AGRICULTURAL TRADE IN SELECTED CROPS OF ANDHRA PRADESH

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CERTIFICATE

This is to certify that the thesis entitled "**AGRICULTURAL TRADE IN SELECTED CROPS OF ANDHRA PRADESH**" submitted in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY IN AGRICULTURE** of the Acharya N.G. Ranga Agricultural University, Hyderabad is a record of the bonafide research work carried out by **Ms. M. USHA RANI** under my guidance and supervision. The subject of the thesis has been approved by the Students Advisory Committee.

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of investigation have been duly acknowledged by the author of the thesis.

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DECLARATION

I, **M. USHA RANI**, hereby declare that the thesis entitled **"AGRICULTURAL TRADE IN SELECTED CROPS OF ANDHRA PRADESH"** submitted to the Acharya N.G. Ranga Agricultural University for the degree of **DOCTOR OF PHILOSOPHY IN AGRICULTURE** is a result of original research work done by me. I also declare that any material contained in the thesis has not been published earlier in any manner.

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LIST OF ABBREVIATIONS

ADF : Augmented Dickey Fuller Test
AOA : Agreement on Agriculture
CIF : Cost Insurance and Freight
DRC : Domestic Resource Cost
EPC : Effective Protection Coefficient
EU : European Union
FOB : Free on Board
GATT : General Agreement on Tariff and Trade
NPC : *Nominal Protection Coefficient*
NPCI : Nominal Protection Coefficient of Inputs
NSLp : Net Social Loss to producers
NSLc : Net Social Loss to consumers
NSL : Net Social Loss
PC : Profitability Coefficient
TRIPS : Trade Related Intellectual Property Rights
WGp : Welfare Gain to producers
WGc : Welfare Gain to consumers
WTO : World Trade Organization

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ABSTRACT

The present study entitled "Agricultural trade in selected crops of Andhra Pradesh" was undertaken to analyse the export competitiveness of major crops of Andhra Pradesh with reference to two time periods viz., pre-WTO and post-WTO periods. The crops selected were rice, maize, groundnut and cotton. The study also includes the nature and extent of integration between domestic and international markets, export competitiveness of major crops, impact of liberalization on agricultural trade and impact of AoA of WTO on A.P agriculture. The data were collected using secondary sources from various published documents and several suitable econometric models were employed to obtain consistent estimates and meaningful inferences.

Annual compound growth rates, Markov Chain model, Cointegration tests, Policy Analysis Matrix and Partial equilibrium methods were used as analytical tools.

In India there was a decline in growth of area, production and productivity of rice in post-WTO period. The decline in post-WTO period may be due to tapering down of spread in green revolution technology. In A.P. rice registered impressive growth in production and productivity in post-WTO period. The growth of maize in the state was impressive as the growth in area and production was good in post-WTO period. In India the increase in production and productivity was more impressive in pre-WTO period due to accelerated productivity during this period. In case of groundnut, the performance of the crop was impressive in pre-WTO period

both in India and A.P. The reason could be attributed to area shrinkage, import of edible oil and stagnant real prices of groundnut. There was an impressive growth in cotton in pre-WTO period both in India and A.P. The crisis could be due to issues like rising cost of production, inability to enhance production and paucity of infrastructure for value addition at farm level.

Saudi Arabia was the major growing market for Indian basmati rice. But, India is losing Kuwait, USA and UAE markets. Indonesia, Malaysia and UK are found to be the stable markets for Indian groundnut. India is losing most of the importing countries share of cotton. Only Italy and Bangladesh found to be stable markets for Indian cotton.

The cointegration tests showed that the domestic and international market prices are integrated of the same order which means that they are integrated. There is cointegration between markets both in pre and post-WTO period for all the crops. This shows that there exists a long run equilibrium among prices in all the crops. WTO has no effect on the movement of prices.

Trade competitiveness of rice showed that the state had improved comparative advantage in rice production as shown by DRC levels. The EPC shows that rice production was fairly protected by the government. NPC also showed price competitiveness of rice production in both the periods. Under exportable hypothesis it has poor export competitiveness. The NPC values shows non-competitiveness of maize crop. EPC results revealed that the state is not an efficient producer of maize. The state is an efficient producer of groundnut. Other parameters showed the competitiveness of groundnut. In case of cotton, the state had clear competitiveness and comparative advantage.

The higher international prices of all the crops over the domestic prices resulted in increase in supply of these products which makes the producer to produce more and also makes the traders to export more. Increase in price results in decrease in demand at the consumer level thus affecting the trade.

Liberalization has its impact on the welfare of the state. The distortion in domestic prices would result in a change in revenue to producers and consumers. Welfare gains in all cases were much larger than the respective welfare losses. 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 liberalization was substantial in rice and maize.

Within the provisions of GATT agreement, India has bound tariff of 100 per cent for selected crops. If the state reduces the bound tariff by 24 per cent then also the state has competitiveness in rice production. State does not give any direct export subsidies, hence, the question of reduction of subsidies does not arise. Thus, Indian agriculture is gradually being integrated into the world market.

Introduction

CHAPTER I

INTRODUCTION

India is blessed with diverse agro-climatic conditions, which are conducive to the cultivation of different crops almost round the year. Given these varied conditions, the country is able to grow tropical, sub-tropical and temparate crops. Other factors, which make Indian agriculture a promising sector from the angle of global competition, are low import intensities of this sector and reasonably low labour costs. The contribution of agriculture to GDP was 61 per cent in 1950-51. It came down to 24.2 per cent in 2001-02. Now the agriculture sector accounts for about 18.5 per cent of share in Gross Domestic Product and 65 per cent country's population still depending on it. The over all GDP growth rate in India is 9.6 (2006-07). Agriculture and allied sectors grew at the rate of 2.7.

International trade promotes the economic development of a country. It widens the market and increases the inducement to invest income and saving through more efficient allocation. India has comparative advantage in agriculture, so that there is considerable scope for raising farm income and employment by stepping up agro-based exports without jeoparadising and indeed by consolidating the food security already achieved (Naseeruddin and Sundaresan 1999). Agriculture export can thus serve as the bigger safety net in the process of structural adjustment in India.

The strategies for agricultural development constituted an integral part in overall planning of the Indian economy. Trade policy under planning was highly restrictive and inward oriented. Earlier agricultural policies aimed at achieving

self-sufficiency in agriculture with little emphasis on agricultural exports (Pursell and Gulati, 1993).

India has traditionally been following two distinct strategies for agricultural exports. For traditional commodities such as tea, coffee, tobacco and spices, the trade regime has been relatively open, on the other hand, for food grains, cotton and sugar the policy regime favoured import substitution. Besides enlarging markets for commodities, expansion of export trade facilitates economic development without requiring much investment in social overheads like transport and communication. Exports promote the economy with an increase in national income, the level of output and growth of the country's economy. The expansion of export sector helped India to percolate into the world economy as a supplier of cheap agricultural commodities and raw materials (Kaushik and Paras, 2006).

Indian agriculture is undergoing a perceptible structural transformation due to economic reforms. The decade of 1990s witnessed two very significant developments that have had profound impact on agricultural trade. The first development relates to liberalization of the economy initiated in 1991. The second development relates to the new international trade regime following Uruguay round agreement and formation of WTO.

The economics of globalization is based on Ricardo's principle of comparative advantage. Indian comparative advantage is mainly in the field of agriculture in the form of vast human resources besides diverse natural resources and production environments (Swaminathan, 2002).

The economic environment for trade in agricultural commodities is changing fast in the wake of implementation of WTO agreement. The agreements that have an impact on agricultural trade are Agreement on Agriculture (AoA), Agreement on sanitary and phytosanitary measures (SPS), Agreement on technical barriers to trade (TBT) and Agreement of Trade Related Intellectual Property Rights (TRIPS). The agreements are aimed at promoting trade, by reducing level of protection and by removing various kinds of technical barriers and distortions in agricultural trade resulting from domestic policies. According to Nayyar and Sen (1994) and Bhalla (1995), the trade policy regime undergone a considerable change during the last few years and it has implications on growth, welfare and inter-regional inequalities.

In the beginning of 1990's, when India initiated economic reforms, agricultural exports hovered around $3.2 billion. As at that time international prices of most of the farm commodities were quite above the domestic prices, relaxation of export restriction provided a big boost to agricultural exports which moved close to $ 7 billions in 1996-97. These achievements generated lot of euphoria for trade liberalization and also led to conclude that Indian agriculture is highly export competitive.

The situation, however, changed dramatically in the post-WTO period. Farm exports, which were more than doubled in $ terms during four years between 1992-93 to 1996-97, declined by about 20 per cent in the next three years, surplus of agricultural exports over the imports has dwindled to less than half since 1996-97. Domestic prices of most of agricultural commodities have

turned out to be higher than the international prices and India has become attractive market for imports.

The globalization of Indian economy has created a favourable climate for a number of agricultural commodities to record an increase in exports. A production strategy based on comparative advantage, supported by a progressive export policy would help India consolidate her position in global market.

Andhra Pradesh has a prominent position in the agricultural economy of India. The state has eight agro-climatic zones suited for growing a wide range of export oriented crops comprising of field, plantation, commercial and horticultural crops. The contribution of agriculture in state gross domestic product was 31.46 per cent in 1999-2000 which reduced to 26.64 per cent in 2006-07. Its contribution to the SDP in recent years though declining, still it continues to be the major sector in terms of its contribution to employment creation, export earnings and supply of raw materials to various industries in the state. Agriculture provides employment to 65 per cent of the population in the state.

A large proportion of the cultivated area in the state is devoted to the production of principal crops. They are paddy, maize, groundnut, cotton etc. These crops account for around 40 per cent of the cultivated area in the state.

With agriculture now having been brought under the realm of WTO, freedom of government to support agriculture sector beyond a point is limited. Production pattern will be dedicated by considerations of comparative advantage of crops. It is in this context that this study has been undertaken. This study is contemplated to address some trade issues in major crops of Andhra Pradesh

based on performance of the crops during the two time periods viz., pre-WTO (1985-86 to 1994-95) and post-WTO period (1995-96 to 2004-2005).

Significance of the study

The liberalization of the Indian economy has provided enormous opportunities for agricultural exports. To step up the rate of exports, the Government of India has embarked upon a major programme of macro economic stabilization and structural adjustment through new trade and industrial policies. In the new economic policy, adjustments in the exchange rate of the rupee were effected to bring it in line with the equilibrium in order to improve the country's international competitiveness. The exchange rate policy were followed by major structural reforms in trade policy aimed at substantial liberalization of controls and licenses, decanalisation of many item of trade, reduction in peak tariff rates, abolition of export subsidies and other measures to encourage competitiveness in the economy. In this context, it is important to understand the global competitiveness of various agricultural commodities produced in the state.

Therefore, the present study intends to analyze the global competitiveness of important commodities as well as welfare gains of alternate pricing policies in Andhra Pradesh. In this study an attempt has been made to estimate the Nominal Protection Coefficients (NPCs), Effective Protection Coefficients (EPCs), Domestic Resource Costs (DRCs) and Subsidy Ratio to Producers (SRPs), welfare gains and losses of producers and consumers and impact of liberalization on agricultural trade of four important crops namely rice and maize in the case of cereals, groundnut in the case of oilseeds, and cotton as a representative of

commercial crops. The findings of the study will help planners and policy makers to formulate appropriate agricultural development, export and stabilization policies for the state as a whole.

Objectives of the study

Against this background, the present study is an attempt to analyze the competitiveness of Andhra Pradesh agriculture in the wake of trade liberalization and WTO implementation.

The specific objectives of the present study are:

1. To analyze the global competitiveness of important crops of Andhra Pradesh.
2. To examine the relationship between domestic price and world price of important crops of Andhra Pradesh.
3. To quantify the welfare gains and losses due to liberalization of agricultural trade.
4. To examine the implications of WTO provisions for Andhra Pradesh agriculture.

Hypothesis

The following are the hypothesis framed with regard to each of the above objectives.

1. Andhra Pradesh enjoys comparative advantage in selected agricultural crops.
2. After WTO implementation, domestic prices of selected agricultural commodities have integrated with world prices.

3. Trade liberalization benefits the consumer more than the producer.
4. WTO provisions have positive impact on Andhra Pradesh agriculture.

Limitations of the study

The study was mostly based on the secondary data collected from various published sources. Often data from various sources may not agree with each other and some efforts to choose the better among them are inevitable. Care has been taken up to avoid personal bias in such decisions. However, the limitations in the secondary data are to be recognized. There may be variations in cost of cultivation of the crops. The competitiveness of the crops was also studied with in the specified period though the competitiveness is subject to changes due to fluctuations in prices.

Organization of the thesis

The thesis is organized into six chapters as described below:

Chapter 1. Introduction deals with the importance and scope of the research problem, objectives hypotheses and limitations of the study.

Chapter 2. Review of Literature – provides approximate and relevant concepts and review of the related past studies.

Chapter 3. Methodology – presents the design, method of data collection and various analytical techniques employed in the study.

Chaper 4. Results – deals with the results of analysis of the crops selected.

Chaper 5. Discussion – deals with the critical reasoning of the results.

Chapter 6. Summary and conclusions – deals with the summary of the findings and conclusions are drawn with policy implications.

Review of Literature

CHAPTER II

REVIEW OF LITERATURE

A review of past research helps in identifying the conceptual and methodological issues relevant to the study. Such an attempt would help the researcher to have better and precise understanding of the perspectives of the research problem and would also facilitate the researcher to modify and improve the present analytical framework in the right direction to suit the problem situation. The findings of earlier studies would guide the researcher in setting the hypotheses and objectives and enable to evaluate the validity of own findings. Review of the concepts used in earlier studies help us to adopt, modify and improve the conceptual framework and to provide a link with past approaches. This chapter briefly reviews the concepts, analytical tools and findings of the past studies, which are relevant for the present study.

2.1. Review of concepts

In this section, various concepts used in this study are reviewed and broadly defined under the following titles:

1. Growth
2. Instability
3. Structural change in exports
4. Stationarity of time series
5. Cointegration
6. Competitiveness
7. Net Protection Coefficient

8. Policy Analysis Matrix

2.1.1. Growth

Growth rates are the measures of performance of economic variables. They are not developed to predict; but describe the trends in variable over time. Hence, they are commonly used as indicators of trends in the time series data. Price indices, productivity indices and output series are usually discussed in terms of the changing growth rates over a period of time. Policy decisions are often based on such growth rates which depend on nature and structure of the data.

2.1.2. Instability

In order to study the variability in the area, production and productivity of selected crops, an index of instability was developed as a measure of variability. The formula suggested by Cuddy and Della (1978) was used to compute the index of instability.

2.1.3. Structural change in exports

The structural changes in exports helps us to know the trend in sustaining existing market over last decades but also to know the shifts in shares from one country to another for a period of time. The first order finite Markov model is a stochastic process (X) which describes the finite number of possible outcomes S1 (I = 1, 2.....r) and is a discrete random variable Xt (t = 1,2,3....t). This is said to have the first order Markovian property if the conditional probability distribution of X is dependent only on the state the system is in step 1 (Dent, 1967, Lee *et al.*, 1970 and Gillet, 1976).

2.1.4. Stationarity of time series

As explained by Chatfield (1984) a time series is said to be stationary if there is no systematic change in mean (no trend) and variance and if strictly periodic variation have been removed.

According to Gaynor and Kirkpatrik (1994), a stationary time series is one that does not contain trend, ie., it fluctuates around a constant mean. If the original series does contain trend, but not seasonality it can usually be transformed into a series without trend by taking first or second differences of the data.

Gujarati (1995) defined a stochastic process to be stationary if its mean and variance are constant over time and value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed i.e. if a time series is stationary, its mean, variance and auto covariance (at various lags), remains the same no matter at what time we measure them.

Harris (1995) described the series Yt to be 'stationary' if it tends to return to its mean value and fluctuates around it within a more or less constant range (i.e., it has finite variance). Suppose that the variable Yt is generated by the following process.

$Yt = \rho\ Yt\text{-}1 + ut$

Where, $ut \sim IN(0, \sigma\ )$

The variable Yt will be stationary if $|\ \rho\ | < 1$. If $\rho = 1$ then Yt will be non-stationary. A non-stationary process becomes stationary after it is differenced. Yt is said to be differenced stationary or integration of first order one and denoted I

(1) when differencing it once produces a stationary series. More generally, the order of integration of a series is the number of times it has to be differenced to yield a stationary series. Stationary series are said to be integrated of order zero and denoted I (0).

2.1.5. Cointegration

As per Granger (1969) when there is a pair of series Xt and Yt each of which is I(1), a linear combination of these two series will also be I(1). However, if there exists a constant such that Zt=Yt -α Xt is I(0), then the pair of series Xt and Yt are said to be cointegrated and α is called the cointegrating parameter. This means that there exists a long run equilibrium relationship between the two series. If Zt is not I(0) then the two series may diverge from each other indefinitely. Therefore, the basic idea behind cointegration of series is that the presence of cointegration ensures that the series will move closely together in the long run since the difference between them is stationary with well defined mean and variance. Zt is often called the 'equilibrium' error. The term 'equilibrium' is not used to imply anything about the behaviour of economic agents but rather describes the tendency and economic system to move towards a particular region of the possible outcome space, when distributed from that region.

According to Dalado *et al.* (1990) two variables are said to be cointegrated when three conditions are satisfied viz,

a) The variable must be integrated of the same order. The order of integration is the number of times each variable has to be differenced in order to turn the series stationary.

b) There should be a linear relationship between them. That is, in an equation $Yt = \beta xt + ut$, the β coefficient must be significant

c) The residuals (ut) i.e., the extent by which the two variables deviate from the long run equilibrium relationship given by the equilibrium error (ut) should be stationary.

Cointegration means that despite being individually non-stationary, a linear combination of two or more time series can be stationary (Gujarati, 1995).

2.1.6. Competitiveness

Porter (1990) argued that a theory of international trade must move beyond the comparative advantage to the competitive advantage. The concept of competitive advantage is more comprehensive involving segmented markets, differentiated products, technology differences, economies of scale etc. Thus price-cum-cost comparisons are the preliminary indicators of competitiveness.

2.1.7. Nominal Protection Coefficient

The nominal protection coefficient (NPC) of a commodity is defined as the ratio of the domestic price to its border price (Tweeten, 1992).

Pursell and Gupta (1998) defined NPC of a commodity as the ratio of that commodity's domestic price to its international reference price and referred to it as an estimate of the extent to which its price has been affected by government interventions in the country's international trade. NPC determines the degree of export/import competitiveness of commodities by measuring the divergence of domestic price from the international or border price.

2.1.8. Policy Analysis Matrix (PAM)

The PAM is a double accounting technique that summarises budgetary information for farm and post-farm activities. It is 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, analyzing the matrix and simulating policy changes.

Apparent costs are divided into those inputs that are traded on international markets (fertilizers, pesticides, hybrid seeds) and those domestic factors (labour, land, and capital) which are not traded internationally. This gives the following profit identity.

Revenue – cost of tradable inputs- cost of domestic factors = Profit

2.2. Review of past studies

The review of past studies was classified under the following heads.

1. Structural change in exports
2. Market integration
3. Global competitiveness
4. Impact of liberalization on trade

2.2.1. Structural change in exports

Markovian analysis can be employed to find out the structural changes in any system whose progress through time can be measured in terms of single outcome variable. By using transitional probability matrix, one can predict the demand for future years also.

Atkin and Blandford (1982) studied structural changes in import market shares for apples in U.K. The changes in composition of U.K. apple imports during the period from 1963 to 1974 were analysed using a first order Markov model. The study indicated that changes in market share had been systematic, stable and of long duration. The estimated transitional probability matrix could explain the nature of change by indicating the relative competitive strength of different exporters. The large increase in market share was examined and estimate derived on the effect of U.K. membership of the E.C. for the year 1978-79. The results showed that E.C membership increased French market share in the U.K. market by more than 26 per cent points and decreased the share of Australia and South Africa by 18 and 10 per cent points respectively.

Fialor (1985) analysed the market share of Ghananian cocoa exports for the period from 1951 to 1981 using the Markov model. He decomposed the total change in export into the overall market share effect, the direction of trade effect, and the individual market effect. It was observed that there was an overall contraction in Ghana's cocoa exports during this period to the tune of about 38,000 tonnes. Even though there was an expansion in exports due to increase in the overall market share effect as a consequence of increased world demand to the extent about 2,26,000 tonnes and another 15,000 tonnes due to the direction of trade effect; yet the loss through the individual market share effect was large, 2,78,000 tonnes and this had resulted in the contraction of Ghana's export.

Gemtessa (1991) analysed the direction of trade in coffee using Markov model. The share of Ethopian coffee exports in U.S.A. drastically declined during

1979 to 1989. However, West German market indicated to be the potential market for Ethopian coffee. Further, the loss in the market share of Ethopian coffee in U.S.A., France, U.S.S.R. and another countries was diverted to West Germany's market. It was also projected the the market share of Ethopian coffee export to West Germany would increase to 32 per cent by 2000 mainly because of West Germany's preference for Ethopian mild coffee.

Veena (1992) analysed the direction of trade of Indian coffee exports using Markov chain model. It was observed that India could not retain its previous market share to U.S.A., Netherlands, Yugoslavia and other importers. However, the actual quantity exported to all these countries had increased which was due to increased quantity of Indian coffee exports. India retained its market share to former West Germany, erst-while U.S.S.R. and Italy.

Jalajakshi (1994) pointed the changing pattern of Indian shrimp exports between two periods. Period I covering 1970-80 and period II covering 1980-90. It was indicated that during the period I, India could not retain its previous market share in the EEC countries. Nearly 90 per cent of India' share was directed to Japan and Seven per cent to the UK. In period II, India could retain 11 per cent of its previous market share in the EEC countries due to the gradual acceptance of tropical shrimps in these countries.

Krishna and Sharma (1995) analysed geographical concern of Indian sea food exports. Japan and USA constituted the major markets for Indian frozen shrimps. The composition o Indian seafood exports showed predominant dependence on frozen shrimps as their flagship product. The cross-sectional year

wise share percentage of the total market for frozen shrimps in Japan and USA was studied. India enjoyed more than 15 per cent share of the Japanese market for frozen shrimps in 1982 and 1986 but slipped to the medium bracket for frozen shrimps in 1982 and 1986 but slipped to the medium bracket retaining only 13.41 per cent of the market share in 1992.

Lakshminarayana (1993) made an attempt to study the direction of trade of Indian silk exports by employing first order Markov process. The major importing countries considered for the analysis were the USA, West Germany, United Kingdom, France, Italy and Japan. He revealed that exports to the USA were very stable and would remain highly loyal to Indian silk. In addition, he indicated that the probability of exports to the United Kingdom, West Germany and Japan switching over to the USA was unity implying that entire quantities of exports of these countries would drift to the USA over a period of time.

Nagaraja (1997) analysed the direction of trade of the Indian horticultural commodities exports by employing a first order Markov process which helped in identifying the gains and losses in export value. It revealed that other fresh fruits, vegetables and processed fruits and vegetables export retained their share of 56.7 per cent and obtained 68.5 per cent and 24 per cent for onions and garlic respectively. The results indicated that grapes, onion and mango juice sustained their original share of 59.8 per cent, 19.4 per cent and 49 per cent respectively.

Ajjan *et al.* (1998) studied the direction of export of senna and periwinkle by using Markov chain model for the period from 1985 to 1995. Seven major countries viz., Germany, Belgium, USA, Japan, Italy, Hongkong, and others,

importing Indian senna and periwinkle were considered. In the case of senna, the probability of Germany and USA to retain their import shares in the years to come were estimated to be 0.8258 and 0.8688 which clearly indicated that these two countries would retain their import share in the same position. In the case of periwinkle, France had a high retention of export share (probability of 0.8826) while Germany and others had a retention of as low as 0.026 and 0.054 respectively which clearly indicated that the chance of maintaining the import share of France was 88.26 per cent and in other two cases the chances of maintaining the import share was practically low.

Mandanna *et al.* (1998) analyses the structural change in India's tobacco exports for the period 1980-81 to 1994-95 using the Markov chain analyses, The study reveals that the USSR, the largest market for Indian unmanufactured tobacco, showed a high degree of loyalty for Indian tobacco during the period 1980-81 to 1985-86, this diminished substantially during the periods 1985-86 to 1994-95. The market of Western Europe, Asia and the Middle East have taken the place of the USSR. However, in case of manufactured products, only cigarettes had a dominant presence in the export basket. The diversification of export markets is clearly evident, necessitating efforts in the direction of brand building for Indian tobacco.

Murthy and Subrahmanyam (1999) analysed the direction of onion trade by using Markov chain model during the years 1980-81 to 1994-95. The major gainer among importers of Indian onions over the period of time was Malaysia which was having a transitional probability of 0.6459 from Saudi Arabia and

0.3488 from U.A.E., Sri Lanka in addition to having high probability of retention of its own share, was also likely to gain from Saudi Arabia with a moderate probability and gain of 0.3488. On the other hand, Saudi Arabia which was having zero probability of retention of own share of exports of fresh onion was likely to gain to some extent from Bangladesh and other countries.

Mahesh (2000) analysed the direction of trade of Indian tea exports using Markov chain model during the period 1979-80 to 1998-99. The transition probability matrix indicated that the countries like United Kingdom, U.S.S.R., Iran, U.A.E., Saudi Arabia and other importing countries retained their previous shares of Indian tea while rest of the countries like Germany, Poland and U.S.A could not retain their previous shares of Indian tea.

Reddy and Achoth (2000) applied Markov chain approach and results shows that from 1980's, the Indian agriculture sector has witnessed considerable transformation in terms of cropping pattern, technological advancements, and market demands at both domestic and international levels. In this regard, an attempt has been made to analyse the structural change in Karnataka's agriculture during the period 1980-81 to 1989-90 and 1990-91 to 1993-94 using Markov chain analysis. The study revealed that, though most of the crops have shown stability in the study period, the proportion of area under oilseeds and other commercial crops has increased in the 1980s at the cost of food grains. This may be due to the government's deliberate policy to increase the production of edible oils to reduce the demand-supply imbalances.

Suseela and Eswara Prasad (2003) examined the proportion of turmeric exported by India to different countries over a period of time and the changing pattern of trade among different countries. Analysis of direction of trade showed that UAE was the major importer of Indian turmeric followed by USA, UAE, UK, Iran, Bangladesh and Japan have shown a marked incline. If the present trade continues, the total value of exports would touch a high of 76.2 crores by the year 2010 AD from the present export value of 15.24 crores.

Kumar *et al.* (2006) used Markov chain analysis to estimate market share of onion exports to different countries for the period 2009. It was estimated that Bangladesh would account for highest share of onion fresh exports followed by Malaysia, UAE, Singapore etc. With reinforcement of Free Trade Agreement with Srilanka the declining trend in exports to Srilanka is expected to be reversed. The study concluded that the need to have long term and stable policy towards exports of onion.

Tejaswi *et al.* (2006) applied Markov chain analysis to study the direction of trade and changing pattern of Indian coffee exports to eight major importing countries (Italy, Russian Federation, Germany, Belgium, Spain, Slovania, U.S.A and others). The results showed that USA was the most reliable and loyal importing country with the probability of 80 per cent retention than any other importing countries, followed by 'other' countries (51 per cent) and Russian Federation (36 per cent). Analyzing the losses and gains in market share proportions, other countries was a major net gainer, which was borne by the fact that 100 per cent of Slovania's market share of imports from India, 47 per cent of

Germany's share, 34 per cent of Italy's market share and 4 per cent of Russian Federation market share were diverted to other countries.

2.2.2. Market Integration

The market integration concept explains the relationship between two markets that are spatially or temporally separated. A study on integration of different markets can suggest to the producers as to where, when and how much to sell, which in turn will have a bearing on their production strategies and hence resource allocation.

Chengappa and Muralidharan (1980) in their study on pricing efficiency of Indian coffee interpreted the pricing efficiency of Indian coffee markets in terms of spatial integration. The bivariate correlations of monthly prices among geographical markets at pool sale, wholesale and retail levels used as indices of market integration showed a maximum at pool level because of better control by the Coffee Board. The efficiency was in the declining order from the wholesalers to retailers for want of adequate control by the Board. The location of distribution points and institutional constraints of differential sales tax found to influence the movement of prices in vision.

Lundahl and Peterson (1982) studied the market integration for major food grains for the period of 1969-74. The number of markets for each product considered was 19 for rice, eight for grain millet, 20 for grain corn, 11 for ground corn and 15 for seed beans. Monthly price series were detrended and the residuals were correlated. The results showed that there was not high correlation between

the residuals. For all the food grains, there was a tendency for the correlation to be full towards the end of each year.

Brorsen *et al.* (1984) illustrated the use of univariate and multivariate time series analysis in the investigation of dynamic relationship among selected weekly import prices of rice in the European Economic Community. EEC imported rice from US, Thailand and Argentina. The results showed that Argentinean and US prices moved together. These two prices were influenced by the European market and react quickly to changes in Thailand prices. Thailand prices responded slowly to US and Argentinean prices.

Indira (1988) studied the extent of price relationship for coffee between three pool sale centers, Bangalore, Coimbatore and Vijayawada. It was assumed that prices were set at Bangalore auction centre and information passed from Bangalore to other centres. The results indicated that Bangalore prices were showing positive relationship both with Coimbatore and Vijayawada prices. Coimbatore and Vijayawada prices were also showing positive relationship with each other. Eighty four per cent of the variation in the pool sale prices at Coimbatore auction was explained by the variations at the Bangalore auctions, 88 per cent was explained in Vijayawada prices. It indicated relatively lower influence of Bangalore prices on Coimbatore prices than on Vijayawada prices.

Arshad (1990) made use of Ravallion's regression model to study the integration of palm oil market in Peninsular Malaysia. The crude palm oil market was observed to be spatially efficient. The high integration of the crude palm oil markets was not surprising in view of the efficient and adequate infrastructure

facilities available. The standardization of crude palm oil futures contract made the product homogeneous leading to efficient price discovery thereby enhancing pricing efficiency.

Gemtessa (1991) analysed the integration of Ethopian coffee prices with world prices using the correlation coefficient. The correlation coefficient for the monthly average prices secured at domestic and world markets for12 months lag was calculated. The bivariate correlation coefficient of the two market prices revealed that they move together in the same direction. The lagged cross correlations of domestic and world prices also revealed that they move together in the same direction. The lagged cross-correlations of domestic prices and world prices of coffee had a stronger influence on the domestic prices had on the world prices of coffee.

Baharumshah and Habibullah (1994) employed the cointegration technique to analyze the long run relationship among pepper prices in six different markets of Malaysia. The cointegration technique was applied to weekly pepper prices for the period 1986-91. The empirical findings of the study indicated that regional pepper markets in Malaysia were highly co-integrated and prices of pepper tended to move uniformly across spatial markets indicating competitive pricing behaviour.

Sinha Roy and Nair (1994) using the co-integration approach analyzed the pepper price variations in the world market. It was observed that due to open trade status of pepper, its prices had moved synchronously, indicating integration of the world pepper market. It was pointed out that due to the oligopolistic nature of the

world market for pepper, its prices did not deviate much. The domestic supply variables were found to be responsive to the international market conditions.

Mamatha (1995) used the co-integration analysis for examining the market integration of selected spices between Indian and New York prices. The results indicated that the co-efficients were found to be negative and significantly different from zero in case of Indian and New York prices of pepper, chillies, turmeric and ginger confirming the stationarity of the series. It also revealed that both the Indian and New York price series for selected spices had the same order of integration.

Nasurudeen and Subramanian (1995) observed the price integration of oils and oil seeds. The price integration in most cases was bi-directional except in castor oil. The contemporary belief of influence of groundnut oil price on all edible oil prices was also established. The results of vertical integration confirmed the hypothesis that changes in oilseed price is linked to changes in its oil and cake prices. The vertical integration in oilseed price was much quicker as compared to horizontal integration.

Sharma *et al.* (1998) studied the annual prices of milk, butter and ghee in 6 markets (Delhi, Kanpur, Bombay, Patna, Calcutta and Madras). The price correlation coefficient between the markets ranged from 0.9529 to 0.9917 for milk, 0.8106 to 0.9891 for butter and 0.9573 to 0.9991 for ghee, indicating that prices of milk, ghee and butter in the different markets are highly correlated. This implies that there is a high degree of market integration for milk and milk products and that prices of milk products can not be determined in isolation in a

single market as they are influenced by price variation in other markets. This is more true in case of products such as butter and ghee that have a long shelf life and are easily transportable.

Bhatta and Bhat (1998) studied the extent of price relationship for areca nut between selected markets of Mangalore and Sira using the correlation coefficient method. The results revealed that the Mangalore market was more efficient than Sira market. The commercial nature of the crop and its diversified market conduct was clear from the fact that there was a direct relationship between the supply and price.

Behura and Pradhan (1998) used bivariate price series correlation and Engle-Granger test to analyze the market integration for Orissa marine fish markets. The bivariate correlation coefficients for six selected market pairs ranged between 0.60 and 0.85. The test statistic obtained for all the pair wise markets were found to be less than the asymptotic critical value even at 10 per cent level excepting that of Cuttack-Paradip pair. Thus the marine fish markets in the state were assumed to be not integrated and hence quite uncompetitive. This was mainly attributed to poor infrastructure facilities at landing centers as well as the terminal secondary markets.

Ghosh (2000) investigated intra-state spatial integration of rice markets in India. This study used ML method of co-integration. Intra-state regional integration of rice markets was evaluated by testing the long run linear relationship between the prices of the state-specific variety of rice quoted in spatially separated locations in four selected states. The cointegration results for

Uttar Pradesh indicated that the regional markets are integrated to such an extent that the Law of one price (LOP) holds for III / IV ARWA variety of rice. However, no evidence was found in favour of the LOP for the course or common variety of rice marketed in Bihar, Orissa and West Bengal, even though the regional rice markets were found to be integrated. The results pertaining to inter-state regional integration of rice markets represented by four market centers chosen from the four selected states revealed that even though the markets are integrated, the LOP does not hold.

Kumar (2000) analyzed the relationship between prices of rice in domestic market (New Delhi) with major rice markets of the world viz., Bangalore and Houston (USA) by using the co integration approach. The results clearly revealed that all the price series were not stationary and were not integrated in the long run.

Patel and Patel (2000) examined the extent of market integration and the relationship between the pattern of market arrivals and the prices of rapeseed and mustard in selected markets of Mehsana district, North Gujarat, India. Time-series data on wholesale prices for the period 1975-76 to 1992-93 and the farm harvest prices for the period 1975-76 to 1992-93 were obtained. The spatially located primary as well as secondary wholesale markets in Mehsana were found to be well integrated in terms of movements of prices. There exists normal conspicuous seasonality in prices and arrivals of rapeseed and mustard. Year-wise and market-wise analyses revealed that market arrivals were high in post harvest months when prices were low and low arrivals were observed in subsequent months when prices were high.

Singh and Agarwal (2000) examined the existence of integration between the markets of cumin seed located at different places in Rajasthan state and concluded that the firms in the markets were more actively related to each other. The value of correlation coefficients in weekly wholesale prices of cumin seed in all the selected market pairs of Rajasthan were positive and ranged between 0.36 to 0.09 which showed the existence of integration in the selected market pairs but was not very high. None of the market pairs were perfectly integrated.

Ramakumar and Sundaresan (2000) studied horizontal integration in the pricing of coconut copra and coconut oil between the regional markets with Kerala and between Kerala and Mumbai markets. The results demonstrated that the prices in the major markets with in Kerala were spatially integrated. But, in the prices between Kerala and upcountry market, Mumbai which clearly indicated that the price changes in one market were not transmitted immediately to the other market.

Ishizaki (2001) studied integration of the food grain market by using data from 13 markets in India. Levels of integration were estimated for rice and wheat markets and the level compared for 1986 and 1997. Changes in the integration level were estimated and the role of government in these changes also studied.

Balappa *et al.* (2002) conducted integration tests among all the selected markets in Karnataka (India) both in onion and potatoes. These were governed not only based on arrivals and other factors in the given market but also those prevailing in other markets. This might be due to the movement of produce from one market area to another depending upon price prevailing in the selected

markets might have influenced the movement of prices in the same direction. The individual buyer had practically less influence over the market price. Thus, it can be concluded that prices of onion and potato were stable across the selected markets in the study area. Therefore, to continue the present system of market integration, there is a need to establish cells for vegetables to generate market intelligence which would provide a better platform for guiding the farmers in marketing their produce.

Basu and Dinda (2003) evaluated empirical spatial integration of potato markets in Hooghly district of West Bengal. The results showed that the potato markets of Hooghly district were integrated and the high degree of integration showed that the potato markets in the state were competitive and efficient at the wholesale level.

Mohanty and Langley (2003) analyses the integration between US and Canadian grain prices using cointegration and error correction approach. A free trade agreement implemented in 1989 that later folded into NAFTA affected price integration in the North American Grain Market, but Canada's elimination of freight subsidies in 1995 strengthened it. Empirical results indicated that long term relationships exist among the 4 sub periods. However, cointegration analysis shows significant post-WGTA improvement in market integration, particularly in the speed at which the market adjusts to departures from its long run equilibrium.

Pramod Kumar *et al.* (2003) conducted price integration test on paddy crop in Haryana and this study aims to check the efficiency of regulated wholesale markets by examining the functioning of regulated markets in Haryana

state. India, at the micro and macro levels use for rice crop market integration among wholesale rice markets was analysed with the help of cointegration and error-correction mechanism. The main conclusion emerging was that all the four regulated markets were co integrated and so had a strong long run relationship. However, price transmission was found to be lacking in the short run. At the macro level, the agricultural markets of both the districts surveyed appeared to be efficient. This analysis also concluded that though markets of the regions surveyed appeared to be efficient, they were not perfectly over space. Positive significant coefficient of distance covered was the proof of the fact that there was the possibility of farmers getting higher net price by selling more carefully in a specialized market, even if it was located at a far distance.

Sujatha (2006) studied price integration of major spices in India, the results of which showed that the number of cointegration vectors increased from two in pre-WTO period to three in post-WTO period in case of pepper, turmeric and ginger implying that WTO has increased the strength and stability of price linkages and also the transmission of price signal among various markets within the country as well as between domestic and international markets. The presence of two cointegrating vectors in case of Cardamom during both pre and post-WTO periods indicated that the prices were not pair wise co integrated whereas the presence of three co integrating vectors during both the periods in case of chillies indicated that the prices of chillies were pair wise co integrated.

The results of the study on market integration shows that there is integration of domestic and international prices in both the periods (pre and post-

WTO). The studies made by Mamatha (1995) and Balappa (2002) also showed the same results, ie cointegration between domestic and international market prices.

2.2.3. Global Competitiveness

Brorsen *et al.* (1984) analyzed the relationship among weekly prices at Rotterdam, Netherlands of rice imported in to Europe from the Unites States, Thailand and Argentina. A theoretical model of price determination was developed to explain the hypothesized direction of dynamic influence. Causality tests among the price series were applied. The dynamics of price relationships were then analyzed using dynamic multipliers. Argentinean and the US prices were found to move together. These two prices responded quickly (one to two weeks) to changes in Thailand prices. Thai prices were found to react slowly (taking 10 to 20 weeks) to changes on Argentinean and US prices.

Mishra (1986) evaluated protection versus under pricing of agriculture in India for two major cereals wheat and rice from 1955 to 1980. Nominal protection indices (NRD and NPC) were estimated for six time points at each quinauennium. Besides showing changes over time in the levels of protection or exploitation, the aim was to see whether some comparative statements vis-à-vis industrialized and industrializing countries could also be made.

Gulati *et al.* (1990) studied the effective incentives for wheat cultivators in India by selecting four wheat-growing states (Haryana, Madhya Pradesh, Punjab, Uttar Pradesh) under importable hypothesis. The NPCs for four states averaged for the period 1980-81 through 1986-87 were found to be 0.84, 0.75, 0.85 and

0.77 in the case of Haryana, Madhya Pradesh, Punjab and Uttar Pradesh respectively. These results indicated that wheat cultivators in India had been taxed on pricing front compared with imports. But under export competition hypothesis only one state namely, Punjab was taken for calculation of NPCs. It averaged 1.34, which implies that cultivators in Punjab state were protected.

Gulati *et al.* (1990a) determined the degree of distortion in the trade pricing policies with regard to Indian rice during the 1980s. Six rice growing states (Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, Punjab, and Uttar Pradesh) were selected under importable hypothesis and Punjab was selected for exportable hypothesis where it was deemed to compete with Thai rice. Under importable hypothesis, the results showed that the rice cultivators were taxed on the pricing front and under exportable hypothesis. Punjab rice cultivators seemed to have acquired protection only during 1985-86 and 1986-87, but the average situations for 1980's remained taxed.

Gulati *et al.* (1990b) worked out the protection coefficients for groundnut in India by selecting three different groundnut growing states under both import and export competition hypotheses. Domestic price of groundnut was about 50 per cent more than import price, which implied that groundnut received a significant degree of protection from the existing policies under import competition hypothesis. The NPCs of Gujarat, Andhra Pradesh and Tamil Nadu were 1.47, 1.50, 1.53 under import competition hypothesis and 1.87, 1.96 and 1.95 under export competition hypothesis respectively, indicating the level of incentives were significantly higher under export competition hypothesis than

under import competition hypothesis. Indian export of groundnuts to hard currency areas had been a limited one in the 1980s.

Khatkar *et al.* (1994) found that the international prices of wheat were higher then domestic prices, thereby showing that the farmers were disprotected and taxed. This was further testified by the nominal protection coefficients (NPC) which remounted below unity. The lower NPC also indicated that after 1987-88 wheat and in eighties in general, rice have become efficient exportable commodities. The non-significant relationship between export and international prices showed the ad-hocism and non-judicious export policy in regard to these commodities. Thus the study showed the need to encourage the production of exportable varieties like wheat durum and basmati rice which have a comparative advantage in the world market and reorient the export policy in the context of globalization of the economy.

Rao (1995) analyzed the export competitiveness of Indian onions in major markets using constant market share model over a period, 1979-82 to 1989092. The importing countries for analysis were Malaysia, Singapore, Srilanka, UAE and the rest of the importing countries frouped as others. Onion exports to Malaysia were fairly competitive where in 26 per cent of total change in exports was due to competitiveness of our exports in that market. The UAE was the only country where India's onions were not at all competitive. Regarding onion exports to the world as a whole, only one per cent of the total change in exports was found to be due to competitive effect.

In the study involving estimation of nominal protection coefficients (NPCs) for DCH-32 seed cotton in Karnataka for the period 1983-84 through 1992-92 under both exportable and importable hypothesis, Umapathi et al (1995) indicated an overall situation of disprotection to the cotton cultivators of the area studied. The NPCs were found to be much below unity and implied that DCH-32 seed cotton would be an efficient export crop as well as an efficient import substitute, but for the barriers that delink the domestic market from the world market.

Gowda and Jalajakshi (1995) examined the competitiveness of Indian shrimps in the international markets. The market effect (-1696.01) indicated that the erratic imports into Japanese market were detrimental to our export performance. The negative competitive effect indicated that Indian shrimps were not competitive in the Japanese market. The import growth effect was 37.67 per cent in the case of USA and 451.2 per cent in the case of UK. The positive competitive effect for the USA (98.05) and the UK (92.65) showed that Indian shrimps were competitive in these markets. The market effect was found to be negative in case o USA and UK.

Datta (1996) calculated NPC and DRC of Indian Basmati and Non-Basmati rie. The results revealed that India had very slender competitive strength in export of Basmati rice. However, DRC analysis revealed that an Indian exporter had some amount of buffer, because India required spending of only

Rs.0.89 on non-tradable goods in order to earn one rupee of foreign exchange. In case of non-Basmati rice these two ratios were below one.

Mamatha and Chengappa (1996) conducted a study on competitiveness of Indian pepper exports by applying constant market share model for the period 1988-92. The results showed that import growth effect for Indian pepper was positive in USA and Canadian markets implying increased exports to these countries. However it was negative in the case of CIS, Italy and Germany implying favourable import demand conditions in these countries. Overall a negative competitive effect was observed.

Reddy (1997) worked out the NPC for groundnut, maize, jowar and sunflower in Karnataka. The NPCs of jowar and maize under importable scenario was less than one indicating that jowar and maize were efficient import substitutes. The NPCs under exportable scenario was greater than one. The NPC of groundnut and sunflower under importable and exportable scenario was greater than one, reflecting that groundnut and sunflower were neither import substitute nor efficient exportable commodities.

Reddy *et al.* (1998) analyzed export competitiveness of groundnut with particular reference to Karnataka using nominal protection coefficient technique under importable and exportable hypotheses. Results of the study showed that groundnut had been receiving significant protection by then existing policies as indicated by coefficients greater than unity. Thus groundnut is neither an efficient import substitute nor an exportable commodity, which should be a cause for

concern as it is widely grown in dry land areas, where alternative profitable crops are few.

Reddy *et al.* (1998) analysed the export competitiveness of sunflower production using the nominal protection coefficient (NPC). Data on the domestic prices for sunflowers sold in Karnataka were collected for the period 1984-85 to 1993-94 and compared to the FAO's world prices for 1984-93. Results indicate that sunflower production is efficient import substitute but that sunflower exports are less competitive in the world market.

Pursell and Gupta (1998) found very large changes in the nominal protection of sugar and sugarcane production in India which were due to fluctuations in international market prices. Nominal protection was very high during periods of low world price in the 1960s and the mid 1980s, was negative for a number of years of high world prices in the mid 1970s and early 1980s and was moderate to low by previous standards between 1989 and 1994.

Ravi and Reddy (1998) examines the comparative advantage of selected agricultural commodities in domestic and international markets with particular reference to Karnataka. The export competitiveness of six important crops grown in the state namely jowar and maize as food crops, groundnut and sunflower, cotton as a commercial crop and coffee as a plantation crop is examined using the NPC (Nominal Protection Coefficient) as a measure of competitiveness. Among six commodities studied, Karnataka lacked comparative advantage in most of the crops except cotton. The export potential of jowar, maize, groundnut and sunflower were significantly low. Even though Karnataka is the leading coffee

exporting state, in recent times the domestic market seems more favourable than the export market. Unlike cereals and oilseeds, Karnataka has an absolute advantage in the case of cotton export. India needs to capitalize on this advantage by ensuring its position as a dependable long term supplier of quality cotton through progressive export policies.

Reddy *et al.* (1998) analyzed the competitiveness of major dry land crops of India (sorghum, maize, groundnut and sunflower) by using the nominal protection coefficient (NPC). The pricing policies have allowed domestic prices to deviate from world market prices. The NPCs reveled that with the exception of groundnuts, all the crops are good import substitutes, although none have food export prospects currently. Groundnut which occupies around 10 per cent of the gross cropped area in the country has an NPC of greater than one, both under importable and exportable hypotheses. Therefore, in a liberalized trade regime, groundnut producers can be seriously affected through cheaper imports, forcing them to switch over to other crops.

Selvaraj *et al.* (1998) conducted a study in Tamil Nadu under liberalized trade economy by using protection coefficients (NPC, EPC, ERP and DRC). It was found that rice and cotton had comparative advantage justifying further protection. The above protection coefficients showed that sugarcane and groundnut were highly protected and had comparative disadvantage domestically as compared to world trade.

Datta and Gupta (1999) analysed the global competitiveness position of the Indian sugar industry using nominal protection coefficients (NPCs). The

results indicate that Indian sugar is highly import-competitive in all three years, while the extent of this competitiveness is highest in the states of Gujarat, Karnataka and Maharashtra in 1995. All the major states and the country was a whole are export competitive in 1995.

Jha (2000) expressed that India had comparative advantage in producing a large number of commodities due to lower resource costs. The comparative advantage is high for commercial crops like cotton, tobacco, jute, spices like tea and coffee. The country has also advantage in producing labour intensive crops like rice. The country has, however, no comparative advantage in producing coarse cereals like maize and sorghum. In Wheat, the country was at the margin.

Mahesh (2000) studied the export competitiveness of Indian tea by estimating the NPC and DRC under both importable and exportable hypotheses during the year 1998-99. The results revealed that, under importable hypothesis the NPC and DRC were 0.71 and 0.66, respectively. The NPC was below unity, which indicated that the domestic tea is an effective import substitute, where as the DRC was also less than one implying that the tea growers spend less than a rupee equivalent of foreign exchange on the production. Hence, it is profitable to use non-tradable inputs in the production of tea in India. Under exportable hypothesis, the NPC and DRC were 0.98 and 0.93 respectively. The NPC was less than unity which reveals that tea is competitive in the international market and it represents an effective export commodity where as DRC was less than one implying its export competitiveness in the international market.

Suratha Nayak (2000) studied the export competitiveness and determinants o India's agricultural exports during 1970-71 to 1996-97. The official exchange rate is concerned, it was found that India possessed both comparative and competitive advantage than in exporting non traditional commodities. The commodities which possessed export competitiveness included fine cereals, coffee, oil cakes, fresh fruits, processed fruits and vegetables, spices, processed diary products. and marine products. The commodities which did not possess comparative and competitive advantage included tea, sugar and edible oil. It has also been observed that annual compound growth rate of agricultural export was lower during the 80s (10.5 per cent) than in the 70s (18.9 per cent). A significant growth of 26.3 per cent was observed during 1993-94 and 1994-95 but 16.7 per cent till 1996-97. The analysis brought out clearly that the share of the agricultural export has declined over the period which may be attributed to the stagnant output, low yield rates and no much competitiveness in the world market.

Dahia (2001) conducted a study on world trade and export of potatoes from India and applied NPCs, which are a ratio between domestic price and the world reference price, indicate economic competitiveness. The results show that during 1992-2000, the NPC below one i.e., exports are competitive in the world market during 1994,1995, 1997, 1999 and 2000 and above for other years except 1996 when data were not available i.e., exports are not competitive in the world market.

Mahesh *et al.* (2001) analysed the export performance of the Indian tea industry under the new economic environment. Under importable hypothesis, the

nominal protection coefficient (NPC) and domestic resource cost (DRC) were 0.71 and 0.66 respectively, and under exportable hypothesis, the NPC and DRC were 0.98 and 0.93 respectively, implying that Indian tea exports were moderately competitive and also food import substitute.

Naik and Chaturvedi (2002) computed the NPC for rice under the exportable hypothesis for the period 1992-93 to 2000. They examined the total cost of delivering (including the price) rice for India and the competitor (Thailand) to a common port of an importing country, Ivory Coast. The export competitiveness was assessed for Parmal variety in Delhi market and international prices of Thai white rice. Wholesale price was considered as domestic price. The NPC values remained well below one till 1998-99 and after that it was marginally higher than one.

Chand *et al.* (2004) studied the trade competitiveness of selected oilseeds i.e., rapeseed / mustard, soyabean and sunflower. The results for rapeseed indicated a high level of protection. For sunflower too, the NPC and DRC values favour imports over domestic production. International prices for soyabean oil consistently remained lower than domestic prices and oil import had always been attractive. Seed prices, however, had hovered around international prices and the NPC values under importable hypothesis did not indicate protection. Under exportable hypothesis, the DRC value suggested marginal gains only. Import substitution was clearly a more relevant strategy for soyabean seed.

Veerkar *et al.* (2003) conducted a study in order to identify the countries competitiveness for export of sapota. The NPC values for the year 1999-2000

indicating that export of sapota was most profitable to UK with NPC as low as0.24 followed by Finland. Oman, Switzerland, Mangolia, Hongkong, Canada and Spain, whereas USA, Kuwait, Bahrain, Australia and Qatar were found to be moderately competitive simultaneously (NPC in between 0.5 – 1) and it was non-competitive (NPC > 1) in Saudi Arabia, Singapore and Bahamas.

Manitra and Gulati (2006) used Nominal Protection Coefficient to determine the level and change in competitiveness of dairy products between 1975-2001. They estimate parameters of domestic demand for and supply of raw milk and whole milk powder to determine how a world price increase would effect domestic milk production and whole milk powder exports. Results showed that India's dairy products lack export competitiveness.

Mohammad *et al.* (2006) used PAM to study the economics of sugarcane production in Pakistan. The results showed that DRC was less than one at import parity price showing that Pakistan will have comparative advantage in sugarcane production as an import substitution crop. DRC was more than one at export parity price indicating that no comparative advantage in sugarcane production in future. It is concluded that Pakistan should grow sugarcane only to maintain self sufficiency level as it will be cheaper in domestic market than to invest on import of sugarcane. It will not be feasible to grow for export purposes.

The findings of the study also showed similar results as the studies conducted by Reddy (1997) and Ravi and Reddy (1998) and Gulati and Sharma (1997).

2.2.4. Impact of liberalization on agricultural trade

In the case of Pakistan the structure of prices and subsidies was analyzed by Gotsch and Brown (1997). In Pakistan export crops have historically been taxed and import crops subsidized. This was an attempt to move closer towards food self-sufficiency. In the past the most important deviation from international prices occurred in Sugarcane. Prior to devaluation in 1972, the nominal protection coefficient moved between two and four. However, at the new official exchange and with higher international prices, sugarcane was no longer protected. In 1975, with the exception of maize, the protection coefficients of all major crops had a negative protection rate.

Lutz and Scandizzo (1980) evaluated the effect of government interventions in agricultural commodity markets for a sample of developing countries using standard partial equilibrium methods. The empirical results indicated that the agricultural sector in developing countries was often heavily taxed. As a consequence, agricultural production was discouraged, while consumption was subsidized and increase in the Government revenue provided by taxation were balanced by a loss of foreign exchange earnings.

Jamal (1987) examined the cotton pricing policies pursued by the Pakistan Government and the nature of it's intervention in the cotton trade and quantified the effects of price distortions over the period 1977-78 through 1982-83. Support prices were found to be closer to revenue maximization prices than to the border prices adjusted to farm gate level. Two distinct phases in the trends of NPCs

indicated the Government's divergence in maximizing foreign exchange in earlier years to revenue maximization in the later years.

Chaitip and Prasert (1990) used a special equilibrium model to analyze the effects of trade liberalization on the Asian and the united States rice markets. They indicated that under rice trade liberalization, the East Asian region became the major milled rice deficit area, drawing most of the supplies from major Asian exporters. They asserted that US rice exports to East Asia markets will also rise. Further, if the level of subsidies in rice production in the US declines there would be better chance for the US rice industry to rely on the high level of world rice price.

In their study on the relationship between world price instability and the farm prices in developing countries, Hazell *et al.* (1990) indicated that world prices for agricultural commodities were traditionally unstable, but they were particularly turbulent during late 1970s and early 1980s. they used the available post war data on individual commodity prices to test whether world price instability was increasing and to examine its impact on the producer prices in developing countries. It was found that the recent turbulence was more of a statistical fluke than the beginning of any long-term increase in market instability. Further while the variability in world prices had been entirely transmitted to developing countries in dollar iquivalent of their export unit value, it had not been fully transmitted to the average producer's prices. Real exchange rates, domestic marketing arrangements and Government intervention resulted in controlling price movements in favour of producers in many developing countries.

Bhalla (1995) examined the implications of globalization of Indian agriculture, keeping in view the dimensions of domestic demand and supply of foodgrains and some other important agricultural commodities in India. He asserted that the amount of foodgrain surplus over domestic demand is not likely to be substantial. Hence, he concluded that instead of export of foodgrains, it is realistic to concentrate on the export floriculture, fisheries etc., which besides being high valued, would helps in generating more employment.

Gulati and Sharma (1995) while analyzing the input subsidies in Indian agriculture revealed that the subsidies on key inputs have lost their rationale and are crowing out productive investment, damaging environment, accentuating inequity and promoting inefficient cropping pattern. They concluded that in order to have an accelerated and sustainable growth of Indian agriculture, the reforms in agricultural subsidies must start from liberalizing the out put markets, opening them to export markets and thereafter involving farmers in carrying out reforms in input markets.

Parikh *et al.* (1995) examined the impacts of liberalization, agricultural input subsidy reductions and safety net programmes for India with an applied general equilibrium model with nine agricultural sectors, one non-tradable non-agricultural sector and one tradable non-agricultural sector and one tradable non-agricultural sector and with five rural and five urban income classes. The result showed that non-agricultural trade liberalization is more important for agriculture than even agricultural trade liberalization, both of which help accelerate growth. A policy package involving trade liberalization with moderate residual tariff as

permitted under GATT and agricultural inputs subsidies removal accompanied by targeted safety net programmes along with stepped up investment in irrigation, with the expected additional foreign inflows materializing, producing foreign inflows materializing, produces a scenario that is superior from the point of growth, welfare and distribution.

Gill and Brar (1996) examined the competitiveness of some selected agricultural crops in the light of empirical evidence of domestic and international prices, the world commodity situation and the structure of the global market for agricultural commodities. They asserted that the globalization of agriculture will create increased international trading opportunities for those countries/regions which produce a large surplus both in wheat and rice crops, but to be internationally competitive in wheat and rice, the country like India will have to increase farm productivity, introduce efficiency in market handling and lower the tax rates in marketing of these crops. They suggested to concentrate on the export of processed materials instead of non processed agricultural commodities which will not only retain a large party of the value added with in the country but also help in generating more employment.

Gulati and Sharma (1997) expressed that if India frees up imports and exports of agricultural products at zero duty, there is a possibility of reaping significant gains from trade, while promoting resource use efficiency in domestic cropping patterns. The declining share of cereals in gross cropped area may slow down and even see reversal in some pockets. Similarly, area expansion under oilseeds will decelerate. India may emerge as a marginal exporter of cereals and

cotton, while importing edible oils and pulses. From overall efficiency point of view, agricultural trade liberalization would benefit India.

Selvaraj *et al.* (1998) studied the level of protection and comparative advantage of agriculture in Tamil Nadu under liberalized trade economy on rice, groundnut, sugarcane and cotton. The results showed that rice has comparative advantage justifying further protection. The protection coefficients and domestic resource costs showed that sugarcane is highly protected and has comparative disadvantage domestically as compared to world trade. The results showed that groundnut is highly protected and has comparative disadvantage. In case of cotton, it is disprotected and has comparative advantage.

Blake (2002) evaluated the impact on Uganda of the liberalization of world trade, especially in agricultural commodities, as proposed in the Uruguay Round and of unilateral liberalization of Uganda's own import tariffs. A CGE model of Uganda is used to model the effects of trade liberalization, taking into account the distribution effects by household types. The impact of multilateral liberalization on a low-income country such as Uganda appears to be quite slight, albeit positive, largely because there is only a slight impact on the world prices of the agricultural commodities it exports. The principal gains actually arise from trade reforms that are essentially unilateral in nature. The impact is likely to be pro-poor. Although the largest proportional gains are to the urban self employed, there are significant gains in agriculture that benefit almost all categories of rural household.

Gulati (2002) expressed that Indian agriculture is gradually being integrated into world agriculture. But the volatility of world prices, especially in its downswing, worries the Indian policy makers as it results in gushing imports and undermines the production base of millions of small and marginal farmers. It is more disturbing when exporting countries subsidize their exports or are able to compensate their farmers for fall in world prices.

Ramakrishna *et al.* (2002) studied the impact of globalization on growth, poverty and inequality in Etopia and India. The results indicated that both countries have benefited significantly and have shown improved economic performance due to globalization policies. Globalization has resulted in increasing growth in both the countries. The general poverty had declined and human development improved in both the countries.

Raghavendra (2004) studied the impact of price distortions on important crops of Karnataka state and their consequences on incomes of producers, consumers and government revenues. The results showed that welfare gain to producers was high and consumers incur substantial loss due to rise in prices. The net effect to the economy of the state due to the liberalization was substantial amounting to Rs. 48542 lakhs for rice, Rs.8101.63 lakhs for maize and Rs.32684.75 lakhs for redgram during the year 2001-02.

Rajesh *et al.* (2006) conducted cointegraion 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 among various

pepper markets within the country as well as between the domestic and the international markets. The price of Indian cardamom is poorly integrated with the international prices, indicating its non-decisive role in influencing the trade at international level.

Roy (2006) studied the impact of liberalization on exports and imports of India. The results revealed that in case of exports there has been a significant difference in growth rates between pre and post liberalization era. Growth has increased in latter. No significant change in overall stability of growth patterns has been observed in both the periods. In case of imports, growth has increased in latter. The rate of growth of imports was increasing in pre liberalization era where as, it is decreasing in post liberalization era which is indeed a good sign for the economy.

Methodology

CHAPTER III

METHODOLOGY

Perfect understanding and knowledge of the data is a sine-qua-non for any scientific enquiry. Hence, this chapter deals with the methodology followed in the present study. It includes database, sources and analytical tools employed in analyzing the objectives of the study.

In the present study, analysis was carried out to find out the growth and export competitiveness of four major crops in Andhra Pradesh viz., rice, maize, groundnut and cotton.

3.1. TYPES OF DATA

The growth in area, yield and production of four major crops in A.P., integration of domestic and international markets, competitiveness of these crops and implications of WTO on A.P. agriculture were analyzed and the analytical tools employed in the study are discussed below

To study the competitiveness of exports of selected crops from A.P, the free on board (FOB) prices, cost insurance freight (CIF) prices and domestic wholesale prices that prevailed in major A.P. markets were collected.

In order to assess integration of markets in the state with international markets, monthly wholesale prices were collected for the period through 1986 to 2005. The markets selected for the study are as follows. For rice, Nizamabad as

local market and Thailand for international market. For groundnut Nandyal as local market and Rotterdam as international market. For cotton, Guntur and Liverpool as local and international markets respectively. For maize the markets selected were Warangal for local market and US gulf as international market.

Destination wise exports were collected to study the structural change in exports. The major importing countries considered for analysis of trade in rice were Kuwait, Saudi Arabia, U.K, USA, Yamen and UAE. For cotton, the importing countries selected were China, Bangladesh, Belgium, Italy and Japan. The major importers for groundnut were Indonesia, Malaysia, Philippines and U.K.

For policy analysis matrix, the data on cost of cultivation for the four crops were collected for the study period.

3.2. PERIOD OF STUDY

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).

3.3. SOURCES OF DATA

The secondary data pertaining to area, yield and production of selected crops (rice, maize, groundnut and cotton) were collected from publications of Center for Monitoring Indian Economy (CMIE) pvt ltd, Mumbai. Data on destination wise export quantity, value were obtained from "Monthly statistics of foreign trade of India", published by Directorate General Commercial Intelligence and Statistics, Kolkata. International reference price of the crops under study were collected

from various issues of FAO production year book. The maritime freight rates of wheat were obtained from FAO trade year book (2003). 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 A.P. published by Directorate of Economics and Statistics, 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 (GOI scheme), Hyderabad.

3.4. TOOLS OF ANALYSIS

The following analytical tools were used in the present study in order to analyse the objectives.

3.4.1 Analysis of growth

The growth in area, production, productivity, quantity exported and export value were analyzed using exponential growth function of the form

$Y = ab^t e_t$.....(!)

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.

$\ln Y = \ln a + t \ln b + \ln(e)$ .....(2)

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

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

3.4.2 Instability Analysis

In order to study the variability in the area, production, productivity and export trade of selected crops, an index of instability was developed as a measure of variability.

The coefficient of variation (CV) was calculated using the formula

$$CV = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (X)}$$

3.4.3 Markov Chain analysis

The structural change in exports was examined using the Markov chain model. Central to the Markov model is the transitional probability matrix 'P'. The elements P_{ij} of this matrix indicate the probability that exports will switch from country 'i' to country 'j' over time. The diagonal element P_{ij} where $i \neq j$, measures the probability of a country retaining its market share. In other words, an examination of the diagonal elements of the transitional probability matrix indicates the loyalty of an importing country to a particular country's exports.

In the context of current application, structural change was treated as a random process in which five importing countries for Basmati rice and groundnut and four importing countries for cotton were considered. The average export of the selected crops from India amongst importing countries in any period depends only on the export in the previous period and this dependence is same among all the periods. This is algebraically expressed as

$$E_{jt} = \sum_{i=1}^{n} [\, E_{it-1} \,] P_{ij} + e_{jt}$$

Where

E_{jt} = exports from India to the jth country in the year t

E_{it-1} = exports of ith country during the year t-1

P_{ij} = the probability that exports will shift from ith country to jth country

e_{jt} = the error term which is statistically independent of E_{it-1}

N = the number of importing countries

The transitional probabilities P_{ij}, which can be arranged in a (c*n) matrix, have the following properties.

$0 \leq P_{ij} \leq 1$

$$\sum_{i=1}^{n} P_{ij} = 1, \text{ for all i}$$

Thus, the expected export share of each country during period 't' is obtained by multiplying the exports to these countries in the previous period (t-1) with the

transitional probability matrix. The probability matrix was estimated for the period 1995-96 to 2005-06.

Thus transitional probability matrix is estimated in the linear programming (LP) framework by a method referred to as minimization of Mean Absolute Deviation (MAD).

Min OP* = 1 e

Subject to

XP* + V=Y

GP* = 1

P* ≥ 0

Where

P* is a vector of probabilities Pij

O is the vector of zeros

1 is an appropriately dimensional vectors of areas

e is the vector of absolute errors

Y is the proportion of exports to each country

X is a block diagonal matrix of lagged values of Y

Y is the vector of errors

G is a grouping matrix to add the row elements of P arranged in P* to unity.

3.4.4 Cointegration Technique

The cointegration approach to market integration is intuitively appealing and straightforward in application. Integrated markets are those where prices are determined interdependently. This has generally been assumed to mean that the

price changes in one market will be fully transmitted to the other markets. Markets that are not integrated may convey inaccurate price that might distort marketing decisions and contribute to inefficient product movements.

According to this approach, two series are said to be co-integrated when there exists a long run relationship between them. In other words, two series cannot drift from one another in the long run. That is, there exists an equilibrating mechanism to bring the two series together. Applying this concept to any two given markets, cointegraion between their price series implies long run dependence between them. Since, the very essence of market integration is the price dependence across markets, it follows that cointegration between prices in two given markets implies integration of the markets.

To examine the price relation between two markets, let us consider the following basic relationship that is commonly used to test for the existence of market integration.

$$P_{it} = \alpha_0 + \alpha_1 P_{jt} + \varepsilon_t \quad \text{.....(1)}$$

Where Pi and Pj are price series of a specific commodity in two markets i and j. ε_t is the residual term assumed to be distributed identically and independently. The test of market integration is straight forward if pi and pj are stationary variables. Often, however, economic variables are non stationary in which case the conventional tests are biased towards rejecting the null hypothesis. Thus,

before proceeding to further analysis, it is important to check for the stationarity of the variables.

Stationary series is defined as one whose parameters that describe the series(namely the mean, variance and autocorrelation) are independent of time, or rather exhibit constant mean and variance and have autocorrelation that are invariant through time. Once the non stationarity status of the variables is determined, the next step is to test for the presence of cointegrating (long run equilibrium) relationship between the variables.

The Augmented Dicky Fuller(1979) test is used (ADF test) to determine the stationarity of a variable. The test is based on the Dicky Fuller value statistic of B1 given by the following equation.

$$\Delta Pt = \beta_0 + \beta_1 P_{t-1} + \sum_{K=1}^{N} \delta_k \Delta P\, t\text{-}k + \eta t \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where

$\Delta Pt = P_t - P_{t-1}$

The test statistic is simply the statistic, however, under the null hypothesis it is not distributed as student-t, but this ratio can be compared with critical values tabulated in Fuller (1976). In estimating Equation (2), the null hypothesis is Ho: Pt is I (1), which is rejected [in favour of 1(0)} if β_1 is found to be negative and statistically significant. The above test can also be carried out for the first difference of the variables. That is, we estimate the following regression equation:

$$\Delta^2 P_t = \theta_0 + \theta_1 \Delta P_{t-1} + \sum_{K=1}^{N} \Phi_k \Delta^2 P_{t-k} + \mu_t \quad \text{.....(3)}$$

Where the null hypothesis is Ho:P_t is I (2), which is rejected [in favour of I (1)] if θ_1 is found to be negative and statistically significant. In general, a series P_t is said to be

integrated of order 'd', if the series achieves stationary after differencing d times. denoted Pt ~ I(d). Consequently, if Pt is stationary after differencing once, this we may denote Pt ~ I (1).

Having established that the variables are non-stationary in level, we may then test for cointegration. Only variables that are of the same order of integration may constitute a potential co-integrating relationship.

Alternative and quicker finding out whether two price series are co-integrted is the Co-integrating Regression Dublin Watson (CRDW) test. In CRDW we use the Durbin Watson 'd' obtained from the co-integrating regression. Here null hypothesis is d=0.

Important domestic markets considered in the state are Nizamabad for rice, Nandyal for groundnut, Warangal for maize and Guntur for cotton. Based on the past studies of Reddy (1997) and Ramesh Chand (2002) the following international markets have been considered. They are Thailand for rice, US gulf for maize, Liverpool for cotton and Rotterdam for groundnut. In order to test the secular relationship between domestic and international markets of selected crops the above mentioned procedure was followed.

3.4.5 Policy Analysis Matrix (PAM)

The PAM is essentially a double accounting technique that summarizes budgetary information for farm and post-farm activities. 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, analyzing the matrix and simulating policy changes.

The method rests upon a familiar identity: profit =revenue-costs. For reasons that will soon be apparent costs are divided into those inputs that are traded on international markets (fertilizers, pesticides, hybrid seeds) and those domestic factors (labour, land, and capital), which are not traded internationally. This gives us the following profit identity:

Revenue-Cost of tradable inputs-Costs of domestic factors=profit

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, fertilizers, farm yard manures, pesticides and the going 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 economic analysis when the objective is to maximize national income. These are sometimes called shadow prices, efficiency values, or opportunity costs.

The determination of social values is one of the main tasks of economists, since these values offer the best indication of optimizing 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 on international markets, figuring out social prices is difficult and one way to do so involves mentally subtracting the effects of policy. The social costs have been calculated using Value Marginal Product approach, which uses factor share(Si) of various inputs (Xi) together with the mean values of inputs and outputs(Y) and prices (Pi). The computation of the social cost of input is as follows.

$$P_{xi} = [(Si/Xi)*Y]\ P_y$$

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

Private revenue-Private cost of tradable inputs-Private cost of domestic factors = **Private profit**

Social revenue - Social cost of tradable inputs - Social cost of domestic factors = **Social profit.**

The Policy Analysis Matrix

	REVENUES	COST OF TRADABLE INPUTS	COST OF DOMESTIC FACTORS	PROFITS
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 thing to keep 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 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 firms or farmers to participate and they would leave the industry.

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.

3.4.5.1 Effective protection coefficient (EPC):

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

$EPCi = (VAi^{d} / VAi^{b})$

Where VAi^d is the value added output I at domestic prices and VAi^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.

3.4.5.2 Nominal Protection Coefficient (NPC)

Nominal Protection Coefficient is a straightforward measure of competitiveness. It is calculated as a ratio between the domestic price 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).

3.4.5.3 Domestic Resources Coefficient (DRC)

The 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:

$DRC = a_{ij} v_j / (Pi^b - a_{ij} Pi^b)$

Where a_{ij} (j = K + 1 to n) is the technical coefficient (input use per unit os output) for domestic resource (non- trade intermediary input) j in the production of output i and vj 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 1 (Yao, 1977).

The PAM matrix to determine the level of comparative advantage of crop production was analyzed. The non-tradable inputs considered are labour (human and bullock), FYM, rental value of land, as these are not traded internationally. The tradable inputs are hybrid seed, fertilizers, and pesticides. The social costs have been calculated using Marginal Value Product approach that uses factor shares (Si) of various inputs (Xi) together with the mean value of inputs and output (Y) and price (Py). The computation of social cost of input is as follows

$Pxi = \{ (Si/Xi)^* Y\} ^*Py$

Trade competitiveness of selected crops was estimated under two distinct hypotheses. 1) The importable hypothesis and the 2) Exportable hypothesis

3.4.6 Partial Equilibrium Methods

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).

Price distortions on domestic as well as international market and domestic agricultural policies will have an impact on imcomes of producers, consumers and government revenues. These distortions are created on account of protectionist policies followed by the governments. With liberalization, 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 summarized as follows. The following formulae are applied for different prices affecting producers and consumers.

(1) Net social loss in production (NSLp)

$$NSLp = \tfrac{1}{2} (Qw-Q) (Pw-Pp)$$

$$= \tfrac{1}{2} t^2 p^n s^v$$

(2) Net social loss in consumption (NSLc)

$$NSLc=1/2 (Cw-C)(Pw-Pc)$$

$$= \tfrac{1}{2} t^2 c^n d^w$$

(3) Total net social loss (NSL)

$$NSL=NSLp-NSLc$$

(4) Welfare gain of producers (Gp)

$$Gp=Q(Pp-Pw)-NSLp$$

(5) Welfare gain of consumers (Gc)

$$Gc=Q(Pw-Pc)-NSLc$$

(6)Net effect of liberalization on welfare in the state

$$Q(Pp-Pw)-Q(Pw-Pc)$$

(6) Change in government revenue

$$dG=(NSLp+NSLc)-Gp-Gc$$

Where

Qw = Production at world prices

Q = Production at domestic prices

Pw= Border prices

Pp= Price faced by domestic producers

Pc = Price faced by domestic consumer

Cw = consumption at world prices

C= Consumption at domestic prices

W= Value of consumption at Pc

V= Value of production at Pp

Ns = Elasticity of domestic supply

Nd = Elasticity of domestic demand

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

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 assumed based on the past studies of Reddy(1997) and Raghavendra(2004).

For calculation of production values, the wholesale price of commodities were used, whereas, for consumption values, the retail price of commodities were used. However, consumption gains and lossed 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 conceptualization we present in Figure 3.1. An illustration of effects of price distortions. SS' represent the domestic supply function and NN' 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.

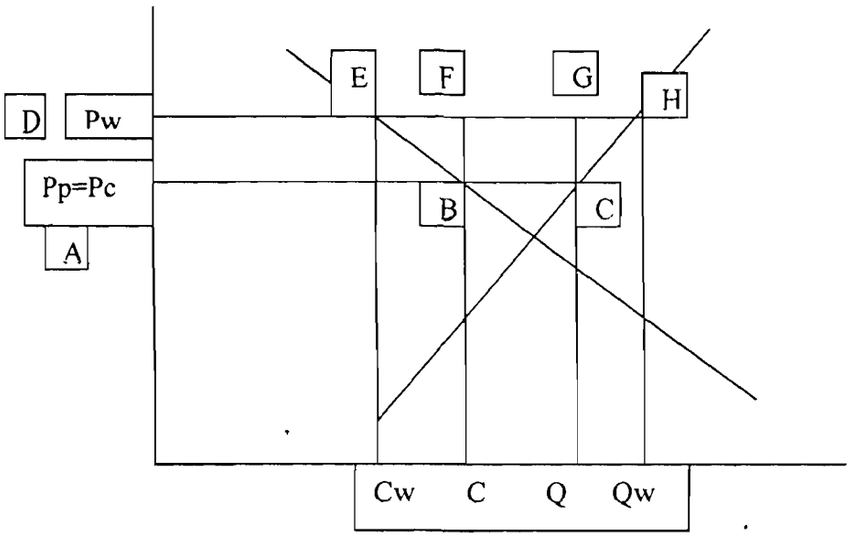

Fig: 3.1

Eq. (A) NSLp = CHG

Eq. (B) NSLc= BFE

Eq. (C) NSL = CHG + BFE

Eq (D) WGp = ACHD

Eq. (E) WGc= ABED

Eq (F) Net effect of liberalization of welfare in the state = CwCFE + Q QwHG

Results

CHAPTER IV

RESULTS

Analysis was carried out with in the framework of the specified methodology and also with specific reference to each of the objectives set forth for the present study. As described in the methodology, several statistical models were tried to obtain consistent estimates and these estimates were used to draw meaningful inferences which are presented in this chapter. For better exposition, the results are presented in following sections.

4.1 Growth rates in area, yield and production of important crops.

4.2 Direction of trade.

4.3 Relationship between domestic market prices and world market prices of crops.

4.4 Trade competitiveness of selected crops.

4.5 Impact of economic liberalization on trade and welfare.

4.6 Implications of WTO provisions for Andhra Pradesh's agriculture.

4.1 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 as well as for the nation. 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.

4.1.1 Rice

In Table 4.1 the compound growth rates of area, production and productivity of rice for Andhra Pradesh state are presented.

In Andhra Pradesh are under rice crop had increased from 34.52 lakh hectares to 39.82 lakh hectares in 2005-06. For the same period production increased from 76.13 lakh tones to 117.04 lakh tones at a compound growth rate of 1.66 per cent with a slightly higher instability of 9.75 per cent. Where as yield had increased at the rate of 1.55 per cent.

In the pre-WTO period the growth in area was almost stagnant (0.72%) with an 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.

The compound growth rates of area, production and productivity of rice in India are presented in Table 4.2. During the period 1985-86 to 2005-06 rice area in India had increased from 41.13 million hectares to 42.12 million hectares with a compound growth rate of 0.33 per cent. Production had increased at a rate of 1.81 per cent from 63.82 million tones to 85.31 million tones and productivity increased at the rate of 1.47 per cent per annum from 1550 kilograms to 2026 kilograms per hectare.

Growth in area in pre-WTO period was 0.62 per cent, but it was negative (-0.34%) in post-WTO period, where as instability is same in both the periods.

Table 4.1. Growth rates of area, production and productivity of rice in A.P. for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	3.56	0.059 (0.008)	0.07	0.82	0.72	7.98
Production (lakh tones)	4.24	0.08 (0.01)	0.45	2.72	3.40	10.76
Yield (kg/hec)	7.61	0.04 (0.005)	0.68	4.37	2.64	5.31
II Period						
Area (lakh hec)	3.71	0.09 (0.013)	0.19	-1.45	-1.93	12.79
Production (lakh tones)	4.60	0.11 (0.016)	0.0005	0.07	0.11	0.94
Yield (kg/hec)	7.82	0.035 (0.005)	0.56	3.42	1.81	4.61
Overall Period						
Area (lakh hec)	3.63	0.05 (0.004)	0.016	-0.57	-0.23	11.26
Production (lakh tones)	4.35	0.068 (0.005)	0.304	2.95	1.55	8.45
Yield (kg/hec)	7.66	0.027 (0.002)	0.760	8.04	1.66	9.75

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

Table 4.2. Growth rates of area, production and productivity of rice in India for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	3.69	0.016 (0.002)	0.41	2.39	0.62	2.09
Production (lakh tones)	4.06	0.04 (0.006)	0.75	4.97	3.47	5.45
Yield (kg/hec)	7.27	0.028 (0.004)	0.82	6.06	2.81	3.67
II Period						
Area (lakh hec)	3.78	0.02 (0.003)	0.12	-1.05	-0.34	2.62
Production (lakh tones)	4.39	0.05 (0.008)	0.05	0.67	0.58	6.83
Yield (kg/hec)	7.51	0.036 (0.005)	0.22	1.53	0.92	4.82
Overall Period						
Area (lakh hec)	3.71	0.013 (0.001)	0.31	2.86	0.33	2.82
Production (lakh tones)	4.15	0.036 (0.003)	0.65	5.83	1.81	7.25
Yield (kg/hec)	7.34	0.025 (0.002)	0.72	6.86	1.47	5.10

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

Growth in production and yield were higher in pre-WTO period than in post-WTO period. Instability is high in post-WTO period than in pre-WTO period.

4.1.2 Maize

Results presented in Table 4.3 on growth rates of area, production and productivity of maize in Andhra Pradesh revealed that 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. Production increased from 4.14 lakh tones in 1985-86 to 30.87 lakh tones in 2005-06. Yield increase was also quite substantial from 1433 kilograms per hectare in 1985-86 to 4073 kilograms per hectare in 2005-06.

Growth in area and production was quite high in the post-WTO period (8.77 and 5.41 respectively) whereas instability in production was higher in pre-WTO period. 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.

For India, growth of area under maize crop was almost stable. Production increased from 6.64 million tones in 1985-86 to 14.14 million tones in 2005-06 at a compound growth rate of 3.79 per cent. Yield increased at 2.6 per cent per annum. Instability was quite high in production and productivity which was 8.37 per cent and 9.39 per cent respectively (Table 4.4)

Table 4.3.Growth rates of area, production and productivity of maize in A.P. for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	1.088	0.02 (0.002)	0.27	1.86	0.55	3.33
Production (lakh tones)	0.085	0.018 (0.002)	0.27	1.85	0.49	22.14
Yield (kg/hec)	7.14	0.05 (0.007)	0.90	9.30	7.38	7.42
II Period						
Area (lakh hec)	1.09	0.065 (0.009)	0.89	8.71	8.77	8.76
Production (lakh tones)	0.14	0.039 (0.005)	0.90	9.12	5.41	10.92
Yield (kg/hec)	7.93	0.071 (0.01)	0.30	1.99	2.12	9.20
Overall Period						
Area (lakh hec)	0.85	0.065 (0.004)	0.79	8.82	4.49	16.44
Production (lakh tones)	1.25	0.05 (0.004)	0.95	21.23	9.13	23.50
Yield (kg/hec)	7.29	0.05 (0.004)	0.85	10.89	4.63	6.38

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

Table 4.4 Growth rates of area, production and productivity of maize in India for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	1.74	0:013 (0.002)	0.44	2.53	0.55	1.77
Production (lakh tones)	1.87	0.09 (0.01)	0.50	3.87	4.28	11.10
Yield (kg/hec)	7.04	0.08 (0.013)	0.48	2.74	3.71	10.28
II Period						
Area (lakh hec)	1.75	0.02 (0.003)	0.82	6.21	2.22	3.01
Production (lakh tones)	2.24	0.049 (0.007)	0.76	5.11	4.12	6.66
Yield (kg/hec)	7.39	0.039 (0.006)	0.51	2.93	1.86	5.22
Overall Period						
Area (lakh hec)	1.70	0.01 (0.001)	0.78	8.14	1.15	3.64
Production (lakh tones)	1.89	0.047 (0.003)	0.83	9.46	3.79	8.37
Yield (kg/hec)	7.09	0.043 (0.003)	0.73	7.11	2.60	9.39

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

A comparison of the two periods revealed that growth in area was quite high in post-WTO period (2.22%) and also instability in area expansion was also high in post-WTO period than in pre-WTO period. Growth in production was almost same in both the periods whereas instability was high in pre-WTO period (11.1%). It is interesting to know that growth in yield obtained was higher in the pre-WTO period (3.71%) than in post-WTO period, and this was accompanied by a very high degree of instability in yield (10.28%).

4.1.3 Groundnut

Trends in area, production and productivity of groundnut in Andhra Pradesh are presented in Table 4.5. 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 negative growth rate of 0.69 per cent. But performance of production was not encouraging. It was 13.11 lakh tones in 1985-86 to 13.66 lakh tones in 2005-06. It had grown at a rate of -1.55 per cent with very high degree of instability in its production (28.88%). 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. Instability in production was substiantial at 18.8 per cent.

The performance of the crop in terms of growth in area, production and productivity in the post-WTO period was dismal with negative trends. 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 grew at 0.99 per cent. Though, instability in yield

Table 4.5. Growth rates of area, production and productivity of groundnut in A.P. for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	2.79	0.069 (0.01)	0.63	3.96	4.15	8.88
Production (lakh tones)	2.60	0.12 (0.01)	0.46	2.80	5.20	16.94
Yield (kg/hec)	6.71	0.07 (0.01)	0.08	0.89	0.99	13.26
II Period						
Area (lakh hec)	3.06	0.06 (0.01)	0.41	-2.50	-2.54	8.75
Production (lakh tons)	3.03	0.22 (0.03)	0.26	-1.79	-5.67	27.79
Yield (kg/hec)	6.88	0.167 (0.02)	0.16	-1.31	-3.20	22.30
Overall Period						
Area (lakh hec)	3.05	0.07 (0.005)	0.07	-1.29	-0.69	15.07
Production (lakh tons)	2.97	0.14 (0.01)	0.09	-1.45	-1.55	28.88
Yield (kg/hec)	6.83	0.08 (0.006)	0.07	-1.27	-0.86	18.86

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

Table 4.6. Growth rates of area, production and productivity of groundnut in India for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	1.97	0.054 (0.008)	0.35	2.07	1.82	6.87
Production (lakh tones)	1.74	0.109 (0.01)	0.42	2.4	4.32	13.7
Yield (kg/hec)	6.68	0.08 (0.01)	0.3	1.88	2.49	10.59
II Period						
Area (lakh hec)	2.05	0.037 (0.006)	0.68	-4.18	-2.5	4.92
Production (lakh tones)	2.08	0.16 (0.02)	0.12	-1.05	-2.74	19.31
Yield (kg/hec)	6.93	0.14 (0.02)	0.001	-0.109	-0.26	18.36
Overall Period						
Area (lakh hec)	2.13	0.04 (0.003)	0.37	-3.29	-1.23	9.14
Production (lakh tones)	1.97	0.103 (0.008)	0.002	-0.22	-0.19	19.38
Yield (kg/hec)	6.76	0.07 (0.006)	0.12	1.57	1.04	15.99

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

and production was higher in both periods, it was high in post-WTO period compared to pre-WTO period.

The groundnut scenario in the country has undergone sea change in the 20 years period (Table 4.6). Area under groundnut crop showed stagnant growth. Trends in production also showed the similar nature. It was 5.12 million tones in 1985-86 and increased to 7.02 million tones in 2005-06 with high instability percentage of 19.38 per cent. A similar trend was observed in yield front also. It was 720 kilograms per hectare in 1985-86 and increased to 1050 kilograms per hectare in 2005-06 with an instability of 15.09 per cent.

Between the two periods, the performance of groundnut was encouraging in pre-WTO period with positive growth rates, but after implementation of WTO growth in area and production declined at compound growth rates of 2.5 per cent and 2.74 per cent respectively. Instability in production and yield was higher in post-WTO period than in pre-WTO period.

4.1.4 Cotton

Growth rates in area, production and productivity of cotton in Andhra Pradesh are summarized in Table 4.7. 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. But, instability in production was very high.(31.84%).

The performance of area and production was very 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

Table 4.7.Growth rates of area, production and productivity of cotton in A.P. for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	1.57	0.08 (0.01)	0.64	4.01	4.86	13.73
Production (lakh tons)	1.75	0.16 (0.02)	0.51	3.12	8.11	23.44
Yield (kg/hec)	5.31	0.16 (0.023)	0.15	1.28	3.08	19.39
II Period						
Area (lakh hec)	2.35	0.09 (0.01)	0.01	-0.42	-0.005	13.58
Production (lakh tons)	2.67	0.13 (0.019)	0.13	1.20	2.33	17.85
Yield (kg/hec)	5.45	0.11 (0.016)	0.25	1.77	2.92	15.99
Overall Period						
Area (lakh hec)	1.66	0.07 (0.005)	0.68	6.50	3.73	15.13
Production (lakh tons)	1.90	0.105 (0.008)	0.68	6.60	5.47	31.84
Yield (kg/hec)	5.37	0.09 (0.007)	0.21	2.36	1.66	11.76

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

growth in area showed negative trend (-0.005%), but growth rates of production and yield were satisfactory (2.33% and 2.92% respectively). Instability in all growth parameters was very high in pre-WTO period than in post-WTO period.

Growth performance of area, production and productivity of cotton in India is given in Table 4.8. The area under cotton in India seems to have reached a plateau except for a few fluctuations in some years (0.95%). Production and yield grew at the rate of 2.49 per cent and 1.24 per cent respectively. But there was a high instability in all the parameters.

Performance of cotton crop in India was better in pre-WTO period than in post-WTO period in case of production and yield. They grew at a rate of 5.57 per cent and 4.55 per cent respectively. Growth in area was more in post-WTO period at the rate of 3.29 than in pre-WTO period. Instability in the growth of area, yield and production was very high in post-WTO period than in pre-WTO period.

4.2 Direction of trade and structural change in exports

The dynamics in the direction of exports and the changing pattern in the trade of major crops from India by shift in export shares from one country to another over a period of time were analysed by employing the first order Markov chain model. The trend in sustaining the existing markets and the gains and losses in the export share of major crops from India by the major importing countries were obtained from the transitional probability matrices.

The actual proportion of exports to different countries have been assumed in computing the transitional probability matrix for the period under study. The matrix explains the switching behaviour of selected major Indian crops among

Table 4.8. Growth rates of area, production and productivity of cotton in India for selected periods

Description	Intercept	Slope	R square	T value	Growth rate(%)	Instability index(%)
I Period						
Area (lakh hec)	1.94	0.035 (0.005)	0.27	1.72	0.99	4.48
Production (lakh tones)	1.94	0.09 (0.015)	0.59	3.43	5.57	12.01
Yield (Kg/hec)	5.13	0.06 (0.01)	0.68	4.17	4.55	8.45
II Period						
Area (lakh hec)	1.87	0.227 (0.03)	0.08	0.88	3.29	20.66
Production (lakh tones)	2.46	0.14 (0.023)	0.0006	0.07	0.168	19.54
Yield (kg/hec)	5.36	0.138 (0.022)	0.05	0.69	1.56	0.50
Overall Period						
Area (lakh hec)	1.92	0.107 (0.008)	0.05	1.05	0.95	16.54
Production (lakh tones)	2.09	0.08 (0.007)	0.38	3.33	2.49	17.81
Yield (kg/hec)	5.28	0.07 (0.006)	0.16	1.90	1.24	16.44

Note: Figures in parentheses indicate standard error.
I period: 1985-86 to 1994-95
II period: 1995-96 to 2004-05
Overall period: 1985-86 to 2004-05
* ** *** denote significant at 1,5 and 10 percent respectively.

major importing countries over a period of time indicating the change in direction. The row elements in the transitional probability matrix provide the information on the probability retention in the volume of trade and extent of loss in trade on account of competing countries. The column elements indicate the probability of the gains in the volume of trade from other competing countries. The diagonal elements indicate the probability retention of Indian exports to a particular country as of previous year.

Though, the present study was designed to study two periods, the first period from 1984-85 to 1994-95 termed as pre-WTO period and the second period from 1995-96 to 2004-05 designated as post-WTO period, the direction of trade was studied only from 1995-96 to 2004-05. In pre-WTO period the exports of the commodities under study to different countries were nil or very meager except for rice. So, only the data from 1995-96 to 2004-05 has been considered for the study. In case of maize, there were no exports to a particular country for the period. As it is difficult to study the direction of trade without continuous exports, the study has not been carried out for maize. The results of the analysis for other crops are presented below.

4.2.1 Basmati Rice

The transitional probabilities presented in Table 4.9 depict a broad indication of the changes in the direction of basmati rice trade over a period of ten years. The time period considered for the analysis was 1996-97 to 2005-06. The six major importing countries considered for the analysis of trade in Indian

basmati rice were Kuwait, Saudi Arabia, UK, USA, Yamen and UAE. The export to remaining countries was pooled under other countries.

As could be seen form the table, the transitional probability matrix indicated that exports to Saudi Arabia had been retained to the tune of about 68 per cent of previous year share in the current period. About eight per cent was directed to UK, seven per cent to UAE and eleven per cent to other countries. Saudi Arabia gained 80 per cent of UAE market, 57 per cent of USA market share and 51 per cent of 'others' market share.

Regarding other countries, India retained 28 per cent of its previous exports to these importing countries and the remaining 72 per cent was captured by the major destinations of Indian basmati rice exports namely Saudi Arabia, Yamen and UK. About 52 per cent was lost to Saudi Arabia and 10 per cent to Yamen. Others gained 100 per cent of Yamen's share, 39 per cent of Kuwait's share, 15 per cent of USA's share and 11 per cent of Saudi Arabia's share.

During the current period, India's basmati rice exports to UK were retained to the tune of about 30 per cent. On the other hand nearly 54 per cent was lost to Kuwait and 7 per cent each to USA and Saudi Arabia. But it gained 13 per cent of Kuwait's share and 8 per cent of Saudi Arabia's share.

India retained nine per cent of its previous year's basmati rice exports share to USA. Of the remaining 91 per cent, a major share (57%) was diverted to Saudi Arabia, 17 per cent to Kuwait and 15 per cent of 'others' share.

India's basmati rice exports to the Kuwait market were retained to the tune of four per cent. Of the remaining 96 per cent, 53 per cent was diverted to UK, 20

Table 4.9: Transition probability matrix for basmati rice (1995-96 to 2005-2006)

	Kuwait	Saudi Arabia	UK	U.S.A	Yamen	UAE	Others
Kuwait	0.040	0.256	0.130	0.182	0.000	0.000	0.392
Saudi Arabia	0.015	0.681	0.082	0.033	0.001	0.074	0.115
U.K	0.539	0.075	0.297	0.070	0.019	0.000	0.000
U.S.A	0.177	0.574	0.000	0.099	0.000	0.000	0.150
Yamen	0.000	0.000	0.000	0.000	0.000	0.000	1.000
UAE	0.205	0.795	0.000	0.000	0.000	0.000	0.000
Others	0.000	0.519	0.058	0.000	0.102	0.042	0.280

Table 4.10 Actual and predicted values of India's basmati rice exports to major importing countries

(value in lakh Rs.)

Year	Kuwait		Saudi arabia		UK		U.S.A		Yamen		UAE		Others	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
1996-97	9823.53	12038.74	64207.25	71486.79	9576.36	10024.80	2309.49	6863.45	60.02	1369.15	6991.37	5213.74	11009.85	17841.61
1997-98	19540.45	19408.74	96499.31	95778.31	10922.42	15095.14	9225.66	8418.76	116.60	2762.54	8095.16	8153.27	24103.07	27006.60
1998-99	8934.72	13322.47	136787.98	111670.46	16790.08	18255.54	2008.65	7514.27	475.86	2022.31	7355.53	10767.34	153380.69	24310.34
1999-00	12592.36	14770.82	105851.37	100771.18	17305.33	16793.19	7070.65	7696.25	1921.98	2785.41	10245.40	8800.96	23046.71	26544.65
2000-01	22734.60	23097.71	109878.46	113277.27	30370.39	22734.34	13077.13	11184.24	1330.72	3762.39	9053.04	9397.38	30151.79	33282.75
2001-02	19611.09	15489.01	105880.68	99285.87	19325.84	18234.84	9465.01	9353.12	3213.43	2694.95	4997.31	8750.06	21783.24	30596.27
2002-03	17279.24	16900.92	105221.40	111238.57	20515.73	19307.07	10422.31	9085.02	4052.12	4609.25	8432.85	9480.47	40335.65	35783.32
2003-04	1376.89	17284.97	106796.30	113857.88	21939.14	18294.52	9337.22	6234.97	360.91	5522.22	10488.35	9961.16	49005.69	28304.35
2004-05	23387.77	21279.07	158411.10	151809.27	25445.34	25871.56	7960.92	12053.42	8967.75	4658.90	13869.83	13376.49	39382.69	48574.04
2005-06	23792.73	20870.88	166442.47	167824.97	22625.52	26552.21	11051.68	12500.76	11144.82	6032.41	15957.45	14555.12	53295.05	56192.75

per cent to UAE and 17 per cent to USA. However, Kuwait gained 25 per cent of Saudi Arabia's share, 39 per cent of other's share, 18 per cent of USA's share and 13 per cent of UK's share.

During the current period India could not retain its previous rice exports share to UAE and Yamen. The entire share of UAE was diverted to Saudi Arabia and Kuwait.

A comparison of actual and predicted values of export of basmati rice from India (Table 4.10) revealed that both are closer to each other implying that the model was reasonably efficient and the direction of export patterns captured was accurate.

4.2.2 Groundnut

The transitional probability matrix presented in Table 4.11 shows changes in the direction of groundnut trade. The time period considered was from 1996-97 to 2005-06. The table revealed that Indian exports to Indonesia, Malaysia, UK and 'others' were stable maintaining a major share of exports to these countries.

Indonesia has indeed been a rapidly growing market for Indian groundnut. The high retention of this market was further reinforced by the high probability of transfer from Malaysia (0.14) and others (0.19). However, there were small probabilities of loss to Philippines (0.03) and others (0.057).

UK had a fairly high retention of 0.689 and high transfer probability of 0.2423 to the Philippines and 0.068 to the 'other' countries. It gained from 'others' share by 0.0884 times.

Table 4.11: Transition probability matrix for Groundnut (1996-97 to 2005-2006)

	Indonesia	Malaysia	Philippines	UK	Others
Indonesia	0.912	0.000	0.030	0.000	0.057
Malaysia	0.145	0.646	0.208	0.000	0.000
Philippines	0.000	0.454	0.000	0.000	0.546
UK	0.000	0.000	0.242	0.689	0.068
Others	0.192	0.143	0.003	0.088	0.573

Table 4.12 Actual and predicted values of India's groundnut exports to major importing countries

(Value in lakh Rs.)

Year	Indonesia		Malaysia		Philippines		U.K.		Others	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
1995-96	10461.05	11005.53	932.73	1881.52	651.18	1381.19	3509.98	3026.60	6880.47	5132.94
1996-97	18292.01	18065.41	2124.00	3178.87	2234.01	2074.86	4397.93	3519.59	5536.45	5733.63
1997-98	15937.29	19449.18	2356.08	6930.95	4450.54	3290.68	9260.35	8476.51	23711.88	17554.58
1998-99	3976.99	4858.81	1782.98	2316.44	975.18	1036.94	2186.44	1952.40	5044.69	3798.32
1999-00	5872.48	6899.85	1230.56	2425.83	1363.26	1128.74	2777.58	2539.52	7078.82	5323.97
2000-01	16727.62	17122.87	4189.92	4275.34	1403.47	2079.07	2820.73	2517.95	6498.55	5635.10
2001-02	13552.09	13813.73	3672.31	3749.14	1531.44	1558.36	1533.43	1476.53	4751.17	4435.17
2002-03	9871.42	10165.28	4241.84	3315.32	373.37	1316.35	527.33	612.28	2816.22	2416.04
2003-04	16309.47	20332.05	10118.48	11330.34	4034.76	3460.03	3284.49	4091.38	20682.98	15206.90
2004-05	18789.02	21263.94	12712.88	11364.13	3202.59	4165.59	3780.92	3649.47	11814.73	9846.21
2005-06	131156.40	140550.50	70100.93	68656.56	33867.20	23456.71	19577.42	139665.72	55575.55	59140.07

Malaysia has a probability of retention of 0.6468, which is reinforced by high probability of transfer from Philippines (0.4541) and moderately from others (0.1428). But there was a tendency to loose its market share to Indonesia (0.1451) and Philippines (0.2082).

'Other' importers also had moderate retention of 0.53 and the transfer from Philippines (0.5459), UK (0.068) and Indonesia (0.057) further strengthened this. However, there were small probability of loss to Indonesia (0.1925) and Malaysia (0.1428).

The Philippines was not a stable market for Indian groundnut export. Philippines had lost its share (0.5459) to 'others' and a share of (0.4541) to Malaysia but in turn it also gained 0.2082 share of Malaysia's market and a market share of 0.2423 of UK.

The actual and predicted values of groundnut exports are depicted in Table 4.12. A comparison of these values indicated that the actual and predicted values of exports are almost similar implying that the model was reasonably efficient and the direction of export patterns captured was fairly accurate.

4.2.3 Cotton

Changes in direction of cotton trade showed by transitional probability matrix are presented in Table 4.13. The table reveals that stable markets for Indian exports were Bangladesh, Italy and 'others'.

'Others' had high retention to the extent of 0.726 and fairly small transfer probability of 0.355 to Belgium, 0.157 to Japan, 0.039 to China and 0.0433 to

Table 4.13: Transition probability matrix for cotton (1996-97 to 2005-2006)

	China	Bangladesh	Belgium	Italy	Japan	Others
China	0.000	0.000	0.000	0.000	0.000	1.000
Bangladesh	0.288	0.490	0.011	0.000	0.000	0.209
Belgium	0.000	0.000	0.000	0.000	0.000	1.000
Italy	0.000	0.000	0.083	0.533	0.185	0.197
Japan	0.138	0.477	0.000	0.000	0.000	0.383
Others	0.039	0.000	0.355	0.043	0.157	0.726

Table 4.14 Actual and predicted values of India's cotton exports to major importing countries

(Value in lakh Rs.)

Year	China		Bangladesh		Belgium		Italy		Japan		Others	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
1996-97	8624.30	7411.48	1987.64	8066.12	1893.14	4420.79	7328.19	9220.96	14868.30	20627.35	122749.30	107187.06
1997-98	3985.70	4894.36	5268.78	3308.17	693.76	2256.20	4923.57	5319.23	6881.26	10682.45	62239.43	54571.92
1998-99	1053.26	1142.18	880.52	1689.46	629.00	4955.01	2039.67	1669.63	2637.34	2489.36	13452.41	13044.65
1999-00	11.47	533.30	40.86	1408.09	462.89	1222.80	1566.06	967.89	2910.00	772.62	3075.81	4138.98
2000-01	1473.23	1128.53	973.19	1488.68	640.02	5288.35	2654.59	2031.67	2121.23	2727.44	14244.26	13993.36
2001-02	15.54	352.81	201.69	826.08	127.96	798.08	340.30	275.00	1524.65	402.41	2162.14	2406.34
2002-03	2115.30	2384.25	6572.30	3942.35	368.09	2674.88	381.62	517.12	1513.48	1208.12	7245.40	9772.00
2003-04	4215.21	4421.19	12942.90	7058.62	608.23	4589.99	281.76	690.11	1502.32	2009.86	12469.68	17212.38
2004-05	3815.41	3688.01	8828.25	4808.68	411.56	9259.12	102.34	1171.22	1012.24	4067.87	25789.44	25203.05
2005-06	34156.61	1752.50	4713.60	2558.73	214.90	2991.32	10.76	364.27	522.16	1302.00	8280.35	41570.29

Italy. They had gained all of China and Belgium's share, 0.383 of Japan's share and 0.209 of Bangladesh's share.

Italy also had a fair degree of retention of 0.533 per cent. However its share to the tune of 0.185 was lost to Japan, 0.917 to 'others' and 0.0833 to Belgium.

Bangladesh had a probability retention of 0.49. It gained from Japan's market share (0.477). But there was a tendency to loose its market share of 0.288 to China, 0.209 to 'others' and 0.0108 to Belgium.

China, Japan and Belgium were not stable markets for Indian cotton exports. Though China had lost all its share to 'others', but it gained Bangladesh (0.288), Japan (0.138) and 'others'(0.039).

Belgium had lost all its share to 'others' but there was a tendency to gain 0.0833 of Italy's share, 0.355 of 'others' and 0.0108 of Bangladesh share.

Actual and predicted values considered for the study are presented in Table 4.14. A comparison of these indicated that the actual and estimated export values are almost closer for all the countries except for some years implying that the model was reasonably efficient and the credibility of the direction of export pattern changes was fairly accurate.

4.3 Relationship between domestic market prices and international prices of selected crops

To estimate long run equilibrium relationship with short-term disturbances that stem from the perception of non-stationarity of macro economic time series data defined in terms of time variant mean and variance co-integration technique

Table .4.15 : Test for stationarity of domestic and international price series (pre-WTO period)

Sl.No	Price series	Order of integration	Augmented Dickey Fuller (ADF) value	Dickey fuller 10% critical value
1.	**Rice**			
A	Domestic Market (Nizamabad)	1	-3.78	-2.57
B	International Market (Thailand)	1	-4.39	-2.57
2.	**Maize**			
A	Domestic Market (Warangal)	1	-2.84	-2.57
B	International Market (US Gulf)	1	-3.23	-2.57
3.	**Groundnut**			
A	Domestic Market (Nandyal)	1	-3.52	-2.57
B	International Market (Rotterdam)	1	-3.66	-2.57
4	**Cotton**			
A	Domestic Market (Guntur)	1	-3.45	-2.57
B	International Market (Liverpool)	1	-2.89	-2.57

Table 4.16: Test for stationarity of domestic and international price series (post-WTO period)

Sl.No	Price series	Order of integration	Augmented Dickey Fuller (ADF) value	Dickey fuller 10% critical value
1.	**Rice**			
a	Domestic Market (Nizamabad)	1	-3.35	-2.57
b	International Market (Thailand)	1	-3.01	-2.57
2.	**Maize**			
a	Domestic Market (Warangal)	1	-2.97	-2.57
b	International Market (US Gulf)	1	-6.40	-2.57
3.	**Groundnut**			
a	Domestic Market (Nandyal)	1	-3.19	-2.57
b	International Market (Rotterdam)	1	-3.16	-2.57
4	**Cotton**			
a	Domestic Market (Guntur)	1	-6.09	-2.57
b	International Market (Liverpool)	1	-3.46	-2.57

was used. Non-stationarity variables derived from 'stochastic trends' which include seasonal components, are called integrated variables. Two integrated variables can be 'co-integrated' when they converge in the long run despite short period divergences. This notion of long run convergence was verified for international and domestic price series of the selected crops (Rice, Maize, Groundnut, cotton) using cointegration methodology.

This exercise was carried out for two periods viz, pre-WTO and post-WTO period in order to study the effect of WTO on the movement of price series. The annual price series of domestic and international markets are verified for stationarity in terms of Augmented Dickey Fuller (ADF) unit root test. The results of the unit test are presented in the Tables 4.15 and 4.16. Both international and local market price series were found to be stationary at the first difference for the selected crops implying integration of 'order 1' for both the periods.

The critical value for ADF statistics for testing the hypothesis that domestic and international market price series are co-integrated at 10 per cent level is greater than -2.57. The hypothesis that prices are not integrated is rejected in all cases for both periods ie, pre-WTO and post-WTO periods. This means that all local market prices are integrated with world market prices.

4.4 Trade competitiveness of selected commodities

In accordance with the theory of comparative advantage in international trade and against the background of globalization policies, it becomes imperative to study the export competitiveness of major commodities. Measures of trade

competitiveness and methodology followed are presented in methodology chapter.

4.4.1 Trade competitiveness of rice

Results of policy analysis matrix (PAM) are presented in Table 4.17. The table reveals that domestic resource cost (DRC) is less than one for the study period. This implies that the value of domestic resources used up in producing a unit of rice is less than what it would cost to import. In other words estimates for DRC indicated comparative advantage in producing rice. When average DRC is considered between the two periods, DRC was more in pre-WTO period than in post-WTO period. It was 0.78 in pre-WTO period and 0.48 in post-WTO period. This shows that comparative advantage in rice production in Andhra Pradesh improved over the years.

Effective Protection Coefficients (EPC) also indicated that Andhra Pradesh is an efficient producer of rice. EPC was 0.9 in pre-WTO period and decreased to 0.64 in post-WTO period which is an indication that rice production was fairly protected by the government. NPCI was below than one in both the periods which shows that the average market prices of these inputs are lower than world prices.

The estimates of NPC are similar to that of EPC. NPC is less than one over the study period. It has decreased from 0.71 in pre-WTO period to 0.57 in post-WTO period. The NPC for rice indicates that the state had price competitiveness in rice. Subsidy Ratio to Producer (SRP) was also less than one, implying that rice production in the state was fairly protected. Results of NPC

Table No: 4.17 : Results of policy analysis matrix (PAM) of rice

Year	NPC	NPCI	EPC	DRC	SRP	PC
1986-87	0.89	0.32	1.2	0.95	0.52	1.25
1987-88	0.81	0.38	1.12	0.96	0.42	2.3
1988-89	0.68	0.28	0.91	0.76	0.25	1.67
1989-90	0.63	0.37	0.76	0.63	0.1	1.05
1990-91	0.65	0.41	0.82	0.7	0.17	1.89
1991-92	0.66	0.34	0.79	0.68	0.11	1.43
1992-93	0.77	0.28	0.97	0.82	0.35	1.98
1993-94	0.65	0.36	0.88	0.73	0.2	2.31
1994-95	0.69	0.35	0.73	0.79	0.3	0.98
Average*	**0.71**	**0.34**	**0.9**	**0.78**	**0.26**	**1.65**
1995-96	0.64	0.28	0.53	0.48	-0.23	0.61
1996-97	0.41	0.26	0.47	0.26	-0.26	0.51
1997-98	0.44	0.29	0.49	0.38	-0.29	0.36
1998-99	0.47	0.26	0.55	0.3	-0.18	0.63
1999-00	0.54	0.41	0.59	0.47	-0.17	0.55
2000-01	0.62	0.41	0.71	0.56	-0.06	0.77
2001-02	0.72	0.47	0.84	0.68	0.02	1.13
2002-03	0.72	0.33	0.88	0.68	0.13	1.63
2003-04	0.64	0.35	0.73	0.56	0.002	1.007
Average**	**0.57**	**0.34**	**0.64**	**0.48**	**-0.11**	**0.79**

*Average of 1986-87 to 1994-95
**Average of 1995-95 to 2003-04

Table No: 4.18 Nominal protection coefficient (NPC) for rice under exportabe hypothesis.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Wholesale price in A.P		Rs/Qtl	301.56	321.78	350.63	374.06	430.62	487.17	562.65	710 75	795.41	1096.88	1000.00	977.43	1033.33	1207.00	1373.94	1126.24	1362.12	1488.18	1437.50	1370.28
Transport cost	Chennai	Rs/Qtl	27.75	29.00	29.00	29.65	29.80	30.00	31.60	31.75	32.00	32.00	33.20	33.65	33.75	34.00	34.00	34.50	34.50	34.58	35.25	35.87
Marketing margins@ 5%		Rs/Qtl	15.08	16.09	17.53	18.70	21.53	24.36	28.13	35.54	39 77	54.84	50.00	48.87	51.67	60.35	68.70	56.31	68.11	74.41	71.88	68.51
C&F Handling charges		Rs/Qtl	14.00	14 20	14.50	15.60	16.00	17 20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	30.00	31.50	32 00	32.80
Wharfage charges		Rs/Qtl	3 15	3 50	3.60	4.00	4.00	5.00	5.45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.30	7.80	7.90	8.20
Service charges		Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.00	4.20	4.20	4.60
Service Tax		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.35	0.35	0.37
Equals FOB price		Rs/Qtl	363.70	386 73	417.74	444.66	504.65	566.65	648.96	808.08	899 17	1217.13	1118.18	1097.29	1157.35	1340.56	1518.21	1258.62	1506.35	1641.02	1589.08	1520.63
Plus Freight from India to Bangkok		Rs/Qtl	8.16	7 59	8.74	10.32	11.54	13.45	13.20	19.46	24.14	28.49	30.61	29.12	28.99	27.30	29.92	28.61	27.86	27 89	28 02	28.01
Plus Insurance @ 1%of price		Rs/Qtl	3.02	3.22	3.51	3.74	4.31	4.87	5.63	7.11	7 95	10.97	10.00	9.77	10.33	12.07	13.74	11.26	13.62	14.88	14.38	13.70
Equals landed price		Rs/Qtl	374.87	397.54	429.99	458.72	520.49	584.97	667.79	834.65	931.26	1256.59	1158.79	1136.19	1196.67	1379.93	1561.87	1298.49	1547.83	1683.79	1631 47	1562.35
FoB price	Bangkok	$/Qtl	21.70	21.00	23.00	28.40	30.50	27.80	30.20	27.80	25.00	27.00	32.10	33.80	30.20	30.50	24.80	20.20	17 70	19.18	19.94	24.57
Exchange rate		1$=Rs	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.12	42.08	43.28	45.61	47.61	47 61	48.10
FoB price	Bangkok	Rs/Qtl	258.01	257 04	293.94	368.35	441.64	462.87	541.79	680.27	724.00	847.80	1007.62	1128.92	1071.19	1132.16	1043.58	874.26	807.30	913.16	949.34	1181.82
Nominal protection coefficients			1.45	1.55	1.46	1.25	1.18	1.26	1.23	1.23	1.29	1.48	1.15	1.01	1.12	1.22	1.50	1.49	1.92	1.84	1.72	1.32

Note : C F charges include empty container lift on charges, container yard to CFS, container transportation, cargo container stuffing charges, customs and port sundries, documentation charges.

Wharfage charges-ship landing charges.

under exportable hypothesis revealed that the state had poor competitiveness for rice exports (Table 4.18). The situation still worsened after WTO than in pre-WTO period.

4.4.2 Trade competitiveness of maize

Maize had varying results, in some years it was non-competitive although the average for 1986-87 to 1994-95 indicates that it is competitive.

In comparison between the two periods, it showed that in both the periods the maize production in the state was non-competitive. EPC was almost same in both the periods which implies that maize production was highly protected (1.57 and 1.6). The DRC of 1.31 in pre-WTO period connotes that the value of domestic resources used up in producing a unit output of this crop was more than what it would cost to import from other countries. Even after WTO, this ratio was increased to 1.44 which means that competitiveness has still decreased over the years. SRP was less than one in both the periods implying maize production was fairly protected by government. NPCI (Nominal Protection Coefficient of inputs) of 0.33 and 0.34 in both the periods shows that input market prices are lower than world prices by 33 and 34 per cent respectively.

The NPC was below one (0.86) in pre-WTO period which is an indication of price competitiveness in maize trade. In post-WTO period the NPC started improving which indicates non-competitiveness in maize trade. Estimates of exportable hypothesis of NPC showed that maize does not represent an efficient export crop. The NPCs fluctuated between 2 and 3.3. (Table 4.19).

Table No. 4.19: Results of policy analysis matrix (PAM) of maize

Year	NPC	NPCI	EPC	DRC	SRP	PC
1986-87	0.83	0.29	2.12	1.79	0.51	2.12
1987-88	0.79	0.37	1.83	1.61	0.37	1.63
1988-89	0.74	0.33	1.78	1.54	0.46	1.41
1989-90	0.65	0.41	1.64	1.02	0.21	1.23
1990-91	0.89	0.34	1.31	1.2	0.39	2.3
1991-92	0.79	0.29	1.08	0.98	0.29	1.18
1992-93	1.01	0.38	1.65	1.21	0.49	2.34
1993-94	0.97	0.31	1.19	1.11	0.08	1.78
1994-95	1.11	0.33	1.56	1.39	0.27	1.46
Average*	**0.86**	**0.33**	**1.57**	**1.31**	**0.34**	**1.71**
1995-96	0.97	0.32	1.19	2.31	0.57	1.33
1996-97	0.86	0.28	1.06	1.34	0.38	1.5
1997-98	1.3	0.33	0.58	2.92	0.96	1.67
1998-99	1.01	0.35	1.06	1.8	0.63	1.94
1999-00	0.97	0.35	0.85	0.79	0.68	1.3
2000-01	1.09	0.39	0.93	1.25	0.62	1.03
2001-02	1.26	0.4	2.53	1.03	0.8	1.21
2002-03	1.13	0.33	4.06	0.79	0.82	1.03
2003-04	1.09	0.34	2.14	0.74	0.68	1.34
Average**	**1.07**	**0.34**	**1.6**	**1.44**	**0.68**	**1.37**

*Average of 1986-87 to 1994-95
**Average of 1995-95 to 2003-04

Table 4.20 : Nominal protection coefficient (NPC) for maize under exportable hypothesis.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Wholesale price in A.P		Rs/Qtl	201.96	178.83	180.00	188.87	197.74	217.50	301.30	294.17	300.25	321.72	357.26	392.81	425.67	485.31	501.45	542.94	561.52	583.21	538.48	601.23
Transport cost	Mumbai	Rs/Qtl	82.50	85.90	78.60	80.00	83.50	85.60	90.00	90.00	92.50	95.70	97.50	98.50	100.00	101.50	104.50	106.70	107.40	109.30	112.60	113.80
Marketing margins@ 5%		Rs/Qtl	10.10	8.94	9.00	9.44	9.89	10.88	15.07	14.71	15.01	16.09	17.86	19.64	21.28	24.27	25.07	27.15	28.08	29.16	26.92	30.06
C&F Handling charges		Rs/Qtl	14.00	14.20	14.50	15.60	16.00	17.20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	30.00	31.50	32.00	32.80
Wharfage charges		Rs/Qtl	3.15	3.50	3.60	4.00	4.00	5.00	5.45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.30	7.80	7.90	8.20
Service charges		Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.00	4.20	4.20	4.60
Service Tax		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.35	0.35	0.37
Equals FOB price		Rs/Qtl	313.87	293.53	288.18	300.56	313.83	339.10	432.95	428.92	439.75	466.92	507.60	548.29	585.55	650.29	672.59	718.36	738.62	765.52	722.45	791.06
Plus Freight from India to US gulf		Rs/Qtl	35.67	36.72	32.37	33.40	63.10	69.93	73.55	100.33	122.47	132.13	141.26	146.96	156.07	163.33	178.50	183.59	193.48	197.54	201.23	211.87
Plus Insurance @ 1%of price		Rs/Qtl	2.02	1.79	1.80	1.89	1.98	2.18	3.01	2.94	3.00	3.22	3.57	3.93	4.26	4.85	5.01	5.43	5.62	5.83	5.38	6.01
Equals landed price		Rs/Qtl	351.56	332.04	322.35	335.85	378.90	411.20	509.51	532.19	565.23	602.26	652.44	699.18	745.88	818.47	856.11	907.38	937.71	968.89	929.07	1008.94
FoB price	US gulf	$/Qtl	11.20	8.80	7.60	10.70	11.10	10.90	10.70	10.40	10.20	10.80	12.40	16.50	11.70	10.20	9.00	8.80	8.90	9.93	10.50	11.17
Exchange rate		1$=Rs	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.12	42.08	43.28	45.61	47.61	47.61	48.10
FoB price	US gulf	Rs/Qtl	133.17	107.71	97.13	138.78	160.73	181.49	191.96	254.49	295.39	339.12	389.24	551.10	415.00	378.62	378.72	380.86	405.93	472.77	499.91	537.28
Nominal protection coefficients			2.64	3.08	3.32	2.42	2.36	2.27	2.65	2.09	1.91	1.78	1.68	1.27	1.80	2.16	2.26	2.38	2.31	2.05	1.86	1.88

Note : C F charges include empty container lift on charges, container yard to CFS, container transportation, cargo container stuffing charges, customs and port sundries, documentation charges.
Wharfage – ship landing charges

Table No .4.21 : Results of policy analysis matrix (PAM) of groundnut

Year	NPC	NPCI	EPC	DRC	SRP	PC
1986-87	0.98	0.54	1.09	0.97	0.16	1.08
1987-88	1.09	0.59	1.11	0.8	0.26	2.1
1988-89	0.98	0.62	1.21	1	0.33	1.73
1989-90	1.02	0.63	1.03	1.05	0.19	1.41
1990-91	1.12	0.57	1.47	1.24	0.37	1.58
1991-92	1.14	0.49	1.32	0.97	0.57	2.39
1992-93	0.6	0.53	0.97	0.42	0.22	2.08
1993-94	0.62	0.55	0.59	0.51	-0.21	0.86
1994-95	0.61	0.61	0.51	0.49	-0.31	0.71
Average*	**0.9**	**0.57**	**1.03**	**0.82**	**0.17**	**1.54**
1995-96	0.66	0.59	0.65	0.56	-0.15	0.32
1996-97	0.77	0.53	0.93	0.74	0.05	1.34
1997-98	0.49	0.55	0.47	0.39	-0.35	0.19
1998-99	0.62	0.49	0.67	0.53	-0.11	0.66
1999-00	0.51	0.66	0.45	0.42	-0.41	0.03
2000-01	0.52	0.64	0.48	0.38	-0.34	0.26
2001-02	0.39	0.7	0.31	0.28	-0.55	0.05
2002-03	0.54	0.57	0.52	0.4	-0.27	0.37
2003-04	0.41	0.58	0.37	0.28	-0.56	0.03
Average**	**0.54**	**0.59**	**0.53**	**0.44**	**-0.29**	**0.36**

*Average of 1986-87 to 1994-95
**Average of 1995-95 to 2003-04

Table No : 4.22 Nominal protection coefficient (NPC) for groundnut under exportable hypothesis.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Wholesale price in A.P		Rs/Qtl	578.24	601.53	689.14	619.05	654.47	825.13	1034.38	1000.53	918.38	1105.98	1235.12	1120.00	1340.82	1374.95	1326.78	1308.13	1457.25	1623.11	1900.86	1677.01
Transport cost	chennai	Rs/Qtl	27.75	29.00	29.00	29.65	29.80	30.00	31.60	31.75	32.00	32.00	33.20	33.65	33.75	34.00	34.00	34.50	34.50	34.58	35.25	35.87
Marketing margins@ 5%		Rs/Qtl	28.91	30.08	34.46	30.95	32.72	41.26	51.72	50.03	45.92	55.30	61.76	56.00	67.04	68.75	66.34	65.41	72.86	81.16	95.04	83.85
C&F Handling charges		Rs/Qtl	14.00	14.20	14.50	15.60	18.00	17.20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	30.00	31.50	32.00	32.80
Wharfage charges		Rs/Qtl	3.15	3.50	3.60	4.00	4.00	5.00	5.45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.30	7.80	7.90	8.20
Service charges		Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.00	4.20	4.20	4.60
Service Tax		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.35	0.35	0.37
Equals FOB price		Rs/Qtl	654.21	680.47	773.18	701.90	739.69	921.51	1144.28	1112.35	1028.29	1226.69	1365.06	1246.99	1480.21	1516.91	1468.69	1449.61	1606.23	1782.70	2075.60	1842.70
Plus Freight from India to Rotterdam		Rs/Qtl	24.01	21.47	23.64	32.96	41.04	59.11	54.54	66.24	86.59	88.77	60.11	72.65	66.08	45.84	49.28	40.83	42.21	52.32	68.56	71.23
Plus Insurance @ 1%of price		Rs/Qtl	5.78	6.02	6.89	6.19	6.54	8.25	10.34	10.01	9.18	11.06	12.35	11.20	13.41	13.75	13.27	13.08	14.57	16.23	19.01	16.77
Equals landed price		Rs/Qtl	684.00	707.95	803.71	741.05	787.28	988.87	1209.16	1188.59	1124.06	1326.52	1437.52	1330.84	1559.70	1576.50	1531.24	1503.52	1663.02	1851.25	2163.17	1930.70
FoB price	Rotterdam	$/Qtl	37.80	34.80	39.78	32.39	33.60	36.10	42.20	47.06	48.77	47.10	51.35	48.02	69.74	64.51	59.45	53.32	75.32	65.40	85.59	91.00
Exchange rate		1$=Rs	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.12	42.08	43.28	45.61	47.61	47.61	48.10
FoB price	Rotterdam	Rs/Qtl	449.44	425.95	508.36	420.07	486.53	601.00	757.07	1151.54	1412.30	1478.83	1611.83	1603.81	2473.84	2394.52	2501.60	2307.66	3435.35	3113.69	4074.94	4377.10
Nominal protection coefficients			1.52	1.66	1.58	1.76	1.62	1.65	1.60	1.03	0.80	0.90	0.89	0.83	0.63	0.66	0.61	0.65	0.48	0.59	0.53	0.44

Note : C F charges include empty container lift on charges, container yard to CFS, container transportation, cargo container stuffing charges, customs and port sundries, documentation charges.
Wharfage – ship landing charges

4.4.3 Trade competitiveness of groundnut

Results of policy analysis matrix for groundnut are furnished in Table 4.20. 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 hectare of groundnut is less than what it would cost to import. In other words estimates of DRC indicated comparative advantage in groundnut production. In post-WTO period DRC is still less (0.44), which indicates further 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.

NPC under exportable hypothesis (Table 4.21)showed that the state had poor competitiveness for groundnut exports in pre-WTO period which is shown by NPC greater than one. In post-WTO period it was less than one (0.62) indicates its competitiveness.

4.4.4 Trade competitiveness of cotton

The results pertaining to Policy Analysis Matrix are presented in Table 4.22 revealed that the overall average for both the periods indicated that cotton

Table No. 4.23: Results of policy analysis matrix (PAM) of cotton

Year	NPC	NPCI	EPC	DRC	SRP	PC
1986-87	0.61	0.39	0.65	0.42	-0.24	0.38
1987-88	0.32	0.41	0.29	0.39	-0.31	0.23
1988-89	0.51	0.38	0.57	0.49	-0.25	0.49
1989-90	0.46	0.39	0.51	0.47	0.17	1.19
1990-91	0.31	0.43	0.38	0.31	-0.28	0.31
1991-92	0.42	0.42	0.47	0.43	-0.22	0.43
1992-93	0.44	0.38	0.51	0.39	-0.17	0.39
1993-94	0.29	0.47	0.39	0.36	-0.29	0.36
1994-95	0.31	0.46	0.33	0.29	-0.41	0.29
Average*	**0.4**	**0.41**	**0.45**	**0.39**	**-0.22**	**0.45**
1995-96	0.32	0.38	0.31	0.25	-0.44	0.21
1996-97	0.29	0.41	0.26	0.21	-0.53	0.13
1997-98	0.32	0.41	0.3	0.23	-0.47	0.18
1998-99	0.37	0.41	0.35	0.27	-0.4	0.23
1999-00	0.39	0.46	0.37	0.28	-0.39	0.27
2000-01	0.36	0.42	0.34	0.27	-0.43	0.27
2001-02	0.38	0.46	0.36	0.29	-0.42	0.25
2002-03	0.41	0.33	0.43	0.26	-0.29	0.45
2003-04	0.34	0.39	0.33	0.24	-0.45	0.29
Average**	**0.35**	**0.4**	**0.33**	**0.25**	**0.42**	**0.25**

*Average of 1986-87 to 1994-95
**Average of 1995-95 to 2003-04

Table 4.24: Nominal protection coefficient (NPC) for cotton under exportable hypothesis.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Wholesale price in A.P		Rs/Qtl	589.78	728.37	648.93	841.06	1004.42	770.27	1137.05	1159.53	1060.53	1605.24	1872.84	1590.50	2027.80	2068.35	1564.41	1800.00	1657.64	1782.03	2369.03	2104.59
Transport cost	Mumbai	Rs/Qtl	82.50	85.90	78.60	80.00	83.50	85.60	90.00	90.00	92.50	95.70	97.50	98.50	100.00	101.50	104.50	106.70	107.40	109.30	112.60	113.80
Marketing margins@ 5%		Rs/Qtl	29.49	36.42	32.45	42.05	50.22	38.51	56.85	57.98	53.03	80.26	93.64	79.53	101.39	103.42	78.22	90.00	82.88	89.10	118.45	105.23
C&F Handling charges		Rs/Qtl	14.00	14.20	14.50	15.60	16.00	17.20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	30.00	31.50	32.00	32.80
Wharfage charges		Rs/Qtl	3.15	3.50	3.60	4.00	4.00	5.00	5.45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.30	7.80	7.90	8.20
Service charges		Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.00	4.20	4.20	4.60
Service Tax		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.35	0.35	0.37
Equals FOB price at Mumbai		Rs/Qtl	721.08	870.55	780.56	985.36	1160.84	919.50	1310.48	1337.55	1238.05	1814.61	2098.96	1805.87	2267.79	2312.48	1788.70	2038.27	1889.54	2024.28	2644.53	2369.59
Plus Freight from India to Liverpool		Rs/Qtl	35.67	36.72	32.37	33.40	63.10	69.93	73.55	100.33	122.47	132.13	141.26	146.96	156.07	163.33	178.50	183.59	193.48	197.54	201.23	211.87
Plus Insurance @ 1%of price		Rs/Qtl	5.90	7.28	6.49	8.41	10.04	7.70	11.37	11.60	10.61	16.05	18.73	15.91	20.28	20.68	15.64	18.00	16.58	17.82	23.69	21.05
Equals landed price		Rs/Qtl	762.65	914.55	819.42	1027.17	1233.99	997.14	1395.40	1449.47	1371.12	1962.79	2258.95	1968.73	2444.14	2496.49	1982.84	2239.86	2099.60	2239.64	2869.45	2602.51
FoB price	Liverpool	$/Qtl	132.00	105.60	164.70	139.90	167.30	181.90	169.40	127.60	127.80	176.00	216.50	177.40	174.50	144.30	117.00	129.10	105.70	101.90	139.70	136.60
Exchange rate		1$=Rs	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.12	42.08	43.28	45.61	47.61	47.61	48.10
FoB price	Liverpool	Rs/Qtl	1569.48	1292.54	2104.87	1814.50	2422.50	3028.64	3039.04	3122.37	3701.09	5526.40	6795.94	5925.16	6189.52	5356.42	4923.36	5587.45	4820.98	4851.46	6651.12	6570.46
Nominal protection coefficients			0.49	0.71	0.39	0.57	0.51	0.33	0.46	0.46	0.37	0.36	0.33	0.33	0.39	0.47	0.40	0.40	0.44	0.46	0.43	0.40

Note : C F charges include empty container lift on charges, container yard to CFS, container transportation, cargo container stuffing charges, customs and port sundries, documentation charges.
Wharfage – ship landing charges

crop had clear cut competitive advantage. Average NPC and EPC were remained below one for both the periods. The DRC was 0.39 in pre-WTO period and 0.25 in post-WTO period. The level of DRC showed that import substitution by domestic production is socially desirable. The level of SRP (-0.22 in pre-WTO period and -0.21 in post-WTO period) shows that the cotton crop in the state had not been protected. NPCI was almost same in both the period and less than one.

The results of NPC under exportable hypothesis also showed similar results as importable hypothesis. NPC was less than one for the reference period, which states that the state has comparative advantage in cotton production (Table 4.24).

4.5 Impact of economic liberalization on trade and welfare gains and losses

The impact of liberalization on the agricultural sector has been analyzed for the selected crops. The empirical estimates of welfare impact of liberalization are depicted in tables 4.25, 4.26 and 4.27. These are estimated based on the supply and demand elasticities assumed for the study and on the nominal protection coefficients. The supply elasticities used for the analysis were 0.10 for rice, 0.20 for maize, 0.15 for groundnut and 0.20 for cotton. The demand elasticity assumed was 0.20 for all crops. Both supply and demand elasticities were assumed based on the past studies of Reddy (1997) and Raghavendra (2004). We have also assumed that whatever amount produced will be consumed in the state.

The monetary effects of liberalization are presented in Table 4.25. The net social losses in production and consumption critically depend on the extent of

Table 4.25. Net monetary effects of price distortions in selected crops of Andhra Pradesh

(Rs in Lakhs)

S.No	Commodity	NSLp	NSLc	NSL	Estimated welfare gain to producers WGp	Estimated welfare loss to consumers WCc	Net effect of liberalization on the weifare in the state
1	Rice	13262.4	2670.9	19218.2	602763.8	587137.5	15626.3
2	Maize	6474.6	436.0	6910.6	96465.0	89554.4	6910.6
3	Groundnut	63231.5	-	545261.4	-	-	-
4	Cotton	372216.35	-	1683807.3	-	-	-

Note: Consumption gains and losses have not been calculated for groundnut and cotton since the product undergoes considerable transformation before consumption.

NSLp – Net social loss in production
NSLc – Net social loss in consumption
NSL – Total net social loss

Table 4.26.Gains and losses due to projected changes in prices

(Rs in Lakhs)

S.No	Commodity	Value of production at PP(v)	Percentage of WGp to value of production	Value of consumption at PC(w)	Percentage of WGc to value of consumption
1	Rice	1315337	45.82	1889561.6	37.84
2	Maize	124046.4	77.76	211962.8	42.25
3	Groundnut	274860.3	23.00	-	-
4	Cotton	460776	365.42	-	-

protection and on the elasticities. The loss to society due to liberalization in terms of consumption of rice was Rs. 2670.9 lakhs. For maize it was Rs. 436 lakhs. The loss to society due to inefficiency in production resulting from a rise in the price was Rs.13262.4 lakhs from rice, Rs.6474.6 lakhs from maize, Rs. 2205.75 lakhs from groundnut and Rs. 372216.35 from cotton.

The gross real effects of the price distortion are often sizable. Since the effects of production and consumption are opposite, they are additive with respect to trade effects. For, Andhra Pradesh, the liberalization of agriculture would result in change in production due to the change in prices. International prices adjusted for transport cost are higher to the extent of 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 liberalization period (2004-05). These higher world prices (Table 4.27) would result in increased domestic production of the four crops to the extent of 4.32, 3.03, 4.3 and 12.43 lakh tones respectively for rice, maize, groundnut and cotton. Consequently, higher international prices would have a negative impact on consumption levels, which would result in a decrease in the consumption of rice by 0.87 lakh tones and maize by 0.2 lakh tonnes.

Further, distortion in domestic prices would result in a change in revenue to producers and consumers. Welfare gains in all cases were much larger than the respective welfare losses. The results revealed that (Table 4.26) welfare gain to producers would be very high in the case of cotton at 365.42 per cent (Rs.1683807.35 lakhs) of total value of production. The producer gain from maize

Table 4.27.Effect of liberalization on agricultural trade

S.No	Commodity	Increase in price (%)	Increase in supply (lakh tones)	Decrease in demand (lakh tones)
1	Rice	45	4.32	0.87
2	Maize	72	2.97	0.20
3	Groundnut	175	4.30	0.15
4	Cotton	284	12.43	12.43

was at 77.76 per cent (Rs.96465 lakhs). It would be 45.82 per cent (Rs. 602763.8 lakhs) in case of rice and 23 per cent (Rs. 545261.4 lakhs) in case of groundnut. Anologously, consumers in the state incur substantial welfare loss due to rise in prices in rice (Rs. 587137.5 lakhs) and maize (Rs. 89554.4 lakhs). Thus, the net effect to the economy of the state due to the liberalization was substantial amounting to Rs. 15626.3 lakhs for rice and Rs. 6910.6 lakhs for maize during the period 2004-05.

Consumption gains and losses have not been calculated for groundnut and cotton, since groundnut is consumed in the form of edible oil and average consumption of groundnut oil was not available. Whereas, cotton is used in several forms and average use of each form is not available. But it can be inferred that groundnut and cotton consumers would incur welfare losses, as the international prices were higher than domestic prices.

4.6 Implications of the provisions of AoA of WTO on Andhra Pradesh's Agriculture

The agreement on agriculture aims at progressive reduction of protection to and subsidization of the agricultural sector by member countries. The agreement incorporates three broad areas of commitment, namely market access, domestic support and export subsidies. The Table 4.28 indicates implications of the provisions of the WTO on important crops of Andhra Pradesh.

a) **Market access**

The key elements of the market access commitments for agricultural products are the establishment of tariffication, tariff reduction and binding of all agricultural tariffs.

The new tariff resulting from 'tariffication' and the applied tariff are being brought down to reasonable levels. The developed countries are to cut their agricultural tariffs by an average of 36 per cent over six years while developing countries are committed to slash the same by 24 per cent in 10 years from 1995.

Within the provisions of GATT agreement India has bound tariff of 100 per cent for the selected crops. But now the applied rate for rice is 76.80 per cent. If the state reduces bound tariff by 24 per cent as per the agreement then also state will have competitiveness in rice production. This is evident from the EPC (0.64) which is below one.

The state is charging very low tariff for other commodities. For maize it is 66.40 per cent, for groundnut it is 35.20 per cent and for cotton 35.20 per cent. Despite charging tariff well below the WTO provisions, the state continues to enjoy the competitiveness in these crops.

b) **Domestic support**

The central thrust of the domestic support provisions of the Agreement on Agriculture is to encourage a further shift away from trade distorting measures and policies. The agreement particularly targets subsidies granted by government to farmers. There are two main categories of domestic support subsidies.

i) Green box subsidies – allowed under agreement

Table 4.28 .Implications of the provisions of Agreement on Agriculture (AoA) of WTO on important crops grown in Andhra Pradesh

Elements of AoA	Rice	Maize	Groundnut	Cotton
1.**Market Access**	Starting from 1995, the developed countries are to cut their agricultural tariffs by an average of 36 per cent over six years. While developing countries are committed to slash the same by 24 per cent in 10 years.			
Tariffication				
a)Bound tariff (%)	100	100	100	100
b)Present tariff(%)	76.80	66.40	35.20	35.20
Reduction in the face value of bound tariff	Even if the state reduces the tariff to 74 per cent, it has comparative advantage in rice production.This is evident from EPC 0.64 which is less than one.	State is charging less than WTO provisions of import tariff. EPC is 1.6 which shows state non-competitiveness of the crop.	Import tariff charged is lower than WTO provisions. Hence, state has comparative advantage in production of this crop(EPC is 0.53)	State has competitiveness in this crop because EPC is 0.33. The current import tariff charge on this crop is very low.
2. **Domestic Support**	In India, presently minimum support price provided to commodities is less than the external reference price determined under the agreement. Product specific support is almost negative.			
Subsidy Ratio to Producers	-0.11	0.68	-0.29	-0.42
3.**Export Subsidy**	Nil	Nil	Nil	Nil

ii) Amber box subsidies – Product specific and non-product specific subsidies.

But in India both the product and non-product specific subsidies were deemed to be negative. This is also evident from the subsidy ratio to producer coefficient of -0.42 for cotton, -0.29 for groundnut and -0.11 for rice.

c) **Export subsidies**

Presently, the state is not giving any direct export subsidies, hence, the reduction of the same does not arise.

Discussion

CHAPTER V

DISCUSSION

Having studied the results obtained through various statistical analyse it would be worthwhile to further probe and discuss the reasons for the findings. Accordingly the results are discussed here under the following major headings.

5.1 Growth in area, yield and production of selected crops.

5.2 Direction of trade.

5.3 Relationship between domestic market prices and world market prices of selected crops

5.4 Trade competitiveness of selected crops.

5.5 Impact of economic liberalization on trade and welfare.

5.6 Implications of WTO provisions for Andhra Pradesh's agriculture.

5.1 Growth in area, yield and production of selected crops

The globalized trade environment has put a greater onus on the countries to be competitive in their trade endeavours. Growth should be both in quantity in order to capture a significant share of the world market and in productivity to enhance efficiency and competitiveness. In order to derive the maximum benefits from the new world trade environment, it is essential to properly assess the available export surpluses of various commodities in the country and to give grater emphasis to production strategy for the commodities for which the country has greater comparative advantage. Hence growth in area, production and productivity of the important crops of the state as well as nation was assessed.

5.1.1 Rice

Contributing about 45 per cent consistently to India's cereal production, rice continues to hold the key to sustained food sufficiency and exports in the country. But declining (positive) growth of area, production and productivity of rice in the post-WTO period is a worrying dimension. However, the growth in the production during pre-WTO period was much more yield based than area led growth (Table 4.2). Procurement of large quantities of crop by the public agencies at minimum support price, provision of subsidized irrigation, fertilizers, other inputs and strong research cum extension support had positive impact on the rice production in the country as opined by Rao (1994).

The decline in production and productivity growth in the post-WTO period could be due to tapering down of the spread in green revolution technology and also the decline in production in recent years was mainly due to the fact that rice area in about a million hectare has shrunk in West Bengal because of moisture stress at the time of sowing (Venkataramani, 2002).

The trend of growth shows that in future years also there may be only a slight increase in area and productivity. This could be attributed to likely non-availability of land suitable for rice cultivation and the silting up of major and medium irrigation facilities, which might decrease the water availability for increasing rice area.

In Andhra Pradesh rice registered impressive growth in production and productivity in the post-WTO period than in the pre-WTO period.

The results had provided some interesting findings that there was an increase in the productivity after implementation of WTO, though there was a decline in production and productivity during the pre-WTO period. Instability in production and productivity was also higher in this period.

In the post-WTO era, there is need for adequate rice production not only for the domestic market but also for exports. 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 in productivity in order to meet the demands of sustainability and preservation of environment quality as opined by Mishra (2004).

5.1.2 Maize

Maize is the most important coarse cereal after sorghum and pearl millet. It has become the third most important food crop in India next to rice and wheat. Its importance is likely to increase in the coming years as it had wide industrial uses unlike most of the other cereals.

In Andhra Pradesh, maize registered impressive growth both in area and production, but growth in productivity showed decreasing trend in the post-WTO period. In the pre-WTO period the growth in aggregate production was mainly due to area expansion.

In the aggregate, the growth of maize in the state was impressive as area and production grew at 4.49 and 9.13 per cent per annum (Table 4.3).

Maize showed a gradual increase in area under cultivation in the post-WTO period in India. But the increase in production as well as productivity was

more impressive in the pre-WTO period than in the post-WTO period and this could partly be attributed to the accelerated productivity during the period. The overall growth scenario of maize production reveals a positive trend, as it possesses tremendous potential, as it is a major raw material for many agro-based industries such as feeds for dairy, poultry 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 as opined by Rai (2002).

5.1.3 Groundnut

In India groundnut is a dominant oilseed crop among the nine major oilseeds, accounting for 39 per cent of the oilseed output. Gujarat, Andhra Pradesh, Tamilnadu, Maharashtra and Karnataka are the major producers of groundnut in the country accounting for more than 80 per cent of the production.

Groundnut being an important crop of the state covers majority area under oilseeds. The overall performance of groundnut is not encouraging. The productivity growth showed a decreasing trend. Instability in area, production and productivity was also high (Table 4.5).

The performance of groundnut production was impressive in the pre-WTO period, mainly because of high growth in the area. However yield showed decelerating growth during this period. In the post-WTO period area, production and productivity showed negative growth.

The overall performance of groundnut crop in the country was not good. The growth in area, production and productivity was impressive in the pre-WTO

period with high instability in yield and production. The increase in production was due to growth in both area and yield. The post-WTO period was marked by the stagnation and negative growth in yield and area and production respectively. The decrease in production was due to area shrinkage. A relatively better performance of groundnut crop in the pre-WTO period might be due to expansion in area, availability of improved oilseeds production technology and its adoption, remunerative support prices and institutional support, particularly establishment of Technology Mission on Oilseeds (TMO) in 1986 as suggested by Hegde (2004).

But the production started declining after WTO era due to decrease in area under cultivation, which could be attributed to imports of edible oils and relatively stagnant real prices of groundnut. These factors acted as disincentives to the producers to expand area under the crop (Deshpande, 2004). Currently India is the largest importer of edible oil in the world and more than 40 per cent of domestic demand is met through imports (Chand *et al.*, 2004). All these factors resulted in stagnation in the domestic groundnut production in recent years, which could partly be attributed to trade liberalization response to WTO obligations.

5.1.4 Cotton

Cotton is a principal commercial crop and it contributes significantly to the national economy. India has the largest area under cotton in the world but occupies third position in production. The overall growth in production of this crop in the state was modest with high production instability (Table 4.7). The area expansion reached a stagnation stage. The performance of growth in production

was impressive in the pre-WTO period as it recorded 8.11 per cent annual growth as a result of the productivity and area improvement. However the growth performance started deteriorating especially after the WTO.

The overall growth of production in India exhibited a positive trend, which was largely due to expansion of area. The production performance was impressive in the pre-WTO period due to augmented growth in productivity (Table 4.8). But this situation deteriorated after WTO implementation.

Cotton production crisis both in state and the country could be linked to issues like rising cost of production, hike in use of pesticides with inadequate pest suppression, inability to enhance production due to improper water management, deterioration in genetic purity of cotton varieties and hybrid seeds, inadequate price support and paucity of infrastructure for value addition at farm level (Mayee *et al.*, 2002).

Productivity of crops in Andhra Pradesh during pre-WTO period showed stagnation. One of the reasons attributed for this could be the inadequate use of resources and investment in the fields of agriculture, irrigation and related areas, particularly during the pre-WTO period as argued by Reddy (1997). It should be note that despite favourable conditions for agricultural production, the productivity of most of the crops in the country is much less than the world average and less than half of those already achieved in agriculturally advanced countries.

In order to emerge as a significant player in the world market, it is necessary for the country to ensure a sizeable marketable surplus of the exportable

farm products. Hence the agricultural development in the country needs to be put on a faster track to meet domestic demand and export needs. This calls for evaluation of innovative, farmer friendly and implementable farm policies, which lead to faster growth in productivity than population and domestic demand as put forth by Venkataramani (2002).

5.2 Direction of trade of selected crops

The finite Markov chain process, which is a stochastic process was used in the analysis of economic variables for which particular time order data available. Hence, the changes in exports of selected crops to different countries after WTO implementation were analysed using this tool. It captures the net effect of switching pattern of export trade over a period of time. This was achieved by examining the gains and losses in the export share of selected crops by major importing countries. The present study was carried out for the period from 1996-97 to 2005-06.

5.2.1 Basmati rice

The results (Table 4.9) indicated that the Indian export markets, which remained stable over the period were Saudi Arabia and 'others'. The Saudi Arabia has indeed been a growing market for Indian basmati rice. The high retention of this market was further reinforced by high probability of transfers from UAE, USA and 'others' countries.

'Others' countries had moderate probability retention of 0.28 an high transfer probability of 0.519 to Saudi Arabia, 0.012 to Yamen and 0.058 to UK. They had gained from Yamen and UAE highly. USA and UK had moderate rates

of retention and Kuwait had a poor rate of retention. Kuwait retained only a proportion of 0.04 from its previous years. However, this was reinforced by high probability of transfers from UK, UAE and USA. But there was a strong tendency to loose its market share to 'others' and Saudi Arabia.

Despite USA's poor retention, it was strengthened by moderate probability of transfer from Kuwait. But there was a strong indication of loss of its market share to Saudi Arabia and Kuwait. UAE and Yamen are not stable markets for Indian basmati rice export as revealed by very poor retention rates. UAE had lost its total share to Saudi Arabia and Kuwait. Yamen had lost its entire share to 'others'. Thus, Saudi Arabia is the major growing market for Indian basmati rice. But, it should be noted that India losing Kuwait and USA markets. Hence, proper steps need to be taken to strengthen exports to these countries.

The results are in conformity with the study conducted by Raghavendra (2004) pertaining to export performance of major agricultural crops in India. The results are also in conformity with Ajjan *et al.* (1998) study on export performance of senna and periwinkle in India.

5.2.2 Groundnut

Indonesia has emerged as the major market for Indian groundnut exports. There are very small probability of loss to Philippines and 'others'. The Malaysia also exhibited a high degree of retention of 0.6468. However, there is a moderate probability of loss to Philippines and Indonesia. But, it had gained majority of Philippines share (45%) and a moderate share of others. Other importers also had

a fairly high retention of 0.5736. They gained majority of Philippine's share (54 %).

Indian exports to UK achieved a high degree of retention of 68 per cent. But it lost some of its share to Philippines. Philippines is a poor market for India's groundnut exports. It had lost its entire market to Malaysia and 'others'. Thus, Indonesia, Malaysia and UK emerged as stable markets for Indian groundnut exports (Table 4.11).

The results are on par with the study on direction of trade and changing pattern of Indian coffee exports to different countries over a period of time conducted by Tejaswi *et al.*(2006).

5.2.3 Cotton

Export pattern of cotton in the post-WTO period revealed that Italy, Bangladesh and 'others' were fairly stable markets for Indian cotton exports (Table 4.13). 'Other' importers had a high retention of 72 per cent and it was strengthened by very high probability of transfers from China (1.00) and Belgium (1.00). It had a moderate probability of transfers from Japan, Bangladesh and Italy. But these countries also tend to lose in moderate probability (0.355) to Japan and small probabilities to Japan, China and Italy.

Italy had moderate probability of retention and small transfer probabilities to Japan and 'other' countries.

Bangladesh had a probability retention of 0.49 and it had gained significantly from Japan. It also tend to lose in moderate probabilities to China and 'other' countries. Japan, China, Belgium turned out to be unstable markets for

Indian cotton. Belgium and China had lost its share to 'others'. However, China gained moderate shares of Bangladesh and Japan. Belgium gained a considerable share of 'others'.

There is a growing concern that India is losing most of the importing countries share. Only Italy and Bangladesh found moderately stable markets for Indian cotton exports.

The results are in conformity with Gemtessa (1998) who studied on the direction of exports of Ethopian coffee.

5.3 Relationship between domestic market prices and world market prices of selected crops

In order to verify the integration between domestic and world prices the cointegration tests were used. Markets are said to be integrated when prices are determined interdependently. This has been generally assumed to mean that the price changes in one market are fully transmitted to other markets.

The results of the cointegration tests showed there is integration between domestic and international prices in all the crops in both pre-WTO and post-WTO periods. It implies that there was long run equilibrium relationship between domestic and world market prices. It is evident from this that WTO has no effect on the integration of price series in these crops. The results are in conformity with the findings of Mamatha (1995) and Balappa *et al.* (2002).

5.4 Trade competitiveness of selected crops

In order to derive maximum benefits from the new world trade environment, India need to give emphasis to production strategy with respect to

the commodities for which the country has greater comparative advantage. A country's performance in international market depends largely on its export competitiveness. Assuming identical quality of domestic and foreign products the export competitiveness signifies a situation when the difference between the domestic supply price and international price is expressed in domestic prices net of freight, transport and related costs involved in taking produce from exporting country to the importing country. In other words, a unit of a commodity fetches a price, which is considerably higher than for what it is sold in the domestic market.

There are three kinds of measures, which have been widely used to reveal trade competitiveness. These are Nominal Protection Coefficients (NPC), Effective Protection Coefficients (EPC) and Domestic Resource Cost (DRC). The first two measures are used to find the level of protection of dis-protection and level of government intervention in different commodities. While Domestic Resource Cost (DRC) has been generally used to measure efficiency and comparative advantage in production vis-à-vis export or import of various commodities. Trade competitiveness has been estimated for selected commodities of the state based on both importable and exportable hypotheses. The results are discussed as below.

5.4.1 Trade competitiveness of rice

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.

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 Coefficient (SRP) was computed to analyze the degree of state protection to the selected crops. Results presented in Table 4.17 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 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 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) and Jha (2000).

5.4.2 Trade competitiveness of maize

The lower NPC values for maize under importable hypothesis in pre-WTO period shows that the domestic process received by the farmers were 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 4.20). This result is in conformity with those of the studies conducted by Reddy (1997) and Ravi and Reddy (1998).

5.4.3 Trade competitiveness of groundnut

Groundnut showed a comparative advantage when NPC is considered. When EPC is considered the state was not an efficient producer of groundnut as EPC was more than unity. The levels of DRC shows that costs involved in producing one hectare of groundnut was more than the cost of importing it.

After WTO, the competitiveness of groundnut still improved with much less values of NPC, EPC, DRC than in pre-WTO period. The results are in contradiction with the results of Chand (2002), Reddy et al., (1998) and Gulati (2002). NPC of inputs shows that the input costs were lower than the world prices.

Under exportable hypothesis it is assumed that Indian groundnut would compete with US groundnut in Europe (Rotterdam). The NPCs were above unity in pre-WTO period that means groundnut was not an efficient export crop. But after WTO the magnitude of state subsidy in the form of fertilizer subsidy has come down drastically due to decontrol of phosphatic fertilizers and real prices of groundnut by and large have remained constant during this period. Perhaps these factors might be rendering groundnut competitive internationally in the post-WTO period.

5.4.4 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 4.23). The levels

of both NPC and EPC showed that state had disprotected 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), Ravi and Reddy (1998), Jha (2000) and Gulati (2002).

5.5 Impact of economic liberalization on trade and welfare.

A wide range of economic policy changes covering trade, finance and industry affects agricultural production. The new economic policy aims at economic stability and structural adjustment. The new policy sets a target for agricultural exports and proposes remunerative prices for agricultural products.

Using standard partial equilibrium methods proposed by Lutz and Scandizzo (1980) and the NPC coefficients obtained in the present study, an attempt has been made in the present study to investigate the impact of price distortions on output of each good produced and their consequences on the incomes of the producers, consumers and government revenues.

One of the major objectives of price intervention policies for agricultural products is to protect social interests. A second reason for intervention derives from the fact that some countries would like to achieve internal price stability. A third reason for this intervention applies only to food commodities. Through price intervention, government attempt to provide low cost food for consumers.

International prices appear to capture the opportunities open to the country through trade even though distortions from international prices are not easy to measure, since even relatively homogeneous commodities often show a large range of 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 liberalization of trade in agriculture on 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 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. 372216.35 lakhs) under existing WTO provisions. However, the net social loss in the production was least in the case of maize (Rs. 6474.6 lakhs). Whereas net social loss in consumption was Rs. 436 lakhs.

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 liberalization 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-liberalization 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 tones, 3.03 lakh tones, 4.3 lakh tones and 12.43 lakh tones respectively for rice, maize, groundnut and cotton.

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 tones and maize by 0.2 lakh tones.

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 liberalization of agriculture will have a positive impact on 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 gain 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 77.76 per cent of its value of production. The welfare gain to producers in case of rice and groundnut were at 45.82 and 23 per cent respectively.

Anologously, consumers in the state incur substantial welfare loss due to price distortions in rice (Rs.587137.5 lakhs) and maize (Rs. 89554.4 lakhs).Thus, the net effect of liberalization on welfare in the state was substantial amounting to Rs. 15626.3 lakhs in rice and Rs. 6910.6 lakhs in maize during the period 2004-05.

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 several limitations in the above analysis. First, we are not explicitly considering the quality and usually, high quality products in 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 liberalization 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.

5.6 Implications of WTO provisions for Andhra Pradesh's agriculture

The Uruguay Round Agreement on Agriculture marked as a watershed in the history of world trade in agriculture. Government protects farmers to shield them from the market forces. The Uruguay Round Agreement commits all WTO

members to long reforms, with the objective of making agricultural trade fairer and more market oriented.

The agreement on agriculture concerns at progressive reduction of protection to trade and subsidization of the agricultural sector by member countries. The agreement consists of three broad areas of commitment, namely, market access, domestic support and export subsidies.

1. Market Access

Commitment under market access involve three things.

I) It seeks to replace quantitative restrictions on export and imports by equivalent tariffs known as tariffication.

II) It provides for application of "Bound Tariff Rates", which would give the protection.

III) The new tariff resulting from tariffication and the applied tariff are committed to be brought down starting since 1995. Developed countries are required to reduce tariff by 36 per cent in six years with minimum of 15 per cent for each commodity while developing countries are required to reduce on the average by 24 per cent in 10 years with a minimum of 10 per cent for each commodity.

India has a bound tariff rate of 100 per cent for selected crops. Now the applied rate for rice is 76.80 per cent. If state reduces its bound tariff rate by 24 per cent, the state still retains its competitiveness in rice production because EPC was less than unity. This implies the state has disprotected its rice production.

For maize, groundnut and cotton, India charged tariffs far below the bound tariff. For maize, India is charging 66.40 per cent, for groundnut 35.20 per cent and for cotton 35.20 per cent tariff. Though India is charging very low tariff than the WTO provisions, the state has got competitiveness in these crops. The estimates of EPC showed that the state had disprotected the production of these crops.

2. Domestic Support

The AoA aims at gradual elimination of trade distorting measures and policies. It divides support given to agriculture in two broad categories.

I) Trade distorting Amber box subsidies.

II) Non trade distorting Green box subsidies.

Amber box support given to agriculture is either product specific subsidies or non-product specific subsidies or both. Product specific subsidies are estimated as difference between prices minus international reference price. In India at present the minimum support price (or domestic price) provided to commodities is less than the international reference price. Hence product specific support is negative [Goyal (2000), Deepika (2001), Rao (2001), Vyas (2001), Gulati (2002) and Sharma (2004)].

Since the non product specific support amounts to 7.5 per cent to the value of agricultural production, Aggregate Measure of Support (AMS) to Indian agriculture could still be below the de *minimis* of 10 per cent in terms of the Uruguay Round stipulations [Gulati (2002), Vyas (2001) and Rao (2001)].

Subsidy Ratio to Producers coefficients for all crops is very low. This shows that these crops in the state are dis-protected or taxed.

3. Export Subsidies

The export subsidies subject to reduction commitments are

i. Direct subsidies contingent on export performance.

ii. Government export sales or stock disposals or price below domestic market prices.

iii. Other payments on the export of an agricultural product that are financed by virtue of Government action (including levis).

iv. Subsidies on agricultural products contingent on their incorporation in exported products; and

v. Subsidies affecting marketing and transport costs of export.

Following the 1991 economic reforms, India terminated its policy of granting cash incentives to exports but retained the income tax exemptions for export profits. Since income tax exemption was not one of the export subsidy practices listed in Articles of AoA. This means India does not give direct export subsidies [Deepika (2001), Gulati (2002)]. To sum up, Indian agriculture is gradually being integrated into world agriculture.

Summary and conclusions

CHAPTER VI

SUMMARY AND CONCLUSIONS

The concluding chapter gives a summary of the findings of the present study and the policy implications emerging from it. Agriculture forms the backbone of the Indian economy and despite concerted industrialization in the last five decades, agriculture continues to dominate the national economy.

At the time of independence, 77 per cent of the population was dependent on agriculture. Now it is about 69 per cent, which is still substantial. Hence, a robust growth in agriculture is essential to tackle agricultural problems in the country.

International trade widens the market and increases the inducement to invest income and saving through more efficient allocation. Thus international trade helps to augment the economic development of the nation. India has comparative advantage in agriculture, so that there is considerable scope for raising farm income and employment by stepping up agro based exports.

Economic integration and trade liberalization will have great impacts on the national economy in general and agricultural sector in particular. With the implementation of the Agreement on Agriculture (AoA) by the members of WTO, the international trade opportunities are expected to change as trade barriers are reduced and free trade take place. These changes will also ensure that competitiveness of countries will play a major role in the international trade. Therefore there is a need to find out not

only the extent to which we are export competitive once the agreement is implemented and whether India can protect its major agricultural commodity sectors.

A large proportion of the cultivated area in Andhra Pradesh state is devoted to the production of its principal crops namely paddy, maize, groundnut and cotton. These crops account for 40 per cent of the cultivated area in the state.

With agriculture now having been brought under the realm of GATT and the WTO, freedom of government to support agriculture sector beyond a point is limited. Production pattern will be dictated by considerations of comparative advantage of crops and this needs to be studied. It is in this context the present study has been undertaken. The specific objectives of the present study are:

I. To analyze the global competitiveness of important crops of Andhara Pradesh.

II. To examine the relationship between domestic price and world price of important crops of Andhra Pradesh.

III. To quantify welfare gains and losses due to liberalization of agricultural trade.

IV. To examine the implications of WTO provisions for Andhra Pradesh's agriculture.

The study was based on published data. The time series data on area, yield and production of selected crops (rice, maize groundnut and cotton) was collected for the period from 1985-86 to 2005-06 from publications of Centre for Monitoring Indian Economy (CMIE), Pvt. Ltd. Mumbai. The whole period was divided into two periods viz, pre-WTO and post-WTO periods to study the effect of WTO. The requisite data for development of Policy Analysis Matrix were collected from various issues of FAO

Production Year and FAO Trade Year Book in addition to cost of cultivation data from the Directorate of Agriculture, Government of Andhra Pradesh.

The growth in area, production, productivity were analysed using the exponential growth function. In order to study the variability in the area, production, productivity an index of instability was used as a measure of variability.

The structural change in exports was examined using the Markov chain model. To examine the price relation between domestic and international markets for selected crops the cointegration test was employed. In order to assess the competitiveness of the crops, Policy Analysis Matrix (PAM) approach was used. The welfare gains or losses both to the producers and consumers were estimated using the partial equilibrium method. The results of the study are summarized and presented below.

6.1. Growth in area, yield and production of important crops:

The growth in area, yield and production of important crops are summarized below.

Rice

In Andhra Pradesh area under rice crop increased from 34.52 lakh hectares during 1985-86to 39.82 lakh hectares in 2005-06. For the same period production increased from 76.13 lakh tonnes to 117.04 lakh tonnes at a compound growth rate of 1.66 with slightly higher instability of 9.75 per cent, where as yield increased at the rate of 1.55 per cent. In the pre-WTO period growth in area was almost stagnant (0.72 per cent) with high instability (7.98 per cent). In pre-WTO period growth in yield and production were higher when compared to post-WTO period.

During the period 1985-86 to 2005-06 rice area in India had increased from 41.13 million hectares to 42.12 million hectares with compound growth rate of 0.33 per cent. Production increased at the rate of 1.81 per cent from 63.82 million tonnes to 85.31 million tonnes and productivity had increased at 1.47 per cent from 1550 kilograms per hectare to 2026 kilograms per hectare. Growth in area was 0.62 per cent in pre-WTO period, but negative (-0.34 per cent) in post-WTO period. Growth in production and yield were higher in pre-WTO period than in post-WTO period, but instability showed opposite trend.

Maize

Maize area in Andhra Pradesh increased by around two and half times from 2.88 lakh hectares in 1985-86 to 7.58 lakh hectares in 2005-06 at the rate of 4.49 per cent per annum. Production of maize recorded impressive growth of 9.13 per cent per annum for the reference period. Aggregate production increased from 4.14 lakh tones in 1985-86 to 30.87 lakh tones in 2005-06. Yield increase was also quite substantial. Growth in area and production was quite high in the post-WTO period (8.77 and 5.41 per cent respectively). Increase in yield was impressive in the pre-WTO period, which had grown at 7.38 per cent, but in the post-WTO period, the growth was 2.12 per cent only.

In India, growth of area in maize crop was stable. Production increased from 6.64 million tones during 1985-86 to 14.14 million tones during 2005-06 at a compound growth rate of 3.79 per cent. Yield increased at 2.6 per cent per annum. Instability was quite high in production and productivity, which increased by 8.37 per cent and 9.39 per cent respectively. Growth in area was quite high in the post-WTO period (2.22 per cent). Growth in production was almost constant in both the periods. It is interesting to know

that growth in yield was higher in pre-WTO period (3.71 per cent) than in the post-WTO period.

Groundnut

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 negative growth rate of 0.69 per cent. But performance of production was not encouraging. It had grown at a negative compound growth rate of 1.55 per cent with very high instability in its production. (28.885). Productivity started plummeting from 787 kilograms per hectare in 1985-86 to 728 kilograms per hectare in 2005-06 with negative growth rate of 0.86 per cent.

The groundnut scenario in the country has undergone sea change in the 20 year period. Area under groundnut crop showed stagnant growth. Trends in production were also fluctuating over the years (5.12 million tones in 1985-86 to 7.02 million tones) with high instability percentage of 19.38. A similar trend was seen in yield front also.

Cotton

In Andhra Pradesh the production and area growth rates of cotton were quite impressive with 5.47 and 3.73 per cent respectively. But, instability in production was very high (31.84%). The performance of area, production and yield were satisfactory in the pre-WTO period. In post-WTO period growth in area showed negative trend.

In India, the performance of the crop was better in pre-WTO period than in post-WTO period in case of production and yield (5.57% and 4.45% respectively). Instability was very high in post-WTO periods in all the parameters.

6.2. Direction of trade

Basmati rice

Saudi Arabia is the major growing market for Indian basmati rice. But it should be noted that India losing Kuwait, USA and UAE markets. Hence, proper steps need to be taken to strengthen our export to these countries.

Groundnut

Indonesia, Malaysia and UK are found to be stable markets for Indian groundnut whereas Philippines is not a stable market.

Cotton

There is a growing concern that India is losing most of the importing countries share of cotton. Only Italy and Bangladesh are found moderately stable markets for Indian cotton.

6.3. Relationship between domestic market price and world market prices of crops

The results of the cointegration tests showed that integration between domestic and world prices in all the crops in both the periods viz, pre and post-WTO periods. It implies that there is a long run equilibrium relationship between domestic and world market prices.

6.4. Trade competitiveness of selected crops

Rice

DRC was 0.78 in before WTO period but it was reduced to 0.48 in the after WTO period, which implies comparative advantage in rice production improved over the years. The EPC had deteriorated from 0.9 in the pre-WTO period to 0.64 in the post-WTO period. This shows that rice production is fairly protected by the government. NPC was

less than one over the study period indicating price competitiveness in rice production in the state. Results of NPC under exportable hypothesis revealed that the state had poor competitiveness for rice exports.

Maize

Maize had experienced varying results. In some years it was non competitive, although the average for 1986-87 to 1994-95 indicates that it is competitive. DRC was 1.31 in pre-WTO period which increased to 1.44 in post-WTO period which means that the competitiveness has decreased over the years.

Groundnut

The results showed that the state has comparative advantage in groundnut productions as indicated by low DRC levels (0.44). The estimates of NPC also showed the similar results in both the periods. But the state is not an efficient producer of groundnut as revealed by low EPC levels.

Cotton

The results showed that the state had clear cut comparative advantage in cotton production. Even under exportable hypothesis also the state had comparative advantage in cotton production. SRP shows that the state had not protected the cotton crop.

6.5. Impact of liberalization on trade and welfare

The present study attempted to investigate the impact of price distortions on important crops of Andhra Pradesh and their consequences on incomes of producers, consumers and government revenues. For Andhra Pradesh, the liberalization of agriculture would result in a change in production due to changes in prices. International prices adjusted for transport cost were higher for all crops at 45 per cent for rice, 72 per

cent for maize, 175 per cent for groundnut and 284 per cent for cotton compared to domestic prices during the post-liberalization period (2004-05). These higher world prices would result in increase of domestic production to the extent of 4.32, 2.97, 4.3 and 12.43 lakh tones respectively for rice, maize, groundnut and cotton. Consequently, higher international prices would have a negative impact on consumption levels, which would result in a decrease in the consumption of rice (0.87 lakh tones) and maize (0.2 lakh tones).

Further distortion in domestic prices would result in a change in revenue to producers and consumers. Welfare gains in all cases were much larger than the respective welfare losses. Welfare gain to producers would be very high in the case of cotton at 365 per cent of total value of production. The producer gain from maize was at 77.76 per cent (Rs. 96465 lakhs), 45.82 per cent (Rs. 602763.8 lakhs) in the case of rice and 23 per cent (Rs. 545261.4 lakhs) to its value of production in the case of rice. Anologously, consumers in the state incur substantial welfare loss due to rise in prices to the extent of Rs. 587137.5 lakhs from rice and Rs. 89554.4 lakhs from maize. Thus, the net effect to the economy of the state due to the liberalization was substantial amounting to Rs. Rs.15626.3 lakhs for rice and Rs. 6910.6 lakhs for maize during the year 2004-05.

6.6. Implications of the provisions of AoA of WTO on Andhra Pradesh's agriculture

The Agreement on Agriculture (AoA) incorporates three broad areas of commitment, namely market access, domestic support and export subsidies. Within the provisions of GATT agreement India has bound tariff of 100 per cent for selected crops. But now the applied rate for rice is 76.80 per cent. If the state reduces bound tariff by 24 per cent as per the agreement then also the state has competitiveness in rice production.

The state is charging very low tariff for other commodities. Though the state is charging well below the WTO provisions, it continues to have competitiveness in these crops.

In India both the product and non-product specific subsidies were deemed to be negative. State does not give any direct export subsidies, hence the question of reduction of subsidies does not arise. Thus Indian agriculture is gradually being integrated into the world market.

Policy implications

A. Commodity specific policy implications/recommendations

Based on the results of the study following commodity specific policy recommendations are made.

1. In view of dismantling of quantitative restrictions on textile exports, India stands to gain substantially. 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 problem, 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.
2. There is a vast scope for augmenting exports of superfine quality rice (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 increase the production of superfine especially for exports.

3. Of late area under groundnut in the state is declining due to stagnant real prices of groundnut and imports of cheap edible oils. 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 to extend production and income enhancing support from the state.

B. **General policy implications/recommendations**

1. 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. State should encourage enhancing the exports of these commodities.
2. Government should encourage farmers to extend area under these crops through supportive measures like announcement of a remunerative Minimum Support price (MSP).
3. There is stagnation in the productivity of crops due to lack of update technology and lack of new improved varieties. So, necessary steps should be made to improve the same.
4. Infrastructure is a key factor in long-term output growth and in growth of total factor productivity. The quality of exports of all products, raw or processed should meet. Hence appropriate quality control measures, modern processing and infrastructural facilities (such as roads, power supply, storage etc.), which are not currently available, should be developed without much loss of time.

5. A crucial requirement for the farmers to gain from the liberalization is that they should be in a position to operate in the commodity markets with good understanding of market dynamics and adequate bargaining power. So suitable marketing information systems should be created.

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Appendices

Appendix 1 :Area production and yield of rice in Andhra Pradesh

YEARS	AREA lakh hec	PRODUCTIVITY kg/hec	PRODN lakh tons
1984-85	34.98	2021	69.09
1985-86	34.52	2264	76.13
1986-87	34.59	1951	65.91
1987-88	32.07	2258	70.87
1988-89	42.18	2572	106.21
1989-90	42.06	2403	99.59
1990-91	40.36	2442	96.54
1991-92	39.36	2400	92.49
1992-93	36.04	2495	87.92
1993-94	35.47	2759	95.62
1994-95	36.37	2609	92.77
1995-96	36.92	2498	90.14
1996-97	41.09	2654	106.86
1997-98	35	2471	85.1
1998-99	43.16	2812	118.78
1999-00	40.14	2710	106.38
2000-01	42.43	2936	124.58
2001-02	38.25	2978	113.9
2002-03	28.22	2597	73.27
2003-04	29.75	3011	89.53
2004-05	30.86	3111	96.01
2005-06	39.82	2939	117.04

Appendix 2 :Area, production and yield of rice in India

YEAR	AREA(mhac)	PRODn('000tns)	YIELD(kg/ha)
1986	41.13	63.82	1550
1987	41.17	60.56	1470
1988	38.81	56.86	1470
1989	41.74	70.49	1690
1990	42.17	73.57	1740
1991	42.69	74.29	1740
1992	42.65	74.68	1750
1993	41.78	72.87	1740
1994	42.54	80.3	1890
1995	42.81	81.81	1910
1996	42.84	76.98	1800
1997	43.43	81.74	1882
1998	43.45	82.53	1900
1999	44.6	85.99	1930
2000	44.97	89.49	1990
2001	44.36	84.87	1913
2002	44.9	93.34	2079
2003	41.18	71.82	1744
2004	42.5	88.28	2077
2005	42.12	85.31	2026

Appendix 3: Area, production and yield of Maize in Andhra Pradesh

YEARS	AREA lakh hec	PRODUCTIVITY kg/hec	PRODN lakh tons
1984-85	3.13	1383	4.33
1985-86	2.88	1433	4.14
1986-87	3.08	1494	4.6
1987-88	3.03	1756	5.33
1988-89	2.97	1653	4.91
1989-90	2.98	2244	6.7
1990-91	3.09	2086	6.45
1991-92	3.18	2001	6.35
1992-93	3.22	2660	8.56
1993-94	3.04	2554	7.66
1994-95	3.21	2678	8.58
1995-96	3.33	2630	8.76
1996-97	3.61	3299	11.9
1997-98	3.96	2737	10.83
1998-99	3.99	3470	13.83
1999-00	4.52	3258	14.72
2000-01	5.28	2996	15.81
2001-02	4.28	3401	14.57
2002-03	6.57	2827	14.86
2003-04	7.21	3437	24.77
2004-05	6.57	3142	20.64
2005-06	7.58	4073	30.87

Appendix 4: Area, production and yield of maize in India

YEAR	AREA('000HA	PRODn(mtns)	YIELD(kg/ha)
1986	5.79	6.64	1150
1987	5.92	7.59	1280
1988	5.56	5.72	1030
1989	5.87	8.22	1400
1990	5.91	9.65	1630
1991	5.9	8.96	1520
1992	5.86	8.06	1380
1993	5.92	9.99	1690
1994	5.99	9.6	1600
1995	6.14	8.88	1450
1996	5.98	9.53	1590
1997	6.26	10.77	1720
1998	6.32	10.81	1710
1999	6.08	10.68	1760
2000	6.42	11.51	1792
2001	6.56	12.07	1840
2002	6.58	13.16	2000
2003	6.64	11.15	1681
2004	7.32	14.93	2039
2005	7.49	14.14	1887

Appendix 5 :Area, production and yield of Groundnut in Andhra Pradesh

YEARS	AREA lakh hec	PRODUCTIVITY kg/hec	PRODN lakh tons
1984-85	16.76	751	12.58
1985-86	16.66	787	13.11
1986-87	15.71	833	13.08
1987-88	19.11	997	19.06
1988-89	23.12	938	21.7
1989-90	22.82	915	20.87
1990-91	23.94	947	22.67
1991-92	24.81	867	21.52
1992-93	23.72	828	19.65
1993-94	23.52	1082	25.46
1994-95	21.76	767	16.71
1995-96	22.2	1183	26.25
1996-97	21.98	930	20.45
1997-98	18.34	630	11.56
1998-99	19.92	1082	21.55
1999-00	17.95	607	10.89
2000-01	18.74	1145	21.43
2001-02	16.91	739	12.5
2002-03	14.7	559	8.2
2003-04	14.93	660	9.86
2004-05	18.41	891	16.39
2005-06	18.76	728	13.66

Appendix 6 : Area, production and yield of groundnut in India.

YEAR	AREA('000HA	PRODn('mtns)	YIELD(kg/ha)
1986	7.13	5.12	720
1987	6.98	5.88	840
1988	6.84	5.85	860
1989	8.53	9.66	1130
1990	8.71	8.1	930
1991	8.31	7.52	900
1992	8.67	7.09	820
1993	8.17	8.56	1060
1994	8.32	7.83	940
1995	7.85	8.06	1030
1996	7.52	7.57	1010
1997	7.59	8.64	1138
1998	7.09	7.37	1040
1999	7.57	9.16	1210
2000	6.87	5.26	766
2001	6.73	6.22	924
2002	6.24	7.03	1127
2003	5.94	4.12	694
2004	6	8.18	1364
2005	6.69	7.02	1050

Appendix 7: Area, production and yield of Cotton in Andhra Pradesh

YEARS	AREA lakh hec	PRODUCTIVITY kg/hec	PRODN lakh tons
1984-85	5.54	302	9.84
1985-86	6.2	204	7.43
1986-87	4.11	252	6.09
1987-88	5.74	159	5.37
1988-89	6.28	153	5.66
1989-90	6.5	244	9.31
1990-91	6.55	288	11.1
1991-92	7.07	312	12.99
1992-93	8.05	242	11.47
1993-94	7.28	315	13.49
1994-95	8.45	287	14.26
1995-96	10.59	259	16.1
1996-97	10.15	315	18.78
1997-98	9.06	246	13.2
1998-99	12.81	202	15.22
1999-00	10.46	257	15.79
2000-01	10.22	277	16.63
2001-02	11.08	286	18.77
2002-03	8.03	229	10.86
2003-04	8.37	384	18.9
2004-05	11.78	316	21.9
2005-06	10.33	347	21.08

Appendix 8: Area, production and yield of cotton in India

YEAR	AREA(mhc)	PRODn(mbales)	YIELD(kg/ha)
1986	7.53	8.72	200
1987	6.95	6.91	170
1988	6.46	6.38	170
1989	7.34	8.74	200
1990	7.69	11.42	250
1991	7.44	9.84	220
1992	7.66	9.71	220
1993	7.54	11.4	260
1994	7.32	10.74	250
1995	7.87	11.89	260
1996	9.03	12.86	240
1997	3.12	14.23	265
1998	8.9	11.14	213
1999	9.28	12.17	220
2000	8.71	11.59	225
2001	8.58	9.65	191
2002	9.13	10	186
2003	7.67	8.62	191
2004	7.63	13.87	309
2005	8.92	17	324

Appendix 9 : Computation of international reference price of rice.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
FOB price	Bangk	$/Qtl	21.70	21.00	23.00	28.40	30.50	27.80	30.20	27.80	25.00	27.00	32.10	33.80	30.20	30.50	24.80	20.20	17.27	19.18	19.94	24.57
Plus freight from Bangkok to India		$/Qtl	0.69	0.62	0.68	0.80	0.80	0.81	0.74	0.80	0.83	0.91	0.98	0.87	0.82	0.74	0.71	0.66	0.65	0.63	0.67	0.74
Plus insurance @ 1% of price		$/Qtl	0.22	0.21	0.23	0.28	0.31	0.28	0.30	0.28	0.25	0.27	0.32	0.34	0.30	0.31	0.25	0.20	0.17	0.19	0.20	0.20
Plus customcess 5% on FOB		$/Qtl	1.09	1.05	1.15	1.42	1.53	1.39	1.51	1.39	1.25	1.35	1.61	1.69	1.51	1.53	1.24	1.01	0.86	0.96	1.00	1.22
Equals CIF price		$/Qtl	23.69	22.88	25.06	30.90	33.13	30.28	32.75	30.26	27.33	29.53	35.00	36.70	32.83	33.07	27.00	22.07	18.96	20.96	21.81	26.73
Exchange Rate		1$=Rs	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.42	42.08	43.28	45.61	47.61	47.61	45.67
Equals CIF price		Rs/Qtl	281.66	280.05	320.32	400.77	479.68	504.09	587.49	740.55	791.58	927.15	1098.69	1225.78	1164.46	1227.39	1136.12	955.32	864.59	997.94	1038.20	1220.75
Import duty		Rs/Qtl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	934.08	987.24	910.01	762.35	778.40	760.98	759.31	680.03
Transport cost	Chenn	Rs/Qtl	27.75	29.00	29.00	29.65	29.80	30.00	31.60	31.75	32.00	32.00	33.20	33.65	33.75	34.00	34.00	43.50	38.12	37.66	37.43	38.45
C&F Handling charges		Rs/Qtl	14.00	14.20	14.50	15.60	16.00	17.20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	31.00	31.00	32.09	33.02
Wharfage charges		Rs/Qtl	3.15	3.50	3.60	4.00	4.00	5.00	5.45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.45	7.65	7.89	7.40
Service charges	US gul	Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.13	4.16	4.09	4.10
Service cost		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0.33	0.32	0.34	0.34
Equals landed cost	Hydera	Rs/Qtl	328.72	328.91	369.90	452.66	532.18	559.21	645.67	802.34	855.57	992.56	1166.86	1296.77	2170.89	2287.85	2121.70	1793.74	1724.02	1839.71	1879.35	1984.09
Reference price			328.72	328.91	369.90	452.66	532.18	559.21	645.67	802.34	855.57	992.56	1166.86	1296.77	2170.89	2287.85	2121.70	1793.74	1724.02	1839.71	1879.35	1984.09

Appendix 10 : Computation of international reference price of maize.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
FOB price	US gulf	$/Qtl	11 20	8 80	7.60	10.70	11.10	10 90	10 70	10 40	10.20	10.80	12.40	16.50	11.70	10.20	9.00	8.80	7.45	9 93	10 51	11 17
Plus freight from US gulf to India		$/Qtl	3 00	3.00	2.53	2.58	4.36	4.20	4 10	4 10	4 23	4.21	4.50	4.40	4.40	4.40	4.24	4.24	4.24	4 76	4 72	4 76
Plus insurance @ 1% of price		$/Qtl	0 11	0.09	0.08	0.11	0.11	0.11	0.11	0 10	0 10	0.11	0.12	0.17	0.12	0.10	0.09	0.09	0 07	0.99	1 05	1 11
Plus customcess 5% on FOB		$/Qtl	0 56	0.44	0.38	0.54	0.56	0.55	0.54	0 52	0 51	0.54	0.62	0.83	0.59	0.51	0.45	0.44	0.37	4 95	5 25	5 55
Equals CIF price		$/Qtl	14 87	12.33	10.59	13.92	16.12	15.75	15.44	15 12	15.04	15.66	17 64	21 89	16.80	15.21	13.78	13.57	12.14	20.63	21 53	22 59
Exchange Rate		1$=Rs	11 89	12.24	12.78	12.97	14.48	16.55	17 94	24 47	28 96	31 40	31.39	33.40	35.47	37.12	42.08	434.28	45.61	47.61	47.61	45 76
Equals CIF price		Rs/Qtl	176 83	150 89	135.33	180.50	233.48	262.30	277 03	370 08	435 59	491 60	553.85	731.13	595.97	564.67	579.95	587.31	553.66	982.19	1025 04	1033 72
Import duty		Rs/Qtl	0 00	0 00	0 00	0.00	0.00	0.00	0 00	0 00	0.00	0.00	0.00	365.93	275.56	251.41	251.47	252.89	225.62	250.55	253 34	254 43
Transport cost	Mumbai	Rs/Qtl	82.50	85 90	78.60	80.00	83.50	85.60	90.00	90 00	92.50	95.70	97.50	98.50	100.00	101.50	104.50	106.70	106.70	107.01	107 05	108 11
C&F Handling charges		Rs/Qtl	14 00	14.20	14.50	15 60	16.00	17.20	18.00	21 00	22 75	23.80	25.00	27 00	27.50	28.00	30.00	30.00	30.00	32.34	31 38	31 40
Wharfage charges		Rs/Qtl	3 15	3 50	3.60	4.00	4.00	5 00	5.45	5 80	6 00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.30	7.54	7 42	7 45
Service charges	US gulf	Rs/Qtl	2 00	2.00	2.30	2.45	2.50	2.70	2 90	3 00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4 00	4.00	4.14	4 31	4 35
Service tax		Rs/Qtl	0 16	0.16	0.18	0.20	0.20	0.22	0 23	0.24	0.24	0 26	0.28	0.29	0.30	0 31	0.32	0.32	0.32	0.35	0.32	0 33
Equals landed cost	Hyderabad	Rs/Qtl	278.64	256 65	234.51	282.75	339.68	373.02	393.61	490 12	560 08	620.71	586.32	1232.90	1010.13	956 79	977.49	988.47	927.60	1384.12	1428.86	1439 79
Reference price			278.64	256 65	234.51	282.75	339.68	373.02	393.61	490 12	560.08	620.71	586.32	1232.90	1010.13	956.79	977.49	988.47	927.60	1384.12	1428 86	1439 79

Appendix 11 :Computational of international reference price of groundnut.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
FOB price	Rotterdam	$/Qtl	37.80	34.80	39.78	32.39	33.60	36.10	42.20	47.06	48.77	47.10	51.35	48.02	69.74	64.51	59.45	53.32	75.32	65.49	85.59	91.00
Plus freight from Rotterdam to India		$/Qtl	2.02	1.75	1.85	2.54	2.83	3.55	3.04	2.71	2.99	2.83	1.92	2.18	1.86	1.24	1.17	0.94	1.03	2.01	2.03	1.96
Plus insurance @ 1% of price		$/Qtl	0.38	0.35	0.4	0.32	0.34	0.36	0.42	0.47	0.49	0.47	0.51	0.48	0.70	0.65	0.59	0.53	0.75	0.65	0.85	0.91
Plus customcess 5% on FOB		$/Qtl	1.89	1.74	1.99	1.62	1.68	1.80	2.11	2.35	2.44	2.35	2.57	2.40	3.49	3.23	2.97	2.67	3.75	3.25	4.25	4.55
Equals CIF price		$/Qtl	42.09	38.64	44.01	36.87	38.45	41.81	47.77	52.59	54.68	52.75	56.34	53.07	75.79	69.61	64.19	57.46	80.85	71.40	92.72	98.42
Exchange Rate		1$=Rs	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.12	42.08	43.28	45.61	47.61	48.61	45.76
Equals CIF price		Rs/Qtl	500.41	472.98	562.50	478.24	556.76	696.17	857.03	1286.87	1583.63	1656.32	1768.65	1772.68	2688.35	2584.03	2700.97	2486.95	3687.57	3399.35	4507.12	4503.70
Import duty		Rs/Qtl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	564.54	870.79	842.87	880.56	812.30	842.30	890.34	900.00	912.03
Transport cost	Chennai	Rs/Qtl	27.75	29.00	29.00	29.65	29.80	30.00	31.60	31.75	32.00	32.00	33.20	33.65	33.75	34.00	34.00	34.50	35.21	35.23	35.21	36.12
C&F Handling charges		Rs/Qtl	14.00	14.20	14.50	15.60	16.00	17.20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	31.00	32.34	31.38	31.40
Wharfage charges		Rs/Qtl	3.15	3.50	3.60	4.00	4.00	5.00	5.45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.32	7.54	7.42	7.45
Service charges	US gulf	Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.12	4.14	4.31	4.35
Service tax		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0.33	0.35	0.32	0.33
Equals landed cost	Hyderabad	Rs/Qtl	533.47	507.64	597.59	514.53	593.26	734.09	897.21	1327.66	1624.87	1697.93	1811.83	2831.81	3604.00	3472.12	3627.10	3345.32	4607.85	4369.29	5485.76	5495.38
Reference price		Rs/Qtl	533.47	507.64	597.59	514.53	593.26	734.09	897.21	1327.66	1624.87	1697.93	1811.83	2381.21	3604.00	3472.12	3627.10	3345.32	4607.85	4369.29	5485.76	5495.38

Appendix 12: Computation of international reference price of cotton.

Particulars	Place	Unit	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
FOB price	Liverpool	$/Qtl	132.00	105.60	164.70	139.90	167.70	181.90	169.40	127.60	127.80	176.00	216.50	177.40	174.50	144.30	117.00	129.10	105.70	101.90	139 70	136.60
Plus freight from Liverpool to India		$/Qtl	1.19	1.35	1.72	1.99	2.62	2.92	2.26	2.20	2.36	2.30	2.26	2.22	1.97	1.15	1.21	0.95	1.21	1.28	1 34	1.35
Plus insurance @ 1% of price		$/Qtl	1 32	1.06	1.65	1.40	1.67	1.82	1.69	1.28	1.28	1.76	2.17	1.77	1.75	1.44	1.17	1.29	1.05	1.01	1 39	1.36
Plus customcess 5% on FOB		$/Qtl	6.60	5.28	8.24	7.00	8.37	9.10	8.47	6.38	6.39	8.80	10.83	8.87	8.73	7.22	5.85	6.46	5 29	5.05	6 85	6.80
Equals CIF price		1$=Rs	141 11	113.29	176.31	150.28	179.96	195.73	181.82	137.46	137.82	188 86	231.75	190.26	186.94	154.11	125.23	137.80	113.25	109.24	149 28	146.11
Exchange Rate		Rs/Qtl	11.89	12.24	12.78	12.97	14.48	16.65	17.94	24.47	28.96	31.40	31.39	33.40	35.47	37.12	42.08	43.28	45.61	47 61	47.61	45.76
Equals CIF price		Rs/Qtl	1677.81	1386.63	2253.19	1949.13	2605.80	3258.92	3261.84	3363.53	3991.37	5930.19	7274.57	6354.71	6630.90	5720.63	5269.59	5963.82	5165 10	5200.92	7107 22	6685.99
Import duty		Rs/Qtl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2085.66	2178.71	1885.46	1733.02	1966.78	1848.62	1868.55	1900 23	1910.25
Transport cost	Mumbai	Rs/Qtl	82.50	85.90	78.60	80 00	83.50	85.60	90.00	90.00	92.50	95.70	97.50	98.50	100.00	101.50	104.50	106.70	108 32	109.45	107 22	108.12
C&F Handling charges		Rs/Qtl	14.00	14.20	14.50	15.60	16.00	17.20	18.00	21.00	22.75	23.80	25.00	27.00	27.50	28.00	30.00	30.00	31.00	32.34	31.38	31.40
Wharfage charges		Rs/Qtl	3.15	3.50	3.60	4.00	4.00	5.00	5 45	5.80	6.00	6.10	6.25	6.40	7.00	7.00	7.25	7.25	7.32	7.54	7.42	7.45
Service charges	US gulf	Rs/Qtl	2.00	2.00	2.30	2.45	2.50	2.70	2.90	3.00	3.00	3.25	3.45	3.65	3.80	3.90	4.00	4.00	4.12	4.14	4.31	4 35
Service tax		Rs/Qtl	0.16	0.16	0.18	0.20	0.20	0.22	0.23	0.24	0.24	0.26	0.28	0.29	0.30	0.31	0.32	0.32	0 33	0.35	0.32	0.33
Equals landed cost	Hyderabad	Rs/Qtl	1779.62	1492.39	2352.38	2051.37	2712.00	3369.63	3378 42	3483.57	4115.86	6059.30	7407.05	8576.20	8948.22	7746.80	7148.68	8078.87	7164.81	7223.29	9158.10	8747.89
Reference price			1779.62	1492.39	2352.38	2051.37	2712.00	3369.63	3378.42	3483.57	4115.86	6059.30	7407.05	8576.20	8948.22	7746.80	7148.68	8078.87	7164.81	7223.29	9158.10	8747.89