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Article

Effects of Government Price Policies on Major Agricultural Commodities in Andhra Pradesh, India

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Abstract: This study was concerned with analysis of export competitiveness and quantification of impact of price policies in Andhra Pradesh, using Policy Analysis Matrix and Partial Equilibrium Model in the Marshallian economic surplus framework. The findings from Policy Analysis Matrix revealed that, on the input side, the farmers are more subsidized for rice and maize, as Nominal Protection coefficient on Tradable Inputs are less than one across all the major importing countries (unlike for chickpea, cotton lint and chilies (dry)). On the output side (Nominal Protection coefficient on Tradable output), the farmers producing rice, maize and chilies (dry) are more protective compared to social prices. Considering both input and output policies together, the farmers are simultaneously protective (Effective Protection Coefficient) for rice and maize and hence, the overall transfer from society to farmers is positive (Subsidy Ratio to Producers). The findings from Partial Equilibrium Model showed that total net social loss was found to be positive implying protectionism favored the farmers across all the selected commodities. Further, the net social loss in production turned out to be positive confirming the main postulate of this study, a price greater than the equilibrium price will reduce the quantity demanded. The protectionist policies further led to a positive effect of trade liberalization on the welfare in the State and an increase in foreign exchange earnings, except for chickpea. Unlike farmers, consumers in Andhra Pradesh suffered welfare loss due to higher domestic prices over border prices for rice, maize and chilies (dry).

Keywords: price policies; protectionism; nominal protection coefficient on tradable output; welfare gains or loss; net social loss; trade liberalization; Andhra Pradesh

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1. Introduction

India is one of the major players in the agriculture sector world-wide and it is the primary source of livelihood for about 58 percent of its population. However, this sector's contribution to Government revenue is minimal, despite it enjoys net exporter status and contributes considerable foreign exchange. In 2020–21, the net agricultural exports from India accounted for Rs 1.54 lakh crore and the percent share of agricultural exports to national exports was 14.30 and these two parameters showed increasing trend since past one decade. Though the country experienced both weather-related challenges (drought, floods, etc.) and COVID-19 pandemic, still the agriculture sector showed resilience against these shocks, as it grew at 3.6 per cent in 2020–21 and improved to 3.9 per cent during 2021–22.

Andhra Pradesh is one of the top performing States in India in terms of consistency. The State is extending several landmark decisions for the welfare of farming community such as interest free loans, free crop insurance scheme, free electric power during daytime for crop cultivation, subsidized inputs, testing of Agri-inputs, direct money transfer, etc., so as to continue them in farm business. The valuation of agriculture exports from the State is around the 0.16 lakh crore and it accounts for 16.65 percent of total exports during 2020–21 (Statistical Abstract, 2021). Based on global export trends and considering agricultural exports as one of the engines for economic growth, the Government sees agricultural exports as the priority area for economic development of the State.

The trade liberalization offered several opportunities and challenges to the farmers and other stakeholders in the supply chain of agricultural commodities to ensure export competitiveness. Rice, maize, chickpea, cotton and chilies (dry) are the major food grains and commercial crops cultivated in Andhra Pradesh. These commodities should compete with the major importing countries, provided they are cost-effective, high quality, different from competing products, acceptable to consumers at affordable prices. The provision of input and output subsidies by the importing countries definitely contributes to their export competitiveness. So, in analyzing the competitiveness of commodities, it helps to ascertain whether their comparative advantage in the markets also has a competitive advantage. It also helps to identify incentive policy choices to further enhance the comparative advantage so as to become a competitive exporter of the selected commodities in the outside markets. Further, the Government's active participation in production, marketing and price policies in agriculture will certainly influence the welfare gains or losses to the farmers, consumers and also exert an influence on the Government revenue. In India, though agriculture is a state subject, agricultural policy is formulated at the national level and state formulates its policy accordingly. The agricultural policy starts from announcing Minimum Support Prices (MSP) for supporting production, procuring output and distributing the same to the public at issue prices. These price interventions are assumed to generate Government revenue, lead to internal price stability and supply of commodities at affordable prices to the population Below Poverty Line (BPL). From input side, the Government intervenes through subsidizing prices, crop insurance programs, liberal credit at low rates of interest, power and irrigation water subsidies etc., to make the farmers continue production. These price distortions are often followed as protectionist policies by the Government; but they exert considerable influences on welfare of farmers, consumers and Government. The body of literature highlights that the more the degree of protectionism, the more volatility in prices in the international market (Johnson, 1975; Johnson, 1950; Shei & Thompson, 1977). So, these protectionist policies frequently change suiting to international market environment and this requires quantification of their effects on the production and consumption of major agricultural commodities in Andhra Pradesh. Even the welfare and distribution effects of the consumers at the expense of farmers also should be addressed. In this context, this study analyzes the export competitiveness of selected commodities and impact of price policies of the State on welfare gains and losses for farmers, consumers and Government revenue.

2. Review of Literature

According to Ogbe et al. (2011), the findings from Policy Analysis Matrix (PAM) revealed that outputs are taxed for production of rice and maize in Nigeria. Both Effective Protection Coefficient (EPC) and Subsidy Ratio to Producers (SRP) confirmed that production of these two commodities is subsidized on the use of tradable inputs. This contributed towards higher competitiveness at the farm level (under irrigated rice, upland rice and upland maize) and a strong comparative advantage. PAM is used to analyze the impact of intensifying rice production systems in Southeastern Nigeria (Ugochukwu & Ezedinma, 2011) and profitability of rice farming in India (Kanaka et al., 2015). Souza et al. (2017) combine primary data from representative companies and secondary data to make economic and accounting evaluations of the rice production chain in Rio Grande do Sul (Brazil) and Uruguay. Soejono et al. (2020) analyzed the comparative and competitive advantages of Pronojiwo snake fruit using PAM. The results showed that Pronojiwo snake fruit farming has comparative and competitive advantages or strong competitiveness. So, the strategies to promote export competitiveness of Pronojiwo snake fruit are to maintain product quality and promote effective means of transportation. The study from Adesiyan et al. (2018) showed that yam, rice and cassava production generate a positive private and social profits with the highest in cassava and lowest in yam production. Similarly, government interventions have had a negative effect of about 20, 75 and 17 percent on prices of yam, rice and cassava, respectively below their world prices. This study concludes that the food production system is competitive and therefore profitable under the prevailing policy framework in Nigeria if value is added.

Raghavendra analyzed the price distortion effects on major crops viz., rice, maize and red gram in Karnataka through employing Partial equilibrium Model (PEM). The consequences of price distortion had positively influenced the welfare gains for producers, unlike consumers. The net effect of trade liberalization on the State was positive with respect to all the selected commodities. Reddy et al. (2005) studied the effects of price distortions on rice in Karnataka in the context of free trade. They concluded that loss to society due to free trade was Rs. 5,800 million and due to inefficient production from a price rise was Rs. 4,200 million. As rice is export competitive during the post-liberalization period (2001–02), there is increase in domestic production of rice by 0.453 million tonnes. Consequently, there is decline in rice consumption by 0.799 million tonnes. Rajesh et al. (2006) conducted cointegration tests and spatial integration of Indian major pepper and cardamom markets during pre- and post-liberalization era by using maximum likelihood method of cointegration. The results suggested that liberalization has improved the transmission of

price signals of pepper both in domestic and international markets. On the contrary, the cardamom price is poorly integrated with the international prices, indicating its non-decisive role in influencing the trade at international level. Usharani (2008) concluded that the loss for consumers of rice due to liberalization was Rs. 267.1 million and for maize, it was Rs. 43.6 million. The welfare gains to producers were higher for cotton at 365.42 percent (Rs. 168380.7 million) of total value of production, from maize it was at 77.76 percent (Rs. 9646.5 million), for rice 45.82 percent (Rs. 60276.4 million) and for groundnut it was 23 percent (Rs. 54526.1 million). Fathelrahman et al. (2021) studied the impact of food trade liberalization in India, Egypt, Pakistan, Saudi Arabia, and the United Arab Emirates (UAE) using the PEM-World Integrated Trade Solution (WITS). The simulation results showed that welfare gains for consumers are higher for India, Egypt, and Pakistan with 2571, 340, and 25 million USD, respectively compared to Saudi Arabia and the UAE with 14 and 17 million USD. These findings reflected that with a reduction in tariffs, there are considerable welfare impacts for consumers across the selected countries.

3. Materials and Methods

3.1. Policy Analysis Matrix (PAM)

This technique was employed to measure divergences between private and social valuations of revenues, costs, and profits during TE 2020–21. In this study, the inputs for production of selected commodities were disintegrated into tradable inputs and non-tradable inputs. For this study, tradable inputs include - seeds, fertilizers (nitrogen, phosphate and potash), plant protection chemicals, and depreciation on machinery were considered, while non-tradable inputs include - human labor, bullock labor, machine labor, irrigation, farmyard manure, imputed rental value of land. In this study, the social price is computed based on the importable hypothesis.

Table 1. Illustrative PAM.

Year	Revenues	Costs		Profit
		Tradable inputs	Non-tradable inputs (Domestic factors)	
Private prices	A = $p_i^p q_i^p$	B = $\sum a_j p_j^p q_j^p$	C = $\sum b_k p_k^p q_k^p$	D = A – B – C = π^p
Social prices	E = $p_i^s q_i^s$	F = $\sum a_j p_j^s q_j^s$	G = $\sum b_k p_k^s q_k^s$	H = E – F – G = π^s
Divergences	I = A – E	J = B – F	K = C – G	L = D – H = I – J – K

Source: (Monke & Pearson, 1989).

In the above table, A = private revenue, B = tradable input cost (*e.g.,* fertilizer, herbicides, pesticides, seeds, and so on), C = domestic factor cost such as land, labor, capital, *etc*., D = private profit, E, F, G and H are social values of A, B, C and D respectively. The divergences denoted by letters I, J, K and L were explained in the ensuing pages. Quantities of inputs and outputs with their respective unit prices, exchange rate, Free on Board (FOB), tariff, transport costs *etc*. were inputted into PAM software, which produced the PAM results. Others are p_i^p = price of output in private prices, q_i^p = quantity of output in private prices, a_j = tradable input coefficients, p_j^p = price of tradable input in private prices, q_j^p = quantity of tradable input in private prices, b_k = domestic input coefficients, p_k^p = price of domestic input in private prices, q_k^p = quantity of domestic input in private prices, π^p = private profit, p_i^s = output price in social prices, q_i^s = quantity of output in social prices, p_j^s = tradable input price in social prices, q_j^s = quantity of tradable input in social prices, p_k^s = domestic input price in social prices, q_k^s = quantity of domestic input in social prices, π^s = social profit. These quantities in the PAM are used to compute the following measures of protection incentives that cast light on export competitiveness and how these are affected by Government policies:

Nominal Protection Coefficient on Tradable Inputs (NPCI) = B/F
Nominal Protection Coefficient on Tradable Outputs (NPCO) = A/E
Effective Protection Coefficient (EPC) = (A-B)/(E-F)
Subsidy Ratio to Producers (SRP) = L/E

For selected commodities, five competing countries (export competitiveness) based on leading imports from India were identified (Table 2) and the divergence was studied from the perspective of Andhra Pradesh.

Table 2. Selected competing countries for measuring divergence of exports from Andhra Pradesh (TE 2020-21).

Commodities	Major importing countries
Rice	Saudi Arabia, Iran, Benin, Nepal, Iraq
Maize	Bangladesh, Nepal, Vietnam, Bhutan, Malaysia
Chickpea	Algeria, UAE, Bangladesh, Nepal, Sri Lanka
Cotton	Bangladesh, China, Indonesia, Iran, Italy
Chilies (dry)	Chinese mainland, Bangladesh, Thailand, Sri Lanka, USA

The secondary data required for construction of PAM are crop yields, output, inputs used and their market prices, and output (domestic and export) prices. The data are collected from the Reports of Commission for Agricultural Costs and Prices (CACP), Cost of Cultivation Scheme of Commission for Agricultural Costs and Prices, Government of India; Directorates of Agriculture of selected States, www.indiastat.com, www.fao.org, etc. for the period 2017–18, 2018–19 and 2020–21 i.e., TE 2020–21. The domestic prices are obtained from the Agmarknet Portal, Agricultural Marketing Board, Government of India.

The social costs have been calculated using Value Marginal Product approach considering factor share (S_i) of inputs (X_i), mean values of inputs and outputs (Y) and prices (P_i) given by:

$$\begin{aligned} P_{X_i} &= \left[\left(S_i / X_i\right) * Y\right] * P_y \\ &= \frac{X_i}{\left(\sum P_i X_i / n\right)} * \frac{Y}{X_i} * P_y X_i \end{aligned} \quad (1)$$

3.2. Partial Equilibrium Model (PEM)

The welfare gains or losses both to producers and consumers are estimated using the PEM (Lutz & Scandizzo, 1980). It is known that protectionist policies of the Government show an impact on incomes of producers, consumers and Government revenues in the context of trade liberalization. In this context, PEM was employed to ascertain the welfare gains or losses to the producers, consumers and change in Government revenue. In Figure 1, supply and demand functions are drawn. It is assumed that due to price distortions, the border price (adjusted for transaction costs, OPb) is higher than domestic price, OPd. It is further assumed that OPd = consumer price (OPc). The difference between OPd and OPb i.e., PdPb represents the tax imposed on the imported commodity. Following this representation, we arrive at different formulae as given below.

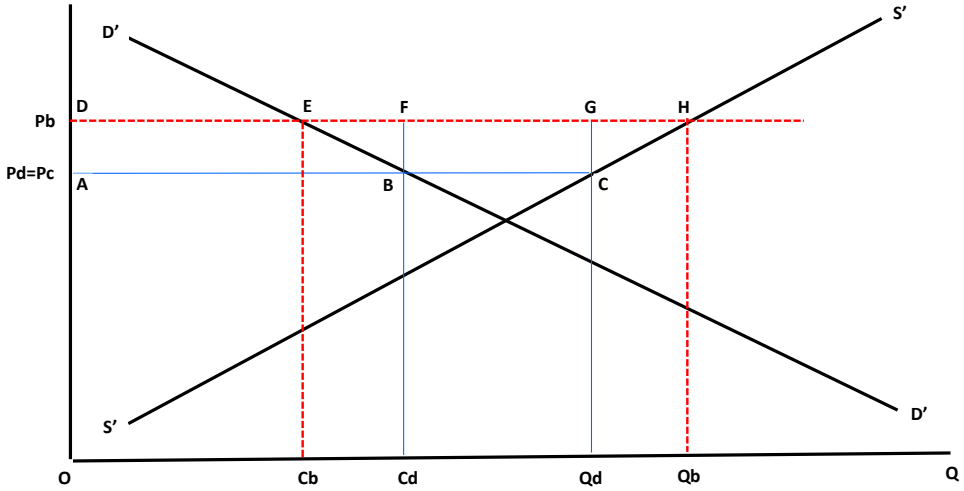

Figure 1. Partial equilibrium theory of trade (government price policy effects).

- Net Social (Economic) Loss in production (NSLp) = 1/2(Qb–Qd) (Pb–Pd) = CHG
- Net Social (Economic) Loss in Consumption (NSLc) = 1/2(Cb–Cd)(Pb–Pc) = BFE
- Total Net Social Loss (NSL) = NSLp – NSLc = CHG + BFE
- Welfare (Loss or) Gain of producers or farmers (WL/Gp) = Qd(Pd-Pb) – NSLp = ACHD (Loss)
- Welfare (Loss or) Gain of consumers (WL/Gc) =Cd(Pb-Pc) – NSLc = ABED
- Change in Government revenue (ΔG) = (NSLp + NSLc) – WGp – WGc = BCGF
- Change in Foreign Exchange Earnings (ΔFEE) = Pb(Qb-Qd+Cd-cb) = CbCFE & QdQbHG (Losses)
- Net effect of liberalization on welfare in the State = Qd(Pd-Pb) – Qd(Pb-Pc)

where,
Qb = Quantity of production at border prices
Qd = Quantity of production at domestic prices
Pb = Border prices (adjusted for transaction costs)
Pd = Domestic market price
Pc = (Retail) price for consumers in the domestic market
Cb = Quantity of consumption at border prices
Cd = Quantity of consumption at domestic prices

For analysis, the demand and supply elasticities are assumed based on the past studies of Aayog (2018), Reddy (1997), and Lutz & Scandizzo (1980).To arrive at production values, Minimum Support Prices (MSPs) or wholesale market prices (chilies (dry) of selected commodities are considered, while for consumption values, retail prices were used. The border prices of selected commodities are derived from respective international prices after adjusting the transaction costs. The changes in quantities produced and consumed resulting from changes of domestic prices to their respective border price equivalents are calculated as follows:

$\Delta Q_i = nS_i * (\Delta P_i/P_i)*Q_i$
$\Delta C_i = nD_i * (\Delta P_i/P_i)*C_i$

where,
$\Delta Q_i = (Q_{ib} - Q_{id})$ = Change in quantity of commodity 'i' produced
$\Delta C_i = (C_{id} - C_{ib})$ = Change in quantity of commodity 'i' consumed
$\Delta P_i = (P_{ib} - C_{id})$ = Change in price of commodity 'i'
ηS_i = own price elasticity of supply for commodity 'i'
ηD_i = own price elasticity of demand for commodity 'i'

The active intervention in the form of price policies by the Government in production, marketing and consumption of the above commodities is pervasive. Further, the level and nature of intervention vary across these crops, and this helps to evaluate their appropriateness in achieving policy goals. Accordingly, the concept of economic surplus was used in estimating the production and consumption effects, efficiency effects, welfare and distribution effects resulting from Government's policies with respect to selected crops. This helps to discuss the relevance of the findings to the formulated policies and thus, enable to design improved policy in the ensuing future.

4. Results and Discussion

4.1. Measures of Protection Incentives

4.1.1. Nominal Protection Coefficient on Tradable Inputs (NPCI)

The NPCI is less than one with respect to all the selected countries for rice (0.33) and maize (0.68) implying that the farmers are more subsidized or less taxed in Andhra Pradesh (Table 3). That is, both rice and maize farmers in Andhra Pradesh pay for tradable inputs lower than they should in a perfectly competitive market when compared to selected countries. However, NPCI is more than one with respect to all the selected countries for chickpea (5.19), cotton lint (3.17) and chillies (dry) (2.82) inferring that the farmers of above three crops are less subsidized or more taxed in Andhra Pradesh and hence, they pay for tradable inputs higher than they should in a perfectly competitive market when compared to respective competing countries. These findings are in agreement with the works of Adesiyan et al. (2018), Ahmed (2016), and Soejono et al. (2020).

Table 3. Measures of protection incentives of selected commodities from Andhra Pradesh across major importing countries (TE 2020–21).

Indicators	Rice					Maize					Chickpea				
	Andhra Pradesh & Saudi Arabia	Andhra Pradesh & Iran	Andhra Pradesh & Benin	Andhra Pradesh & Nepal	Andhra Pradesh & Iraq	Andhra Pradesh & Bangladesh	Andhra Pradesh & Nepal	Andhra Pradesh & Vietnam	Andhra Pradesh & Bhutan	Andhra Pradesh & Malaysia	Andhra Pradesh & Algeria	Andhra Pradesh & UAE	Andhra Pradesh & Bangladesh	Andhra Pradesh & Nepal	Andhra Pradesh & Sri Lanka
NPCI	0.33	0.33	0.33	0.33	0.33	0.68	0.68	0.68	0.68	0.68	5.19	5.19	5.19	5.19	5.19
NPCO	1.00	1.08	1.14	1.12	1.18	1.34	1.28	1.21	1.03	1.19	0.70	0.89	0.90	0.98	0.73
EPC	1.09	1.19	1.26	1.24	1.33	1.51	1.43	1.33	1.09	1.30	0.57	0.74	0.75	0.82	0.61
SRP	0.43	0.54	0.62	0.60	0.69	0.66	0.59	0.50	0.27	0.47	−0.70	−0.62	−0.62	−0.58	−0.69

Table 3. *Cont.*

Indicators	Cotton Lint						Chillies (Dry)			
	Andhra Pradesh & Bangladesh	Andhra Pradesh & China	Andhra Pradesh & Indonesia	Andhra Pradesh & Iran	Andhra Pradesh & Italy	Andhra Pradesh & Chinese mainland	Andhra Pradesh & Bangladesh	Andhra Pradesh & Thailand	Andhra Pradesh & Sri Lanka	Andhra Pradesh & USA
NPCI	3.17	3.17	3.17	3.17	3.17	2.82	2.82	2.82	2.82	2.82
NPCO	0.97	1.01	1.05	0.95	0.91	1.10	1.20	1.06	0.94	1.06
EPC	0.89	0.92	0.97	0.87	0.84	0.86	0.95	0.82	0.72	0.82
SRP	−0.31	−0.29	−0.26	−0.33	−0.35	−0.38	−0.33	−0.41	−0.48	−0.41

4.1.2. Nominal Protection Coefficient on Tradable Outputs (NPCO)

NPCO for Andhra Pradesh is ≥ 1.00 with respect to all the selected countries for rice, maize, chilies (dry) and cotton (China and Indonesia only), implying that the price policies offered by the Government of Andhra Pradesh are more protective to the above farmers thereby, they receive a higher price compared to social (shadow) price(s) (Table 3). For example, with respect to Iraq (1.18), the Government policy in Andhra Pradesh is able to maintain the price of rice at a rate of 18 percent higher than social (shadow) price. This shows that farmers in Andhra Pradesh get 18 percent higher profit than social price of Iraq. However, with respect to chickpeas for all the selected countries and cotton lint (Bangladesh, Iran and Italy), NPCO is <1.00, indicating that the price policies of Andhra Pradesh are less protective to these farmers. For example, with respect to Bangladesh (0.97), the Government policy in Andhra Pradesh is able to maintain the price of cotton lint at a rate of 3 percent lower than social (shadow) price. This indicates that the farmers in Andhra Pradesh get 3 per cent less profit than social price of Bangladesh.

4.1.3. Effective Protection Coefficient (EPC)

EPC is ≥ 1.00 across all the selected countries for rice and maize indicating that the policies in Andhra Pradesh are simultaneously protective (input and output side policies together) in the production of above two commodities (Table 3). For example, with respect to Iraq (1.33), the combination of input and output policies is more effective in protecting rice production in Andhra Pradesh, as the farmers derive 33 percent higher profits over social prices. However, for chickpeas, cotton lint and chillies (dry), EPC < 1.00 thereby, farmers are simultaneously less protective in terms of input and output side policies together. This also indicates that the farmers are more taxed. The empirical findings of NPCI, NPCO and EPC showed interesting resemblance with previous studies of Amao et al. (2015); Poernomo (2018); Saptana et al. (2022).

4.1.4. Subsidy Ratio to Producers (SRP)x

The SRP is positive for Andhra Pradesh with respect to all the selected countries for rice and maize. This indicates the overall transfer from society to farmers (Table 3). However, for chickpeas, cotton lint and chilies (dry), the SRP is negative indicating that these farmers are more taxed in their production and hence, there is decrease in gross revenue.

4.2. Impact of Price Policies of the Government

4.2.1. Welfare Gains or Losses to Producers and Consumers

The empirical estimates (Tables 4 – 6) are based on the supply and demand elasticities and on average NPCOs computed earlier. Unfortunately, estimates of the price elasticities of supply and demand for the selected commodities viz., rice, maize, chickpea, cotton and chillies (dry) are not readily available for Andhra Pradesh. Also, these elasticities could not be calculated because of data limitations. Therefore, assumptions about the potential ranges of these basic parameters were made by examining the substantial empirical evidence that is available for other States in India and developing countries. Furthermore, low and high ranges of the elasticities are used because of the wide variation in existing elasticities estimates in the available literature. Supply elasticities estimates for selected commodities range between 0.23 to 0.95 and demand price elasticities range between − 0.45 to − 0.70 (Aayog, 2018; Reddy, 1997; Lutz & Scandizzo, 1980) .Thus, these low and high ranges of supply and demand elasticities were adopted for the selected commodities in this study. The NPCO (average) estimates for the selected commodities are obtained from PAM calculated earlier under Section 4.1.

The net monetary effects (Table 4) revealed that the loss to society due to liberalization during TE 2020–21 in terms of consumption of rice was Rs. 4258.9 lakh (higher compared to 2004–05); for maize it was Rs. 394.7 lakh (lesser compared to 2004–05), Rs. 4.5 lakh for chickpeas and Rs. 657.1 lakh for chilies (dry). The loss to society due to inefficiency in production was Rs. 3774.9 from rice (lesser compared to 2004–05); Rs. 497 lakh from maize (lesser compared to 2004–05); Rs. 505.1 lakh from chickpeas; Rs. 11.5 lakh from cotton and Rs. 357.1 from chilies (dry). From the findings it is clear that the NSLP is highest for rice and least for cotton. Similarly, NSLC is highest for rice (Rs. 4258.9 lakh). The net social losses in production and consumption critically depend on production and elasticities. Regarding Total NSL, it was highest from rice (Rs. 8033.7 lakh) followed by chilies (dry) (Rs. 1014.3 lakh), maize (Rs. 891.7 lakh) and chickpeas (Rs. 509.6 lakh). So, distortion in domestic prices resulted in a change in revenue to producers and consumers. It is interesting that welfare gains for rice, maize and chilies (dry) producers are much higher than their respective Total NSL.

Table 4. Net monetary effects of price distortions in selected crops of Andhra Pradesh (TE 2020-21) (Rs. Lakh).

Crop	NPCO		NSLP		NSLC		Total NSL		Estimated WL/GP		Estimated WL/GC		Net Effect of Trade Liberalization on the Welfare in the State	
	2004–05*	TE 2020–21	2004–05	TE 2020–21	2004-05	TE 2020–21	2004–05	TE 2020–21	2004–05	TE 2020–21	2004–05	TE 2020–21	2004–05	TE 2020–21
Rice	0.57	1.11	13262.4	3774.9	2670.9	4258.9	19218.2	8033.7	602763.8	76368.7	587137.5	−94677.7	15626.3	189081.9
Maize	1.07	1.21	6474.6	497.0	436.0	394.7	6910.6	891.7	96465.0	5230.4	89554.4	−4942.9	6910.6	14308.9
Chickpea		0.84		505.1		4.5		509.6		−5808.4		42.9		−5698.2
Cotton#	0.35	0.98	372216.4	11.5	-	-	-	-	1683807.4	−1030.6	-	-	-	--
Chilies (dry)		1.07		357.1		657.1		1014.3		10277.3		−20225.3		32621.2

Note: # - Consumption gains and losses not calculated for cotton, since the product undergoes considerable transformation before reaching the consumer and per capita consumption data of each product are not available
* - Usharani (2008).

Table 5. Effect of liberalization on agricultural trade—Gross real effects of price distortions (TE 2020–21).

S.No	Crop	Domestic Price vs Border Price (%)		Consumer Price vs Border Price (%)	Increase/Decrease in Supply (Lakh Tonnes)			Increase/Decrease in Demand (Lakh Tonnes)			ΔG (Rs. Lakh)	ΔFEE (Rs. Lakh)
		2004–05*	TE 2020–21		2004–05	TE 2020-21		2004–05	TE 2020–21		TE 2020–21	TE 2020–21
						Low (0.23)	High (0.95)		Low (−0.45)	High (−0.70)		
1.	Rice	45	10.4	14.1	4.32	−2.84	−11.71	0.87	6.05	9.42	26342.7	12340.9
2.	Maize	72	21.0	31.5	2.97	−0.71	−2.94	0.20	1.02	1.58	604.2	2224.7
3.	Chickpea		−16.0	−1.2		0.23	0.96		−0.003	−0.01	6275.1	−5555.8
4.	Cotton	284	−2.2	−0.5	12.43	0.04	0.18	12.43	−0.02	−0.03	1042.1	−10.4
5.	Chilies (dry)		7.2	14.9		−0.12	−0.51		0.41	0.64	10962.3	1091.2

Note: * - Usharani (2008).

Table 6. Gains or Losses due to projected changes in prices of selected commodities in Andhra Pradesh (TE 2020–21).

Crop	Value of Production at Pd (Rs. Lakh)		% of Estimated WL/GP in Value of Production at Pd		Value of Consumption at Pb (Rs. Lakh)		% of Estimated WL/GC in Value of Consumption at Pb	
	2004–05*	TE 2020–21	2004–05	TE 2020–21	2004–05	TE 2020–21	2004–05	TE 2020–21
Rice	131533	850754.58	45.82	8.98	1889561.6	698017.24	37.84	−13.56
Maize	124046	33000.73	77.76	15.85	211962.8	22539.94	42.25	−21.93
Chickpea		27842.22		−20.86		39458.93		0.11
Cotton	460776	45306.33	365.4	−2.27				
Chillies (dry)		158334.78		6.49		137780.18		−14.68

Note: * - Usharani (2008).

4.2.2. Production and Consumption Effects

The gross real effects of the price distortions are often sizable. Since production and consumption effects have opposite signs, they are additive with respect to trade effects. Where no Government subsidies are involved, price distortions lead to a reduction in trade; but export or import subsidies cause an expansion of trade. For Andhra Pradesh, the liberalization of agriculture would result in change in production due to changes in prices. Border prices were lesser by 10.4, 21 and 7.2 percent compared to their respective domestic prices (Table 5) during TE 2020–21 for rice, maize and chilies (dry). This would result in an incremental decline in their domestic production i.e., reduction in rice production of between 2.84 lakh tonnes to 11.71 lakh tonnes; maize production between 0.71 lakh tonnes to 2.94 lakh tonnes and chilies (dry) production between 0.12 lakh tonnes to 0.51 lakh tonnes. This is because lower border prices would discourage domestic production of these crops. These low and high estimates correspond to the assumed low and high supply elasticities for each commodity. These findings for rice and maize are in contrast to the findings of 2004–05 (Usharani, 2008). Lower border prices would have a positive impact on domestic consumption levels, and this led to an increase in the consumption of rice between 6.05 lakh tonnes to 9.42 lakh tonnes; for maize between 1.02 lakh tonnes to 1.58 lakh tonnes and chilies (dry) between 0.41 lakh tonnes to 0.64 lakh tonnes. These low and high estimates correspond to the assumed low and high demand elasticities for each commodity. However, for chickpeas and cotton, border prices are higher than domestic prices by 16 and 2.2 percent respectively during TE 2020–21. This positively influenced their domestic production from 0.23 to 0.96 lakh tonnes for chickpeas and 0.04 to 0.18 lakh tonnes for cotton respectively considering low and high supply elasticities for these commodities. Further, there will be a decline in their domestic demand between 0.003 lakh tonnes to 0.01 lakh tonnes for chickpeas and 0.02 lakh tonnes to 0.03 lakh tonnes for cotton respectively considering low and high demand elasticities for these commodities.

The results from Table 6 further showed that welfare gain to farmers as a percentage of total value of production was highest for maize at 15.85 percent (Rs. 5230.4 lakhs) followed by rice (8.98% i.e., Rs. 76368.7 lakh) and chilies (dry) (6.49% i.e., Rs. 10277.3 lakh), as domestic prices outweighed their respective border prices. However, in 2004–05, similar findings were highest for cotton at 365.42 percent (Rs. 1683807.4 lakh) and lowest for rice i.e., 45.82 percent (Rs. 602763.8 lakh) due to lower domestic prices compared to border prices. Analogously, consumers in Andhra Pradesh incur substantial welfare loss due to rise in domestic prices of rice (−Rs. 94677.7 lakh); maize (−Rs. 4942.9 lakh) and chilies (dry) (−Rs. 20225.3 lakh), unlike chickpeas (Rs. 42.9 lakh) (Table 4). So, the estimated welfare loss of consumers as a percentage of total value of consumption at border prices from rice was at 13.56 percent, 21.93 percent for maize and 14.68 percent for chilies (dry).

On the whole, there is a substantial increase in Government revenue (ΔG) due to price distortions from across all the selected commodities in Andhra Pradesh (Table 5). Rice, maize and chilies (dry) have contributed foreign exchange (ΔFEE) positively worth of Rs. 12340.9 lakh from rice, Rs. 2224.7 from maize and Rs. 1091.2 from chilies (dry), unlike chickpeas (Rs. −5555.8 lakh) and cotton (Rs. −10.4 lakh). So, the net effect on Andhra Pradesh economy due to trade liberalization was substantial amounting to Rs. 189081.9 lakh from rice; Rs. 14308.9 lakh from maize and Rs. 32621.2 lakh from chilies (dry) during TE 2020–21, unlike for chickpeas (−Rs. 5698.2 lakh) (Table 4). In view of the net importer status of chickpeas and lower border prices compared to domestic prices, the net effect of trade liberalization was negative to the tune of Rs. 5698.2 lakh. So, Government of Andhra Pradesh is encouraging the farmers to cultivate pulses to meet domestic demand and nutrition security of the mounting population and also to check imports. However, consumption gains or losses have not been calculated for cotton, since cotton is used in several forms and average use of each form is not available. However, it can be inferred that cotton farmers would gain welfare, as the border prices were slightly higher than domestic prices.

4.2.3. Efficiency Effects

The estimates of efficiency losses in production and consumption in monetary values (gross monetary effects of price distortions) are given in Table 7. The total efficiency losses to the economy are simply the sum of the NSLp and NSLc. From the table, Andhra Pradesh suffered a total efficiency loss for selected commodities ranging from Rs. 4519.1 lakh to Rs. 10076.9 lakh during TE 2020–21. So, the distorted price policies led to an efficiency loss that account for 0.02 to 0.05 percent of Agricultural and Allied sector GVA of Andhra Pradesh for the TE 2020–21 (Base = 2011–12).

Table 7. Gross Monetary Effects of Government Price Policies (TE 2020–21) (Rs. Lakh)

Crops	NSLp		NSLc		Total NSL		Estimated WL/GP		Estimated WL/GC	
	Low#	High#	Low	High	Low	High	Low	High	Low	High
Rice	868.2	3586.1	2519.8	3919.6	3387.9	7505.8	79275.3	76557.4	−87899.0	−86499.2
Maize	114.3	472.2	244.9	380.9	359.2	853.1	5613.1	5255.2	−4303.3	−4167.2
Chick-peas	116.2	479.8	0.1	0.2	116.3	480.0	−5419.5	−5783.1	47.5	47.6
Cotton	2.6	10.9	0.3	0.4	2.9	11.3	−1021.8	−1030.1	236.6	236.8
Chilies (dry)	82.1	339.3	570.5	887.4	652.6	1226.7	10552.3	10295.2	−18997.7	−18680.8
		Total			4519.1	10076.9	88999.5	85294.7	−110915.9	−109062.8

Note: # - The low and high estimates correspond to the assumed low and high supply elasticities for each commodity.

4.2.4. Welfare and Distribution Effects

A major effect of the pricing policies of the selected commodities is the differential impact of the policies on farmers and consumers. The lower commodity (domestic) prices tax farmers and benefit consumers. Farmers suffer a welfare loss as measured by the change in producers' surplus, and the consumers' welfare gain is measured by the change in consumers' surplus.

During TE 2020–21, rice, maize and chilies (dry) farmers gained an increase of welfare between Rs. 76557.4 lakh to Rs. 79275.3 lakh; Rs. 5255.2 lakh to Rs. 5613.1 lakh and Rs. 10295.2 lakh to Rs. 10552.3 lakh respectively and this is because of higher domestic prices compared to border prices (Table 7). But chickpeas and cotton farmers suffered welfare loss of Rs. 5419.5 lakh to Rs. 5783.1 lakh and Rs. 1021.8 lakh to Rs. 1030.1 lakh, as the domestic prices are lower compared to border prices. Chickpeas farmers suffered more than cotton farmers because of the relatively larger deviations in domestic prices (−16 %) of chickpeas compared to its border prices. Across all the commodities put together, welfare gain for farmers was Rs. 85294.7 lakh to Rs. 88999.5 lakh during TE 2020–21.

Consumers gained an increase of welfare between Rs. 47.5 lakh to Rs. 47.6 lakh and Rs. 236.6 lakh to Rs. 236.8 lakh for chickpeas and cotton respectively over the same period. So, the magnitude of the welfare loss to farmers was larger than the consumers' welfare gains for these two commodities. However, the consumers of rice (14.1%), maize (31.5%) and chilies (dry) (14.9%) suffered welfare losses due to larger deviations of consumer (retail) prices compared to their respective border prices, unlike chickpeas (−1.2%) and cotton (−0.5%). Across all the commodities together, the total loss of consumers' welfare was Rs. 109062.8 lakh to Rs. 110915.9 lakh during TE 2020–21. So, the magnitude of net loss of consumers' welfare compared to welfare gain of farmers is approximately higher by Rs. 21916 lakh to Rs. 23768 lakh during TE 2020–21 and this implies welfare transfers from consumers to farmers.

Based on the evidence provided by the analysis, the above welfare transfers are 2.35 to 4.85 times less than the efficiency losses (Total NSL). Therefore, the largest impact of the pricing policies occurred as welfare transfers from consumers to farmers. Considering the Below Poverty Line (BPL) category population in Andhra Pradesh, (137 lakh families; Socio-Economic Survey, 2020–21), the price policies have alleviated the existing unequal income distribution. Farmers and rural people being the poorest sections of the population, the price policies have increased their income position of the poor and improved their standard of living.

The analysis further illustrates the existence of harmony between the Government's stated objectives and the policy measures undertaken. So, the objectives of increased production of rice, maize and chilies (dry), improved standards of living and welfare of farmers and increased nutritional well-being of the population from increased food production seem to have been furthered by the price policies pursued during the period TE 2020–21. However, the price policies reduced the production of chickpeas and cotton and especially the State still continued to be net-importer of chickpeas to adjust its domestic supply and demand. However, from consumers' side, it will be appropriate to offer more food subsidies on rice and explore other mechanisms for efficient supply of chickpeas to poor consumer groups (BPL) to ensure nutrition security.

5. Summary and Conclusions

The results from PAM revealed that NPCIs are < 1 for rice and maize and NPCOs are >1 for rice, maize and chilies (dry) and these reflect that the farmers are more protected compared to social prices. So, the Government can enhance subsidies for chickpeas, cotton lint and chilies (dry) to enhance comparative advantage through cost-effective and quality production. As the farmers

producing chickpeas, cotton, lint and chillies (dry) are taxed on domestic input, the Government should reduce taxes and provide incentives for farmers to boost their comparative advantage. So, it is necessary to distribute certified superior seeds, complete and balanced fertilization, organic fertilizers, mechanization, etc., on subsidized basis to enhance quality output. However, unfavorable exchange rates, domestic and export price fluctuations need to be addressed to make the inputs and output available at favourable prices. It is essential that for the importing countries, where the market size for selected commodities is increasing, it provides Andhra Pradesh an incentive to increase their area and production and an opportunity to increase the exports. Hence, Government initiatives are needed to produce the commodities with desired international standards preferred by the importers.

The findings from PEM revealed that Government policy led to increase in domestic prices of rice, maize and chilies (dry) relative to their equivalent border prices. Consequently, domestic farmers were less taxed by the price policy, while the consumers lost from the increased prices. So, these price policies have led to increase in their production. However, in case of chickpeas and cotton, Government policy has lowered their domestic prices compared to their respective equivalent border prices and hence, domestic farmers were heavily taxed by the price policy, while the consumers gain from the lowered prices. Consequently, the price policies with respect to chickpeas and cotton have led to decrease in their production. The possibility of welfare gains accruing to the farmers of rice, maize and chillies (dry) appeared to be high in a free trade regime. Consequently, there will be welfare losses to the consumers of these commodities. However, welfare gains clearly outweighed the Total NSL for above three commodities. On the whole, there is a positive net effect of trade on the welfare in Andhra Pradesh. It is interesting that in case of chickpeas, free trade resulted in a reduction in farmers' prices, which as a consequence led to their welfare loss. Even again, the welfare gains to the consumers will outweigh the welfare loss to the farmers. So, the policy mechanism in Andhra Pradesh with respect to chickpeas has caused welfare loss to the farmer, thereby affecting his ability to invest in production. To correct this anomaly, the consumers will have to bear some of the burdens, as it is quite easy for them to shift the same through substitution (red or white rajma beans instead of chickpeas). It is essential to find alternative ways to expand chickpeas production. Instead of depending only on input subsidies, technological improvements are a better alternative, as they can raise its supply in the State and at the same time benefit both farmers (cost-effective production) and consumers in the form of lower prices. Even the Government intervention will serve as a price stabilizing mechanism in periods of oversupply and/or undersupply to reduce damaging price fluctuations to both farmers and consumers. Price policies offered by the Government should be in accordance with the international prices through considering the inflation rate and rational inter-product price relationships which would not cause farmers to switch resources from the socially desirable crop mix to more lucrative but less socially desirable enterprises.

This study suffers from a few limitations. Firstly, in general, high-quality products from the State will attract a higher domestic price and this alters the comparative advantage scenario. But, in this study, average prices have been used. Secondly, cross-substitution effects were not considered, while determining the welfare gains and losses. In general, the net loss in consumption and production could be exaggerated due to the omission of the substitution effects.

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