital is available from cost of cultivation of principal crops (CCPC) scheme[7]. The DRC can also be written as

$$DRC = \frac{\text{Value added in domestic currency}}{\text{Value added in foreign currency}} \times SCF$$

where, SCF is standard correction factor, which is given as

$$SCF = \frac{OER}{SER}$$

where OER refers to official exchange rate and SER denotes shadow exchange rate. Comparison of DRC and SER indicates comparative advantage or disadvantage of a commodity in terms of domestic resources.

4. FINDINGS

Performance of Agriculture in Tamil Nadu

Dynamics of aggregate crop growth at state level was examined cropwise and the estimated compound growth rates for Tamil Nadu furnished in Table 1.

Table 1. Performance of Agriculture in Tamil Nadu (1956-57 to 1993-94)

Crop	Area during 1993-94 ('000 ha)	Compound growth rate (per cent)		
		Area	Production	Productivity
Rice	2306.26 (32.22)	-0.54 (0.36)	1.79*** (0.45)	2.34*** (0.36)
Jowar	506.30 (7.07)	-0.83** (0.34)	0.10 (0.55)	0.93* (0.47)
Bajra	212.54 (2.97)	-2.08*** (0.33)	0.06 (0.58)	2.19*** (0.44)
Maize	37.62 (0.53)	5.57*** (1.32)	7.00*** (1.25)	1.36* (0.76)
Ragi	157.99 (2.21)	-2.48*** (0.31)	-0.38 (0.49)	2.15*** (0.39)
Cereals	3336.92 (46.62)	-1.06*** (0.29)	1.21*** (0.40)	2.29*** (0.35)
Blackgram	216.31 (3.02)	5.91*** (1.03)	7.56*** (1.11)	1.55* (0.79)
Greengram	105.52 (1.47)	2.83*** (0.94)	5.10*** (1.14)	2.21*** (0.80)
Redgram	109.54 (1.53)	2.19*** (0.57)	3.46*** (0.78)	1.24** (0.54)
Pulses	689.86 (1.53)	1.71*** (0.39)	3.52*** (0.62)	1.78*** (0.33)
Foodgrains	4026.78 (56.25)	-0.71*** (0.24)	1.28*** (0.39)	2.00*** (0.31)
Chillies	73.43 (1.03)	0.06 (0.65)	-2.64** (1.15)	-2.70*** (0.95)
Sugarcane	249.38 (3.48)	4.04*** (0.65)	5.63*** (0.83)	1.52*** (0.39)
Fruits	255.34 (3.57)	3.53*** (0.80)	3.76*** (0.69)	0.23 (0.76)
Vegetables	170.92 (2.39)	3.21** (1.35)	7.72*** (1.41)	4.51** (1.79)
Groundnut	1158.35 (16.18)	0.48 (0.34)	0.94 (0.63)	0.46 (0.51)
Oilseeds	1586.10 (22.16)	0.81 (0.31)	2.23*** (0.57)	1.42 (1.07)
Cotton	229.05 (3.20)	-1.68*** (0.51)	0.36 (0.94)	2.07 (0.70)
Total Cropped area	7158.46 (100.00)	-	-	-

(Figures in parentheses with respect to area under crops indicated percentage to total cropped area and figures in parentheses with respect to compound growth rate donote standard error of the compound growth rate).

*** - $p \leq 0.01$ (two tailed test)

** - $p \leq 0.05$ (two tailed test)

* - $p \leq 0.10$ (two tailed test)

It could be seen from the Table 1 that the area under cereal crops, except maize, registered negative growth. The area coverage tended to decline per annum by 0.54 per cent in rice, 0.83 per cent in jowar, 2.08 per cent in bajra and 2.48 per cent in ragi, while the area under maize showed positive growth rate of 5.57 per cent during the same period. The area under pulses exhibited positive growth rate of 1.71 per cent, the highest growth rate being recorded by blackgram with 5.91 per cent followed by greengram and redgram with 2.83 per cent and 2.19 per cent, respectively. Foodgrains as a whole showed negative growth rate of 0.71 per cent during the past four decades. The area under fruits and vegetables grew at a rate of 3.53 and 3.21 per cent per annum, respectively. Among the non-food crops, the area under cotton showed a negative growth rate with 1.68 per cent. The area under groundnut and total oilseeds showed positive growth rate, though not significant.

Productivity trends have been positive irrespective of food and non-food crops. Among the cereals, the growth rate was maximum in rice with 2.34 per cent followed by bajra, ragi, maize and jowar with 2.19 per cent, 2.15 per cent, 1.36 per cent and 0.93 per cent, respectively. With respect to pulses, the overall growth rate in productivity was 1.78 per cent per annum. The reasons are obvious. Evolution of yield increasing technologies and their transfer to fields facilitated the increase in productivity of crops.

Production of all crops registered positive growth except ragi. Though there has been decline in area over years in the case of rice, jowar, bajra and cotton, the potential loss in area was more than compensated by productivity increase and as a result, the growth in production exhibited upward trend. However, in the case of ragi, on account of sharp of decline in acreage, the production tended to decrease at 0.38 per cent per annum inspite of the fact that there was moderate growth of 2.15 per cent per annum in terms of productivity. With regard to sugarcane, fruits, vegetables and oilseeds, both area and productivity increase contributed for positive production trend throughout.

Level of Protection and Comparative Advantage in Agriculture

In the study, the coefficients were estimated using both the official exchange rate and the associated shadow exchange rate. The official exchange rate (OER) and shadow exchange rate (SER) for the years 1981-82 through 1992-93 are set out in Appendix I. Rice, cotton, sugarcane and groundnut, the major agricultural commodities of the state, were considered for the analysis. The wholesale prices of these commodities both in nominal and real terms are presented in Appendix II. The international prices of selected agricultural commodities at official and shadow exchange rates were measured both in nominal and real terms .

Net Protection Coefficient (NPC) : The world prices arrived from linear trend equation and econometric model at official and shadow exchange rates are presented in Appendix V. Deflated international prices of major agricultural commodities estimated from econometric equation both at official and shadow exchange rates are furnished in Appendix VI. Various

measures of simulation errors (Appendix VII) implied that the econometric model outperformed in each case the linear time trend model. According to estimates, the absolute simulation error, measured by the root mean square simulation error (RMSE) or the mean absolute simulation error (MAE) was much lower for the econometric model than for the linear time trend model. The same holds true for the relative simulation error indicated by the mean absolute percentage error (MAPE). Theil's inequality coefficient compares the simulation errors of the respective model with a naive simulation on the basis of the previous year's value. It showed that the econometric model performed better than a naive simulation as compared to linear time trend mode. However, in order to examine as to whether the introduction of price uncertainity into the estimation of world prices raise nominal or net protection coefficient by a significant amount, net protection coefficients derived from three approaches are presented and discussed.

Rice : An examination of Table 2 indicated that overall rice has been disprotected in Tamil Nadu, although the situation improved in the mid eighties. The average net protection coefficient worked out to 0.90 in all the three approaches. World Bank (1997) obtained an average net protection coefficient of 0.67 for India for the period between 1980-81 and 198687. According to Bhatia (1994), domestic to world price ratio of rice was 0.43 for India during 1992. In the present study, the NPCs were found equal or more than one both at official and shadow exchange rates during the period between 1985-86 and 1987-88.

Cotton: The average NPC (Table 2) ranged between 0.91 and 0.93 at official exchange rate and it was 0.89 at shadow exchange rate. The ratio implied that cotton was disprotected. Bhatia (1994) and World Bank (1991) found 0.66 for cotton during 1992 and an average of 0.80 between 1980-81 and 1986-87 for India, respectively. The estimated coefficents indicated that cotton has been less protected in Tamil Nadu compared to other estimates. The level of disprotection was found high in early eighties, however the condition has improved during late 80s, the ratios being almost equal and more than one during the period between 1986-87 and 1989-90.

Sugarcane: The average net protection coefficient (Table 3) ranged between 2.43 and 2.59 at official exchange rate and it ranged from 2.35 and 2.57 at shadow exchange rate. These coefficients implied that sugarcane has been highly protected in Tamil Nadu. This is in line with World Bank (1991) and Bhatia (1994). The ratio worked out to 1.55 and 1.28 for sugar for India according to World Bank (1991) and Bhatia (1994), respectively. It is clear from the fact that protection for sugar is explicit, both in terms of product and non product subsidies. The minimum support price announced by Tamil Nadu is always higher than the support price of India. Moreover, sugarcane is high fertilizer consuming crop, hence it was benefited from non product subsidies like fertilizer and irrigation etc. The highest productivity of sugarcane in Tamil Nadu is also an encouraging factor for high level of protection.

Table 2. Net Protection Coefficients of Rice and Cotton at Official Exchange Rate

Year	Rice			Cotton		
	NPC_1	NPC_2	NPC_3	NPC_1	NPC_2	NPC_3
1980-81	0.67	0.46	0.71	0.66	0.42	0.69
1981-82	0.58 (0.58)	0.45 (0.40)	0.78 (0.80)	0.94 (0.93)	0.65 (0.57)	0.95 (0.96)
1982-83	1.00 (0.97)	0.74 (0.63)	0.89 (0.90)	0.91 (0.89)	0.66 (0.58)	0.84 (0.83)
1983-84	1.00 (0.99)	0.80 (0.71)	0.75 (0.77)	0.85 (0.84)	0.70 (0.63)	0.84 (0.86)
1984-85	0.95 (0.90)	0.83 (0.72)	0.83 (0.78)	0.82 (0.77)	0.72 (0.64)	0.85 (0.80)
1985-86	1.20 (1.15)	1.15 (1.01)	1.06 (0.99)	0.79 (0.75)	0.75 (0.67)	0.79 (0.74)
1986-87	1.20 (1.12)	1.27 (1.12)	1.23 (1.11)	1.03 (0.96)	1.09 (0.96)	0.91 (0.83)
1987-88	1.06 (1.01)	1.22 (1.13)	1.26 (1.24)	1.12 (1.06)	1.27 (1.18)	1.25 (1.21)
1988-89	0.86 (0.84)	1.03 (1.00)	0.89 (0.88)	1.36 (1.32)	1.71 (1.64)	1.27 (1.23)
1989-90	0.78 (0.71)	0.95 (0.87)	0.96 (0.84)	0.92 (0.83)	1.16 (1.06)	0.98 (0.87)
1990-91	0.81 (0.74)	1.07 (1.00)	0.73 (0.68)	0.79 (0.72)	1.02 (0.95)	0.81 (0.75)
1991-92	0.67 (0.65)	0.85 (0.85)	0.69 (0.66)	0.73 (0.70)	0.96 (0.95)	0.70 (0.67)
Mean	0.90 (0.88)	0.90 (0.86)	0.90 (0.88)	0.91 (0.89)	0.93 (0.89)	0.91 (0.89)

(Figures in parentheses denote Net Protection Coefficients at Shadow Exchange Rate)

$$NPC_1 = \frac{P_d}{P_W}, \quad NPC_2 = \frac{P_d}{P_W^*}, \quad NPC_3 = \frac{P_d}{P_W^{**}}$$

P_d = Domestic price
P_W = World price
P_W^* = World price obtained from linear trend
P_W^{**} = World price obtained from econometric model

Groundnut: The Net protection coefficient (Table 3) ranged from 2.16 to 2.21 at official exchange rate, while it ranged from 2.11 to 2.15 at shadow exchange rate. These coefficients indicated that groundnut was highly protected and this is consistent with earlier studies by World Bank (1991) and Bhatia (1994).

It was observed from the analysis that within agriculture, levels of protection are found very uneven among the crops. Rice and cotton have been disprotected and in contrast

sugarcane and groundnut have been highly protected. It was argued that (World Bank, 1991) disprotection for rice and cotton and high protection for oilseeds and sugarcane has influenced allocation of resources away from commodities in which India has a comparative advantages, leading to efficiency losses and misallocation of resources, including net losses in output and foreign exchange. Bhatia (1994) indicated in terms of export competitiveness that India is

Table 3. Net Protection Coefficients for Sugar and Groundnut at Official Exchange Rate

Year	Sugar			Groundnut		
	NPC_1	NPC_2	NPC_3	NPC_1	NPC_2	NPC_3
1980-81	1.54	1.33	2.23	1.48	1.62	1.35
1981-82	1.85 (1.83)	1.54 (1.19)	2.25 (3.12)	1.02 (1.00)	1.06 (1.07)	1.36 (1.29)
1982-83	3.12 (3.03)	2.31 (1.55)	1.98 (2.68)	1.62 (1.57)	1.69 (1.73)	1.38 (1.30)
1983-84	2.40 (2.38)	2.02 (1.83)	1.30 (1.87)	2.26 (2.24)	2.36 (2.44)	1.68 (1.58)
1984-85	4.31 (4.11)	3.65 (2.58)	2.39 (2.13)	1.42 (1.35)	1.44 (1.39)	1.54 (1.48)
1985-86	4.79 (4.57)	4.52 (3.55)	3.04 (2.57)	1.48 (1.41)	1.48 (1.43)	1.47 (1.41)
1986-87	3.19 (2.98)	3.33 (2.95)	4.67 (3.14)	2.14 (1.99)	2.12 (1.99)	2.00 (1.91)
1987-88	2.92 (2.78)	3.26 (3.29)	2.87 (3.63)	2.64 (2.51)	2.58 (2.49)	2.86 (2.46)
1988-89	1.86 (1.80)	2.10 (2.27)	1.52 (1.71)	1.91 (1.84)	1.85 (1.77)	2.21 (2.06)
1989-90	1.57 (1.43)	1.75 (1.64)	3.47 (1.96)	2.73 (2.49)	2.61 (2.34)	2.15 (2.10)
1990-91	1.81 (1.66)	2.13 (2.35)	1.90 (1.63)	3.58 (3.29)	3.37 (3.03)	3.52 (3.32)
1991-92	1.74 (1.68)	2.10 (2.62)	1.51 (1.57)	4.08 (3.93)	3.79 (2.53)	5.02 (4.58)
Mean	2.59 (2.57)	2.50 (2.35)	2.43 (2.37)	2.20 (2.15)	2.16 (2.11)	2.21 (2.14)

(Figures in parentheses indicate Net Protection Coefficients at Shadow Exchange Rate)

$$NPC_1 = \frac{P_d}{PW}, \quad NPC_2 = \frac{P_d}{PW^*}, \quad NPC_3 = \frac{P_d}{PW^{**}}$$

P_d = Domestic price
PW = World price
PW* = World price obtained from linear trend
PW** = World price obtained from econometric model

placed at advantageous position in the international trade of oils and sugar. In Tamil Nadu, the ratios of prices of sugar and groundnut were at variance by more than 100 per cent from unity, which showed that the production mix has been skewed and one could expect that pull of resources into sugarcane and groundnut and away from rice and cotton is quite obvious as rice and sugarcane; groundnut and cotton compete for land and other resources. Hence, one could watch interms of economic costs.

Effective Protection Coefficient (EPC) : As noted in Table 4, the EPCs for rice and cotton were less than one, while for sugarcane and groundnut, the EPCs were more than one. For rice, the average EPC worked out to 0.68 on OER basis and 0.63 on SER basis. Similarly, for cotton, the average EPC was 0.93 and 0.87

Table 4. Effective Protection Coefficients for Select Agricultural Commodities

Particular/Year	Crop			
	Rice	Cotton	Sugarcane	Groundnut
OER basis				
1989-90	0.72	0.90	1.57	2.73
1990-91	0.72	0.79	1.81	3.58
1991-92	0.60	1.11	1.74	5.02
Average	0.68	0.93	1.71	3.78
SER basis				
1989-90	0.65	0.82	1.43	2.49
1990-91	0.66	0.72	1.66	3.29
1991-92	0.58	1.07	1.68	4.83
Average	0.63	0.87	1.59	3.54

OER = Official Exchange Rate
SER = Shadow Exchange Rate

on OER and SER basis, respectively. On the contrary, the average EPC for sugarcane worked out to 1.71 and 1.59 on OER and SER basis, respectively and for groundnut it was 3.78 and 3.54 respectively, on OER and SER basis. The results were consistent with World Bank (1991) indicating that there was discrimination against rice and cotton production in Tamil Nadu. Nevertheless, the results indicated that rice and cotton have been efficient import substitutes and that possibilities exist for expanding exports[8]. In contrast, groundnut and sugarcane have not been efficient import substitutes, which put into question the current programmes to promote self sufficiently in edible oils. Comparing sugarcane and groundnut, there was high level of incentives to groundnut production.

Effective Rate of Protection (ERP) : The estimates of ERP (Table 5) implied that the factors of production of rice can be paid upto 32 to 37 per cent more than under free trade and still remain competitive with imports. There is thus an incentive for factors to be pulled into production of rice. Similarly, the factors of production of cotton can be paid upto seven to 13

per cent more than under free trade and still remain competitive with imports. Hence, there is an incentive for factors to be pulled into cotton production. The ERP of sugarcane and groundnut indicated that incentives for factors of production to be pulled out of production of

Table 5. Effective Rate of Protection of Select Agricultural Commodities

Particular/Year	Crop			
	Rice	Cotton	Sugarcane	Groundnut
OER basis				
1989-90	28.00	10.00	-57.00	-173.00
1990-91	28.00	21.00	-81.00	-258.00
1991-92	40.00	-11.00	-74.00	-402.00
Average	32.00	7.00	-71.00	-278.00
SER basis				
1989-90	35.00	18.00	-43.00	-149.00
1990-91	34.00	28.00	-66.00	-229.00
1991-92	42.00	-7.00	-68.00	-383.00
AVERAGE	37.00	13.00	-59.00	-254.00

OER = Official Exchange Rate, SER = shadow exchange rate

sugarcane and groundnut, more specifically groundnut, which could be based on the economic costs. The phenomenon could be explained by the fact that there is output market distortions both at domestic and international market. Import of edible oils[9] causes domestic price to shoot up, as a result domestic prices of groundnut were always higher than the international price, which brought out high level of protection for groundnut. In the case of sugar, administered price[10] could be main cause for the existence of high level of protection for sugar.

Table 6. Domestic Resource Cost for Select Agricultural Commodities

Particular/Year	Crop			
	Rice	Cotton	Sugarcane	Groundnut
OER basis				
1989-90	0.35	0.37	1.50	1.69
1990-91	0.23	0.31	1.72	2.83
1991-92	0.18	0.81	1.59	4.22
Average	0.25	0.50	1.60	2.91
SER basis				
1989-90	0.32	0.34	1.36	1.54
1990-91	0.21	0.29	1.57	2.60
1991-92	0.17	0.78	1.54	4.06
Average	0.23	0.47	1.49	2.73

OER = Official Exchange Rate, SER = Shadow Exchange Rate

Domestic Resource Cost: For rice and cotton, comparative advantage is the conclusion in the majority of the coefficients (Table 6). The average of DRC was 0.25 and 0.23 for rice and 0.50 and 0.47 for cotton on OER and SER basis, respectively. On the other hand, the average DRC worked out to 1.60 and 1.49 for sugarcane and it was 2.91 and 2.73 for groundnut, respectively, on OER and SER basis. It could also be noted from the Table 7 that DRC of rice and cotton were less than SER, hence it is less costly to produce rice and cotton in terms of

Table 7. Domestic Resource Cost for Select Agricultural Commodities – Another Approach

(Rs./$)

Year	Commodity				
	SER	Rice	Cotton	Sugarcane	Groundnut
1989-90	18.05	10.73	13.47	23.59	40.99
1990-91	19.57	11.89	12.98	29.77	58.86
1991-92	25.42	14.11	26.12	41.09	118.32
Average	21.01	12.24	17.52	31.48	72.72

SER = Shadow Exchange Rate

domestic resources at Rs.12.24 and Rs.17.52 per $ than to import rice and cotton at Rs.21.01 per $. The DRC estimates of sugarcane and groundnut were greater than SER indicating comparative disadvantage in these goods, hence it is less costly in terms of domestic resources to import sugarcane and groundnut at Rs.21.01 per $ than to produce sugarcane and groundnut domestically at Rs.31.48 and Rs.72.72 per $.

5. Conclusion and Policy Implication

Area under rice showed declining tendency, while productivity exhibited positive growth trend. Rice has comparative advantage justifying further protection. It is also evident from the results that the factors of production of rice can be paid upto 32 to 37 per cent more than under free trade and still remain competitive with imports. Hence, incentives should be given to augment rice production in the state. Tamil Nadu has comparative advantage in terms of productivity and output-input ratio. Since there is good demand for non-basmati type of rice in the world market, the state could generate surplus for trade through stabilising acreage and improving productivity.

Area under cotton registered negative growth rate. The results indicated that cotton is disprotected and has comparative advantage. It is evident that the factors of production of cotton can be paid up to seven to 13 per cent more than under free trade and still remain competitive with imports. Therefore, incentives for production of cotton could be increased. Emphasis should be given for evolving new varieties/hybrids and popularising technological practices including IPM (Integrated Pest Management).

The performance indicators of sugarcane, such as, area production and productivity showed positive growth rates. The protection coefficients and domestic resource costs showed that sugarcane is highly protected and has comparative disadvantage domestically as compared to world trade. The phenonienon has to be addressed carefully in terms of policy implications. Given the premise that sugarcane in the state has productivity advantage in the country as a whole, what disturbs one is unit cost of production. The question is now to convert the comparative advantage into competitive advantage globally? The answer lies in diversification of sugar industry that undertakes activities, such as, alcohol production from molasses and establishment of alcohol based industries, paper production, which makes sugar a by-product of sugarcane industry and makes sugar cheaper. Diversification of sugar industries protects the producer and consumer in terms of price. The state should encourage modernisation and diversification of sugarcane industry in the years to come.

Groundnut showed marginal increase in area, production and productivity. The productivity gain is not keeping pace with acreage growth. The analysis of protection and domestic resource cost showed that groundnut is highly protected in Tamil Nadu and it has comparative disadvantage. However, one could interpret the result with caution. Groundnut is the second largest crop in the state next to rice, which is being grown mainly in rainfed and low fertility soils. Tamil Nadu has comparative advantage is terms of productivity at national level. There is scope for productivity enhancement through providing protective irrigation and crop management. This would reduce unit cost of production and make the crop economically viable. World trade scenario favours Indian export of by products of oil seeds. The implicit benefits interms of employment, soil fertility and growing condition favour cultivation of groundnut in Tamil Nadu.

Overall, the results indicate that in order to reap the benefits from the liberalised trade economy, Tamil Nadu could assess the available export surplus of various commodities and give greater emphasis on production strategy for the commodities through incentives for which Tamil Nadu has greater comparative advantage. Moreover, it lies with the appropriate decision to export or import of these commodities or transfer of resources from one commodity to another.

Notes

1. $Y=a(b^t)$, applying logarithms to the equation yields $\log Y = \log a + (\log b)t$ or $Y = A + \beta t$, where A is log a and β refers to log b. The rate of growth (r) was estimated from the equation, i.e., r = (Antilog of β-1) x 100. The test of significance of the growth rate was applied, which is given by $SE(r) = 100\ \beta/\log^e SE\ (\log \beta)$. Using the log base rule, $\log^e$ is worked out to 0.4343. The test of significance, t test is given as $t = r/SE(r)$ with n-2 df.
2. Net production coefficients (NPC) measure actual divergence or distortions between any commodity's domestic price and its world price. The divergence represents the presence of

market intervention, such as, taxes, subsidies, government controlled prices and other policy instruments.

3. $P_w^* = a+bt+ut$

4. $P_w = P_w^*+u$

5. $$SER = \frac{OER*[(M+T_m)]+(x-T_x)]}{M+X}$$

Where, SER is shadow exchange rate, OER is official exchange rate, M is value of all imports, X is value of all exports, Tm denotes net taxes on all imports and Tx refers to net taxes on all exports.

6. The existing bank rate was considered for scarcity price of capital. The scarcity price of 16 per cent for capital was incorporated into the analysis or scarcity price for capital was assigned with 116 per cent.

7. In the absence of such apportioned cost of fixed capital, interest on working capital is also used as an estimate of fixed costs. But it is arbitrary and does not constitute the primary factors.

8. India's share in world exports of rice was 3.7 per cent during 1980 and sharply increased to 7.6 per cent in 1991. The export of raw cotton as percentage of production in India was only four in 1971-72, increased to 11.0 during 1980-81 thereafter, it declined to 9.6 in 1991-92 and 3.2 during 1992-93.

9. Import of edible oils was valued at 23 crores during 1970-71, which shot up to 683 crores during 1980-81 and it decreased to 326 crores in 1990-91. During 1993-94, it was estimated at 164 crores.

10 Minimum support price announced by the Government of India for sugarcane was Rs.230 per tonne, while it was fixed at Rs.280 per tonne by the Government of Tamil Nadu during 1990-91. The minimum support price tended to increase to Rs.391.00 per tonne (GOI) and Rs.525 per tonne (GO TN) during 1993-94.

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APPENDIX I

Official and Shadow Exchange Rates, India, 1981-82 to1992-93

(Rs. Per US $)

Year	Official Exchange Rate (OER)	Equilibrium or Shadow Exchange Rate (SER)
1981-82	8.79	9.06
1982-83	9.67	9.93
1983-84	10.34	10.42
1984-85	11.89	12.53
1985-86	12.24	12.84
1986-87	12.78	13.74
1987-88	12.97	13.61
1988-89	14.48	14.99
1989-90	16.45	18.05
1990-91	17.94	19.57
1991-92	24.47	25.42
1992-93	30.65	32.09

APPENDIX II

Average and Deflated Wholesale Prices of Major Agricultural Commodities in Tamil Nadu

(Rs./Qtl.)

Year	Rice (common)	Cotton (lint)	Sugar	Groundnut (shelled)
1980-81	230.18	1142.58	774.38	482.72
	(250.89)	(1245.41)	(844.07)	(526.16)
1981-82	253.09	1660.79	616.35	576.58
	(253.09)	(1660.79)	(616.35)	(576.58)
1982-83	270.41	1473.61	456.04	567.41
	(256.89)	(1399.93)	(433.24)	(539.04)
1983-84	283.32	1683.07	466.94	675.51
	(252.15)	(1497.93)	(415.58)	(601.20)
1984-85	277.60	1669.06	507.84	701.99
	(230.14)	(1385.32)	(421.51)	(582.65)
1985-86	322.60	1492.95	592.98	642.32
	(258.08)	(1194.36)	(474.38)	(513.86)
1986-87	312.91	1624.41	574.14	838.32
	(234.68)	(1218.31)	(430.61)	(628.74)
1987-88	349.71	2421.66	600.46	976.32
	(244.80)	(1695.16)	(420.32)	(683.42)
1988-89	371.15	2974.04	605.04	813.80
	(241.25)	(1933.11)	(393.28)	(528.97)
1989-90	421.56	2661.25	799.00	952.75
	(252.94)	(1596.75)	(479.40)	(571.65)
1990-91	427.35	2726.64	793.19	1257.35
	(235.04)	(1499.65)	(436.25)	(691.54)
1991-92	498.26	2918.53	827.13	1445.34
	(239.16)	(1400.89)	(397.02)	(693.76)
Mean	334.85	2037.38	634.46	827.53
	(245.76)	(1477.30)	(480.17)	(594.80)
CV (%)	24.27	31.93	20.86	35.08
	(3.87)	(14.79)	(26.88)	(11.10)

(Figures in parentheses denote deflated wholesale prices)

Source: Various issues of Statistical Abstract of Tamil Nadu

Note: Nominal prices were converted into real prices using wholesale price index with base year, 1981-82.

APPENDIX III

Nominal and Deflated International Prices of Major Agricultural Commodities at Official Exchange Rate

(Rs./Qtl.)

Year	Rice (common)	Cotton (lint)	Sugar	Groundnut (shelled)
1980-81	342.42	1727.89	501.41	325.02
	(373.23)	(1883.40)	(546.54)	(354.27)
1981-82	434.05	1765.00	333.61	565.88
	(434.05)	(1765.00)	(333.61)	(565.88)
1982-83	269.44	1621.22	146.31	351.00
	(255.97)	(1540.16)	(138.99)	(333.45)
1983-84	282.28	1977.78	194.71	299.04
	(251.22)	(1760.22)	(173.29)	(266.15)
1984-85	293.60	2044.21	117.23	493.88
	(243.25)	(1696.69)	(97.30)	(409.92)
1985-86	267.74	1900.61	123.70	434.95
	(200.81)	(1520.49)	(98.96)	(347.96)
1986-87	260.77	1571.20	179.43	392.30
	(182.54)	(1178.40)	(134.57)	(294.23)
1987-88	329.66	2168.46	205.73	370.72
	(214.28)	(1517.92)	(144.01)	(259.50)
1988-89	429.28	2180.74	324.81	427.06
	(279.03)	(1417.48)	(211.13)	(277.59)
1989-90	543.17	2905.95	507.80	348.50
	(325.90)	(1743.57)	(304.68)	(209.10)
1990-91	525.80	3455.52	438.11	351.32
	(289.23)	(1900.54)	(240.96)	(193.23)
1991-92	743.20	4017.90	474.10	353.82
	(356.71)	(1928.59)	(227.57)	(169.83)
Mean	393.41	2277.96	295.58	392.79
	(283.85)	(1654.29)	(220.97)	(306.76)
CV (%)	37.79	34.04	51.74	19.41
	(26.70)	(13.56)	(57.70)	(35.24)

(Figures in parentheses indicate deflated international prices)
Rice – Milled – Thailand – Thai white 5% broken Bangkok – FOB
Cotton – Lint – Liverpool – CIF
Sugar – Raw – Daily – FOB, Stowed Caribb Ports Bulk
Groundnut – Shelled – Nigerian – CIF – UK
Note: Nominal prices were converted into real prices using wholesale price index with base year, 1981-82.

APPENDIX IV

Nominal and Deflated International Prices of Major Agricultural Commodities at Shadow Exchange Rate

(Rs./Qtl.)

Year	Rice (common)	Cotton (lint)	Sugar	Groundnut (shelled)
1981-82	438.41	1781.70	336.96	571.56
	(438.41)	(1781.70)	(336.96)	(571.56)
1982-83	276.68	1664.81	150.24	360.44
	(262.85)	(1581.57)	(142.73)	(342.41)
1983-84	284.66	1993.08	196.22	301.35
	(253.16)	(1773.84)	(174.63)	(268.21)
1984-85	308.83	2154.24	123.54	520.46
	(256.33)	(1788.01)	(102.54)	(431.98)
1985-86	280.56	1993.78	129.76	456.27
	(210.65)	(1595.02)	(103.81)	(365.02)
1986-87	280.36	1689.22	192.91	421.77
	(196.25)	(1266.92)	(144.68)	(316.33)
1987-88	345.93	2275.46	215.88	389.01
	(224.85)	(1592.82)	(151.11)	(272.30)
1988-89	444.40	2257.55	336.25	442.10
	(288.86)	(1467.41)	(218.57)	(287.37)
1989-90	596.00	3188.50	557.19	382.40
	(357.60)	(1913.16)	(334.31)	(229.44)
1990-91	573.65	3769.48	477.92	382.24
	(315.51)	(2073.22)	(262.85)	(210.79)
1991-92	772.05	4173.89	492.51	367.56
	(370.59)	(2003.46)	(236.40)	(176.42)
Mean	418.32	2449.25	291.76	417.74
	(288.64)	(1712.47)	(200.78)	(315.62)
CV (%)	39.65	35.29	54.05	18.39
	(25.99)	(13.98)	(41.83)	(35.41)

(Figures in parentheses indicate deflated international prices)

Note: Nominal prices were converted into real prices using wholesale price index with base year, 1981-82.

APPENDIX V

International Prices of Major Agricultural Commodities Trend Free Data at Official and Shadow Exchange Rate

(Rs./Qtl.)

Year	Rice (common)	Cotton (lint)	Sugar	Groundnut (shelled)
1980-81	496.06	2698.18	581.07	298.02
1981-82	559.75	2557.83	398.79	543.79
	(625.99)	(2893.26)	(517.09)	(530.03)
1982-83	367.20	2238.59	197.00	333.82
	(426.74)	(2554.06)	(294.71)	(327.22)
1983-84	352.12	2418.69	230.92	286.77
	(397.00)	(2660.00)	(255.03)	(276.43)
1984-85	335.12	2308.65	138.96	486.52
	(383.85)	(2598.86)	(196.68)	(503.85)
1985-86	281.70	1988.59	130.95	432.50
	(318.37)	(2216.09)	(167.24)	(447.96)
1986-87	246.80	1485.72	172.19	394.76
	(280.35)	(1689.21)	(194.73)	(421.77)
1987-88	287.76	1903.52	184.01	378.08
	(308.40)	(2053.14)	(182.03)	(397.31)
1988-89	359.45	1739.34	288.60	439.33
	(369.37)	(1812.92)	(266.74)	(458.71)
1989-90	445.40	2288.09	456.11	365.68
	(483.44)	(2521.65)	(482.02)	(407.32)
1990-91	400.17	2661.20	372.94	343.41
	(423.57)	(2880.22)	(337.08)	(415.46)
1991-92	589.56	3047.11	394.44	380.81
	(548.45)	(3062.32)	(316.01)	(409.09)
Mean	393.42	2277.69	295.58	392.79
	(418.32)	(2449.25)	(291.76)	(417.74)
CV (%)	27.79	19.44	48.63	18.88
	(26.21)	(18.42)	(40.21)	(17.16)

(Figures in parentheses denotes trend free data at Shadow exchange rate)

Note: Estimated using trend equation.

APPENDIX VI

Estimated Deflated International Prices of Major Agricultural Commodities at Official and Shadow Exchange Rates

(Rs./Qtl.)

Year	Rice (common)	Cotton (lint)	Sugar	Groundnut (shelled)
1980-81	315.57	1804.72	377.69	388.68
1981-82	323.09	1742.39	273.77	423.93
	(316.24)	(1725.83)	(197.78)	(446.45)
1982-83	289.19	1674.13	219.04	390.54
	(286.14)	(1679.81)	(161.29)	(412.25)
1983-84	338.37	1784.07	320.69	357.96
	(327.52)	(1747.15)	(221.49)	(380.97)
1984-85	276.78	1632.68	176.37	377.43
	(292.95)	(1729.18)	(197.67)	(392.71)
1985-86	244.60	1501.87	156.09	349.12
	(261.86)	(1603.39)	(184.39)	(364.14)
1986-87	190.90	1342.07	92.05	313.71
	(210.93)	(1460.30)	(137.07)	(328.40)
1987-88	194.61	1354.87	146.04	238.89
	(197.49)	(1392.27)	(115.68)	(258.66)
1988-89	268.64	1524.18	259.00	239.13
	(274.68)	(1567.65)	(229.68)	(256.26)
1989-90	263.37	1628.69	138.19	265.34
	(301.97)	(1833.33)	(244.54)	(272.46)
1990-91	321.03	1860.42	229.71	197.68
	(345.83)	(1999.83)	(266.86)	(208.21)
1991-92	344.28	2001.37	262.32	137.07
	(359.43)	(2098.28)	(252.39)	(151.32)
Mean	283.87	1654.29	220.97	306.71
	(288.64)	(1712.47)	(200.78)	(315.61)
CV (%)	19.30	12.08	37.57	29.19
	(17.67)	(12.36)	(24.05)	(29.44)

(Figures in parentheses indicate estimated deflated international prices at shadow exchange rate)
Note: Estimated prices wee arrived from the econometric equation.