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Competitiveness of Major Crops in Post-WTO Period in Andhra Pradesh

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ABSTRACT

In Andhra Pradesh, rice, maize, cotton and groundnut are the major crops. There are significant changes in the competitiveness and policy environment and its implications for crop competitiveness in post-WTO regime. This paper examines the trends in area, production and yield and competitiveness of major crops in pre- and post-WTO period and its implications on the producer, consumer surplus and social cost benefits at state level. Rice, maize and cotton registered impressive growth in production in post-WTO period. Trade competitiveness of rice showed that the state had improved competitiveness in rice production as shown by domestic resource cost (DRC) and nominal protection coefficient (NPC) levels. The effective protection coefficient (EPC) shows that rice production was fairly protected by the government. In case of maize NPC values shows non-competitiveness and EPC results revealed inefficiency in production. Growth rate of production of groundnut is lower during post-WTO period, even though it is efficient and competitive producer mainly due to the high fluctuations in prices and yields. The state is an efficient and competitive producer of cotton and its area increased steeply. Welfare gains in all crops were much larger than the respective welfare losses due to liberalisation. Welfare gain was high in case of cotton, followed by rice, groundnut and maize. The net effect to the economy of the state due to liberalisation was substantial in rice and maize.

Keywords: WTO, Welfare gains, Crop competitiveness.

JEL: Q110, Q170

I

INTRODUCTION

Andhra Pradesh has a prominent position in the agricultural economy of India. A large proportion of the cultivated area in the state is devoted to the production of principal crops like rice, maize, groundnut and cotton. These crops account for about 40 per cent of the cultivated area in the state. In the post-WTO period, the main criteria in prioritising crop choices at state level are relative competitiveness. It is in this context that this study has been undertaken to assess the competitiveness of major crops of Andhra Pradesh based on the performance of the crops during two time periods, viz., pre-WTO (1985-86 to 1994-95) and post-WTO period (1995-96 to 2004-2005). The specific objectives of the present study are, (i) To analyse the global competitiveness of major crops of Andhra Pradesh, and (ii) To quantify the welfare gains and losses due to liberalisation of agricultural trade. The following are the

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hypothesis framed with regard to each of the above objectives: (i) Andhra Pradesh enjoys comparative advantage in selected agricultural crops, and (ii) Trade liberalisation benefits the consumer more than the producer.

The paper is organised into four sections as described below: Section I Introduction – deals with the importance of the research problem, objectives and hypotheses of the study. Section II presents the method of data collection and various analytical techniques employed in the paper. Section III deals with the results of analysis of the crops selected. The final section presents the summary and policy implications.

II

METHODOLOGY

The growth in area, yield and production of four major crops in Andhra Pradesh, competitiveness of these crops and implications of WTO on agriculture were analysed and the analytical tools employed in the study are discussed below. To study the competitiveness of selected crops from Andhra Pradesh, the free on board (FOB) prices, cost insurance freight (CIF) prices and domestic wholesale prices that prevailed in the major markets were collected. The markets selected for the study are as follows: for rice, Nizamabad as the local market and Thailand as the international market. For groundnut, Nandyal as the local market and Rotterdam as the international market. For cotton, Guntur and Liverpool as the local and international markets, respectively. For maize the markets selected were Warangal for local market and U.S.A. as the international market. For policy analysis matrix, the data on the cost of cultivation for the four crops were collected for the study period. The study is based on secondary data covering a period of 20 years from 1985-86 to 2004-05. The study period was divided into two, viz., pre-WTO (1985-86 to 1994-95) and post-WTO (1995-96 to 2004-2005).

The secondary data pertaining to area, yield and production of selected crops (rice, maize, groundnut and cotton) were collected from Directorate of Economics and Statistics (DES), Andhra Pradesh. International reference price of the crops under study were collected from various issues of FAO Production Year Book. The maritime freight rates of rice were obtained from FAO Trade Year Book (2005). Information on domestic prices of selected crops and other agricultural statistics were compiled from various issues of Season and Crop Report and Statistical Abstract of Andhra Pradesh published by Directorate of Economics and Statistics (DES), Hyderabad. Information on transportation costs, port clearance charges etc for the selected crops over the years were obtained from port authority, Kakinada and railway department, Hyderabad. Data on cost of cultivation of selected crops were obtained from Cost of Cultivation scheme (Government of India scheme), Hyderabad.

The growth in area, production, productivity of crops were analysed using exponential growth function of the form

$$Y = at^b e_t \quad \dots(1)$$

where

Y = Dependent variable for which growth rate is estimated

a = Intercept

b = Regression coefficient

t = Time variable

e = Random error

The compound growth rate was obtained from the logarithmic form of the equation (1) as below.

$$\log Y = \log a + b \log t + \ln(e_t) \quad \dots(2)$$

The per cent compound growth rate (g) was derived using the relationship.

$$g = (\text{Antilog of } b - 1) * 100 \quad \dots(3)$$

Instability Index

Instability index (II) = Standard deviation of natural logarithm (Y_{t+1}/Y_t) where, Y_t is the area/production/yield in the current year and Y_{t+1} is for the next year. This index is unit free and very robust, and it measures deviations from the underlying trend (log linear in this case). When there are no deviations from trend, the ratio of Y_{t+1}/Y_t is constant and thus standard deviation is zero (Chand, 2002). As the series fluctuates more, the ratio of Y_{t+1} and Y_t also fluctuates more, and standard deviation increases.

Policy Analysis Matrix (PAM)

The PAM is essentially a double accounting technique that summarises budgetary information for farm and post-farm activities (Yao, 1997). While simple to use, it is theoretically rigorous and derived from social cost-benefit analysis and international trade theory in economics. The basic steps in using the PAM method are identifying the commodity system, assembling representative budgets for each activity in the system, calculating social values, aggregating the budgetary data into a matrix, analysing the matrix and simulating policy changes.

The method rests upon a familiar identity: profit = revenue-costs. Costs are divided into those inputs that are traded in the international markets (fertilisers, pesticides, hybrid seeds) and those domestic factors (labour, land, and capital), which are not traded internationally. This gives us the following profit identity:

$$\text{Profit} = \text{Revenue} - \text{Cost of tradable inputs} - \text{Costs of domestic factors}$$

PAM is measured in two types of prices: private and social, which are defined clearly in the context of working with a PAM.

Private values are prices at which we observe goods and services actually being exchanged and those which we have used in our budgets—the price of crop, the cost of seed, fertilisers, farm yard manures, pesticides and the wage rate. These are also called market or financial prices. Social values are the prices, which would prevail in the absence of any policy distortions (such as taxes or subsidies) or market failures (such as monopolies). They reflect the value to society as a whole rather than to private individuals, and are the values used in the economic analysis when the objective is to maximise national income. The determination of social values is one of the main tasks of economists, since these values offer the best indication of optimising income and social welfare. For internationally traded goods, we use world prices (Free on Board (FOB) for exports and Cost Insurance Freight (CIF) for imports) and in case of domestic factors, which are not traded in the international markets, figuring out social prices is difficult. For these goods, the social costs have been calculated using Value of Marginal Product approach, which uses factor share (S_i) of various inputs (X_i) together with the mean values of inputs and outputs (Y) and prices (P_y). The computation of the social cost of input is as follows.

$$P_{xi} = [(S_i/X_i) * Y] P_y \quad \dots(4)$$

Once all private values have been matched with their social equivalents, we arrive at two identities:

Private Profits = Private revenue - Private cost of tradable inputs - Private cost of domestic factors

Social Profits = Social revenue - Social cost of tradable inputs - Social cost of domestic factors

TABLE 1. THE POLICY ANALYSIS MATRIX

(1)	Revenues (2)	Cost of tradable inputs (3)	Cost of domestic factors (4)	Profits (5)
Private values	A	B	C	D
Social values	E	F	G	H
Divergences	I	J	K	L

From the table, Private profit (D)=A-B-C, Social profit (H)= E-F-G, Output transfers (I)=A-E, Input transfers(J)= B-F, Factor transfers (K)=C-G, Net transfers (L)=D-H or I-J-K.

Private Cost Ratio (PCR):C/(A-B). Domestic Resource Ratio (DRC): Nominal Protection Coefficient (NPC) on tradable outputs (NPCO): A/E , Nominal Protection Coefficient on tradable inputs (NPCI): B/F, Effective Protection Coefficient (EPC): (A – B)/(E – F), Profitability Coefficient (PC): (A-B-C)/(E-F-G) of D/H, Subsidy Ratio to Producers (SRP): L/E or (D – H)/E.

An important aspect to be kept in mind is that for a given commodity system, the costs and profits represent an aggregate for all activities from farm to wholesale. For revenues, A is the whole price, and E is the world price of the comparable product in the comparable location.

From this table, several useful values appear. Private profit (D) is the aggregate measure of net returns for all activities in the system and a high value would suggest a system that is competitive from a financial point of view. In other words, profits are being generated for the participants in that system. A negative value would be a strong indication that the system is unsustainable, since there are no incentives for individual farmers to continue cultivation of the crop.

In contrast, social profit (H) represents the foreign exchange saved by reducing imports or earned by expanding exports of a unit of this commodity. A positive value means that production is adding to national income, while a negative value suggests that the country as a whole would be better off in terms of national growth by not producing this commodity. As such, it is an indication of international competitive advantage.

Cell L is the difference between D and H, thus describes the value of the resources going in to (if positive) or coming out of (if negative) the commodity system from the economy as a whole.

Nominal Protection Coefficient (NPC) is a straightforward measure of competitiveness. It is calculated as a ratio between the domestic prices to the international price of a comparable grade of commodity, adjusted for all the transfer costs such as freight, insurance, handling costs, margins, losses etc. A decision criterion is if NPC is less than one, then the commodity is competitive (under importable hypothesis it is considered a good import substitute and under exportable hypothesis, it is worth exporting). If NPC is greater than one, the commodity is not competitive (not a good import substitute or not worth exporting).

The EPC is an indicator for measuring trade price and exchange rate related distortions through tradable input and output prices of the value added of a particular product. The EPC captures transfers due to distortions in input as well as output prices on the product's value addition that is output price (gross value) less specified (usually variable) traded input costs. The EPC for commodity is defined as

$$EPC_i = (VA_i^d / VA_i^b) \dots(5)$$

where VA_i^d is the value added output “i” at domestic prices and VA_i^b is the value-added output “i” at border prices. The EPC can be positive, negative or zero. A positive EPC indicates that the value added at domestic prices is higher than value added at border prices, and hence the output is effectively protected through the combination of domestic output and input price policy. In contrast, a negative EPC implies overall producer taxation; domestic value added is effectively taxed. When EPC is zero, the output is neither taxed nor subsidised, and value added at domestic price is equal to the value added at border prices.

The Domestic Resource Cost (DRC) ratio also measures the efficiency of domestic production in terms of its international cost competitiveness. The DRC coefficient compares the opportunity costs of using domestic primary resources- land, labour and capital and of traded inputs in domestic production to the value added by that production at border prices:

$$DRC = a_{ij} v_j / (P_i^b - a_{ij} P_i^b) \quad \dots(6)$$

where a_{ij} ($j = K + 1$ to n) is the technical coefficient (input use per unit of output) for domestic resource (non- trade intermediary input) j in the production of output i and v_j is the shadow price of such an input. When DRC ratio is lower than one, domestic production is efficient and internationally competitive because the opportunity cost of spent domestic resources is smaller than the net foreign exchange gained in export or saved by substituting for imports. A DRC ratio of less than one is thus taken as an indicator of long run comparative advantage. The opposite is true when DRC ratio is larger than one (Yao, 1997).

Trade competitiveness of selected crops was estimated under both importable hypothesis and exportable hypothesis (however, on exportable hypothesis results were not presented due to space limitation). The welfare gains or losses both to producers and consumers were estimated using the partial equilibrium method which is followed by Lutz and Scandizzo (1980).

Partial Equilibrium Analysis

Price distortions on the domestic as well as international markets and domestic agricultural policies will have an impact on the incomes of producers, consumers and government revenues. These distortions are created on account of protectionist policies followed by the governments. With liberalisation, these policy distortions will change. In the current study the extent of price discrepancies were computed. Partial equilibrium methods can readily be used to evaluate the impact of the price changes on demand, supply and welfare. The basic analytical structures of the partial equilibrium models are summarised as follows. The following formulae are applied for different prices affecting the producers and consumers.

(1) Net social loss in production (NSL_p)

$$= \frac{1}{2} (Q_w - Q) (P_w - P_p) = \frac{1}{2} t_p^2 n_s V$$

(2) Net social loss in consumption (NSL_c)

$$= \frac{1}{2} (C_w - C) (P_c - P_p) = \frac{1}{2} t_c^2 n_d W$$

(3) Total net social loss (NSL)

$$= NSL_p - NSL_c$$

(4) Welfare gain of producers = G_p

$$= Q(P_p - P_w) - NSL_p$$

(5) Welfare gain of consumers = G_c

$$= Q(P_w - P_c) - NSL_c$$

(6) Net effect of liberalisation on welfare in the state (NELWS)

$$Q(P_p - P_w) - Q(P_w - P_c)$$

(7) Change in government revenue (dG)

$$dG = (NSL_p + NSL_c) - G_p - G_c$$

where

Q_w = Production at world prices

Q = Production at domestic prices

P_w = Border prices

P_p = Price faced by domestic producers

P_c = Price faced by domestic consumers

t_c, t_p = proportion of tariff in domestic prices at the consumer (t_c) or the producer (t_p) level

N_s = Elasticity of domestic supply

N_d = Elasticity of domestic demand

V = Value of production at P_p

W = Value of consumption at P_c

C_w = Consumption at world prices

C = Consumption at domestic prices.

The basic parameters needed in this evaluation are the elasticities of supply and demand. The evidence on agricultural supply elasticity is unfortunately weak and diverse. In the present study, the supply and demand elasticities were taken from Reddy(1997) and Raghavendra (2004). For calculation of production values, the wholesale price of commodities was used, whereas, for consumption values, the retail

prices of commodities were used. However, consumption gains and losses have not been calculated for groundnut and cotton since the product undergoes considerable transformation before consumption and the average consumption of each type is not available. The world reference prices were derived from the international price, adjusted for transport and marketing and trading margins in order to make the domestic commodity comparable with the internationally traded commodity. For the purpose of easier conceptualisation it has been presented in Figure 1. An illustration of effects of price distortions. S' represent the domestic supply function and N' is the domestic demand schedule. The world market price is OD and domestic price is OA . For reasons of simplicity no distinction is made between producer and consumer price. AD represents the increase in export tax. At the bottom of figure, the welfare gains and losses determined in equations (A) – (F) are related to the corresponding areas in figure.

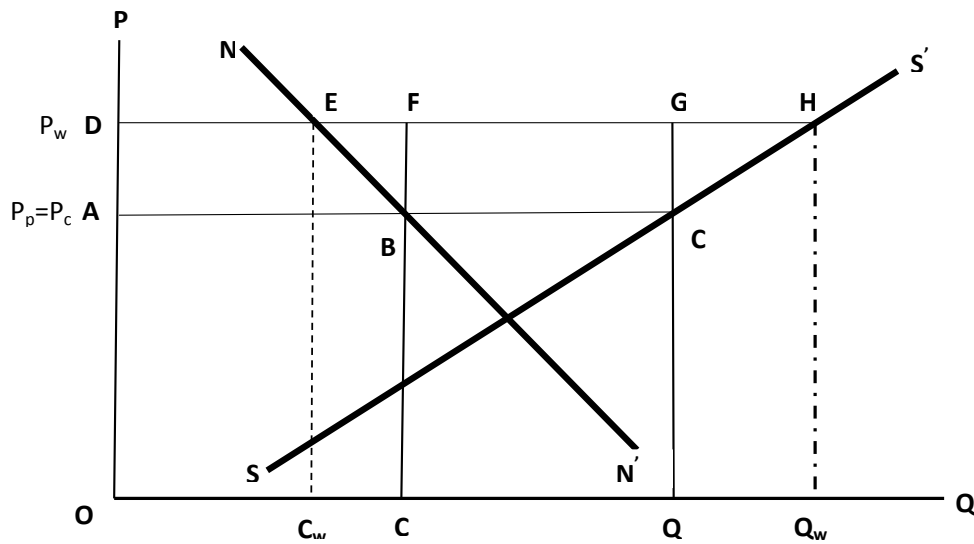


Figure 1. Effect of Export Tax.

Eq. (1) $NSL_p = CHG$

Eq. (2) $NSL_c = BFE$

Eq. (3) $NSL = CHG + BFE$

Eq (4) $WG_p = ACHD$

Eq. (5) $WG_c = ABED$

Eq (6) Net effect of liberalization of welfare in the state = $C_wCFE + Q Q_wHG$

Eq. (7) Change in government revenue (dG) = $BCGF$.

IV

RESULTS

Growth Rates in Area, Yield and Production of Important Crops

Compound growth rates in area, yield and production of rice, maize, groundnut and cotton were worked out for the state and presented in Table 2. The growth rates were worked out for two sub-periods, namely, pre-WTO period (1985-86 to 1994-95) and post-WTO period (1995-96 to 2005-2006) as well as for the entire study period. The results of growth analysis are presented below.

TABLE 2. GROWTH RATES AND INSTABILITY INDEX OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN ANDHRA PRADESH

Crop (1)	Growth rate			Instability index		
	Period I (2)	Period II (3)	Overall (4)	Period I (5)	Period II (6)	Overall (7)
	Area					
Rice	0.72	-1.93	-0.23	7.98	12.79	11.26
Maize	0.55	8.77	4.49	3.33	8.76	16.44
Groundnut	4.15	-2.54	-0.69	8.88	8.75	15.07
Cotton	4.86	-0.005	3.73	13.73	13.58	15.13
	Production					
Rice	3.4	0.11	1.55	10.76	0.94	8.45
Maize	0.49	5.41	9.13	22.14	10.92	23.5
Groundnut	5.2	-5.67	-1.55	16.94	27.79	28.88
Cotton	8.11	2.33	5.47	23.44	17.85	31.84
	Yield					
Rice	2.64	1.81	1.66	5.31	4.61	9.75
Maize	7.38	2.12	4.63	7.42	9.2	6.38
Groundnut	0.99	-3.2	-0.86	13.26	22.3	18.86
Cotton	3.08	2.92	1.66	19.39	15.99	11.76

In Andhra Pradesh, area under rice crop had increased from 34.52 lakh hectares in 1985-86 to 41.0 in 1995-96 but declined thereafter to 39.82 lakh hectares in 2005-06. For the same period production increased from 76.13 lakh tonnes in 1985-86 to 106.86 in 1995-96 and to 117.04 lakh tonnes at a compound growth rate (overall) of 1.55 per cent with instability of 8.45 per cent. Whereas yield had increased at the rate of 1.66 per cent. In the pre-WTO period, the growth in area showed slight increase (0.72 per cent ACGR) with slightly lower instability of 7.98 per cent. Where as in post-WTO period, there was a negative growth rate in area with a very high degree of instability. In pre-WTO period, the growth rates in yield and production were higher when compared to the post-WTO period. Traditionally Andhra Pradesh is surplus rice production, keeping the opportunity to export in post-WTO period and also to meet the demand for deficit state, there is a need for increasing rice production. Hence, it is necessary to augment exportable surplus of good quality rice at competitive prices. This increase in production has necessarily to come from increased efficiency and productivity given the negative growth in area.

The maize area in Andhra Pradesh increased by two and half times from 2.88 lakh hectares in 1985-86 to 7.58 lakh hectares in 2005-06. The area had grown at the rate of 4.49 per cent during the reference period. Production of maize recorded an impressive growth of 9.13 per cent per annum during the reference period. Growth in area and production was quite high in the post-WTO period (8.77 and 5.41 respectively). Increase in yield was high in pre-WTO period, which had grown at 7.38 per cent. But, in the post-WTO period the growth in yield was 2.12 per cent only as yield is already high (one of the highest in the country) at more than 40 quintal/ha. Maize possess tremendous potential, as it is a major raw material for many agro-based industries such as feeds for dairy, poultry, breweries and piggery and other industries. Diversified use of maize for starch industry, corn oil production, baby corns, pop corns etc., would further provide the much needed impetus to the growth of maize.

The performance of groundnut crop in Andhra Pradesh was debilitating. Area augmented from 16.66 lakh hectares in 1985-86 to 18.76 lakh hectares in 2005-06 with a growth rate of 0.69 per cent. But the growth rate of production is -1.55 per cent. Productivity started plummeting from 787 kilograms per hectare in 1985-86 to 728 kilograms per hectare in 2005-06 with a negative growth rate of 0.86. The performance of the crop in terms of growth in area, production and productivity in the post-WTO period was dismal with negative trends due decline in domestic prices and high fluctuations in yield. But in pre-WTO period, area and production grew at a high rate of 4.15 per cent and 5.2 per cent respectively, whereas yield growth was just 0.99 per cent. It is also noted that the newly released improved varieties were not widely adopted by the farmers due to many reasons (Reddy and Bantilan, 2012).

The production and area growth rates of cotton were quite impressive with 5.47 per cent and 3.73 per cent respectively. Growth rate of yield was also satisfactory with 1.66 per cent. The performance of area and production was impressive in pre-WTO period with growth rates of 4.86 per cent and 8.11 per cent respectively. Growth in yield was also quite satisfactory in pre -WTO period. In post-WTO period the growth in area was almost stagnant (-0.005 per cent), but growth rates of production and yield were satisfactory (2.33 per cent and 2.92 per cent respectively). However, in the recent years, area, production and yield steeply rose due to wider adoption of Bt cotton varieties even in drylands. For example area increased from 10.33 lakh hectares in 2005-06 to 18.79 lakh hectares in 2011-12. Yield increased from 347 kg/ha to 443 kg/ha. As a result there is a steep increase in production from 21.08 lakh bales (of 170 kg each) to 49 lakh bales in 2011-12.

Trade Competitiveness of Rice

The results of policy analysis matrix (PAM) for rice are presented in Table 3. It is interesting to observe that rice, which is the major crop in the state, had been largely competitive on an importable basis with their NPC values being below unity during

the reference period. EPC estimates showed that out of twenty years reference period, for two years (1986-87 and 1987-88) it was more than one, which showed that the state had protected the crop in these years. However, for the reference period the average EPC showed that Andhra Pradesh is an efficient producer of rice. Over the years EPC had declined which implies that increasing rate of competitiveness of rice. This could be due to emergence of efficient production technology and impact of WTO in the country.

TABLE 3. RESULTS OF POLICY ANALYSIS MATRIX (PAM) OF RICE

Year (1)	NPC (2)	NPCI (3)	EPC (4)	DRC (5)	SRP (6)	PC (7)
TE 1989	0.79	0.33	1.08	0.89	0.40	1.74
TE 1992	0.65	0.37	0.79	0.67	0.13	1.46
TE 1995	0.70	0.33	0.86	0.78	0.28	1.76
Pre-WTO period	0.71	0.34	0.90	0.78	0.26	1.65
TE 1998	0.50	0.28	0.50	0.37	-0.26	0.49
TE 2001	0.54	0.36	0.62	0.44	-0.14	0.65
TE 2004	0.69	0.38	0.82	0.64	0.05	1.26
Post-WTO	0.57	0.34	0.64	0.48	-0.11	0.79

The estimates of DRC for the reference period revealed that the state had comparative advantage in the rice production (DRC is below one). The level of DRC shows that the value of domestic resources used in producing a hectare of rice in Andhra Pradesh was less than what it could cost to import. The DRC level decreased in the post-WTO period, which shows that comparative advantage in rice production has improved in this period. Subsidy Ratio to Producer (SRP) coefficient was computed to analyse the degree of state protection to the selected crops. The results presented in Table 3 revealed that the average SRP for the state in post-WTO is -0.11 and in pre-WTO period it was 0.26. This implies that the state had not protected the rice production in post-WTO period, but moderately protected the rice production in pre-WTO period. However, the levels of incentives provided to the farmers in this period are also very meager as compared to magnitude of protection in the developed countries.

In case of NPC under exportable hypothesis, the results were different. It implies that the state had non-competitiveness of price in rice production as revealed by NPC values (above one in all the years). The higher NPC implies that domestic prices received by the farmers were higher than the international prices for the crop. Nominal Protection Coefficient of Input transfer (NPCI) was less than one in both the periods. It was 0.34 in both the periods which implies that the average market prices of these inputs are only 34 per cent of world prices. The results are in contradiction with the results of Gill and Brar (1996).

Trade Competitiveness of Maize

The lower NPC values for maize under importable hypothesis in pre-WTO period show that the domestic process received by the farmers was lower than the international prices, implying that maize cultivators in the state were disprotected. But in post-WTO period the NPC values were above one which shows the non-competitiveness of maize crop in this period. EPC for maize indicated that Andhra Pradesh was not an efficient producer of maize in both the periods (EPC was more than one in both the periods).

When DRC is taken into consideration, the state had comparative disadvantage in maize production. This means that the value of domestic resources used in producing one hectare of maize was more than what it would cost to import. The comparative disadvantage could be due to cultivation of maize on marginal lands with low level of package of practices. Under exportable hypothesis NPCs were greater than unity for all the years. This implies that Andhra Pradesh do not have any advantage in the export of this crop (Table 4). This result is in conformity with those of the studies conducted by Reddy (1997). However, with the wider adoption on hybrid varieties there is a lot of scope in increasing competitiveness of maize in the state.

TABLE 4. RESULTS OF POLICY ANALYSIS MATRIX (PAM) OF MAIZE

Year (1)	NPC (2)	NPCI (3)	EPC (4)	DRC (5)	SRP (6)	PC (7)
TE 1989	0.79	0.33	1.91	1.65	0.45	1.72
TE 1992	0.78	0.35	1.34	1.07	0.30	1.57
TE 1995	1.03	0.34	1.47	1.24	0.28	1.86
Pre-WTO period	0.86	0.33	1.57	1.31	0.34	1.71
TE 1998	1.04	0.31	0.94	2.19	0.64	1.50
TE 2001	1.02	0.36	0.95	1.28	0.64	1.42
TE 2004	1.16	0.36	2.91	0.85	0.77	1.19
Post-WTO	1.07	0.34	1.60	1.44	0.68	1.37

Trade Competitiveness of Groundnut

The results of policy analysis matrix for groundnut are furnished in Table 5. The table reveals that DRC is less than one in both the periods. This demonstrates that the value of domestic resources used in producing a quintal of groundnut is less than what it would cost to import. In other words the estimates of DRC indicated comparative advantage in groundnut production. In post-WTO period DRC is much less (0.44), which indicates higher competitiveness in groundnut production. EPC was more than one pre-WTO period which states that the state is not an efficient producer of groundnut. EPC was 0.53 in post-WTO period which shows that the groundnut production efficiency of the state was improved over the years. In pre-WTO period positive SRP showed that groundnut production was protected by state which started declining in post-WTO period as revealed by negative SRP. NPC was

less than one in both the periods which shows the competitiveness. But it was more in pre-WTO period (0.9) than in post-WTO period (0.54). NPCI was below one in both the periods, shows that the input costs were lower than the world prices. NPC under exportable hypothesis showed that the state had poor competitiveness for groundnut exports in pre-WTO period which is shown by NPC greater than one. The results are in line with the results of Chand (2002) and Gulati (2002).

TABLE 5. RESULTS OF POLICY ANALYSIS MATRIX (PAM) OF GROUNDNUT

Year (1)	NPC (2)	NPCI (3)	EPC (4)	DRC (5)	SRP (6)	PC (7)
TE 1989	1.02	0.58	1.14	0.92	0.25	1.64
TE 1992	1.09	0.56	1.27	1.09	0.38	1.79
TE 1995	0.61	0.56	0.69	0.47	-0.10	1.22
Pre-WTO period	0.90	0.57	1.03	0.82	0.17	1.54
TE 1998	0.64	0.56	0.68	0.56	-0.15	0.62
TE 2001	0.55	0.60	0.53	0.44	-0.29	0.32
TE 2004	0.45	0.62	0.40	0.32	-0.46	0.15
Post-WTO	0.54	0.59	0.53	0.44	-0.29	0.36

Trade Competitiveness of Cotton

The results of trade competitiveness measures indicated that state had clear competitiveness on importable as well as exportable bases. The levels of DRCs showed that state had comparative advantage in cotton crop, which implies that imports will cost more than the domestic production (Table 6). The levels of both NPC and EPC showed that state had dis-protected the cotton crop or rather taxed producers. This is also evident from the levels of SRP coefficient, which are negative. The results supported the findings of Gulati and Sharma (1997) and Gulati (2002). The steep increase in yield during the past few years increased competitiveness of cotton further; hence there is a lot of scope for future expansion of area under the crop.

TABLE 6. RESULTS OF POLICY ANALYSIS MATRIX (PAM) OF COTTON

Year (1)	NPC (2)	NPCI (3)	EPC (4)	DRC (5)	SRP (6)	PC (7)
TE 1989	0.48	0.39	0.50	0.43	-0.27	0.37
TE 1992	0.40	0.41	0.45	0.40	0.04	0.31
TE 1995	0.35	0.44	0.41	0.35	-0.29	0.35
Pre-WTO period	0.40	0.41	0.45	0.39	-0.22	0.45
TE 1998	0.31	0.40	0.29	0.23	-0.48	0.17
TE 2001	0.37	0.43	0.35	0.27	-0.41	0.26
TE 2004	0.38	0.39	0.37	0.26	-0.39	0.33
Post-WTO	0.35	0.40	0.33	0.25	0.42	0.25

Impact of Economic Liberalisation on Trade and Welfare

A wide range of economic policy changes covering trade, subsidies, technological improvement affects agricultural production. Using standard partial equilibrium methods proposed by Lutz and Scandizzo (1980) and the NPC coefficients obtained above, an attempt has been made in the paper to investigate the impact of price distortions on output of each major crop produced and their consequences on the incomes of the producers, consumers and government revenues. The major objectives of price intervention policies for agricultural products are price stability, affordability to consumers, and remunerative and stable price to farmers and food security to the vulnerable sections of the society. The international prices appear to capture the opportunities open to the country through trade even though spillovers from international prices are not easy to measure, since even relatively homogeneous commodities often show a large variation in international prices. These prices may be widely fluctuating and may themselves be affected by domestic distortions. Thus, while world markets are the natural forum to appraise the value of tradable commodities, care has to be exercised in selecting a system of border prices that would meaningfully apply to a specific commodity of the region.

In the present study, the partial equilibrium methods and formulae shown under the methodology chapter were applied to evaluate the real and monetary effects of price intervention for important crops namely, rice, maize, groundnut and cotton produced in Andhra Pradesh. In order to assess the impact of liberalisation of trade in agriculture on the producers and consumers, an analysis was carried out for the year 2004-05. These are based on the elasticities and the estimated nominal protection coefficients. The empirical estimates of welfare impact of liberalisation are depicted in Tables 7, 8 and 9.

TABLE 7. NET MONETARY EFFECTS OF PRICE DISTORTIONS IN
SELECTED CROPS OF ANDHRA PRADESH

Commodity (1)	Net monetary effect due to price distortion			Net effect of liberalisation on welfare		
	NSLp (2)	NSLc (3)	NSL (4)	Estimated welfare gain to producers WGp (5)	Estimated welfare loss to consumers WCc (6)	Net effect of liberalisation on the welfare in the state
						(7)
Rice	13262	2671	19218	602764	587138	15626
Maize	6475	436	6911	96465	89554	6911
Groundnut	63232	NC	545261	NC	NC	NC
Cotton	372216	NC	2000000	NC	NC	NC

NSLp-net social loss in production; NSLc-net social loss in consumption; NSL-total net social loss; Note: NC: Not computed as these products under go considerable transformation before final consumption.

The net social losses in production and consumption critically depend on the extent of production and on the elasticities. The net social loss in the production of

cotton was higher (Rs. 372216 lakhs) under existing WTO provisions. However, the net social loss in the production was least in the case of maize (Rs. 6475 lakhs), whereas net social loss in consumption was Rs. 436 lakhs (Table 7). Analogously, consumers in the state incur substantial welfare loss due to price distortions in rice (Rs.587138 lakhs) and maize (Rs. 89554 lakhs). Thus, the net effect of liberalisation on welfare in the state was substantial amounting to Rs. 15626 lakhs in rice and Rs. 6911 lakhs in maize during the period 2004-05.

TABLE 8. EFFECT OF LIBERALISATION ON AGRICULTURAL TRADE

Commodity (1)	Increase in price (per cent) (2)	Increase in supply (lakh tonnes) (3)	Decrease in demand (lakh tonnes) (4)
Rice	45	4.32	0.87
Maize	72	2.97	0.20
Groundnut	175	4.30	0.15
Cotton	284	12.43	12.43

The gross real effects of the price distortions are often sizable, since production and consumption are opposite. They are additive with respect to trade effects. For Andhra Pradesh the liberalisation of agriculture would result in change in production due to changes in prices. The international price adjusted for transfer cost are high in all the four commodities at 45 per cent for rice, 72 per cent for maize, 175 per cent for groundnut and 284 per cent for cotton compared to the domestic prices during the post-liberalisation period (2004-05). These higher world prices would result in incremental increase in domestic production of all the four commodities to the extent of 4.32 lakh tonnes, 3.03 lakh tonnes, 4.3 lakh tonnes and 12.43 lakh tonnes respectively for rice, maize, groundnut and cotton (Table 8). Consequently, higher international prices will have negative impact on the consumption levels, which would result in a decrease in the consumption of rice by 0.87 lakh tonnes and maize by 0.2 lakh tonnes.

Further, the distortions in domestic prices would result in a change in revenue to producers and consumers. The welfare gains in all the commodities were much larger than the respective welfare losses. The liberalisation of agriculture will have a positive impact on the producers of the commodities, which command higher international price. In the case of consumers, increase in price of commodity necessitates them to pay more, which is considered as a loss.

The welfare gains will be very high in the case of cotton at 365.42 per cent of total value of production. The producer gain of maize was at 78 per cent of its value of production. The welfare gain to producers in case of rice and groundnut were at 46 and 23 per cent respectively (Table 9).

TABLE 9. GAINS AND LOSSES DUE TO PROJECTED CHANGES IN PRICES DUE TO LIBERALISATION

Commodity (1)	Value of production at PP (v) (₹ in lakhs) (2)	Per cent of WGp to value of production (3)	Value of consumption at PC (w) (₹ in lakhs) (4)	Per cent of WGc to value of consumption (5)
Rice	1315337	46	1889562	38
Maize	124046	78	211963	42
Groundnut	274860	23	NC	NC
Cotton	460776	365	NC	NC

Note: NC: Not computed as these products under go considerable transformation before final consumption.

Consumption gains and losses were not calculated for groundnut and cotton, since these products undergo considerable transformation before consumption and the average consumption of each type is not available. But it can be inferred based on price distortions that the welfare loss of consumers in groundnut and cotton could be substantial as indicated by higher international prices. There are however some limitations in the above analysis. First, we are not explicitly considering the quality and usually, high quality products in the domestic market will attract higher prices, which will increase the domestic price, thereby increasing the NPC. Second, the single estimated elasticities were not used for calculation of welfare gains and losses. However, a range of elasticities would have provided better results for comparison and the present results provide an average picture. And lastly, due to non-availability of correct data on consumption, it is assumed that whatever is produced is consumed. In general, due to liberalisation there will be increase in domestic price, which tends to increase in supply and decrease in demand that may create surpluses in the state. This will necessitates exploring new markets and expanding existing markets with appropriate trade promotion measures

V

POLICY IMPLICATIONS

Based on the results of the study the following commodity-specific policy recommendations are made. In view of dismantling of quantitative restrictions on textile exports, India stands to gain substantially through cotton trade. In order to be competitive in the world market, it is imperative to ensure domestically the high quality long staple cotton, which is currently being sourced from other countries. Hence, efforts need to be directed towards the production of high quality long staple cotton, which will also overcome the present quality problems in the form of short staple and other quality problems, which are coming in the way of enhancing Indian cotton exports. Efforts should also be made to reduce the cost of production of cotton to sustain the competitive edge of Indian cotton on a long-term basis. The spread of Bt cotton in to even drylands will help in reducing costs and risks in the cultivation, hence there is a need for increasing seed availability of Bt hybrid cotton at affordable prices. There is vast scope for augmenting exports of superfine quality rice like vijaya

masuri, sona masuri (non-basmati), particularly to the countries where Indian ethnic groups are in large numbers. However, the Indian exports are bogged down by quality problems and inadequate efforts to clear doubts about the quality of Indian superfine rice. Further, efforts may be directed to reduce the cost of production through SRI (System of Rice Intensification) rice cultivation and resource saving technology to increase competitiveness of the crop. Area under groundnut in the state is declining due to stagnant and highly fluctuating real prices of groundnut and imports of cheap palm oil and soya oil which are direct substitutes. The results of the study suggest that groundnut production in the state suffers due to negative incentives evidenced by an adverse SRP. Hence, to increase production and exports there is need for supply of certified seeds of newly released improved varieties (it is noted that still 30 year old variety TMV-2 dominates the large area, which needs to be replaced with new varieties like ICGV-91114, K-6 which are proved high yielding and resistant to common diseases and pests) and adoption of low cost and risk reducing technology with the support from the state. Further, Andhra Pradesh has export competitiveness in rice, groundnut and cotton. Hence all efforts should be made to increase the production and productivity of these crops. The state should encourage enhancing the exports of these commodities through establishment of export facilitating centre for farmers at the state level.

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