Report

Production, Market structure and the role of Public Policy: Foodgrains in the new Economy

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March 2011

Preface

Liberalization of the food market has always been a leading issue of contention and invited considerable interest, debates and criticisms. Food is a basic necessity of life and India is a country that can scarcely forget the sinister experiences of famines, shortages and starvation that dotted the past. It is not surprising that despite the comfort of apparent sufficiency in the aftermath of the green revolution, food continues to enjoy enormous significance in the political economy of the country. Although India's plans for market reforms and opening up agriculture with earnest optimism and anticipation, every step on the way was laced with caution and deliberation and every action was weighed carefully for its merit so that the actual progress may have been only measured. After about two decades of experience in the new paradigm, this report is an attempt to revisit the period to assess the achievement in the projected direction. How far the structure of the food market changed in favour of free market forces, to what extent the relevance of public price policy diminished and do the new market based Institutions created during the period live up to the expectation and what could be their possible limitations are some of the questioned raised in the various studies incorporated in this report.

The project taken up in this report could not be accomplished but for the support of both Institute of Economic Growth (IEG) and the Ministry of Agriculture (MOA). The work is done entirely in IEG which provided me with all infrastructure and facilities. Our Director Prof. Bina Agarwal has been extremely supportive and accommodative of my preoccupation with the work. The MOA has as usual sponsored the research and I thank Dr. S.M. Jharwal for letting me undertake the work and Mr. P.C. Bodh for his pleasant coordination. Dr. Sangeeta Chakarvaty of IEG has been a close collaborator in some of the studies in this report. We plan to improve upon them and I acknowledge her methodological inputs. Mr. M. Rajeshwor has been a solid support continuously through the conduct of the studies. Not only did he collaborate closely in some of the work, his expertise with data management and computer software was valuable for the entire work. Mr. Yogesh Bhatt also helped in many ways especially in the study on Crop Insurance. Mrs. Sashi Kad happily typed the manuscripts and allowed me time for the empirical work. I thank all of them sincerely.

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Content

1. Introduction

The transformations that marked India's approach to economic policy making in the early years of the 1990's can only be described in one word as revolutionary. That this transition also touched India's food policy and agriculture can be singled out as the most remarkable aspect of the change. India's policy towards food and farmers' livelihood had for more than a century been chained and restrained by a hysteric concern about food scarcity in the country and poverty in the villages. A dominant feature was the overwhelming presence of the State in the market. The government's indirect stamp was there in all the rules and institutions that made up the market. In this background a successful shift to a market based regime would indeed signify a giant leap, just as a failure would provoke further deliberations on the legendary powers that are vested in the market mechanism. Justifiably the switch was accompanied by hope and optimism from the protagonists of free market who looked forward to a thriving and competitive Indian agriculture in the world market and at the same time also by dark misgivings from the sceptics.

After about 2 decades have elapsed from this change in intentions, it is opportune to look objectively at the lessons gained from the liberalisation process of one of world's largest agricultural sectors. The collection of studies embodied in this report critically revisits India's success in the expected transition in regime and assess the power of the market signals in the changed world. They also enquire on the success with which the various market-based institutions could be developed in this time period and whether they served the purposes. To what extent the experiences of India's market liberalization in agriculture confirmed the adverse implications that sceptics foreboded is a central point of the study. In the following three sections of this chapter we provide a theoretical and policy backdrop for the formulation of our objectives. The questions raised in the report are mentioned along with an outline of the data used and methodologies employed in Section 1.5.

1.2. The entrenched mistrust of the Market in India's Food Policy

The food policy that had evolved and flourished till about the beginning of the last decade of the 20th century drew its sustenance from a basic mistrust of the market mechanism, the origin of which is anything but recent. The Royal Commission on Agriculture had recommended the setting up of a regulated market back in 1928, subsequent to the Bengal famine. Consequent to the demands of the World War II, the Food Policy Committee in 1943 rejected free trade as a policy in preference to central government's management of the food economy in India. Rationing of food was a gift of the colonial government and the war.

While recurrent famines and the contingency of wars created the preference for controls in India during the British rule, independent India's policy advisors expressed little faith in free markets either. The Food grain Procurement Committee (1950) did not find the time ripe for a pro-market shift, considering the 'establishment of a stable and reasonable price level of food grains' a necessary pre-condition for any decontrol! The Food Grain Enquiry Committee (1957) too opined that a complete free trade in basic essentials like food grains under the contemporary conditions would tend to impede the course of 'planned development'. The Agricultural Prices Commission (APC) in its first report in 1965-66 also favoured the continuation of controls stating that the situation cannot be left entirely to market mechanism in which demand will be matched with supply through the device of 'high' price. The APC favoured 'resolute state action' in its long term grain policy. Recognition of the scarcity situation persistently prevailing in the country and the lack of faith in the market to take care of the basic needs of the people were patent.

India inherited a nearly stagnant agriculture described to be 'completed exhausted' (Krishna, 1972) a fast increasing population that was growing at 2.16% per annum between 1951 and 1961 and the recent memory of a devastating famine. Food grains were the key constituent of the Indian diet. Equitable distribution of available grains at reasonable prices remained the basic objective of food policy (Food grains Policy Committee 1966).

The reasons for the lack of confidence in the rule of the price to take care of the food problem is not far to find. Under any situation of shortage the market mechanism was supposed to eliminate the disequilibrium by the upward movement of prices that tend to increase supply and bring down demand at the same time. For an essential item with very little possibility of substitution by cheaper items, compromise on basic nutrition may be a part of the process. For food security, it is not sufficient for food to be physically available in the market but people will have to afford it too. Further the nature of agriculture and its dependence on natural resources also limit the ability of the market to bring about efficient solutions. All this is elaborated in the next section.

1.3. Free-Market and Public Intervention in Food

Free market, the rule of price, laisses-faire and market economy are nearly inter changeable terms used for a related phenomena in which the forces of supply and demand have a supreme power of determining production patterns through their combined influences on prices. The theory of free market holds that property rights are exchanged voluntarily by mutual consents of sellers and buyers rather than by physical force or coercion by a third party, such as the government. A related concept more familiar in economic theory is that of a perfectly competitive market, in which there is no barrier to entry and exit in a market, leading to a large number of players and a free flow of information, goods and services. Essentially perfect competition is an ideal situation of free markets and in real life conditions it is hard to find.

What qualifies a system to be deemed as a free market is not unambiguous. The free market can be conceptualised to be an integrated system of communication in which prices act as signals to direct production decisions. In the process, division of labour and allocation of resources across production lines take place in the optimal manner. Similarly the price signals communicate the production possibilities and resource costs to consumers who allocate their constrained budgets among rival uses optimally. Undistorted price is a key element of a free market and in this market the individual

agents of the economy pursue their own interests voluntarily but end up promoting the interests of society (Adam Smith in the Wealth of Nations). Any shock that creates a discrepancy between demand and supply will lead to a change in prices via the adjustment in the behaviours of the parties.

1.3.1. Rising prices: Good or Bad?

The appropriateness of market price as an instrument to bridge the gap between demand and supply can be doubted in the case of food where the price is decided by an impersonal and government-free market. Such adjustments take place along the demand and supply curves that are usually observed to be rather inelastic to price. Higher production is achieved through either the improvement of productivity or expansion of area. The strength of the first effect is subject to the potential of the available technology and the access to necessary inputs which are not necessarily assured in real life. Several non-price factors such as lack of basic resources, transportation and information problems and constraints on the credit market act to limit the farmers' access to inputs. Extension of area under food, given that total land endowments cannot be stretched indefinitely, could only mean diversion from other uses. This may possibly create supply pressures elsewhere in the economy. Under such severe limitations, the effect of the adjustment could be unduly large on the price rather than on supply.

On the demand side, a price rise would have two important implications. The rule of price ordains that given the interpersonal differences in utility functions, sections of consumers will move away towards other competing good and services if possible while others who can afford linger even as price rises. Food being an essential commodity it is likely that large sections will cut down on other expenses in order to access food or alternatively they are forced to choose huger, malnutrition or starvation even as the demand adjusts to price signals. Even a substitution if any may mean that expenses on health care and education are reduced, The market induced reduction of expenditures on food, health and education means not just welfare losses but by undermining human capital, they have long-term implications for efficiency in the economy. Second, it is also

not clear if the producer necessarily gains from the price rise let alone respond. When agriculture is in the hands of small producers who themselves buy food from he markets the welfare implications of a price rise is shrouded even on the producers side. With unavoidable imperfections in the market, a bulk of the gains from a rise could go to the middlemen - intermediating in the market. Further the rising prices will activate speculative activities among traders leading to further rises creating inflation.

Apart from effecting the allocation of resources across sectors such as agriculture vis a vis the others and within agriculture among the crops, price signals decide which way the benefits will flow. Higher prices are expected to be good news for the farm producers whereas consumers gain from depressed prices in the short run. Thus the basic food security of the people is linked possibly in different ways in the short run and longer run with the movements of the price signals. Favourable prices of food need not hurt the consumers in the aggregate analysis. Since price signals also decide the pattern and intensity of resource flows within agriculture, shaping the choice of crops, productivity in agriculture and quality of products in the long run, a dynamic and lucrative food grain economy ultimately can translate to welfare gains of the same consumers. By providing incentive to farmers higher food prices and improved terms of trade for agriculture can encourage investment flow in agriculture and ameliorate the food situation in the country, raising nutritional standards over time. Yet although depressed food prices turn out to be adverse to both producers and consumers in the longer run, excessively high prices could not only render food unaffordable to large sections of people and jeopardise basic survival, they can hardly be of benefit to the producers politically unacceptable. A sharp price rise even in the short run can do immense harm. In practice producers do not necessarily gain from such high prices and the distribution of the gains depend largely on the efficiency of the markets. Food price is a double-edged weapon that has always called for a balance from the policy side.

1.3.2. The presence of the Government in Market

While the market is visualised as consisting of a set of individual agents, pursuing their own interests in production and consumption, can the proximity of the government to the process constitute a deviation from the concept of a free market? To what extent the purposive intervention of the government in the market marks a deviation from the market principle is not rigidly defined and can indeed be debated. If this is so, free market itself is at best a relative concept since nearly all societies and governments regulate the economies in varying degrees. Contrasts are however sharp among controlled or centrally planned economies on the one hand in which governments even dictate the prices and supplies of commodities for attaining certain social or political objectives and capitalist systems on the other, in which all the means of production are privately owned and operated autonomously for profit. However, in practice, even the most capitalistic systems are not free of government regulation especially in regard to certain sectors and products embodying issues of public interest and non-excludability. Some believe that the concept of a market economy does not preclude government intervention in pricing (von Mises, Ludwig 1996). Perspectives differ on how strong the role of the government should be in guiding the market economy but by and large, the free market is conceptualized as a system free of government subsidies, artificial public pressures and government granted monopolies, by which the government tends to influence, guide or coerce decisions. While free entry and exit in the market is an essential condition of what constitutes a free market, there is a near consensus that the free market could be regulated by the government against frauds and collusions. Most countries accommodate government regulations to safeguard legitimate consumer interests and counteract the unequal power distributions in the market. Even with a sufficiently broad understanding of the concept, numerous complications arise to question the limit of the government's role. The existence of public goods, externalities and risk are some of impediments that come in the way of the markets, left to themselves from yielding the best possible results. Not only efficiency, there are scepticisms about the implications of a free market in its purer form for the welfare of the people especially those who are marginalized and vulnerable to start with. This possibly accounts for the political significance that food

enjoys in the domestic economies of most countries developed and developing alike, the continual interference of the governments in the food markets and the travails of the ongoing international free trade initiatives.

Besides, agricultural production depends intensely on natural resource endowments that are not necessarily purchased in the market. That these resources embody a certain degree of commonality and inter-dependences across geography and time is a feature that makes the market incapable of efficiently pricing the inputs and hence also the output in agriculture. Property rights of many of the resources like water are ill-defined in practice. Resources that in principle form common properties (such as ground water, atmosphere and climate and soil quality) incorporate the features of public goods. They are not excludable and are not amenable to the market-based price rules. Government intervention could thus become necessary even for ensuring efficiency of production.

Risk is another element that has come in the way of optimal resource use through the market mechanism. Agriculture is said to be a risky enterprise and this is of great significance when farming is done by small farmers who operate at the verge of existence and have very little risk taking ability. Risk in agriculture arises both from production uncertainty, given the sector's intimate relation with weather and from volatilities of prices that a free market would expose agriculture to. In many risky circumstances an insurance market usual comes up from this exigency. Due to problems of asymmetric information and because of the poverty of potential purchasers, such a market has been observed not to emerge under free market conditions. Financial instruments to manage risk through the trading of risk did evolve and even for their smooth functioning the government's active support sometimes becomes imperative.

Given the special features of agriculture and the market for food, a number of questions have always perplexed the policy makers and the international negotiators. Should the government interfere? Should the government regulate? To what extent should the government presence be tolerated in a liberalising market? A different relevant question could be: should the government be another participating actor in the market?

Given the volumes of debates and deliberations in theory and in practice that went down to address the subject especially since the WTO was signed, an essential feature of what is termed as the free market is the presence of undistorted prices. Prices in a free market are envisaged to be signals that carry the unvarnished message on what the market wants and what the market can provide. Even if there are appropriate regulations and measures to get over the problems of market imperfections, public goods and risk, at best the concept of undistorted price signal is largely utopian and hence the need for under-defined qualifications such as 'minimally' trade distorting.

How far the 'undistorted' price signals in a market undisturbed by the government's presence will take care of the basic needs of the people can be seriously doubted. However if the government acts on behalf of the people who otherwise have to adjust to price changes in ways that defy any understanding of human justice and opts to become a player by buying grains from the market and selling to the vulnerable consumers, the idea of a free market may not be violated so long as the process is non-coercive. In this case the market price is still determined by demand and supply but with state as an actor in the market. Admittedly the stylisation is not so simple. For addressing the food needs of the people the decision on distribution would be more normative than positive and the same distribution commitment would demand equivalent efforts at procurement for which the government has to compete with private players. The price the government pays could end up being a key determinant of the market price.

1.4. Moving towards a free Market

The structural adjustment programme (SAP) was the first demonstrated instance of confidence showed by Indian planners on the market mechanism. Although the programme had very little to do directly with agriculture the understanding was clear that the adjustment would give agriculture the benefit of playing in a less distorted market. The reforms in foreign exchange regulations, the modifications in industrial and associated trade policy and the drive to bring down subsidies together were expected to

move the terms of trade in favour of agriculture and help to make the sector more efficient and competitive. The emphasis was on setting the prices 'right'. Further, in 1994 and 1995 the formation of the World Trade Organization (WTO) was complete and India as a signatory was committed to the removal of trade barriers and opening up of the economy to international trade. The measures were a continuation of the resolves shown in the SAP. From this time domestic and international trade reforms were carried out gradually and in conjunction.

What happened in India could be understood better in context of the situation at the international level. The years that followed the Uruguay meet of the erstwhile General Agreement of Trade and Tariff (GATT) was one of intense negotiations and disagreements. Agriculture was for the first time brought under the purview of the multilateral governance, a clear acknowledgement of the supremacy of the open price based system in agriculture where products including food could be imported if they were produced cheaply elsewhere. The requirements to remove non-tariff barriers, increase market access and eliminate State support in the matter of essential and sensitive items naturally implied interferences with the domestic policy of a nation both developed or developing, each with its own political concerns. The WTO however gave leeway to the developing countries such as longer adjustment periods, special treatments and safeguards, means to respond to unfair practices coming from partners and to cope with balance of payment (BOP) difficulties. There were also sanitary grounds of restricting imports to protect the health and environment. The WTO also allowed for large government and non-government trading bodies called the State Trading Corporations despite reasons to believe that they influenced the directions of trade, provided trading decisions are taken on commercial grounds.

1.4.1. Market Structures, Public Policy and Institution

Perhaps the entire subject of the report could be subsumed under the title Institutions. Institutions are the set of rules that govern collective behaviour and in the true sense of the word, institutions are not made but they 'emerge'. Some of these institutions are

created through customs and may be subsequently sanctified and governed by legal recognition[1]. They are entities that survive and often transcend the lives of the players operating under their umbrella. In this sense, the market structure that evolves and even the longer run vision that guides the public policy are part of institutions. In every day use and in practice, institutions are considered to be built with purpose and intention. Perhaps the justification of these structures, norms and regulations to qualify as institutions lies in the test of time. Institutions in the market are no exception.

Market structure is a description of the fabric that makes up the market. In this sense market structure is an ex-post concept of what actually emerges as a result. The players in the market, the market channels, the concentration and the size of the market along with its avenues for entry and exit make up the parameters of the structure. Food being an essential item of life, the population itself constitutes the buyers although the consumers vary in the form and quality they prefer the food to take. When international trade takes place consumers can be located beyond the geographical boundary while domestic consumers can also choose grains produced in other countries.

The sellers at one end are the farmers but between the farmers and the buyers is a wide array of intermediation possibilities that makes up the character of the market structure. In India a dominant trait of the structure is the place of the State which has for many years constituted a single largest constituent of the intermediation. Market channels, mostly involving private traders are an important characteristic of the structure. The private entities could be organized and big players such as corporate translating to bulk buyers and exporters, super markets and retail chains or individual middlemen and small scale retailers discharging various functions breaking the marketing chain into several links. Regulations on marketing and foreign trade and fiscal policies of the state governments provide the rules and incentives by which the agents play. The channels are also intimately associated with the infrastructure available and the information dissemination technology. The scope of processing and value addition also gives its form

[1] Examples of institutions that are created through social customs are not hard to find. Marriage is one leading example.

to the channel as also the possibilities created by changes on the demand side. For example, when wheat is made into flour or when procurement is made of dehusked paddy, millers become part of the chain. The rules of entry and exit and the degree of concentration are influenced by the marketing rules (licensing, permits etc.) framed by the government and the institutions promoted. Even the financial market created new potentials. Undoubtedly political consideration play a significant role behind what rule is promulgated.

Institutions are viewed in this context as systems built up on the basis of governmental deliberation of what would be the best way to conduct market functions taking account of economic and political sustainability. Yet, to say whether the institution actually survives, transmutes, metamorphoses or expire requires the test of time. Despite State role such institutions may be designed to be run on commercial principle and driven by market forces. Typically the government role is involved when the market has failed to form on its own appeal. Model rules for formulation of norms and regulation, hand-holding support for initiation, necessary regulatory function to maintain competition and fair play and judicial action on unethical and incompatible practices are some of the ways. In many cases legislation is a privilege that the State can invoke to make certain developments take place. Evaluation is another important function that State undertakes to make the system self-correcting and sustainable. Liberalization is a process that involved creation of new and market oriented institutions, reformulation of public policy in consistency with the change in outlook and the emergence of a changed market structure.

1.5. Objective, Data and Plan of Study

This report is an attempt to re-visit and re-examine the path taken by the Indian food price policy in the years subsequent to the liberalization of market and its reflection on the food price trajectories. In the course of the ensuing chapters we do the following”

1. Trace the course of the agricultural market movement in context of the policy environment.

2. Study the character of India's journey towards the ideals of a free market by anticipating the State's exit and the ingress of the international trade into the market. Simultaneously, we also seek to confirm the diminishing role of the administered price and increasing influence of international forces in determining food prices.
3. In a large country with a political plurality, we examine the transmission of price signals in the presence of public intervention. We look out for possible unevenness in the distribution of gains that are created from a localized market shock inflicted by state procurement.
4. Critically review the effect of trade liberalization and its adverse effect on producer price movements in the domestic economy.
5. Assess the emerging market for trading in risk by examining the performance of two newly created institutions: (a) the Futures market in food items and (b) Crop insurance.
6. Trace the pattern and direction of food price movements and examine if the movements have favoured agriculture.

In what follows in subsequent chapters are a series of studies conducted on the Indian food market, focussing on various aspects. The data used in the studies are taken from different official sources of the Government of India, mainly the Ministry of Agriculture. The key data used in this report relates to prices. We have used mostly wholesale prices that are available for selected markets in each state on a monthly basis. Wholesale prices are prices collected by different agencies of the government from wholesale markets and are quoted for related for large volume transactions between the wholesaler and the retailer. Wholesale price indices are also used at the annual level for the states. We also use monthly retail prices reported by the Ministry of Labour for specific key markets. Retail prices relate to relatively smaller transactions between retailer and the consumer. A few other prices are used also in various contexts. Farmers' price or the farmgate price is approximated by the price reported in the Cost of Cultivation surveys although Farm harvest price could be an alternative source. Import and export prices are unit values as explained in the text. Daily data from NCDEX website relating to both spot and futures prices has also helped. Besides use of data on yield rates, irrigation, rainfall, procurement,

stocks and distribution are based on Ministry of Agriculture's official data. The Agricultural Insurance Company has provided certain key statistics of crop insurance at the state level. International statistics are as reported by FAO. The data issues and sources are mentioned in the respective chapters. The objectives being different, the methods also varied according to the context. However in most of the empirical analyses in this report the underlying movement of prices are assumed to follow a dynamic path and use of methods offered by time-series econometrics, specifically the GARCH group of models that explain both movements of expected prices and their variances is made elaborately. Besides regressions based on Ordinary Least Squares (OLS) on annual data and panel data are used depending on data availability on the variables of interest and as appropriate to the context. Although the period subsequent to 1995-96 is treated as the post-liberalization, the transition to the new regime is generally kept flexible over 1991-2 to 2002-3 since the process was phased as well as gradual. The period 1980-81 onwards is mostly included in the time period of analysis both to mark a contrast and to increase the sample period.

The organization of the chapters is as follows. This chapter is introductory laying down a very broad background to the context and the objectives at hand. In Chapter 2 we give a summary of the policy background in India's food market placing the new evolutions and interjections in context of the traditional path followed by the Indian food policy. In Chapter 3 we examine the nature of India's progress to a free economy by looking for government's role, anticipating on the way a reduction of public presence, a diminution of the role of public price policy and greater alignment of prices to international prices. In Chapter 4 we ask about how the states as different locations are integrated with one another as a market to allow free passage of price signals even if the intervention arises from a public programme. Chapter 5 evaluates how justified are the well recognized misgivings on trade liberalization, how it has disturbed the price movements in terms of sharp and adverse price changes. The subject is viewed in the background of India's concerns of the implications of possible strategies that could be adopted in international negotiations of trade in food. In Chapter 6 deals with the controversial futures market in food grains and enquires whether the institution adds new information to the market and

how justified are the fears on price rise associated with futures trade. In Chapter 7 another risk market is taken up, the proverbial crop insurance that the government seems to promote despite world wide disillusionment and the study dwells on constraints imposed by policy compulsions that hamper its performance and acceptance among farmers. In Chapter 8 the revolutionary changes in the institution for marketing food both interfacing the producer and purchaser are discussed in conjunction with an analysis of the temporal movements of food prices, the possible gains reaching farmers via the terms of trade, the real prices and profitability effects. The relative movements of the wholesale and the politically more important retail prices are reviewed. The same chapter also rounds up with a final view at the extent of transformation effected in the production pattern and the improvements in the consumption standards and self-sufficiency of the nation.

2. Farmers in the Food grain market: Public Policy

2.1. Introduction

The changes in the Government's food grain policy are anticipated to have far reaching effects on the lives of farmers and the on the future of agriculture in India. Before embarking on the ensuing studies on various facets of the market it is pertinent to discuss the nature of changes and the background in which such changes took place. This chapter provides the contours of India's food grain policy in the backdrop of historical transitions of domestic and international sentiments.

2.2. Policy and institutions: The Traditional picture

By food policy we mean the sum total of the proactive interventions, regulations and the state promoted institutions that directly or indirectly shape the prices received by the farmers and what the consumers pay. In this both marketing policy and price policy make up the food policy. Kahlon and Tyagi (1983) define marketing policy as that part of the food policy that does not directly seek to change food prices in any particular direction. The price policy is viewed as the set of strategies that involve public operations with the aim of administering and guiding prices while measures that seek to facilitate smooth market operations by private and public agents enabling prices to be determined fairly by the market forces make up the marketing policy. In this sense the price policy is viewed actually as an interjection to circumvent the free market environment while the market reforms actually intend to promote it. The latter impinge on rules of market operations, infrastructural build ups and regulations on stocking and movement of grains. Nevertheless, marketing policy too can have the strategic and sometimes tacit significance of influencing prices albeit indirectly.

2.2.1. Price policy

The food price policy that gradually emerged in the Indian polity since the 1960s was a departure from the erstwhile colonial policy of laissez-faire, in which the government involvement in the food economy was mostly confined to famine relief and infrastructural support[1]. Soon after independence there was no significant change in the food policy and even the war time strategy of rationing food was sustained till 1950. The serious food shortage that began to surface in the fledgling country shortly after the partition and the emergence of a technology that showed all the potential of delivering India from a humiliating dependence on external sources together created the stage for the strong price policy to be instituted in the 1960s. The policy relied on proactive and conscious administering of prices by the State in order to encourage farmers to adopt the new technology and produce food. While independent India's food policy was fundamentally different from what it inherited from colonial legacy, the underlying motivation guiding public policy remained largely unchanged. Food scarcity was the central concern behind public involvement in the market.

2.2.2. Food Corporation of India and NAFED

The Food Corporation of India (FCI) was the organization that executed the government's food policy. Established in 1965 as the central agency to purchase, transport and distribute food grains, the FCI has a large network of offices, godowns, mills, processing plants and outlets. It purchases directly from producers or through state government agencies, grain is stored either in central pool or in state facilities and the acquired grain is finally distributed at fixed issue prices by FCI uniformly throughout the country. The FCI's handling cost including the salaries and wages paid to FCI personnel adds to the cost of food grains at the consumer's end but the government provides subsidies to make the grains affordable to the consumers. The FCI also stores the undistributed grains strategically.

[1]Infrastructural support to agriculture mostly came through the railways and irrigation.

The FCI dealt with all the cereals at the beginning but since 1980 its operations became confined to rice and wheat while a cooperative organization named National Agricultural Cooperative Marketing Federation (NAFED) started operating in coarse cereals and certain other items. The coarse cereals however required little support compared to rice and wheat owing to their dwindling demand in market, low marketable surplus, their confined spatial origins and their easy perishability.

2.2.3. Procurement

The FCI or its agent in the State government procured grains either directly from the farmers or from millers as in the case of rice. The key feature was that the transaction took place at a price that was decided by the government rather the market forces. Also the prices were announced publicity in advance at the time of production planning so as to influence the farmer's production decision and to reduce their price risk. Thus there was an assurance that the government would purchase the grains offered to it for sale provided the farmers agreed to accept the pre-announced price.

In effect the system, by offering an additional option to the farmers, protected the market price from falling below a certain minimum level. However, except for levies on rice mills, procurement was largely voluntary rather than coercive so the government agency could be perceived as only another competing trader in the market.

2.2.4. The Agricultural Prices Commission and the Minimum Support Price

The Agricultural Prices Commission (APC) was set up in 1966 to advise the government on food prices for its operations. Initially the government based on its recommendations announced a procurement price (PP) and a Minimum Support Prices (MSP) separately for two distinct purposes. The PP announced in the harvest season, ideally offered a certain return to the farmers over their costs though it tended to fall below the prevailing market price while the MSP in principle served as a floor price for the market. The MSP was lower than the procurement price and was guaranteed. Since the early 1970s only one price known as the MSP has been announced and the distinction blurred as all the

produce offered by farmers were guaranteed to be purchased by government. In 1980 the name of the price setting body changed from APC to Commission for Agricultural Costs and Prices (CACP). The Ministry of Agriculture had been collecting primary information on cost of cultivation since 1970-71 on the recommendation of a Technical Committee of the Government of India to assist in price setting. The support price takes into account the cost of cultivation incurred as well as various parities. The purpose is to ensure that farmers receive remunerative prices and the terms of trade do not move against agriculture as they have in the past. At the same time the PP or the MSP served as a key instrument to encourage food production and to guide production patterns in ways that were perceived as socially desirable.

2.2.5. Distribution

Ensuring food security to the nation is a major responsibility of any country. While encouraging production could be a way towards achieving food security at the national level, food security at the household level could only be attained by assuring physical and economic access to nutrition at affordable prices especially to the poorer households. Food distribution is a duty of the central and state governments, specifically the Department of civil supplies.

Statutory rationing of food was a practice[2] that the government India chose to continue after independence. In 1953 it was replaced by a system in which food was distributed through fair price shops (FPS), owned by private agents endowed with licences obtained from the civil supplies departments. Grain was sold to consumers holding ration cards at fixed prices. Both domestic procurements and imports served as sources of grains. The Central Issue Price (CIP) announced by the central government determined the prices but state government often added incidentals over the CIP and in some cases, also distributed at prices lower the CIP. Since the CIP was itself less than the economic cost of the grains depending on the extent of central subsidies, the special distribution schemes implied that

[2] Public distribution had its origin in the rationing system created for meeting the emergencies of the World War II in 1942.

the states were incurring the additional cost. Thus the public distribution system (PDS) was a combined portrayal of the fiscal and political objectives of both the central and the state governments. The entitlement of the consumer was a fixed quota but in the FPS system the consumer could freely buy grains in the open market.

In addition to the PDS, the government also distributed grains through various employment generation programmes as wages. The food for work programme initiated in 1973 depended on the public stocks to a large extent. Also since 1985 the FCI started distributing as an active market player through open auctioning. Open market sales address a situation of price rise through a market based system. They are undertaken only in the presence of surplus public stocks when there is a felt need to stabilize the market price.

2.2.6. Buffer Stocks

The question of maintaining a buffer stock arose originally in response to the famine of 1943. The policy was streamlined when a technical group constituted in 1975 examined the quantum of reserves required over and above operational stocks in order to meet contingencies of crop failure and tide over inter-seasonal price fluctuations. Since carrying stocks over the years involve economic cost of storage, transport and interest rate payments, the group also examined whether the stocks were required to be maintained in physical form or as foreign exchange that could be used to import food when necessary. The Group however preferred the former option, keeping in mind that prices in international market and the exchange rates are likely to vary and it was hard to establish the superiority of the latter method (Kahlon and Tyagi, 1983)

2.2.7. International Trade Policy in India

International trade in strategic food grains was a monopoly of the central government since 1960s and canalisation of trade through public sector bodies was mandatory. The government decided whether to import or export, which grains to import and from which

countries. In general wheat formed the lion share of exports and there were instances when cereal exports were prohibited. Only Basmati rice was freely exported. In general international trade was insignificant and residual in nature. In a large agricultural country like India the food economy was fiercely inward looking.

2.2.8. Marketing Policy

The transition of an economy from subsistence to an exchange based one necessarily calls for a conscious attention towards development of a marketing policy. Although agriculture was characterised by small farms and subsistence farming, the role of exchange was patent for a long time. The idea of a regulated market in India was mooted by the Royal Commission on Agriculture way back in 1928 that found the unequal power relations in the agricultural exchange market inconsistent with the doctrine of free trade in its pure form. The Agricultural Produce (grading and marketing) Act passed in 1937 gave statutory powers to state governments to manage agricultural markets. Agriculture being a state subject, most states passed legislations and created regulated markets for trading fairly in agro-products. The states also could prescribe grades to preserve quality.

Marketing in rural areas has its own complexities. Formation of market was severely inhibited at the micro level by poverty and scattered population in the rural sector. Perhaps, as a response the market operated in three tiers (1) the village (primary) market or 'haat' functioning weekly or bi-weekly (2) the 'mandi' or the wholesale market serving a radius of 5 to 10 miles and (3) retail shops and markets scattered all over villages and towns where consumers visit to make their purchases. The system was dominated by a large network of intermediaries or traders often also known as 'adtyas' and commission agents often operating in long chains to connect the producer with the consumer. The APC Act brought most of the wholesale and primary markets under state regulation. The key purpose of the Act was to protect the interests of the farmers against exploitation by more powerful traders and to narrow the price spread between the producer and consumer. The number of regulated markets stood at only 286 at the time of independence. In 2001 the number was over 7000.

The major means of regulation implied in the APC Act was the formation of representative market committees to frame and administer the rules democratically. Prices are determined fairly by open auctions and disputes are settled by sub-committees. The committee provides for limited storage, infrastructure and grading facilities and charge fees from the players. In addition to the private trader, regulated under the Act, the state government, cooperative, the FCI and the NAFED are members.

2.2.9. Protecting the Consumer's interest

Food grains are basic necessities and any democratically elected power will have to ensure that consumers have access to their minimum needs, especially when there is shortage in the market. The Essential Commodities Act (ECA 1955) was enacted for protecting the interest of the consumers, ensuring equity and controlling prices and supplies of essential goods. More relevantly the ECA was meant to prevent unscrupulous activities of traders through hoarding and black-marketing. The Act specified a list of 'essential' commodities that could be reviewed from time to time, imposed limits on the stocks that could be held privately (obviously the government was excluded), required traders to have licenses and permits and laid down restrictions on the movement of goods between states or even districts at various times.

Though the ECA was enacted by the central government the power of implementing the Act was delegated to the state and UT governments while the central government's role was mostly to guide and monitor the implementing governments. Thus states had the power to frame rules, enforce them and punish the violators. Punishments ranged from imprisonment to imposition of fines. The Act involved issuing of Orders which were generally temporary and sensitive to the contingency of the time. Private traders were required to maintain accounts and records of their stocks and transactions and were liable to produce them to the inspectors. In other words the ECA was a method of stern policing of traders and dealers as also a source of uncertainty for the traders' business plans which could be disrupted at any point by new Orders being clamped down on

certain products or practices. The ECA was further strengthened by other Acts like the Prevention of Black-marketing of Supplies of Essential goods in 1980, meant to preclude 'unethical' trade practices' and the Consumer Protection Act of 1986 that established consumer councils and redressal methods.

In the case of food grains which have always been in the list of essential commodities the ECA was a necessary instrument of the time. India's food economy was marked by shortage that itself fuelled speculative expectations and encourage the profit seeking traders to hoard grains creating artificial scarcity even under conditions of constrained supplies. However the ECA also served to facilitate public procurement. Although the procurement was primarily meant to ensure that farmers obtained remunerative prices (MSP or market prices which was higher) in a shortage situation public purchases were important to feed the distribution channels to the FPS. Thus the implementation of the ECA was especially severe in surplus regions where procurement was active in order to prevent grains from staying away form the market or flowing out to places where prices were higher than the MSP. This was a most obvious violation of the principles of free market in which unrestricted movement of products served to unite the market.

Besides the formal command and control measures in the ECA, informal measures were not unusual for curbing free trading practices. Regular checking of trucks in state borders, harassments leading to time loss and payment of bribes and inter-state fees and taxes also served to discourage cross-state private trading in grains. The FCI also enjoyed preference in obtaining reservation in railways while the private traders were forced to use roadways with its infrastructural weaknesses and multiple check posts. It was felt that the rules gave unfair competitive advantage to FCI in grain trade (World Bank, 2002).

The free market principle would hold that grains would flow both temporarily and spatially in tune with price movements whereas the use of ECA to cordon off surplus or procuring regions would blunt the powers of the market and shift the onus of distribution of grain across the consumers in the countries on the State. In effect such restrictions severely curved the transmission of price signals across markets and states.

2.3. Macro Policy for Indian agriculture

There are indirect and yet effective ways in which the government can influence the food economy through its policy in other matters. The foreign exchange policy, the central bank's control on the interest rates and the statutory wage rates were instruments that also helped in determining the shape of the agricultural market in various ways. Such policies however have little direct implications for inter-crop dimensions and are relevant for the sector as a whole. Similarly the budget, the fiscal policy (expenditure on roads, power irrigation, and the absence of agricultural taxes) and even monetary policy (easy credit during harvests and priority sector lending quota) can be easily visualised to be important influences on agriculture. However, certain state actions or inactions could subtly encourage the food grain sector such as the priority given in railway transportation, the specific marketing infrastructure created and institutions promoted, taxation on food processing activities and the proactive encouragement to diversification from food grains.

2.4. The global situation: Emergence of the World Trade Organization

The geo-political developments taking place in the aftermath of the World War II generated a polarisation of the countries roughly representing two blocs. Among others the centralised economy of one bloc and the capitalistic or free market oriented economy of the other marked a sharp division. India like many others in the developing world, professed non-alliance but largely nurtured the spirit of a planned economy of socialistic nature. The situation did not change till the 1980s, since when some of the nations were motivated to liberalize their markets and integrate their domestic markets with the larger global one. At the end of the decade even the Soviet bloc buckled under economic and political pressures. Among all the factors that provided impetus to this important transition of history, food was of no mean importance.

Although the impact of World War II generated a global economy that was far removed from the concept laissez-fair, the doctrine of free trade, rooted in the Ricardian vision and

further refined by theories on comparative advantage, was cherished and developed in academic discourses. In practice too, there were attempts at moving the world towards one of undistorted price based signals though only a handful of countries were motivated initially. There was a vision of an International Trade Organization (ITO) similar to the other Bretton Woods bodies and with this view, an interim body the General Agreement on Trade and Tariff (GATT) was formed in 1947. In reality the ITO never materialised in 1947-48 as envisaged, but GATT managed to regulate world trade for nearly 50 years through eight rounds of negotiations starting with the first meeting of 23 states in Geneva to discuss tariff reduction. The last round of negotiations started in 1986 as the historic Uruguay Round (UR), the longest one of the lot to end in 1993. The UR was followed by an agreement and the formation of a much awaited regulatory body now called the World Trade Organization (WTO) in 1995.

Food formed a thorny issue in the long period of suspense because it was politically important in all countries and free trade would call for interference in domestic policies. Thus even while the GATT served to regulate trade to an extent, food markets in developed and developing countries remained bound by a maze of non tariff barriers (NTB) like quotas, bans and subsides and the governments were deeply involved in the functioning of the respective food markets. The landmark feature of the WTO was the Agreement on Agriculture (AOA) that triggered the opening up the agriculture markets to global price signals. Obviously free trade in food would be dependent on not only the removal of restrictions on exports and imports but also on how each country reformed its own domestic market.

The first phase of WTO demanded moderate amendments culminating in giving greater market access, reduction of subsidies that distorted prices and tariffication of all NTB. Moreover, the WTO was much less harsh on developing countries than developed ones and provided a leeway to adjust to the new norms. For example the tariff reduction commitments were less for developing countries and adjustments were permissible over a

longer period then the developed countries[3]. The target Aggregate Measure of Support (AMS) was higher for the developing countries[4]. There were provisions for tolerating support so long as they were not trade distorting or minimally so in the form of blue and green boxes so that the government could support agriculture through insurance, infrastructure and information. Protection of environment was possible. Moreover pubic intervention to safeguard food security was possible under certain strictures to ensure minimum distortions. Maintenance of a buffer stock and distribution of grains in a targeted way based on nutritional norms were possible. Other provisions such as the sanitary and phyto-sanitary measures, counter-veiling tariffs and anti-dumping were other protections under the WTO. The WTO also recognized the presence of State Trading Organizations that carried out bulk trade in products.

2.4.1. State Trading Enterprises

The State Trading Enterprises (STE) are large bodies that could be government or non-government owned enterprises including marketing boards which are granted exclusive and special rights, often statutory or constitutional powers, to purchase in the international market. The GATT acknowledged the STE as legitimate participants in trade and the WTO continues the practice despite scepticisms regarding their power to influence the directions of trade and prices, the subtle role of the government behind their actions and their potential to distort world trade (Ackerman and Dixit, 1999).

2.4.2. The Doha Round

The WTO took decisions by consensus and by periodic meetings including the main ministerial meetings. In November 2001 the fourth ministerial took place in Doha initiating a new round of negotiations known as the Doha Development Round (DDR) because of the primacy given to development. However the beneficial impact of the first

[3] Tariff rates were to be cut by 24% over 10 years by developing countries and by 36% over only 6 years by the developed countries. Minimum market access commitments were at levels of 5% of the base period for developed countries and 3% for developing countries.
[4] The de-minimis AMS was 10%for developing and 5%for developed countries

round is not clear[5]. With the DDR indicating further cuts in tariff, the developing countries are concerned about the food and livelihood security of the people. Even the developed countries are divided on various issues like the special safeguard measures and the STEs and progress in negotiations towards a free world trade is under a cloud.

2.5. Liberalisation and reforms of Indian food market

India's food policy till the 1980 was based on government interventions to protect consumer and producer interests, regulation of market, limitations on private stocking and movements of food grains, the near prohibition on international trade except for national exigency and above all, the dominance of large para-statal market agencies like the FCI participating in the market.

The spirit behind the policy could at best be placed somewhere between one of favouring the free market and one of a stern and active central authority (see Chapter 1). The regulated market for food grains protected the market from monopolistic forces while the FCI was an actor like any other in the market. While the policy balanced two opposing forces represented by the consumer and producer interests, the writing had become clear since the 1960s that neither the consumer could gain if farmers lost their incentive to produce nor could the producer attain success if prices continued to be unaffordable to consumers. The MSP had to take account of emerging trends in the market. Thus despite intervening intensely in the market in various ways the government also aimed to create a market that was inherently competitive and generated gains for both farmers and consumers.

The changes in the elements of the food policy brought about by the paradigm shift in 1990s can therefore hardly be termed radical. At best they can be viewed as amendments and revisions to correct some of the ills and shortfalls of strategies that experiences revealed, some of the reviews and retrospections being especially motivated by the shift.

[5]Beginning with the Seattle meeting of 1999, discords and deadlock continued through Cancun (2003) and Honkong (2005) ministerial.

Partly they were corrections and partly served as adjustments to an emerging reality. The broad transitions policy and the inspirations behind hem are described below.

2.5.1. Structural adjustment in macro economy

The food economy being part of the national economy could hardly be insulated from the impact of macro changes in the country. The structural adjustments taking place since 1991 in the aftermath of a fiscal crisis and India's borrowing from the World Bank were the first steps to bring the spirit of free market in the economy and a movement away from state control. The changes effected by the Structural Adjustment Programme (SAP) centered on the elimination of the government granted licenses, relaxations on the controls on imports and exports, a more rationalized monetary policy and above all the gradual elimination of subsidies as part of a strict check on the deficit in the public budget. While agriculture was traditionally in the private domain and indeed could be thought of as competitive if only the large number of operators were considered (lack of competition however emerged from other drawbacks such as unequal economic power and lack of information), state controls on the other sectors of the economy forced a distorted price regime on agriculture too. The effect of the fiscal policy, the industrial policy and the foreign trade policy embraced in the 1990s were therefore expected to profoundly influence agriculture. Expectedly these reforms would mitigate the competitive disadvantage and the adverse terms of trade that agriculture was unfairly subjected to and set the prices it faced right. Thus the macro adjustments promised to be gainful to agriculture.

2.5.2. Trade Liberalization

The stage for trade liberalisation was already set by the adjustments initiated in 1991 and India was moving out from the era of import canalisation and exchange rate controls although most food grains were considered as sensitive items calling for regulation. The signing of the WTO agreement saw India as a founder member in the international organization with commitments to honour. Initially, compliance did not mean a

significant change as far as food was concerned. India's AMS was found to be within the mark thus reducing liability. Tariff bindings were on the lower sides but applied tariff rates were within the bound rates. Although a tariff-line wise import policy commenced in1996, balance of payment considerations allowed a phased removal of Quantitative Restrictions (QR) on trade. India had to dismantle all QRs only in 2001 following Article XI of the GATT. The involvement of the notified STEs in the canalization of trade in sensitive items was a general practice and was compliant with WTO norms. Exports are not subsidised in India and any support given via income tax exemption does not violate the rules too.

The opening up of the food market to the world trade was undoubtedly a land mark decision. Indeed, free trade in agriculture was a much disputed subject in India as it was in many other countries. While studies based on sophisticated models (Anderson 1996) indicated that the developing world and the food producers would benefit as all nations liberalise trade, a number of questions disturbed India. Will exports hurt food security and will the global volatilities undermine livelihood of farmers? What would be the impact if India enters the market as an importer? Can food security be protected if the government bows out of the task of food management? Largely, the understanding of the time was that trade restrictions actually depressed output prices and prevented the farmers from making the profits that the global market would allow them to. In other words, despite the public support, the Indian farmers had in practice been net taxed. Calculations also indicated that India had substantial comparative advantage in agriculture specifically in rice and wheat.

Since 2001, trade barriers have been lifted so that imports were virtually free. Under the WTO regime the countries have to declare tariff bindings based on their base period conditions. India's bound tariffs are fairly high although the applied tariffs are lower except for rice. In practice, India has from time to time controlled exports by banning them or stipulating ceiling prices and occasionally by invoking the SPS provisions. Concerns over the large levels of subsidies that are given in developed countries are disturbing as are the control that large private corporations have over the global grain

trade. The progress of further trade-liberalisation is now eclipsed by serious apprehension about food and livelihood security.

2.6. Domestic Policy Reforms

Liberalization expectedly raised several reservations about the government's presence in the market, regarding the very existence of the FCI, the need for stocking grains vis a vis imports, the system of specifying MSPs in an open ended procurement system, and subsidised food distributions adding to fiscal deficits. In sum whether public food management should be continued was questioned[6].

No radical institutional change was however witnessed though the policy was subjected to serious reviews and deliberation leading to appropriate modification. The FCI was restructured to reduce inefficiency but it was considered a necessary institution for its ability to extend its services to remote areas where free markets would be difficult to form. However the FCI[7] was to operate as another actor in the market. Given that India's production and consumption patterns display significant spatial dimensions, the FCI's strength lies in possessing a massive infrastructure of godowns and storage facilities, a large network of distribution arrangements and its ability to purchase and transport considerable volumes of food grains requiring the effective logistical organization of transportation from surplus to deficit states through purchase at appropriate points, collection at nearby depots and despatch to destinations. The pricing processes were reviewed and greater attention was given by the CACP to domestic demand and supply movements and to the parity with international prices. To improve the terms of trade and make agriculture more business oriented and profitable, the definition of cost was enlarged to the point of including a managerial element in cost while setting the MSP.

[6] Why public intervention may have become unnecessary is supported by the following changes that transpired in the economy (Bathla, 2004): (a) India no longer faces food grain shortages, (b) External trade can help to cope with deficiency situations, (c) Alternate institutional mechanisms can be evolved to ensure price stability and (d) Internal reforms are a prerequisite for the discharge of WTO commitments.

[7] The objectives of the FCI are stated to be (1) effective price support operation to safe-guard the farmers' interests, (2) distribution of grains throughout the country through the PDS and (3) Maintenance of satisfactory levels of operational (3 months sales) and buffer stocks for food security.

2.6.1. Public operations

Procurement and distribution were two major planks of public food grain operation. Procurement became substantially more decentralized during the period of liberalization, In the decentralized procurement system, actively taken up by Uttar Pradesh, West Bengal and Madhya Pradesh part of the grain procured is retained in the state pool for its PDS while the remaining is surrendered to the centre. The purchases were increasingly being made by agencies of the central and state governments. Even private agents were allowed to do the job of procuring of procuring where FCI's own potential was weak and considered cost saving but that was a 'last option'. On the distribution side the proposal of the dismantling of the PDS in favour of the free market was discarded for welfare reasons. However efforts were made to reduce the burden on the public budget without significantly compromising on the food security of the needy sections. The subsidy burden was to be reduced by provision of grains at the 'economic cost' price to the majority of the beneficiaries while trying to bring down the economic cost[8] of operations by making the FCI more efficient. An extension of coverage of the distribution network was effected towards remote areas in 1992 through the Revamped Public Distribution scheme (RPDS) but undoubtedly, the most significant step was taken in 1997 when the targeted public distribution scheme (TPDS) was launched, whereby the entitled consumers were classified as above poverty line (APL) and below poverty line (BPL). Only the BPL targets were entitled to public subsidies while the APL households had to bear the economic cost incurred by the FCI operation. Further a section was also demarcated as the most deprived class who got a certain quota of food grains at a highly subsidised rate through the Antodaya Anna Yojana (AAY). In addition several innovative food based welfare schemes were launched (Mid day meal scheme, Annapurna etc.) and all this made subsidies targeted towards the needy, while addressing food security.

[8] Subsidy is the difference between economic cost of delivering grains through the PDS and the sale value where the economic cost includes all the costs of administration, storage and transportation over and above the price of procurement.

Stocking of grains by government was meant to even out inter-seasonal and inter-year price variations, but too much stability also inhibited private enterprise. Moreover, stocks were expensive to the exchequers. A technical group had already reviewed the stocking policy keeping in view that the size of buffer stocks should be sensitive to the amplitude of inter-year fluctuations in production and prices and the scale of the PDS. The mounting of public stocks in the early years of the 2000s decade was a result of a run of good harvest and the open ended procurement policy of the government as well as the shortfalls in the distribution policy. At that point the FCI was also authorized to export wheat and rice from its stocks at prices below the CIP and to sell in the open market. The buffer stock policy was reviewed and the norms modified in keeping with the requirements and the costs involved. The technology of stocking also was vastly upgraded.

It was felt that the APMC act had finished serving its utility. Partly the situation changed rendering the system obsolete and partly the system had failed. The regulated markets had ended up creating a privileged group of licensed traders who blocked entry of new players thus defeating the aim of competition and in inhibiting private investment to benefit marketing. Moreover the infrastructure created was grossly inadequate especially in view of the advanced information technology potentials that were becoming available. The system failed in narrowing the price spread as a result of which the farmer received only a small portion of the rupee that the consumer paid. Besides, the liberalization of world trade had created new opportunities for the farm sector for which there was an urgent need for investment and entrepreneurial skills. All this necessitated the elimination of entry barriers, inefficiencies and monopoly rents.

In 2002 the government sought to reform the market by allowing more competition and encouraging innovative methods to evolve. Private cooperative, direct marketing and contract farming were to be promoted to bring the producers closer to the processor and the consumer. Central assistance for developing infrastructure was advanced. A system of warehouse receipts that supported grain storage as well as improved liquidity for farmers

was introduced and the Forward Market Act 1952 was amended in 2007 to allow futures trading in cereals. A model plan of legislation was circulated. Most states embarked on amending (APM) regulations to reform their markets.

2.6.2. Stocking and Movement of grains

Market reforms, despite the amendments in APMC Act would be quite ineffective in the presence of the restrictions on stocking and movement of grains that the ECA allowed. The vision of a free market rested on the efficient transmission of price signals and the ability of producers and traders to respond to them. An ideal situation will eliminate the co-existence of high prices prevailing in certain pockets with low prices in others as the movement of goods will tend to even out prices. In other works, there was a visible demand for India to move to a one-market economy tied together by price signals and separated only buy transportation and storage costs. Globalisation is a further extension of this idea in which the whole world would turn into a single market. Moreover there was a confidence that India's food economy has moved from the regime of scarcity to one of sufficiency or even surplus in which any occasional shortfall would be automatically made up by the flow of imports. In other words the ECA has become irrelevant and an undesirable hindrance on traders and investment flow in agriculture (Virmani and Rajeev, 2001). In 1993 the central government began to treat the entire country as a single food zone but the actual realisation of the design largely depended on the strategies taken by the state governments. Rules and regulations varied from state to state. In some states traders are required to obtain government permits to move grains out of a state and it was sometimes extremely difficult to obtain the permits especially in procuring regions. Several states revised the limits of stocking. Control quota and levy continued as compulsive measures for rice. The ECA proved to be a hindrance to other institutional developments such as new marketing channels, contract farming and retail chains. The success of any improved plan for stocking such as the National policy on Handling Storage, Transport depended on the removal of the control regime represented by the ECA

In February, 2002 the food ministry in India withdrew many of their regulatory measures on trading. The list of essential commodities was reviewed and greatly pruned in 2002 though rice and wheat retained their place. Tough it was decided that ECA would remain the umbrella legislation, progressive dismantling of controls and restrictions, removal of licensing requirements and elimination of stocking limits and movement restriction were gradually pursued. The foodstuff Order, 2002, 2003 allowed dealers to freely buy, stocks, sell, distribute or impose any quantity of wheat, paddy, rice, coarse cereals without having to possess a license or permit. The definition of a 'dealer' was amplified to include producers, manufacturers, importers and exporters but the levy on the rice remained.

In the new regime ECA became not only a matter of political contention between the central and state governments, but also emerges as a highly unresolved issue. In general the policy approach taken by the central government has moved towards a united market linked by market signals. The state governments driven by their own local concerns and pressure groups vacillated in opening their borders and their speed of reforms also varied. The inter-state differences had important implications. For example imposition of stock limits in Punjab led to a rise in wheat futures in Mahrasthra in 2009. In 2006 however when prices began to rise, the roles seemed to reverse. Since then the central government has been urging states to maintain checks on stocks in order to keep prices in control and to come down heavily on hoarders and speculators. For various reasons the states hesitated. For example the U.P. government that delayed action felt that it would revive the inspector-raj and would be quite ineffective with licensing having been abolished. Besides, the ECA the foodgrain market of India also remains to be segmented by unequal incidences of various charges like taxes, octrois, mandi fees that disparately add to the cost of transactions.

2.7. Government's new role

Does liberalization mean that government's role will reduce to that of a mute observer? Possibly, this was not what was envisaged. Liberalization hardly implies a growing

irrelevance of the government as many made it out to be. If anything, the changing regime will impose increasing responsibility on the government of monitoring the economy, take time corrective actions on assessed divergences, regulate and send correct signals all of which add to the function of governance. The government will increasingly be associated with facilitating the functioning of the market and creating market based institutions that would carry on the task it relinquished for the benefit of the consumers and producers.

2.7.1. Planning

Price signals, despite their incentive effect are not adequate inputs for increasing production, responses in agriculture being closely linked with non-price facilities including technology. The objectives of the State have broadened beyond those of accelerating growth rates and meeting food security at the national level to encompass inclusiveness, sustainable technology and global competitiveness. Thus the role of the State in removing bottlenecks still remains crucial. The Eighth Five year Plan saw a difference in the way and the meaning of planned development. More significantly the 73rd and the 74th amendments of the Constitution legitimised decentralization of planning which reversed the approach from top down to bottom up. The Rashtrya Krishi Vikas Yojana (RKVY) is the modern version of agricultural planning which has a holistic form in which targets are identified at the micro level and states are provided incentives for their investment in agriculture and for building up their plans from the micro plans. The beneficiaries themselves are part of the planning process while the planning commission creates an innovative network to monitor the process. The government aims to increase food production by bridging the yield gap though the central sector scheme called the National Food Security Mission (NFSM) launched in 2007. Districts with poor crop yields and saturation of the high yielding technology are identified for special promotional actions such as through water saving technology and micronutrients. Long term planning needs to take account of the possibility of climate change that can have significant impact on agriculture. Similarly with the eagerness for clean energy growing in the global market, biofuels are increasingly becoming an option agriculture and this

too creates an added role for the government in guarding against diversion of cropped area to the detriment of food security.

2.7.2. Research

Agricultural research has largely been in the public domain and in the responsibility of a large system under the aegis of the Indian Council of Agricultural research (ICAR). Several organizations including State universities have been contributing to this endeavour. A scientific break through could bring a radical transformation in the market and revolutionize its institutions. However given that achievements have been modest the system has continuously been the target for criticism and in the new era, expectedly the partnership with private sector in research has been sought. However it si also recognized that research is a time consuming process, traversing many failures or non-achievement before a turn around. Moreover most outcomes have to go through a rigorous regulatory process that itself has sometimes been the subject of criticism. The experience with bio-technology highlights the travails of research output and the importance of caution in respect of developments of such momentous consequence.

2.7.3. Public information and early warning

Information is one of the crucial inputs for any market and the government cannot be absolved from the task of promoting a sound and unbiased information system in the public domain. The developments in information technology and in connectivity through internet open up possibilities that have never been present. It has become imperative for the State to harness the technological possibilities, create human resources and necessary infrastructure to build up data base and collect regular market intelligence both for dissemination and for official monitoring of the economy. AGMARKET is one such scheme that collects and disseminates price and other relevant information across agricultural markets.

In agricultural markets most decisions including production and marketing have to be taken under uncertainty and with imperfect information. Decision of traders, food distribution plans of the government, export negotiations, investment decisions of processors are all based on the anticipation of production in agriculture. Insurance on agriculture too depends on the availability of timely information. Traditionally such information reported by the government as advance estimates a number of times in the growing period and beyond the harvest were based on intense observations made by state officials and on the basis of scientific sample surveys. However such a large endeavour inevitably encounters managerial problems leading to delays and inaccuracies which are costly and regularly critiqued. As a response methodologies in various disciplines including the remote sensing techniques are pooled in an umbrella scheme called the FASAL, utilized for cross checking and reinforcing the available information.

2.8. Food Security

Food Security of the people has arrested the attention of international agencies as well as the Indian policy makers. In 1996 at the world food summit of the UN the members had set a goal to halve the number of hungry people in the world by 2015. Food security is defined as physical and economic access of all people at all times to safe and nutritious food in keeping with the dietary preference of the people for their active and healthy life (the last two points are added later). Food can however be sourced from domestic agriculture (self-sufficient) or imported (self-reliance) but in most cases the nations prefer self-reliance due to socio-cultural and environmental reasons as also from a mistrust of trade as a source of food security.

Distinctions are made among food security at the national households and individual levels and strategies of addressing the different levels vary. Measures to assess the disgrace of food insecurity are also sensitive to the objective at hand. For example food security at the national level is measured by indicators like per capita production and availability, imports price levels and stocks. At the household and individual levels food and calorie intakes per capita, anthropometric and other health related measures gender

dimensions and other exclusive specific to certain vulnerable and marginal classes are often used to describe food security.

In India the focus was traditionally on national level food security given that shortage and under-production characterised the food economy and agriculture while population grew at a high rate. India lived in the spectre of a Malthusian predicament for many years. Inequality and deprivation too received their due attention and even the poverty indicators though based on income or total consumption were essentially built on food security norms. India's NSSO supplied data on consumer behaviour through well designed national level household surveys. It was in the early 1990s that the continual fear of a shortage gave way to satisfaction generated by food self-sufficiency as a fall out of the green revolution in agriculture. Soon liberation of the economy also led to high growth rates of incomes. All these positive indicators made the people more conscious of the lacunae in the success story. Analyses of NSSO data showed that while income poverty declined with growth, the proportion of under nourished did not move in consonance with this change (Viswanathan and Meenakhi, 2007, Ghosh and Guha-Khasnobis, 2007). India remained home to 27% of the world's pool of hungry people adding up 800 million heads (compared to China's 17%). Contrary there were evidences that dietary habits were shifting from cereals and the quality of diet also had impaired. Nevertheless significance of the food insecurity of certain sections (income classes, caste, gender, age) undoubtedly enhanced and the public concern on food security.

Even as the desire for growth with social justice became keener, fiscal prudence required that food subsidies be directed to the most needy sections. In 1997 the targeted public distribution scheme (TPPS) was initiated to provide subsidised grains to the below poverty line households and a scheme called Anthodia Anna Yojana (AAY) aimed to provide food at even cheaper rates to the poorest to the BPL households. Various other food based welfare schemes were launched by the government such as the annapurna targeted towards the aged, the mid day meal scheme (targed to school children), wheat based program ICDS for mothers and infants, programmes for SC and ST hostels, food for beggars and welfare homes and adolescent girls. The world food programme, the

emergency programme for Orissa's backward districts and Grain Bank were other endeavour. Similarly the public works programmes including the flagship NAREGA also consider food as a form of payment. Thus emphasis has shifted food security at the national level to households and individual levels and from universality to those who are most likely to be food deprived. Undoubtedly to discharge these commitments there is need to assure enough supplies to the public channel, stocking as emergency reserves and for organization or the logistics for food management in a vast country. The possibility of introducing food stamps is also expended.

Thus, the significance of national level food security again resurfaced, especially since growth of domestic production slowed down after the green revolution lost stream. Given the growing importance of food in the political economy the democratic government is in the process of enacting a National Food Security Act that envisages to provide 25 Kg of rice or wheat at a highly subsidised price to the below poverty line households. This will make food security statutory and the government is liable to answer for any failure. While the minimum quota of 25 Kg as against 35 Kg now given to the poorest households has been seriously questioned, the coverage of the scheme defined by the identified number of poor is an important input for the fiscal arithmetic. Indeed, the criterion for poverty that determines the number of poor and the coverage of any food security programmes has been a subject of disagreement. While the Planning Commission goes by the traditional measures based on ICMR's calorie norm and the correction for price rise over time, with the recognition of multiple dimensions of poverty and the lack of unanimity over what constitutes the calorie norm for individuals several other aspects have found their place in the identification of the poor[9].

[9] The estimates of head count ratio given by several sources as of 2010 are as follows: Planning Commission: 27.5%, Suresh Tendulkar Committee: 37.5%, N.C. Saxena Committee: 50.0% and State Governments: 45%.

3. Giving more Space to Market: Public intervention in India's Food economy

3.1. Introduction

The developments in the food economy in India have a critical importance for not only the country's political economy but also for the basic welfare of a large section of the world's poor who live in this country. India's experience in the two decades since the beginning of a pro-market approach in policy will bring to light the character of the liberalization process that was possible in the country as well as the potentials and limitations of the ideals of free economy in practice.

India's food policy since the 1960s promoted a highly regulated and administered market. In this regime the government continually interfered with the free market mechanism through its presence as a buyer and its price based strategies. We hypothesize that giving more space to market would amount to the following changes. First, the place of government as a buyer and a seller in the dual market would diminish and eventually vanish. Second, the ratio of international trade to total domestic production would over time increase indicating greater integration into the global economy. Third the role of the administered price, i.e., the minimum support price, in deciding market supplies will decline as the market forces of demand and supply take over the basic task.

3.2. Background and organization of study

The administered price policy that the Indian government followed in the pre-liberalization years was provoked by the critical food situation that prevailed in the wake of India's partition in 1947. The emerging understanding that farmers were rational enough to respond positively to price movements (Schultz, 1964, Nerlove, 1958, Krishna,1963, Askari and Cumming, 1975) further strengthened the argument that the

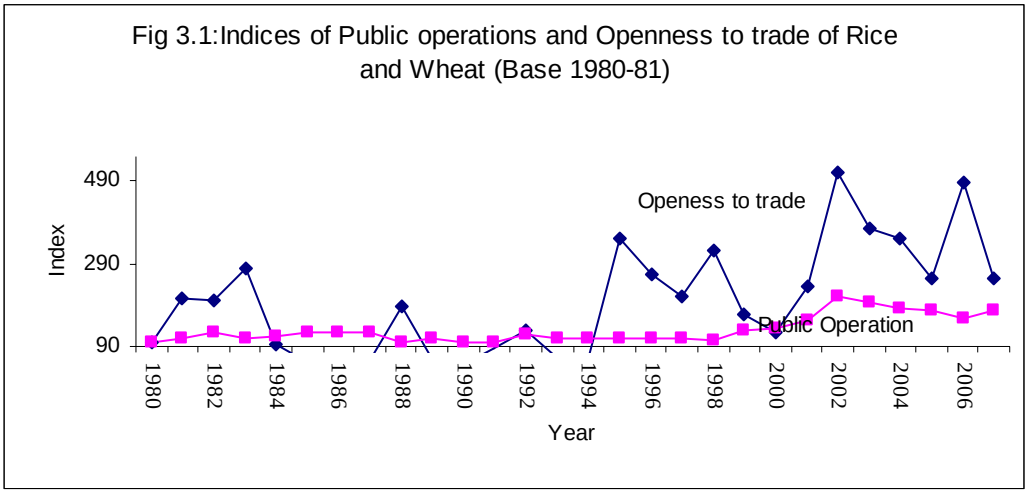
states could purposely direct the farmers' behaviour by tinkering with the prices. The basic tenet of the approach was that the market should determine supply outcomes and resource allocation. This was a radical's departure from the practice. No new technology was also in waiting as in the 1960s that required that farmers get price support to adopt an untried practice. On the contrary, there was a rival view, that far from being protected, agriculture in India was being 'taxed' by the same price policy (Gulati, 1994) so that the Indian farmers lost out in the opportunity for competing in the world market. There was a near consensus that the rule of the market would serve best in allocating resources among alternative uses, even if food production was one such use.

The chapter is organized in the following way. We first trace the share of free market versus state administered market and also of the share of global trade in the food economy in section 3.3. In the remaining sections the role of public stocks and changes in the inter-crop dimensions are addressed. The minimum support price is studied with respect to its observed function as a safety net as its name suggests. We also examine how important it is in determining how much grain is diverted away from the free market into the administered channel.

3.3. The Retreat of the State

The shrinking of the State is often seen as an essential element of liberalization. Globalization is an associated factor that expands the scope of the market. The global market is the larger market that subsumes the domestic markets and in which demand and supply forces emanating from all the constituent economies determine the prices that the domestic players face. Unrestrained by the pressures of food security the farmers of the country could be encouraged to optimally allocate land and other resources to the most lucrative choices, while imports and exports take over the task of filling the demand and supply gaps arising in the food market. The government would also be largely relieved of the task of procuring and carrying over grains in anticipation of a food shortage since imports can meet contingencies. This argument treats food as any other commodity that is traded. With reforms running its course for nearly two decades, it is useful to examine

the revealed responses on how far the government has been able to step away from the market and allow space to the agents of a free market. We specify two indicators to measure them namely PUBOP and OPEN.



We define a simple and composite indicator of the place occupied by the government in the market as PUBOP which is calculated as

PUBOP= (Procurement + Offtake)/ Domestic Production.

This is that part of production that passes the public channel[*] . Expressed as an index with 1980-81 as the base, the plotting of PUBOP in Figure 1 reveals no perceptible sign that state interference has declined in the post liberalisation period. The indicator remained depressed till 1998 but in fact started increasing thereafter.

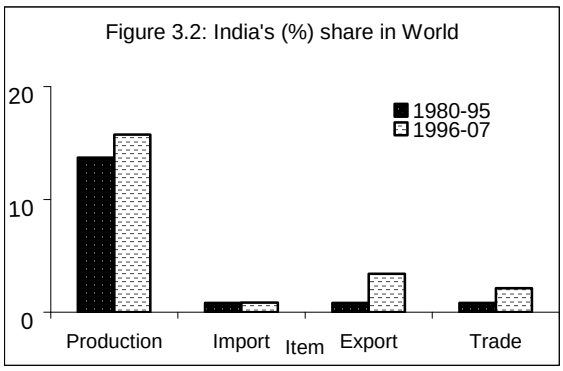
We define OPEN as,

OPEN = (Export +Import)/ Domestic production

to measure the place of trade in the food grain economy. The plot of the indices with 1980-81 as the base also provided in Figure 1 shows that trading did pick up in 1995 and improved slowly subsequently but with greater variability than PUBOP. The relaxations

[*] Not all the output that bypasses the public channel (1- PUBOP) reaches the market economy. This is because a large part of it is retained by the farmers for seed, feed and own consumption.

characteristic of the WTO regime has clearly improved the openness of the food grain economy though the degree of openness remains small but domestic production capability continues to retain its overwhelming importance. Nevertheless there has been an increase in the share of the country in the world production and trade in rice and wheat (Figure 2) and India's progress in opening up denoted by the share of trade in domestic production (Figure 3) is considerable in comparison to China and USA. Details of rice and wheat and the movements of various indicators are presented in the Appendix.



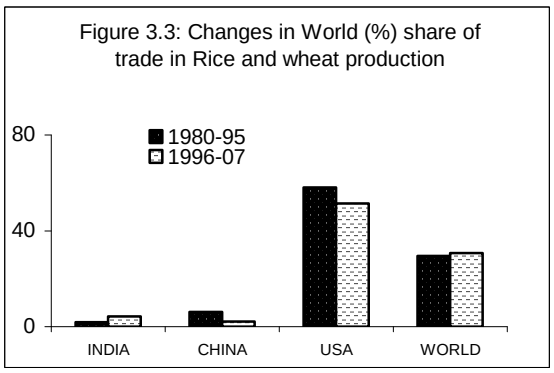


Table 3.1 reveals that till the triennium ending (TE) 1990, India's food imports exceeded exports but the position reversed thereafter and the data for TE 2005-06 and later years establishes India's position as a net exporter of food grains. The value of OPEN moved down between trienniums 1983 and 1995 but expanded nearly four times up to triennium 2005-06. The Appendix tables provide some of the indicators of India's progress in liberalization of food market.

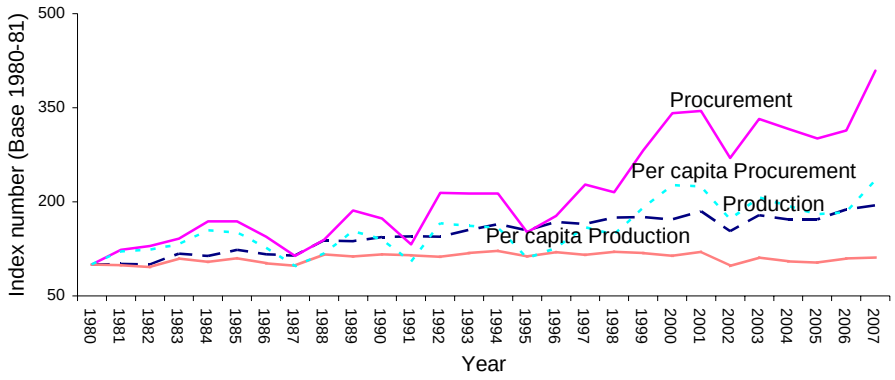
Table 3.1: Public intervention and free trade in Food grain market: Rice and wheat

T.E.	Procurement	Offtake	Public operations	Exports	Imports	Openness
1983	16.47	15.49	31.96	0.55	2.28	2.83
1990	15.78	13.04	28.83	0.38	0.84	1.22
1995	16.13	14.65	30.78	1.84	0.08	1.92
2000	21.33	13.19	34.52	1.96	0.59	2.55
2005	24.08	28.10	52.29	4.06	0.00	4.06
2006	23.25	25.13	48.48	3.44	1.06	4.51
2007	24.43	23.38	47.93	2.70	1.40	4.11

Note: Operation=Procurement+offtake, Openness=Exports+Imports, Figures as percentage of production

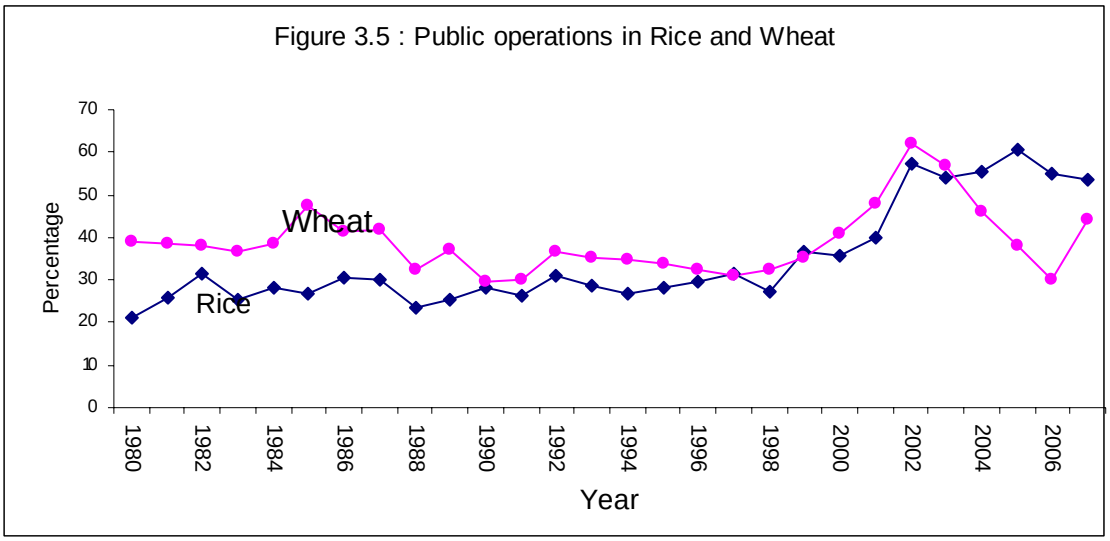
It may be apposite to keep in view that population has been increasing and public operations being done for feeding the people the government's role would take heed of the population size and keep pace with the population growth rate. Figure 3.4 plots production and procurements both total and at per capita levels. The growth in procurement at the per capita level showed better performance than production. The growing commitment to food security via the various distribution and food based welfare schemes has urged the government to seek supplies in the market as a competitor.

Figure 3.4: Growth in production and procurements

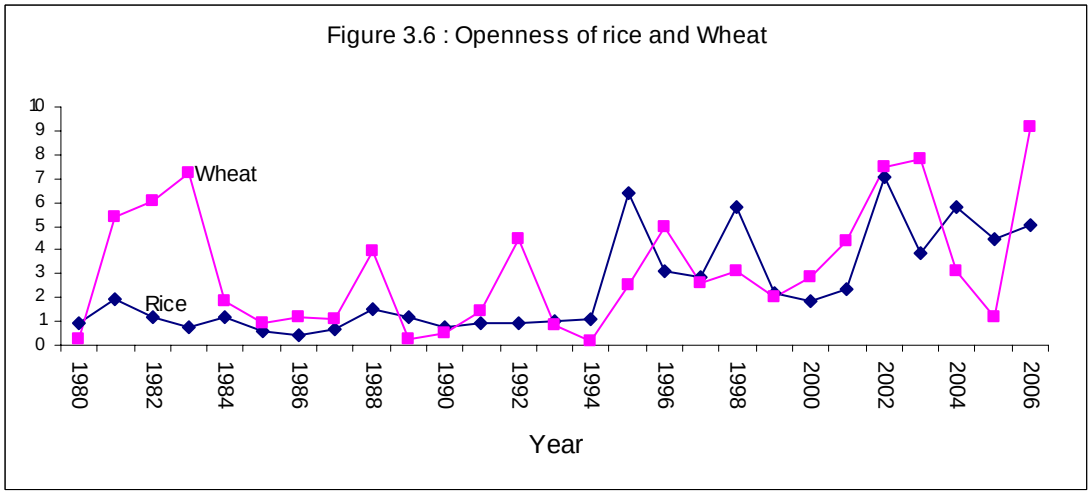


3.4. Inter-crop Dimension

Meanwhile some notable changes are also becoming apparent between the two major staples. Comparing the two periods 1980 to 1995 and 1996 to 2007 PUBOP for wheat went up from 37% to 41% and for rice from 27% to 45% (Appendix table 3.1A). There has been a tendency of catching up by rice which was by far the less important crop in the public demand. This is also demonstrated by the intersection of the curves in Figure 3.5. The improvement in the place of rice was also marked in respect of globalization (figure 3.6) and the global shares in Appendix table 3.2A suggest that rice has emerged as an exportable in India.



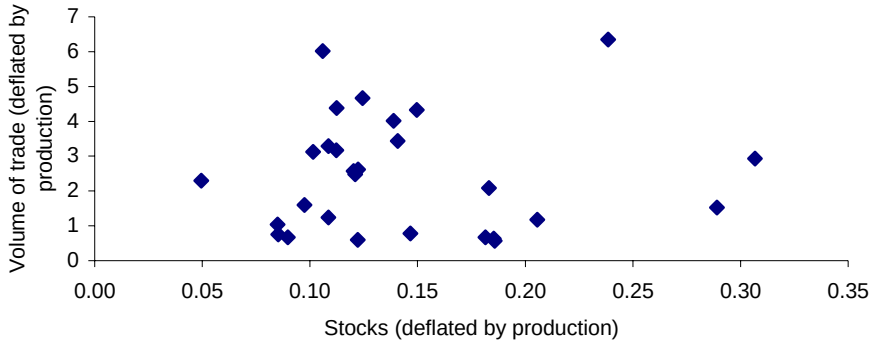
3. 5. Public Stocks and the place of Market



Public stocks serve to stabilize inter-temporal, inter-regional and inter-class variations of food security and can reduce the nation's dependence on international market. Holding stocks is costly besides being inteventionary. Since trade is often viewed as an alternative to the carrying of public stocks, ie., with increasing trades, stockholding becomes unnecessary one would expect a negative relation between public stocking and trade. However the actual reality may be much more complex. In reality information on public stocks is in public domains and has a direct influence on traders' behaviour. While higher levels of stocks may obviate the need for imports they may encourage exports in

expectation that domestic price will fall. A lower level of stocks will lead to higher imports especially if a production shortfall is anticipated. Thus given that a trade response to the policy of public stocking is expected, the link could be weak and the apparently positive slope observed in Figure 3.7 is not surprising.

Figure 3.7: Trade and public stocks in Rice and wheat



3.6. The Role of the Minimum Support Prices

The name Minimum Support Price suggests that MSP is a minimum safety net for farmers against prices falling below certain distress level. In reality, it has served as the key instrument that the government has used for influencing farmers to redirect production efforts towards socially more desirable crops. With, the market forces becoming more active the MSP is expected to become less useful and finally redundant.

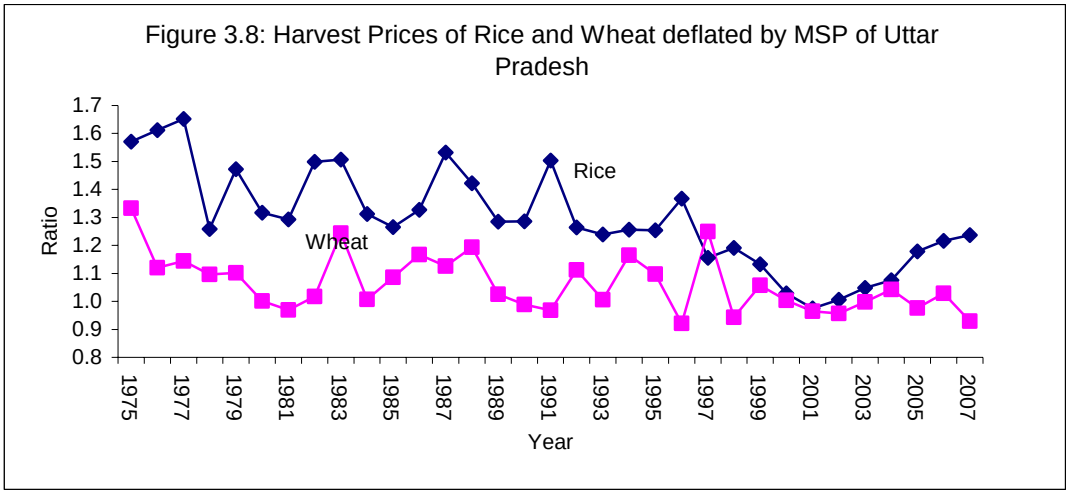


Figure 3.8 based on Uttar Pradesh data shows that the harvest time wholesale prices relative to the MSP has been declining in the later part of 1990s and in 2000s. For wheat it tended to fall below the MSP occasionally although in rice the ratio picked up since 2001. Do MSPs influence the direction of market prices and do they direct grains away from the free market towards public channels? To answer this regression equations 1 and 2 based on sample 1980-2007 with dependent variables RPRICE and WPRICE being respectively the harvest period prices of kharif rice and wheat are presented. The prices are regressed on their lagged values and the MSP represented by RMSP and WMSP respectively for rice and wheat that are announced for the current season, the announcement predating the realization of the harvest prices. All prices are expressed as indices with the base of 1993-94. In addition public stocks that determine the intensity with which the government conducts its procurement operation is considered as a variable but this variable is found to have a low t- value (less than one) for rice and is retained only for wheat price. The equations are all estimated in the log-linear form.

$$\text{RPRICE} = 0.268 + \underset{(4.89)}{0.71\ \text{RPRICE}(-1)} + \underset{(1.76)}{0.24\ \text{RMSP}} \quad \ldots (3.1)$$

Adjusted R^2 =0.98 DW= 1.7, Sample: 1980-2007, variables are in logarithms.

WPRICE = 0.24 + 0.44 WPRICE (-1) + 0.54 WMSP -0.04 RWST … (3.2)

(2.71) (3.57) (-1.35)

Adjusted R^2 = 0.99, DW=1.80 Sample: 1980-2007, variables are in logarithms.

In either case the past values or the short run dynamics played a more dominant role but prices are also driven by the MSP intervention though the response appears to be less intense for rice. Given the past price behaviors, a 1% rise in MSP increases the harvest time price by 0.24% in the case of rice and by 0.54% in the case of wheat.

Table 3.2: Growth rates(%) of public operations

Year	Production	Procurement	Offtake	Stock
2000	-3.80	18.94	-22.43	51.78
2001	5.50	-0.74	68.92	11.98
2002	-18.92	-23.39	55.81	-36.97
2003	14.34	20.46	-3.12	-40.33
2004	-5.66	-6.83	-18.15	-14.76
2005	-2.15	-6.80	0.27	-11.78
2006	6.79	2.03	-14.80	11.49

How far the MSP is effective in diverting food supply from the free market can be examined by looking for the response of the alternative (public) channel to changes in prices. A regression analysis is done with time series data 1980 to 2007 with public procurement as the dependent variable and the free market harvest time price and the MSP for the public channel as explanatory variables in equations 3 and 4 in Table 3.3. The current production is also treated as variable influencing procurements. All the price variables appear with the expected signs. The elasticities with respect to MSP exceed one in both cases and the coefficient of the market price is insignificant in wheat. These equations are however likely to suffer from multicollinearity due to the theoretical nexus among the three variables. The regression equations 1 and 2 also empirically showed that the harvest prices are correlated with the MSPs declared earlier. Thus not having sufficient faith on the coefficients, equations 5 and 6 are estimated using the ratio of the MSP to the harvest price as the explanatory variable. The coefficients of the price variable as specified now at 1.34 and 1.59 for rice and wheat are significant at 1% and 10% respectively. Thus for wheat the variation of the market price from the MSP has

mattered less in determining procurement but the elasticity with respect to production is higher at 0.78 than it is for rice at 0.41. These coefficients are not much different from those estimated in specifications 3 and 4.

Table 3.3 : Effect of Minimum Support Price (MSP) on public Procurement

Variable	Procurement Rice	Procurement Wheat	Procurement Rice	Procurement Wheat
Equation	3	4	5	6
Constant	-4.23 (-0.69)	-0.55 (-0.28)	-4.66 (-0.80)	-0.73 (-0.45)
MSP	1.26 (2.18)	1.59 (2.97)		
MSP/ Market Price			1.34 (2.82)	1.59 (1.70)
Market Price	-1.45 (-2.21)	-1.38 (-1.05)	-	-
Production	0.38 (1.15)	0.74 (1.58)	0.41 (1.28)	0.78 (1.96)
R-Square	0.86	0.53	0.87	0.55
D.W.	2.1	1.67	2.11	1.66

Note: The variables are in logarithms, Sample period: 1980-2007, all price indices are deflated by whole sale price index of all commodities.

3.7. Conclusions

The economic liberalization launched in the first half of the 1990s and the agricultural policy declared in 2001 laid down the objectives of the agricultural policy but did not spell out the way that was going to be achieved. What was understood was the intention that market forces would have a greater say in determining prices in times to come. This leads to the expectations that the government will retreat from the market, prices will move increasingly in tune with international price movements, market will be more open to foreign trade and the government administered MSP will lose its power to influence the market price.

Tracing the course of history many of the expectations are found unfulfilled. Public operations in relation to domestic production has intensified over time and the MSP remains to be decisive in drawing supplies from the free market channel. The market price is significantly influence by the MSP. The share of

Foreign trade in domestic production has however increased indicating greater openness and India has emerged as a net exporter on the average but that does not necessarily reduce the volume that is held in public stocks and despite the possibility of imports, the weight of domestic production is still paramount. Between rice and wheat, rice has gradually gained more significance both in public operations and in trade. The failure of the liberalization programme in food market to consummate itself could be on account of the increased pressure on the government to ensure food security especially of the vulnerable sections as well as the slow down in the production performance relative to demand.

Appendix

Table 3.1 A: Rice and Wheat public operations as percentage of production							
Year	Procurement	Offtakes	Operations	Procurement	Offtakes	Operations	Operations
	Rice			Wheat			Rice and Wheat
1980	9.96	10.96	20.92	18.15	20.68	38.83	28.15
1981	13.19	12.66	25.85	20.59	17.87	38.46	31.05
1982	15.16	16.33	31.49	19.37	18.46	37.83	34.51
1983	12.62	12.76	25.38	20.45	16.38	36.84	30.32
1984	16.82	11.32	28.15	23.49	15.25	38.74	32.7
1985	15.07	11.59	26.66	22.4	24.91	47.31	35.42
1986	15.46	14.92	30.38	17.78	23.35	41.13	34.92
1987	12.38	17.78	30.17	14.14	27.68	41.82	35.39
1988	10.84	12.88	23.72	16.64	16.01	32.64	27.6
1989	15.18	10.16	25.34	22.21	15.07	37.27	30.16
1990	17.39	10.65	28.04	14.06	15.56	29.62	28.72
1991	12.6	13.74	26.34	11.46	18.82	30.28	28.02
1992	17.46	13.57	31.03	22.44	14.09	36.53	33.45
1993	16.89	11.78	28.67	19.83	15.27	35.1	31.42
1994	16.03	10.82	26.85	18.75	16.1	34.85	30.42
1995	12.87	15.11	27.98	13.14	20.48	33.62	30.5
1996	14.51	15.06	29.57	13.41	19.21	32.62	30.97
1997	17.64	13.61	31.25	19.19	11.77	30.96	31.12
1998	13.45	13.77	27.22	19.84	12.49	32.32	29.53
1999	21.21	15.24	36.45	21.41	13.92	35.33	35.91
2000	23.65	12.26	35.92	29.61	11.18	40.79	38.11
2001	23.71	16.42	40.13	26.15	21.98	48.13	43.63
2002	22.85	34.61	57.46	24.03	38	62.03	59.65
2003	25.79	28.29	54.07	23.28	33.67	56.95	55.37
2004	27.59	27.64	55.23	20.63	25.48	46.1	51
2005	31.13	29.25	60.39	13.37	24.87	38.24	50.51
2006	28.26	26.93	55.19	14.68	15.45	30.13	43.94
2007	27.23	26.15	53.38	28.79	15.56	44.35	49.33
1995-1999	15.94	14.56	30.49	17.40	15.57	32.97	31.61
2000-2005	25.79	24.75	50.53	22.85	25.86	48.71	49.71
2006-2007	27.75	26.54	54.29	21.74	15.51	37.24	46.64
1980-1995	14.37	12.94	27.31	18.43	18.5	36.93	31.42
1996-2007	23.09	21.6	44.69	21.2	20.3	41.5	43.26

Table 3.2A: Globalization of India's Agriculture (percentage shares in World totals)										
	Rice			Wheat			Rice and Wheat			
Year	Production	Import	Export	Production	Import	Export	Production	Import	Export	Trade
1980	19.87	0.03	3.73	8.16	0.05	0.06	12.58	0.05	0.48	0.27
1981	19.16	0.37	7.35	7.92	1.95	0	12.08	1.76	0.81	1.28
1982	16.53	0.2	4.45	8.84	2.31	0.1	11.69	2.1	0.55	1.33
1983	19.58	1.78	1.99	8.94	3.1	0.03	12.94	2.96	0.22	1.56
1984	18.42	4.46	1.55	8.91	0.61	0.09	12.62	0.96	0.23	0.59
1985	20.07	0.49	2.73	8.98	0.05	0.38	13.17	0.1	0.61	0.35
1986	19.12	0.17	1.9	8.89	0.02	0.52	12.86	0.03	0.69	0.36
1987	18.05	0.04	2.99	9.33	0.01	0.45	12.72	0.01	0.72	0.37
1988	21.22	6.05	2.86	10.15	1.79	0.02	14.4	2.18	0.28	1.22
1989	21.31	3.27	2.77	8.47	0.09	0.02	13.22	0.46	0.36	0.41
1990	21.14	0.54	4.05	10.15	0.1	0.18	14.47	0.14	0.58	0.37
1991	21.14	0.09	5.16	9.9	0.09	0.57	14.24	0.09	1.02	0.56
1992	20.58	0.66	3.61	10.25	1.88	0.04	14.26	1.75	0.44	1.11
1993	22.64	0.47	4.56	11.45	0.42	0.02	15.97	0.43	0.58	0.51
1994	22.47	0.04	4.95	12.19	0.03	0.09	16.34	0.03	0.74	0.39
1995	20.87	0	21.84	10.68	0.04	1.29	14.64	0.04	4.63	2.36
1996	21.43	0	12.73	11.37	1.23	1.76	15.24	1.04	3.38	2.18
1997	21.31	0	11.37	11.24	1.47	0	15.23	1.26	1.68	1.47
1998	21.8	0.03	17.21	12.06	1.87	0	15.98	1.55	3.3	2.45
1999	21.91	0.13	7.5	13.1	1.11	0.16	16.74	0.93	1.38	1.16
2000	21.27	0.06	6.51	11.95	0.34	1.21	15.74	0.3	2.02	1.17
2001	23.33	0	8.22	12.65	0.03	2.46	17.06	0.02	3.47	1.78
2002	18.95	0	18.48	11.75	0.03	3.66	14.68	0.02	6.2	3.12
2003	22.56	0	12.21	11.53	0.01	4.64	15.78	0.01	6.05	3.03
2004	20.69	0	16.5	11.08	0.01	1.63	14.86	0.01	4.35	2.2
2005	21.94	0	13.77	11.64	0.03	0.6	15.89	0.03	2.97	1.51
2006	22.19	0	15.51	12.41	4.89	0.14	16.4	4.05	2.9	3.47
2007	21.71	0	0	11.52	0	0	15.48	0	0	0
1995-99	21.46	0.03	14.13	11.69	1.14	0.64	15.57	0.96	2.87	1.92
2000-05	21.46	0.01	12.62	11.77	0.08	2.37	15.67	0.07	4.18	2.14
2006-07	21.95	0.00	7.76	11.97	2.45	0.07	15.94	2.03	1.45	1.74
1980-95	20.24	1.05	5.5	9.62	0.8	0.24	13.71	0.83	0.83	0.83
1996-07	21.61	0.02	12.7	11.85	1.01	1.45	15.76	0.84	3.39	2.13

Table3.3A: Changing degree of Openness to trade in Rice and wheat (Percentage of domestic production)										
	INDIA			CHINA			USA			WORLD
YEAR	Import	Export	Trade	Import	Export	Trade	Import	Export	Trade	Trade
1980	0.06	0.60	0.66	9.09	0.90	9.99	0.10	63.58	63.68	31.25
1981	2.26	1.06	3.32	8.41	0.43	8.83	0.10	62.75	62.86	31.35
1982	2.79	0.71	3.50	7.28	0.43	7.71	0.28	54.36	54.63	30.68
1983	3.30	0.25	3.55	4.85	0.56	5.41	0.18	59.65	59.84	29.51
1984	1.18	0.29	1.47	3.53	0.64	4.17	0.38	54.44	54.82	31.45
1985	0.10	0.64	0.75	3.34	0.51	3.86	0.71	37.95	38.67	27.70
1986	0.03	0.72	0.75	4.34	0.54	4.88	1.07	48.31	49.38	26.83
1987	0.01	0.86	0.88	7.58	0.61	8.19	0.85	74.32	75.18	30.11
1988	2.25	0.30	2.55	7.70	0.40	8.10	1.35	74.79	76.15	30.05
1989	0.46	0.36	0.82	6.46	0.18	6.64	1.22	60.46	61.68	26.43
1990	0.13	0.54	0.67	4.10	0.18	4.28	1.44	39.78	41.21	26.60
1991	0.09	1.04	1.13	7.13	0.37	7.49	2.15	62.97	65.12	28.77
1992	2.00	0.48	2.49	2.95	0.53	3.47	2.86	53.55	56.40	31.86
1993	0.41	0.57	0.98	1.92	0.93	2.84	4.50	51.36	55.87	30.82
1994	0.03	0.67	0.70	4.84	0.92	5.76	3.95	50.56	54.51	29.31
1995	0.04	4.61	4.65	6.11	0.32	6.43	3.19	56.68	59.87	28.82
1996	0.96	2.99	3.94	1.40	0.54	1.94	4.14	44.34	48.47	27.50
1997	1.16	1.60	2.77	0.85	0.82	1.68	4.02	41.77	45.79	28.59
1998	1.41	3.16	4.57	0.43	1.74	2.17	4.10	42.03	46.13	29.80
1999	0.85	1.26	2.11	0.47	1.33	1.80	4.24	46.74	50.98	30.55
2000	0.29	2.01	2.30	0.19	1.60	1.79	4.13	47.52	51.65	31.02
2001	0.02	3.20	3.22	0.63	1.61	2.24	5.58	48.25	53.83	30.90
2002	0.03	7.23	7.26	0.36	1.78	2.14	5.01	52.56	57.57	34.15
2003	0.01	5.63	5.64	2.09	2.72	4.81	3.06	50.28	53.34	29.36
2004	0.00	4.56	4.56	0.00	0.95	0.95	0.00	48.48	48.48	30.75
2005	0.03	3.02	3.04	0.71	0.92	1.64	4.07	48.35	52.42	32.09
2006	3.97	2.92	6.89	0.51	1.70	2.22	7.10	50.52	57.62	32.57
1980-95	0.95	0.86	1.80	5.60	0.53	6.13	1.52	56.59	58.12	29.47
1996-07	0.79	3.42	4.21	0.69	1.43	2.12	4.13	47.35	51.48	30.66

Table3.4A: Procurement, Offtake and Stock of Rice and Wheat					
Year	Production	Procurement	Offtake	Stock	Population
	(Mill. (Tonnes)	(Mill. (Tonnes)	(Mill. (Tonnes)	(Mill. (Tonnes)	'000
1980	89.95	11.93	13.39	9.76	669812
1981	90.69	14.73	13.43	10.91	683329
1982	89.9	15.43	15.59	10.88	699638
1983	105.56	16.88	15.12	14.86	715947
1984	102.44	20.17	13.33	21.05	732257
1985	110.88	20.16	19.12	20.55	748566
1986	104.86	17.24	19.38	19.48	764875
1987	103.02	13.57	22.89	9.25	781184
1988	124.58	16.64	17.74	6.17	797493
1989	123.44	22.24	14.99	10.52	813803
1990	129.4	20.67	16.49	15.81	830112
1991	130.36	15.79	20.74	11.07	846421
1992	130.08	25.56	17.95	12.67	864653
1993	140.15	25.43	18.6	20.55	882884
1994	147.59	25.45	19.44	26.8	901116
1995	139.08	18.07	24.35	20.82	919347
1996	151.1	21.16	25.63	16.41	937579
1997	148.22	27.17	18.96	18.13	955811
1998	157.23	25.7	20.73	21.82	974042
1999	157.85	33.63	23.05	28.91	992274
2000	154.65	40.73	18.21	44.69	1010505
2001	166.09	41.16	31.31	50.95	1028737
2002	137.56	32.21	49.84	32.81	1050896
2003	160.68	39.63	49.33	20	1073532
2004	154.85	37.73	41.25	17.41	1096655
2005	154.77	35.92	42.25	15.69	1120277
2006	168.85	37.43	36.77	17.87	1144407
2007	174.84	48.83	37.43	19.64	1169057
1995-1999	150.70	25.15	22.54	21.22	955811
2000-2005	154.77	37.90	38.70	30.26	1063434
2006-2007	171.85	43.13	37.10	18.76	1156732
1980-1995	116.37	18.75	17.66	15.07	790715
1996-2007	157.22	35.11	32.90	25.36	1046148

Table3.5A: Per Capita Production, Procurement, Offtake and Stocks of Rice and Wheat (Kg)				
Year	Production	Procurement	Offtake	Stock*
1980	134.29	17.81	19.99	14.57
1981	132.71	21.56	19.65	15.97
1982	128.49	22.05	22.28	15.55
1983	147.44	23.58	21.12	20.76
1984	139.9	27.54	18.2	28.75
1985	148.13	26.93	25.54	27.45
1986	137.09	22.54	25.34	25.47
1987	131.88	17.37	29.3	11.84
1988	156.21	20.87	22.24	7.74
1989	151.68	27.33	18.42	12.93
1990	155.88	24.9	19.86	19.05
1991	154.01	18.66	24.5	13.08
1992	150.45	29.56	20.76	14.65
1993	158.74	28.8	21.07	23.28
1994	163.78	28.24	21.57	29.74
1995	151.28	19.66	26.49	22.65
1996	161.16	22.57	27.34	17.5
1997	155.08	28.43	19.84	18.97
1998	161.42	26.38	21.28	22.4
1999	159.08	33.89	23.23	29.14
2000	153.04	40.31	18.02	44.23
2001	161.45	40.01	30.44	49.53
2002	130.9	30.65	47.43	31.22
2003	149.67	36.92	45.95	18.63
2004	141.2	34.4	37.61	15.88
2005	138.16	32.06	37.71	14.01
2006	147.54	32.71	32.13	15.62
2007	149.55	41.77	32.02	16.8
1995-1999	157.60	26.19	23.64	22.13
2000-2005	145.74	35.73	36.19	28.92
2006-2007	148.55	37.24	32.075	16.21
1980-1995	146.37	23.59	22.27	18.97
1996-2007	150.69	33.34	31.08	24.49
* Stocks are as of March end.				

4. Spatial implications of Public support*

4.1. Introduction

The results in chapter 3 indicated that the government through its procurement operations remains a single powerful and influential trader who can influence the market and guide price movements. The minimum support price (MSP) is carefully set so that farmers are assured of a remunerative return from agriculture. However, procurement, a costly operation, has traditionally been conducted mostly in targeted pockets and concentrated in specific months in the harvest season for the sake of economy and effectiveness. The minimum support policy has generally been associated with inter-state power equations. Thus, undesirable regional equity implications cannot be ruled out. What is the spatial character of public procurement and whether the gains from the support price disseminate to other regions are important considerations in the assessment.

The market from which grain is procured is ideally a pocket of surplus where supply pressures weigh down on prices. In a scarcity driven economy the designed intent also included adequate collection to feed the public distribution network and prices were allowed to remain low. In that case, the market was artificially insulated from outside markets to prevent outflow, in the process actually crowding out private traders. While the operation could in principle serve both ends, actual strategies deployed for procurement by the states are likely to be sensitive to the dominant objective. Today extending price support to the farmer is the main aim of the procurement policy with the MSP designed to assure farmers a certain return on their cost of cultivation. Through the procurement policy the government supplements the presence of private traders helps in bridging demand and supply across regions. However this purpose will be served without

* This chapter is jointly written with M. Rajeshwor of the same department and Institute and is being developed for publication at the moment.

undue creation of regional imbalances only if markets are integrated so that signals get transmitted fast.

This chapter aims to take a view of the spatial balances in demand and supply, the spatial nature of public procurements and the lateral transmission of price signals. In section 4.2 we look at the production and consumption balances in major states in India identifying the deficit and surplus states by this standard. In section 4.3 the evolving spatial pattern of public procurement operations is presented. Our empirical analysis together with a review of literature is given in section 4.4.

4.2. The Demand and Supply balance in India

In a large country as India, the role of domestic intra-country trade is considerable although part of this trade takes place through the public channel. The varied demand and supply situations prevailing in various parts of the country concertedly influence the direction of physical flows of grains. In the absence of an organized system for data collection on inter-state trade in food grains through private channels and with conceptual difficulties of capturing the effective demand and supply of goods being severe, a comparison between the domestic production and consumption within a state could be a crude indicator of the extent of excess supply in the state.

Consumption data is taken from the NSSO's reports for specific years of survey to depict the demand side while production at the state level net of the usual allowance for seed, feed and wastage and deflated by state population represents the supply side. The wide gaps among the state level differences between the production and consumption provided in Table 4.1 suggest that there may be remarkable opportunity for inter-state trading in rice. Four states Haryana, Madhya Pradesh, Punjab and Uttar Pradesh had been surplus generating for many years, Punjab being the leading one. From 1990s West Bengal has joined the rank and the all India status too turned to surplus in 1993-94 though this has

been an unsteady balance. Statewise surplus figures for rice and wheat together[†] are also provided in Appendix table 4.2A and paints a similar picture.

West Bengal's emergence from a substantially deficit status to a moderately surplus one could be on account of the delayed onset of the green revolution triggered by the development of ground water infrastructure that is well documented (Boyce, 1987). On the other hand, Maharashtra, Orissa and Rajsthan have grown in terms of foodgrain deficit stimulated by improving consumption and a largely indifferent supply response to the situation within the state. Improved consumption can signify either economic growth or successful welfare initiatives of the government. The large deficits shown in the year 1987-88 reflect the poor monsoon performance of the year.

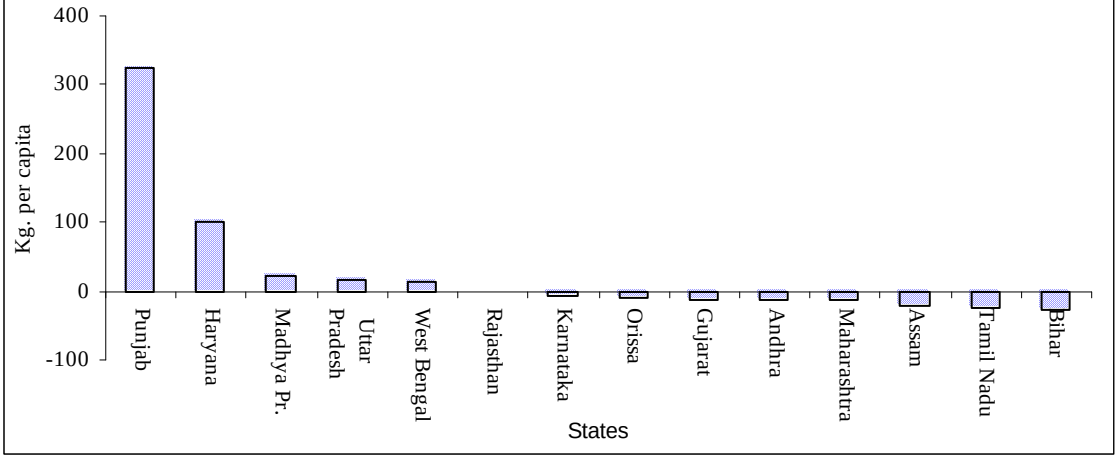
Table 4.1: Statewise annual surplus of Rice in India (Kg. per capita)

States	1983-84	1987-88	1993-94	1999-00	2004-05	2006-07
Andhra	-0.10	-39.17	-11.41	-8.86	-21.48	0.54
Assam	-40.56	-53.33	-17.69	-8.41	-34.68	-62.97
Bihar	-0.71	-12.84	-13.05	-11.02	-58.95	-40.22
Gujarat	-4.78	-13.27	-7.21	-7.25	-4.48	-3.81
Haryana	74.26	79.01	92.81	99.98	105.91	109.16
Karnataka	-14.08	-15.20	-8.04	-3.46	-8.81	-14.55
Madhya Pr.	34.95	11.67	38.21	37.19	-11.38	-5.49
Maharashtra	0.18	-12.87	-9.74	-14.90	-17.34	-18.10
Orissa	4.51	-19.95	7.64	-36.16	-4.68	9.66
Punjab	216.30	271.25	309.32	316.10	345.22	320.76
Rajasthan	1.50	-0.14	-1.06	0.45	-1.14	-2.02
Tamil Nadu	-25.26	-25.22	-16.22	-5.83	-47.90	-26.32
Uttar Pradesh	12.05	13.62	21.03	25.50	2.37	2.72
West Bengal	-9.17	-31.61	2.14	18.52	22.85	21.18
All india	-2.23	-11.80	1.22	3.04	-6.18	-0.98

[†] The sum total of the two crops rice and wheat can help in assessing a state's status as they are substitutable to an extent in the consumer's diet. How far coarse cereals also merit consideration as substitutes is questionable. In the last few decades their demand has been dwindling even among lower income classes. Also since the motivation of this study relates to public operations it is pertinent to note that rice and wheat are the dominant cereals procured by government and distributed through the PDS. A change over in the dietary pattern of the people occurred through the easy availability of wheat and rice due to public action. Data from last three NSSO surveys have shown that there has been a progressive increase in wheat consumption and reduction in the consumption of coarse cereals. Pulses are a source of Protein for the consumer unlike cereals which a eaten for calorie and are complements rather than substitutes of Rice.

A comparison of the states by their food balances is made comprehensively in Figure 4.1 for the 1990s and 2000s period using NSSO quinquennial survey data. The same five states including West Bengal are sources of surplus in India. None of the southern states and none but West Bengal in the East is among the surplus generators. The significant role of a few states as the country's food providers can hardly be denied.

Figure 4.1: Statwise average Surplus of Rice only (1993-94,1999-00 and 2004-05)



4. 3. Contribution to the Public Channel

Rice is grown all over India but the contribution to the public channel is highly concentrated. Punjab, Andhra Pradesh and Uttar Pradesh are the leading three states in terms of their shares and together contribute more than 72% to the public pool. Not all of the procuring states are surplus generators. In fact, Andhra Pradesh, Orissa and Tamilnadu are identified as deficient in section 4.2 (figure 4.1). On the contrary Madhya Pradesh, the third largest surplus state has the last place as a contributor.

Figure 4.2: Average State contribution (%) to Rice Procurement (2006, 07, 08)

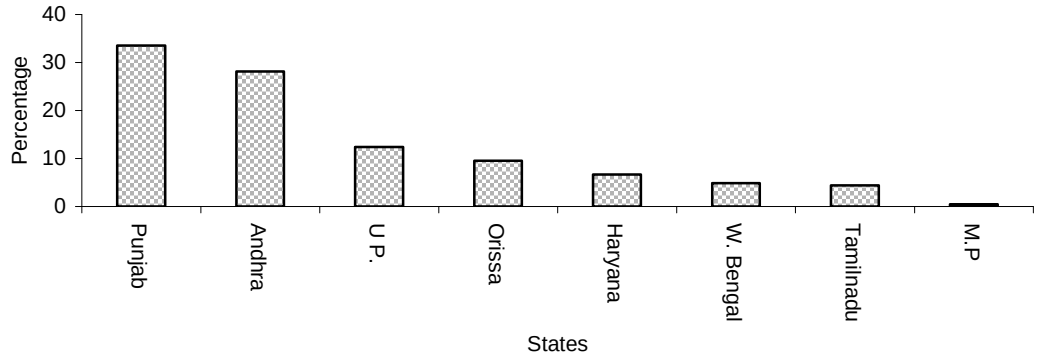


Table 4.2 shows that the share of public purchases in total production of rice in the nation has increased sharply from 14.5% in the period 1986-92 to 27% in 2002-07. We already noted this trend in Chapter 3. Over time, Punjab, Haryana and Uttar Pradesh the dominant surplus generators have improved their shares. The share of Andhra Pradesh increased significantly initially but stagnated thereafter. Tamilnadu experienced stagnation while the share of Madhya Pradesh declined. West Bengal though a marginal contributor gained share and, most remarkably, Orissa emerged as a principal contributor from being a marginal one. In 2002-07 Orissa contributed 26.4% of her rice production to the procured pool. The rise of states like Orissa and Andhra Pradesh in the procurement ladder could be a consequence of the decentralization in which the procurements would lead to local distributions to address hunger.

Table 4.2: Share in Production (%) of Rice Procured

States	1986-92	1992-02	2002-07	1986-07
Punjab	67.73	71.28	84.31	72.94
Haryana	47.75	47.51	52.75	48.69
Uttar Pradesh	12.40	10.11	22.28	13.91
Andhra Pradesh	25.61	45.12	44.57	39.50
Madhya Pradesh	9.03	11.11	4.18	8.77
Orissa	3.70	12.58	26.45	13.11
Tamil Nadu	14.95	11.11	12.40	12.79
West Bengal	0.90	1.48	6.15	2.59
Total	14.47	17.93	27.07	19.13

Source: Computed

4.4. The Lateral diffusion of Public price support: Empirical study

The public operation is meant to create local pressures on market from the demand side. While the state Agency intervenes at specific points, it is the normal trading activities of private agents that lead to an even diffusion of the gain. Greater market efficiency would not only lead to faster adjustments of regional prices and transmission of the price signal to producers but it will be associated with equitable distribution of the gains.

Food commands considerable significance for the political economy of the country and the individual states that have their own elected governments. Food is also a State subject and the actual implementation of a food policy is the discretion of the state governments. When the price policy of the government serves multifarious objectives often one contradictory to the other, the strategies of public procurement could play a critical role in determining the extent of gains that farmers in various states make from the MSP when all the states are not even procuring states. Also, the individual State's political interests in making essential commodities available to the people at large often lead to the creation of various artificial barriers to product movements across its borders, manifested in local restrictive rules and regulations, cordons, inspections, check-posts, levies or fees and unofficial impediments. All this could also contribute to the segmentation of the market. Further, the geography of the states and the nature of transport infrastructure can also influence the direction of the grain flows leading to some states or markets being preferred target destinations.

In the 1960s and 1970s decades the food market was highly regulated and even nationalized for a brief period. With the green revolution in India lasting over two decades, the food scarcity situation was eased by the middle of the 1980s. India initiated economic reforms from the 1980s and more fervently in the 1990s. International trade liberalization and the relaxations of the domestic trade regulations like the APM Act and ECA, heralding the removal of barriers on trading practices would suggest that a price intervention acting as a shock in a one location will set up trading responses that will convey the same signal to others that are not directly impinged by intervention. 'If trade

occurs and is unrestricted, then the marginal trader earns zero profits and prices in the two markets co-move perfectly' (Enke, 1951, Samuelson, 1952, Takayama and Judge, 1971). The effect of market intervention will then be broad-based so far as the crop under support is raised in an extensive area. In the following sub-sections transmission of price signal in respect of rice is assessed following econometric methodologies that are developed in the literature of market integration.

4.4.1. Market integration: Implications and methods

As a concept, market integration is an extension of the theory of general competitive equilibrium to the spatial context. A spatial competitive equilibrium among a number of locations tied by trade relations at fixed transport costs will have a property that finds the price in the importing region equals the price in the exporting region plus the unit transport cots incurred in moving between the two. In this case the markets are said to be spatially integrated (Takayama and Judge, 1971).

Although market integration is not condition for Pareto efficient resource allocation (Ravallion, 1986), several impelling arguments demand that markets be integrated. The most provocative context surrounds the role of market in mitigating the effects of localized famines[‡]. Much of the arguments in favour of a free market economy is based on the logic that given the required infrastructure for transportation, the economic response of traders to price differences will lead to movements of grains from areas of abundance and help in eliminating local scarcities. The irrelevance of government intervention implied in this argument even in critical circumstances is contested by the view that the process could require time long enough to cause starvation. The need for public interjection would be contingent on how fast the markets clear the disequilibrium[§]. Similarly, when supply is abundant, although market can even out the prices in time but an argument can be made that a positive intervention on the demand side can prevent

[‡] Railways in India had been viewed as a crucial solution to famine in the colonial times of the nineteenth and twentieth centuries.

[§] The mere transfer of supplies need not actually eliminate deprivation of consumers if the purchasing power is not adequate, in which case distribution from public pool at affordable prices becomes the recourse.

prices from falling too low but the gains can reach the farmers in different regions when traders transmit the signal through their activities. Thus public action can reinforce and in turn be reinforced by private trade.

Scarcity issues are not the only rationale that demands that markets be well integrated. In the absence of spatial integration, price signals carrying valuable guidance for resource use will not reach the producer and crops that are not in demand will be produced. Non-integration will also hurt the effectiveness of macro level policy changes in touching the incentive structure at the micro level as desired. The multiplicity of price signals across the country would tend to increase uncertainty for operators and create volatility in market.

The curiosity about market integration is longstanding but the methodology has not been static. The bivariate correlation coefficient was once commonly used to measure market integration. That prices in different locations even if unrelated, could be affected by the price of a commonly traded second good (Blyn and Hariss, 1973, 1979) and lead to a spurious indication of co-integration came to be recognized over time. An alternative method involving the long run convergence of spatial variances of prices but this method was shown to be quite useless (Hurd 1975, Ravallion, 1986).

Ravallion suggested a more general form of the bivariate method allowing a local dynamic structure so that different alternative hypotheses about market integration could be tested by imposing appropriate restrictions. The Ravallion model used a radial framework consisting of a single central urban market in six satellite markets. Ravallion studied a thirty six month price series for rice collected from Bangladesh for a period that was known particularly for its unusual price turbulences and also a famine. Ravallion specified the model in a linear rather than a logarithmic form, the preference being consciously based on the ‘at the spot’ information of how transport cost affected price differentials. The study significantly helped in identifying two markets whose trade with Dhaka was highly restricted.

In another approach, Gonzalo and Granger (GG, 1995) suggested that if two variables are cointegrated over time, there must exist an unobserved common factor that may be isolated and estimated to capture the transitory and permanent components of movement. Both the components could be of help in policy making. Gonzalez-Rivera and Helfand, (G&H, 2001) introduced a method of search for geographical boundaries of the market in a study of 19 states in Brazil. They take account of the trading patterns before looking for the connected states. Using data from 1973 to 1997 a sequential procedure is employed to identify the states belonging to the market and any non-exclusion is specifically attributed to factors like remoteness, trade reversals and nonstationary transaction costs. The sequential procedure has statistical limitations as noted in the same paper (page 579) especially when large dimensioned data is involved. The Johansen model is used to estimate the relations, the identified dominant state being used for normalization. The error correction model includes the possibility that each location reacts to every single disequilibrium in the entire area of study. For data with every large dimensions a panel unit root test is suggested (Abauf and Jorion, 1990) but this method cannot bring out the speed of convergence (Maddala and Kim, 1998).

4.4.2. Empirical Studies in India

In the bivariate correlation analysis the coefficient was expected to be 1 ina competitive system. Cummings (1967) concluded that private trade did not need to be replaced by government intervention by showing that the correlation coefficient between markets in respect of wheat prices in northern India during 1956-76 was high but came down when the government intervened. In a similar way Lele (1967, 1971) found that prices of cereals in various selected markets in the country moved together and in fact the aberrations could be on account of price controls (paddy in West Bengal), dissimilar trade patterns (Paddy in Tamil Nadu) and varietal difference. Kainth (1982) found wheat markets to be highly integrated and attributed this to the development of roads. Gupta (1973) found the estimated correlation coefficients for the period 1961 to 1965 to be 0.79 for rice and 0.71 for wheat and 0.55 for jowar. Meanwhile with methodological developments in empirical sciences, confidence on the bivariate correlation based

inferences waned. Palaskas and Hariss (1993) rejected the inference about full market integration of rice, potato and mustard in West Bengal during 1988-1990 as found in a study conducted by Lele (1967).

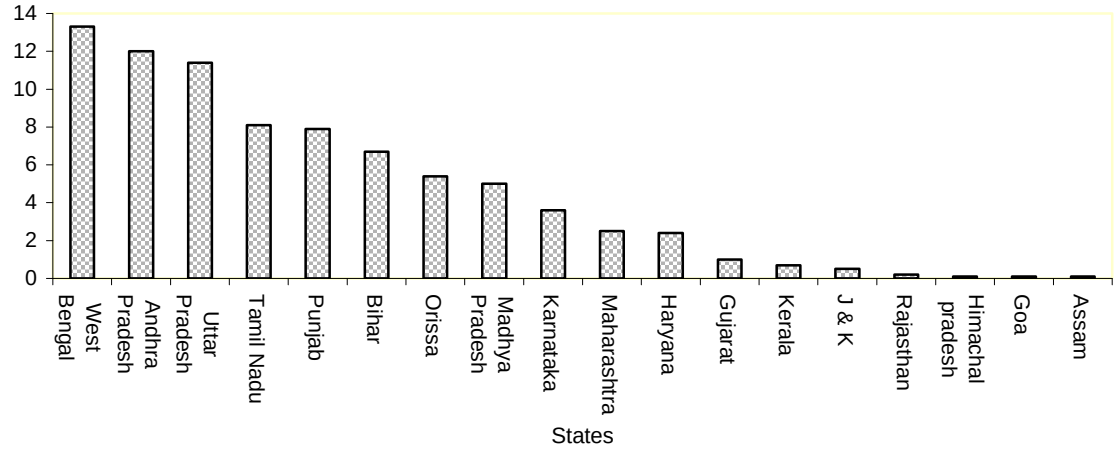
The launch of market reforms intensified the research interest in the flow of price signals and the methodological advances also made it attractive as a subject for application. Improvement of spatial integration of wholesale markets for wheat, rice and other products was affirmed by Wilson (2001). Acharya (2001) also found similar improvement but employing a bivariate correlation approach. Kumar and Sharma (K&S study, 2003) considered a pre-liberalization period and a post-liberalization and separately tested the market integration of coarse paddy and wheat for four markets in Haryana using cointegration and error correction based analysis. The Johansen method was used to find a common trend and market integration in both periods. Despite the presence of a long run relation the study finds short run price adjustments to be weak (2-3 weeks period) though the adjustment rate improved in the post liberalization period. Sekhar and Kumar (S&K study, 2008) assessed the potential role of market in globalised India in mitigating adverse effects of supply shocks using a similar method based on G & G methodology. They find rice market to be well integrated within states and regions and with international markets though the speeds of adjustment are slow. Bathla (2008) used the ADF test and Johansen method to show that prices of rice and wheat except for wheat in Delhi and paddy in Kohlapur followed a I(1) process and confirmed increasing market integration. The three studies used data from different sources and their samples differed (Table 4.3). A half-life approach along with panel unit root method is adopted by Jayasuriya et al (2007) to show that reforms in Indian rice market in 1990s has had a major impact on market integration leading to the convergence between domestic and international prices. The authors used monthly wholesale price data from 1980:4-2002:12 for 23 cities taken from API and ASI, dividing the whole period into pre and post reforms sub-periods.

Table 4.3: Market integration studies on Rice and Wheat: A Comparison			
Author	Kumar and sharma (2003)	Bathla (2009)	Sekhar and Kumar (2008)
Data Source	Haryana State Government	Agricultural Prices in India and AGMARKET Website	Agricultural Prices in India, Agricultural Situation in India
Markets	4 Markets in Haryana	State level markets in India	Major markets in Regions and in India
Sample	1978-1989 and 1989-2001	1998-2008	1986-87 to 2006-07
Result	Longrun relation found but weak short run adjustment	Markets well integrated within states and in regions (but with exceptions) but slow adjustment	Increasing integration but some markets not integrated

4.4.3. Data issues

In any spatial analysis of prices, the quality of data used at that level is of critical significance for the reliability of the results. State level data of monthly wholesale commodity prices in India over a considerable time period is available in published form in central government sources reported in Agricultural prices in India (API) and the Ministry of Agriculture's official publication Agricultural Situation in India (ASI). The data are however reported for the 'mandis' or the wholesale markets. This sub-state level data presents a chaotic picture, with several problems like occasional lack of continuity over time, missing entries, frequent changes in the mandis for which the prices are reported and heterogeneity of variety across markets and sometimes even within the same market over time. Without adequate attention to the quality of data, results from a spatial analysis of prices could be quite misleading. A critical trade off between the extent of information processed and the reliability of the results is encountered. Keeping the limitations in view and emphasizing the quality of potential results, the scope of a study has to be sacrificed severely if necessary.

Figure 4.3: Rice production in Million tonnes in 1998-99



The unit of analysis taken in this study is the state but the transmission of market signals is examined for three regions separately. Figure 4.3 ranks the Indian states by rice production. Although rice is grown in most states, the distribution is skewed. We consider only the states producing at least 2% of the country's rice namely West Bengal, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Punjab, Bihar, Orissa, Madhya Pradesh, Karnataka, Maharashtra and Haryana. Farmers in these states will be benefited by higher prices that procurement at administered MSP can deliver. Since our interest lies in the transmission of the price signals from markets impacted by public intervention, we would like to treat some of the states from where the government procures as 'central' markets along with other neighbouring states where farmers also raise and sell rice as the 'radial' markets. However three of the major procuring states had to be left out from this study. The price data of Punjab and Haryana seemed incompatible owing to a possible varietal dissimilarity with other states as explained subsequently. Uttar Pradesh too shows data incompatibility that could reflect lack of cointegration with neighbouring rice growing state states. The analysis involving Uttar Pradesh is presented separately in section 4.4.6 which brings out the problems encountered if the state is included.

We have attempted to consider the 'common', 'coarse' or comparable other local varieties of rice only[**]. To make sure that unlike cases are not incorporated, the averages of the prices for a common period 1995 to 2000 across markets in a state and across the states are compared to make sure they lie within a reasonably short range. Punjab and Haryana could not be included due to varietal incompatibility. In Punjab the wholesale prices are reported only for the Amritsar market and that too for the 'Fine' variety. Similarly, the prices in Haryana were reported for a single market, Karnal and the variety was 'Fine'. There was also a switch in the variety during the sample period. In Punjab, over 72% of the domestic rice production goes through the public channel and this might account for the irrelevance of reporting for the common varieties in the open market. The share of the common varieties produced in the state that enters the free market is not known to us. Similarly for Haryana too, nearly half of production is procured so that common varieties may be of relative insignificance for free market transactions.

Even within a state, prices across mandis were in many cases far from comparable, in which cases the outlier mandis had to be excluded. Such instances include Balurghat and Siliguri in West Bengal and Indore and Jabalpur in Madhya Pradesh, Nellore in Andhra Pradesh, Sambalpur and Cuttack in Orissa and Saharanpur in Uttar Pradesh where the reported variety was not consistent overtime and were mostly Fine. In Tamilnadu, the prices reported for the Madras market are far lower than the rest and tended to depress the average if included (Tamilnadu excludes Madras data in Figure 4.5). On closer inspection it was noted that the record for Madras market had long sequences of repeated prices reflective of lack of continuous of data collection.

4.4.3 (a) Categorization of States

Three regions or clusters in the country are delineated namely Eastern, Central and Southern regions and in Table 4.1A information on the varieties, sample periods, names

[**] In practice the varietal issue is a source of considerable confusion both in empirical work related to agricultural products and in formulation of price policies and often becomes an unfortunate reason of discredit for otherwise high quality research finding. For most practical purposes of policy making a sharp distinction is made between Grade 1 quality of rice with all others constituting a large range of local and national varieties.

of selected mandis and the common sample period wholesale price averages are mentioned for the states within the three broad regions. The decisions on whether specific mandis as well as states would be taken up for the study depended on the merit of the data in terms of its quality and uniformity. Unavoidable, the sample periods are not uniform across regions but even while restricted by the quality and coverage of data availability for the states under study, an attempt is made to cover the decades 1980s, 1990s and 2000s to the extent possible. The period is chosen to cover the post-food crisis era in India when public policies were relatively liberal. Admittedly, that the economic reforms in the 1990s can create a problem of structural change of market equations cannot be ruled out.

The three Southern states Andhra Pradesh, Karnataka and Tamilnadu have data reported up to 2005-06 so the sample is 1986:April to 2006:March. Since West Bengal, Orissa and Assam all have data up to 2007-08 the sample for Eastern region comprised of these states is longer from 1986:April to 2008:March. The states considered in the Central region are Madhya Pradesh, Maharashtra and Bihar[††] and given the limitation of data availability, the sample period is only 1986:April to 2001:March. The time series data on the prices so obtained are plotted in Figures 4.4, 4.5 ,4.6 and 4.7 to demonstrate the comparability of prices.

[††] The decision of categorizing Bihar within either the Eastern or the Central states based on proximity considerations presented some ambiguity. However, due to inadequacy of updated data as compared to the other Eastern states, Bihar was categorized in the Central group in order not to lose information in the eastern region. Also unlike West Bengal and Orissa that predominantly rice growing and rice eating states, Bihar, like Madhya Pradesh and Maharashtra raise both rice and wheat and the diet is also varied between the tow cereals. This provides additional justification of clustering Bihar with the states on its western border.

Figure 4.4: Comparing Rice Price of Southern region and Madras Mandi

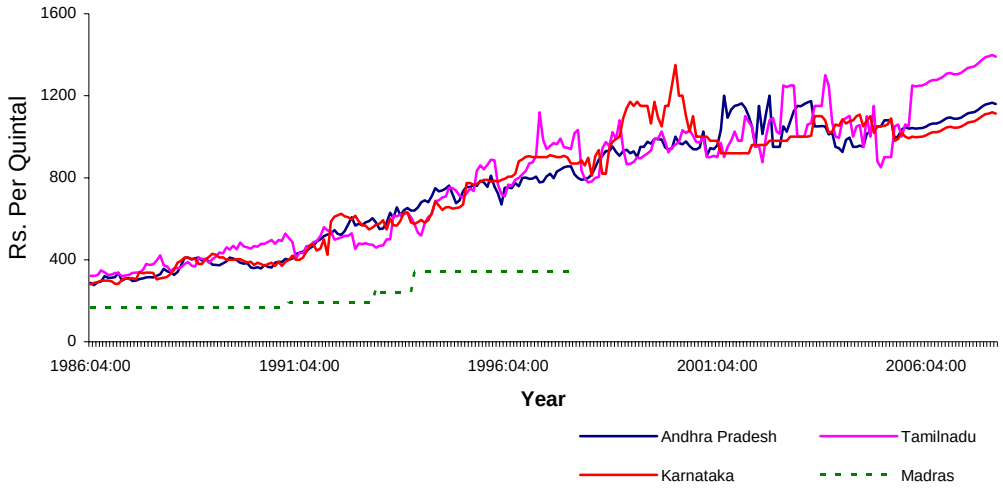


Figure 4.5: Wholesale price of Rice in the Eastern region of India

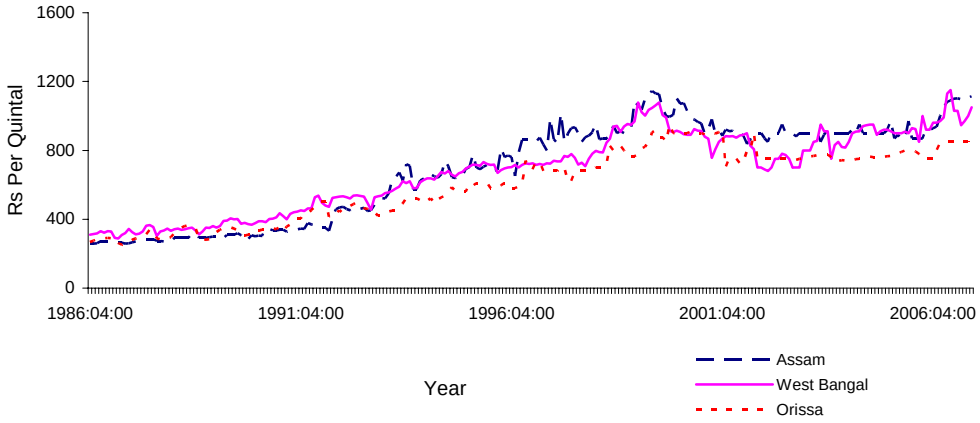


Figure 4.6: Wholesale Price of Rice in the Southern region of India

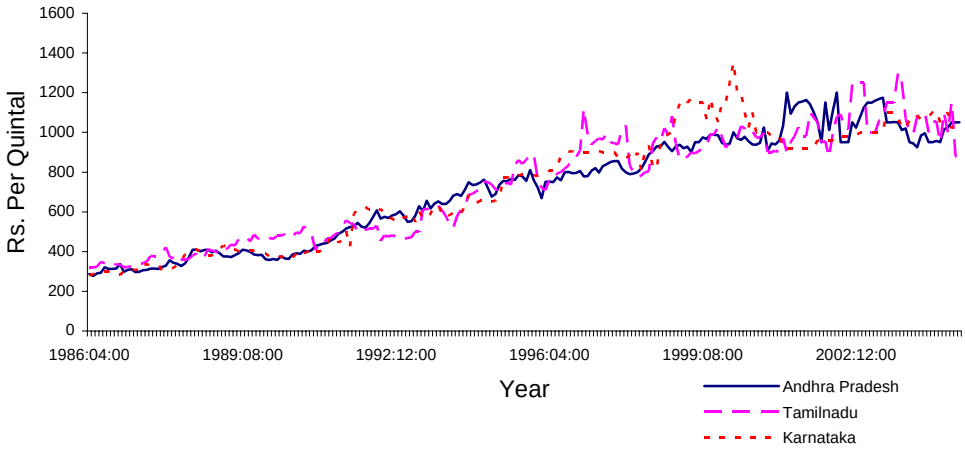


Figure 4.7: Whole sale Price of rice in Central Region

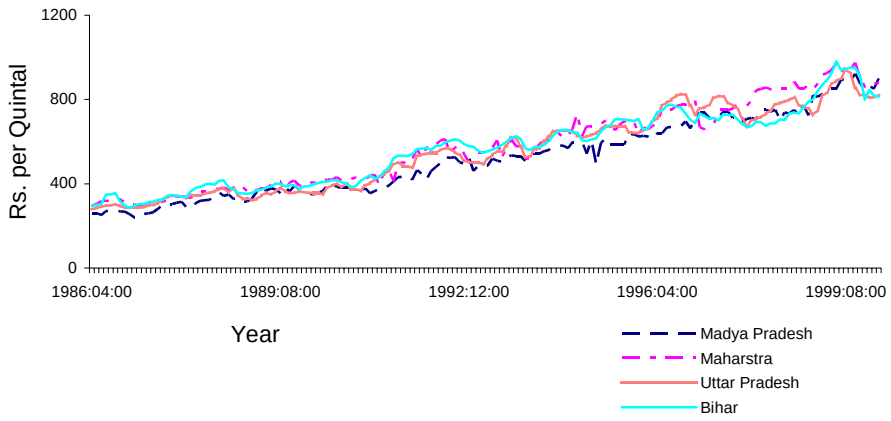


Table 4.4 : Select state categorization	
Region	States
Eastern	Orissa, West Bengal, Assam
Central	Bihar, Madhya Pradesh, Maharashtra,
Southern	Andhra Pradesh, Tamilnadu, Karnataka

4.4.3. (b) Spatial dispersion of prices

Table 4.5 : Changing spatial dispersion of prices of rice across states

	Eastern			Southern			Central		
Period	Lowest price	Highest price	Range %	Lowest price	Highest price	Range%	Lowest Price	Highest price	Range%
1986:4 1992:3	Assam	West Bengal	23.6	Andhra Pradesh	Tamilnadu	10.5	Madhya Pradesh	Bihar	14.4
1992:4 2002:3*	Orissa	Assam	19.8	Tamilnadu	Karnataka	3.9	Madhya Pradesh	Maharashtra	15.0
2002:4 2005:3	Orissa	Assam	19.3	Karnataka	Tamilnadu	3.7			

Note: *For Central region the period is 1992:04-2000:03.

A comparative view of rice prices prevailing across states in three time periods is given in Table 4.5 showing several reversals in relative positions. Orissa in the East and especially Madhya Pradesh in Central region have registered relatively low prices and both are procuring centres. Madhya Pradesh is also a surplus state. Thus rankings in

respect of the average price levels have little to do with the surplus generation and the procurement operations, indeed they possibly reflect the repercussion of trading changes and demand side factors including purchasing power.

The range of price dispersion however showed a uniformly declining tendency. The range was highest in the Eastern region (19.8%) and moderate (15%) in the Central but was low (3.9%) in the Southern region in the period 1992:04-2002:03. Figures 4.8, showing the coefficients of variation (CV), are suggestive of considerable volatility.

4.4.3 © Dynamic analysis of data

In order to examine the dynamic properties of the price series we have conducted tests of unit root and presented the Augmented Dickey-Fuller statistics for the different cases. The equations are presented with two alternative specifications, with constant only and with constant and trend while short term lags are added to the equation The specification is selected on the basis of a comparison of the Akaike Information Criterion (AIC) statistic. Further an F-test of the restriction on the coefficient is made to assess the presence of a deterministic trend in the series and the unrestricted form allowing a time trend is preferred in most cases. The series are found non-stationary at levels and stationary in first difference under all three specifications (Tables 4.6). In other words, they have I(1) property.

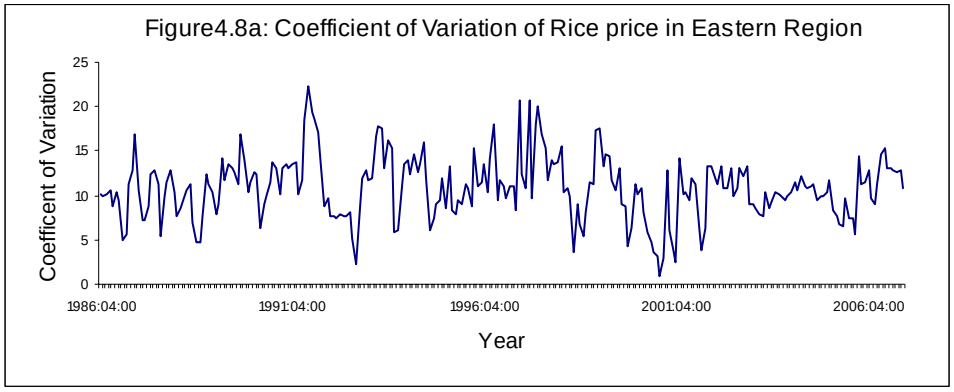
Table 4.6a : ADF test (1986:04-2007:03) Eastern Region

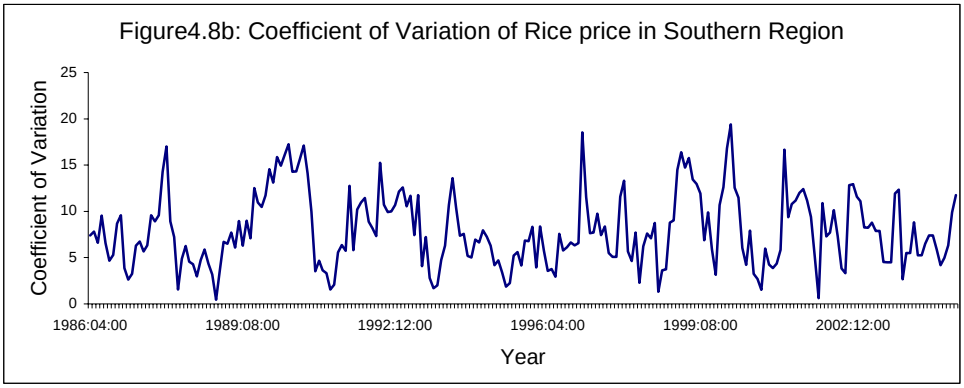
States	Level				1st difference			
	Const.	Const. and trend	No. of Lags	F test	Const. only	Const. and trend	No. of Lags	F test
Assam	-0.7	-1.46	4	1.07	-10.90*	-10.87*	3	2.05
Orissa	-1.16	-2.45	1	3.04	-12.17*	-12.15*	1	1.38
West Bengal	-1.06	-2.79	1	3.89	-9.72*	-9.70*	3	53.3

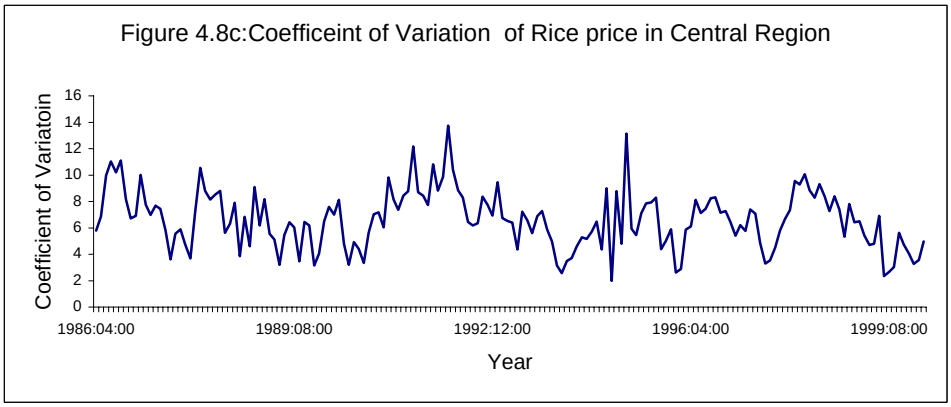
Table 4.6b : ADF test (1986:04-2000:03): Central Region								
States	Level				1st difference			
	Const. only	Const. and trend	No. of Lags	F-Test	Const. only	Const. and trend	No. of Lags	F-Test
Bihar	-0.99	-3.34	1	5.59	-7.61*	-7.59*	1	28.81
Maharashtra	-0.5	-3.61	2	6.52	-12.18*	-12.14*	1	73.69
Madhya Pradesh	0.38	-3.16	1	5.45	-11.58*	-11.62*	1	67.51

Table 4.6c : ADF test (1986:04-2005:03)								
States Sourthern Region	Level				1st difference			
	Const. only	Const. and trend	No. of Lags	F-Test	Const. only	Const. and trend	No. of Lags	F-Test
Andhra Pradesh	-1.12	-3.29	1	5.47	-13.12*	-13.10*	1	85.85
Karnataka	-1.08	-1.99	4	2.1	-8.51*	-8.51*	3	36.23
Tamilnadu	-1.49	-3.04	4	4.93	-9.61*	-9.63*	3	46.43

Notes: *denotes significance at 1% level. Critical values of ADF statistics at 1%, 5% and 10% are (i) with constants -3.46, -2.87and -2.57 , (ii) Trends are -4.00, -3.43 and -3.14 and (iii) None are -2.57, -1.94 and -1.62. The optimum lag length is determined by Akaike Information Criterion (AIC). The unrestricted for of the ADF equation is $\Delta Y_t = \mu + (\gamma - 1)P_{t-1} + \beta_t t + \in_t$ with H0: β=0.







4.4.4. Pair-wise cointegration among states: methodology

In each of the studies discussed in Sub-section 4.4.2 specifically the K&S, the Bathla and the S&K studies, a multivariate study over a number of markets is made based on the G&H(2001) method of identifying a common trend by following a sequence of cointegration analysis. Except for the K&S study which is done for a single state only, the others consider individual markets spanning over different states, letting the data determine which markets are cointegrated. Since many of the restrictions on market movements are created by state policies, it remains unsaid why certain markets located in diverse states cointegrate and why some markets even within a state remain isolated from others. In this study based on the political economy of the food market, we consider the state as our unit of study without enquiring about the transmission of signals across mandis within a state. Our attention to the data quality unavoidably reduces the number of markets in the state that can be taken up for the study.

A long run equilibrium or a cointegrating relation between two price series is given by the equation

$$P_i = \alpha + \beta P_j + \in_i \qquad \ldots\ldots\ldots\ldots (4.1)$$

Where β is the long run coefficient of adjustment and α is a constant and the error $\in_i$ that can be expressed as

$$\in_i = P_i - \alpha - \beta P_j \qquad \ldots\ldots\ldots\ldots (4.2)$$

is the extent of disequilibrium in the short run. When $\in_i$ is positive, it means that the price in the i-th market exceeds the target set by the price in the j-th market through the hypothetical long run cointegrating relation and this disequilibrium stimulates trade flows from marke-j to market-i (or alternatively reduces the usual trade flows from market-i to market-j) which in turn, over time, raises the price in market-j and brings down the price in market-i. Thus the traders' responses tend to eradicate the disequilibrium in the market and, in the short run, the movement can be represented by the error-correction (EC) equation as follows:

$$\Delta P_{it} = \theta_0 + \theta_1 \Delta P_{jt} + \theta_2 \in_{t-1} + \varepsilon_t , \qquad \ldots\ldots\ldots\ldots\ldots (4.3)$$

or since equation (3) is structural with current dated variables alternatively by

$$\Delta P_{it} = \theta_{2i} \in_{t-1} + \alpha_{1i} \Delta P_{i_{t-1}} + \alpha_{2i} \Delta P_{i_{t-2}} \ldots\ldots\ldots + \beta_{1i} \Delta P_{j_{t-1}} + \beta_{2i} \Delta P_{j_{t-2}} \ldots\ldots\ldots + \varepsilon_t \ , \qquad (4.4)$$

in the reduced form. Since market-j is also affected by the disequilibrium we have another EC equation

$$\Delta P_{jt} = \theta_{2j} \in_{t-1} + \alpha_{1j} \Delta P_{i_{t-1}} + \alpha_{2j} \Delta P_{j_{t-2}} \ldots\ldots\ldots + \beta_{1j} \Delta P_{j_{t-1}} + \beta_{2i} \Delta P_{j_{t-2}} \ldots\ldots \ , \qquad (4.5)$$

in the reduced form though the EC variable $\in$ is the same in equations 4.4and 4.5. The price P_i however may be weakly exogenous if the EC coefficient θ_{2j} is found to be zero.

The ADF tests in section 4.4.3 suggested that all the series are I(1), i.e., they are non-stationary of the same order of integration. We will see in section 4.4.6 that only Uttar Pradesh appeared to show I(0) property. The long run combination suggested by equation 2 is meant to ensure that a linear combination of the two prices is stationary. The cointegrating coefficients are essentially weights which reduce the variables to stationarity and that the coefficient of P_i in equation 2 is 1 only means that the equation has been consciously normalized on P_i and any possible scaling of the coefficients should leave the relation unaffected. In theory, cointegration entails no presumption about the relative status of the two variables but in practice, the theory about causality between the two variables can guide the normalizing strategy. Thus if we have sufficient reasons to believe that the movements in Market-j has the ability to change the price in market-i we can choose to normalize on marlet-i.

4.4.4 (a) Engle-Granger method: Methodology

In the literature on cointegration, in which a distinction between a spurious regression and a cointegrated regression becomes important for the mathematical validity of models, the estimation of the cointegration relation presented several thorny issues that needed resolution. The Engle-Granger (1987) test for cointegration involved two stages which first used a simple OLS regression to estimate the relation 4.1. The error $\in$ is then subjected to stationarity test as in the ADF test presented in Section 4.4.3 in the second stage of the process. If both prices are of the same order of integration, say I(1) and are unrelated, then β will be zero. The EGOLS regression so estimated even at levels in static form is then a test for non-cointegratedness (since the null hypothesis is $\beta = 0$) and is shown to produce 'superconsistent' estimators (Stock, 1987). The stationarity test in the second stage can be done only on the estimated values of $\in$ in which case the standard DF critical values are not really inappropriate.

The problem of endogeneity that simultaneous models could address and the indeterminateness of the number of cointegrating equations still remained the weaknesses of the EGOLS method. Possible omission of relevant variables that influence the order of the integration and the possible need to include a deterministic trend in the cointegrating equation for balance remained weaknesses in estimating the relation. Further the possibility that a regime switch can change the relation cannot be ignored. The extant method also does not provide a solution for the normalizing variable in the absence of theoretical support. Reversal of the direction of presumed causality e.g., using P_j as the left hand side variable and P_i as the right hand side variable will not give the same results in terms of coefficients and the estimated EC term unless R^2 is nearly one.

4.4.4 (b) Johansen method: Methodology

The Johansen method combines the simultaneous equations modeling approach with the time series method to avoid some of the problems specifically because the variables in the right hand side become predetermined or exogenous as in

Johansen's Cointegration Test
Consider a VAR of order p:

$$y_t = \alpha_1 y_{t-1} + ... + \alpha_2 y_{t-p} + \beta x_t + \varepsilon_t$$

where y_t is a k-vector of non-stationary I(1) variables, x_t is a d vector of deterministic exogenous variables, ε_t and is a vector of innovations. We can rewrite the VAR as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \beta x_t + \varepsilon_t \quad .....(4.6)$$

Where $\Pi = \alpha\beta'$

And $\beta' yt$ is stationary.

In which the Vector Autoregression Model (VAR) in the prices is reparameterized as a multivariate Vector Error Correction model (VECM) which distinguishes between the

equilibrium relation and the dynamic adjustments to the equilibrium. In Equation 4.6 Π is the EC term, β' **is the** cointegrating coefficient and α is the adjustment coefficient. The coefficient matrix is then subjected to rank test based on its eigen values and trace statistics to arrive at the number of cointegrating relations and the coefficients are identified. Economic theory however remains important for the interpretation of the cointegrating equations and in terms of the normalization strategy and other restrictions as relevant.

4.4.4 © Long run adjustments: Results

Given that transport costs are additive, it is reasonable to consider the cointegration relation to be linear in levels (as in Ravallion, 1986). We start with a premise that there is no a-priori reasoning to support that any one market will be the dominant one in causing the other and so we estimate bi-variate pair-wise cointegration and error correction mechanisms for all possible pairs of states using the Johansen method and the EViews3.1 software. The lags and trend in cointegration is chosen by comparing the AIC.

Cointegration is not observed in the relation between West Bengal and Assam in East and for Karnataka and Andhra Pradesh in the South in table 4.7. In both these pairs, one state is a procuring state and the other is a deficit state. Thus the continuity of markets is not affirmed with a region. The signs of the EC coefficients are all negative as expected. The long run adjustment is close to one only in select cases West Bengal and Orissa, Madhya Pradesh and Maharshtra and Andhra Pradesh and Tamilnadu. These states are in proximity. There is long run over adjustment between Bihar and Maharashtra where the response to a Rs. 100 change in Maharashtra is over Rs. 400 in Bihar and similarly between Assam and Orissa. The long physical distances between these two pairs of states may be responsible for the adjustment rates.

The sign of the cointegration coefficient between Madhya Pradesh and Bihar is positive and needs more investigation. Suspecting that there may be a switch in the regime i.e., a possible reversal of trading direction, we estimated the same cointegrating relation for

alternate samples truncated in 1991-92 to start with and then sequentially including one more year in the sample. The change in relation appear to occur in 1996-97, In table 4.8 cointegrating relations between Madhya Pradesh ,Maharashtra and Bihar are given for the truncated sample up to 1995-96. The economic reforms in the 1990s may be responsible for this departure.

Table 4.7 : Pair wise Cointegrating relations between States

	State/Market		No. of Lags	Trend	AIC	No. of CE	Cointegration coefficient	
	1	2					Value	t-stats
Eastern Region	Assam	Orissa	2	No	19.617	1	-1.406	(-21.07)
	Assam	West Bangal	2	Yes	19.947	0	…	…
	West Bangal	Orissa	1	No	19.322	1	-1.125	(-18.27)
Central Region	Madhya Pradesh	Bihar	2	Yes	17.779	1	1.788	(0.91)
	Madhya Pradesh	Maharashtra	1	No	18.499	1	-0.972	(-27.63)
	Bihar	Maharashtra	1	Yes	18.269	1	-3.377	(-1.84)
Southern Region	Andhra Pradesh	Karnataka	1	Yes	20.074	0	…	…
	Andhra Pradesh	Tamilnadu	1	No	20.951	1	-1.059	(-15.62)
	Tamilnadu	Karnataka	1	Yes	20.824	1	-0.551	(-3.42)

Sample period: Central: 1986:04 2000:03, Southern: 1986:04 2005:03, Eastern: 1986:04 2007:03 The cointegration equations (CE) are normalized on State 1.

Table 4.8 : Pair wise Cointegrating relations between States in Central Region (Truncated sample)

	State/Market		No. of Lags	Trend	AIC	No. of CE	Coefficient	
	1	2					Value	t-stat
Central Region	Madhya Pradesh	Maharastra	2	Yes	18.178	1	-0.565	-4.08
	Madhya Pradesh	Bihar	1	Yes	17.111	1	-0.434	-3.79

Sample period: North-Central Region without Uttar Pradesh : 1986:04 1996:03 The cointegration equations (CE) are normalized on State 1

4.4.4 (d) Error correction: Results

In table 4.9 the ECM coefficients based on the presumption of two market mutual trade flows are presented. For the Central region the truncated sample is considered in order to avoid a bias caused by a possible regime switch. Since the normalization of the cointegrating relation is made on state 1 in each case without making any case for the

causality, the coefficients in Market 2 are expected to have a positive sign, i.e., the price in market 2 will increase in response to a rise in the error term.

For the two cases (West Bengal-Assam, Andhra Pradesh-Karnataka) where the hypothesis of a cointegrating relation was rejected, the ECM could not be worked out. For market 1 the coefficients have the right sign in all cases though insignificant in two cases (Assam-Orissa and West Bengal-Orissa) in the East, and one in South (Andhra Tamilnadu). The short run adjustment therefore appears weak in these cases.

Considering the market 2 as the state of normalization, The signs of the ECM coefficients are as expected in all but one case. Between Assam and Orissa, West Bengal and Orissa and Andhra and Tamilnadu, the EC for market 2 is found faster than for market 1. For Madhya Pradesh and Bihar the ECM coefficient is negative. Since the two states were shown to be cointegrated with a correct sign of the cointegrating coefficient this anomaly could be on account of a simultaneous adjustment to a disequilibrium between one of the states and another third state that the ECM model is failing to capture.

Table 4.9 : Error correction coefficients of Adjustment of Prices in the Two market cases

State/Market		Market 1		Market 2	
1	2	Value	t-stats	Value	t-stats
Assam	Orissa	-0.008	-0.209	0.125	4.950
Assam	West Bengal	…	…	…	…
West Bengal	Orissa	-0.049	-1.490	0.125	4.702
Madhya Pradesh*	Bihar*	-0.441	-4.66	-0.526	-0.70
Madhya Pradesh*	Maharashtra*	-0.434	-4.37	0.014	0.106
Bihar*	Maharashtra*	-0.000	-0.008	0.081	-4.353
Andhra Pradesh	Karnataka	…	…	…	…
Andhra Pradesh	Tamilnadu	-0.006	-0.192	0.199	0.063
Tamilnadu	Karnataka	-0.233	-4.905	0.038	-2.031

Note: The cointegrating equations are normalized on market-1. *using truncated sample (see table no.4.7)

4.4.5. Price transmission of market intervention

In the exercise for each region we separately estimate the ECM holding each region of public intervention as the central market. We also take account of the possibly that the

price adjustment in any state will be in response to disequilibriums created by the intervention in all states in the region. So long as there is trade between the state of intervention and any third state it will create supply pressures that reflect on trade flow to the state of reference assuming the states compete for supply or demand. As mentioned, trade flows are influenced not only by demand and supply factors but also the infrastructure for transporting grains between the states, local taxation and harassment. Moreover the geographical location and larger connectivity facilities often help certain states to be preferred destination from which the grains can be further transported to distant places. Expectedly, such states for the same reason could be preferred location for public procurement. Since traders from radial states might be motivated to send market their wares to the preferred state, a competition can arise between the supplying states.

This may be explained as follows.

$$C \rightarrow A \leftarrow B$$

The above scheme illustrates trade relations where supplies from B and C go to A and A is a location of convergence. When a disequilibrium occurs in the relation between A and B assuming A is also a procuring state, traders in B find it profitable to transport products to A. As price in B adjusts upward to this outflow, that in A decreases due to the resultant excess supply. Even if the equilibrium price relation with C is controlled for, the disequilibrium between A and B steps up the competitive pressure on C so that the price in C also adjusts.

4.4.5 (a) Method of estimation

A VECM model is set up where any state in the region adjusts to the error terms between the central state and each of the other two states as obtained from the cointegrating equations in table 4.7 for the Eastern and Southern regions and 4.8 for the Central region. The exogenous variables include the transport cost represented by the price of diesel and the dummy for the harvest months. For each of the three regions there are three different states for which the ECM equations may exist. A procuring state is considered as the

central state and the error term is estimated with a normalization on the procuring state. In the case of Eastern region there are two procuring states West Bengal and Orissa. The Southern region too contains two procuring states Andhra Pradesh and Tamilnadu whereas in the Central region Madhya Pradesh is the only procuring state treated as the central market. Considering each central state, there are therefore three equations that we estimate simultaneously by SURE method. The error terms link the central state with each of the other two radial states but in case any one state is found to be not cointegrated with the central state the error term does not exist and the ECM equation has only one error variable.

The results in Table 4.10 -4.12 provide the error correction mechanisms in the three regions. The oil price variable is of no consequence but has the expected positive sign except in one case. Each state has its own seasonality pattern. Except Assam, Karnataka and Maharashtra, the harvest dummy has a significant negative coefficient. The aberrant states are not large producers of rice.

Table 4.10: Error Correction Model of Rice in Eastern region of India

Impact States	Assam		Orissa		West Bengal	
	Coefficient	T-stat	Coefficient	T-stat	Coefficient	T-stat
Procuring state is West Bengal						
ECM						
Assam	….	….	….	….	….	….
Orissa	0.081	2.078	0.131	4.769	-0.056	-1.695
Exogenous						
Diesel price	0.055	0.158	-0.132	-0.540	0.280	0.980
Harvest dummy	-4.040	-0.810	-8.110	-2.290	-17.360	-4.120
Procuring state is Orissa						
ECM						
Assam	0.075	1.820	-0.078	-2.693	-0.067	-1.950
West Bengal	-0.124	-2.736	-0.086	-2.702	0.095	2.470
Exogenous						
Diesel price	0.005	0.013	-0.078	-0.330	0.330	1.140
Harvest dummy	-5.220	-1.040	-6.880	-1.960	-16.290	-3.860
Note: Sample1986:04-2007:03. EC term normalized on state of procurement.						

The ECM coefficients for each central state is negative i.e, the increased price balance triggers market flows that bring down its price over time after the initial rise due to a

shock and the response in the partner state is expectedly positive to the movement in the mutual price disequilibrium. The adjustment of the third state reflects the supply pressures created in the central state. Thus any radial state is impacted by the effects of a disequlibrium created with its own price and with that of a third state and the effects are in opposite directions as shown of the signs of the coefficients.

Table 4.11: Error Correction Model of Rice in Southern region of India						
Impact States	Andhra Pradesh		Tamilnadu		Karnataka	
	Coefficient	T-stat	Coefficient	T-stat	Coefficient	T-stat
Procuring state is Andhra Pradesh						
ECM						
Karantaka	….	….	….	….	….	….
Tamilnadu	-0.020	-0.664	0.177	4.024	0.007	0.255
Exogenous						
Diesel price	0.373	0.978	0.004	0.008	-0.053	-0.150
Harvest dummy	-12.650	-2.466	-16.130	-2.200	1.003	-0.210
Procuring state is Tamilnadu						
ECM						
Andhra Pradesh	0.080	2.006	-0.108	-1.884	-0.868	-2.315
Karnataka	-0.110	-2.307	-0.128	-1.860	0.146	3.266
Exogenous						
Diesel price	0.205	0.535	-0.199	-0.340	0.169	0.470
Harvest dummy	-9.464	-1.801	-12.440	-1.650	-3.220	-0.654
Note: Sample1986:04-2005:03						

Table 4.12: Error Correction Model of Rice in Central region of India						
	Bihar		Madhya Pradesh		Maharastra	
	Coefficeint	T-stat	Coefficeint	T-stat	Coefficeint	T-stat
Procuring state is Madhya Pradesh						
ECM						
Maharastra	-0.303	-2.605	-0.084	-0.58	0.547	2.82
Bihar	0.154	1.316	-0.358	-2.45	-0.582	-2.99
Exogenous						
Diesel price	0.717	1.03	0.285	0.33	-0.892	-0.77
Harvest dummy	-8.085	-2.68	-13.65	-3.63	-3.90	-0.78
Note: Sample 1986:04-1996:03						

In the case of the Eastern and the Southern regions where no cointegration was found between West Bengal and Assam and between Andhra and Karnataka, indirect effects are nevertheless observed. The results are consistent with the hypotheses of Orissa, Tamilnadu and Madhya Pradesh as the states of convergence all three being procuring states.

4.4.5 (b) Price effect of intervention

The transmission of price signals in each of the three regions is not unrestricted or fast except in select cases. Two states each in two regions are not found cointegrated and in some of the states the long run adjustment is weak (Table 4.13 (a)). The intervention creates disequilibriums with mutually offsetting effects. Table 4.13 (b) tabulates only the cases where third state effects are present along with direct effects. The third state effects in each case is negative and is of larger magnitude than the direct effect in all but one case. For example when Orissa is the central state, the direct effect on Assam for a unit increase in error term is Rs 0.07 increase but the indirect effect via West Bengal is Rs0.12 decrease. The adjustments are larger in the case of Tamilnadu-Andhra disequilibrium effect on Karnataka price (Rs0.87 negative) and of Madhya Pradesh-Bihar disequilibrium on Maharashtra (Rs 0.58 negative).

Table 4.13 a: Long run adjustment of prices through Cointegration

Region	Strong Adjustment	Weak Adjustment	No cointegration
Eastern	West Bengal-Orissa	Orissa-Assam	Assam-West Bengal
Central		Bihar-Madhya Pradesh Madhya Pradesh-Maharashtra	
Southern	Andhra Pradesh-Tamilnadu	Karnataka-Tamilnadu	Andhra Pradesh-Karnataka

Note: Adjustment is deemed strong or weak based on the cointegrating coefficients value being close to one or not.

An impulse function describes how a time series responds to a unit shock in error term over a time period. The impulse response represented by ψ_i of a series y_{t+i} to a unit shock in u_t at time t is given by $\psi_i = \delta y_{t+i} / \delta u_t$ and is plotted for $\{ \psi_i)_{i=}$ where i varies from 0 to m against "i" for a reasonable time period of length m.

Table 4.13b: Third state effects on price changes due to intervention		
Disequilibrium	Impact states	
Intervention in Orissa	Assam	West Bengal
Orissa-Assam	0.07	-0.07
Orissa-West Bengal	-0.12	0.09
Intervention in Tamilnadu	Andhra Pradesh	Karnataka
Tamil-Andhra	0.08	-0.87
Tamil-Karnataka	-0.11	0.14
Intervention in Madhya Pradesh	Bihar	Maharashtra
Madhya Pradesh-Bihar	0.15	-0.58
Madhya Pradesh-Maharastra	-0.30	0.55

Figures 4.9 plot the impulse effects due to an increase of price by Rs 100 per quintal in the three harvest months October, November and December in the state of intervention in the year 2006 in Eastern region, 2004 in Southern region and 1995 in Central region. Only the path of price adjustment confined to the harvest period is traced as this is the period that is relevant for farmers. The path taken by the prices in the radial states is simulated by the estimated VECM model through five immediate post harvest month i.e, m=5, where the error term is shaped by the shock on the price in the central state.

Figure 4.9a: Persistance of a price intervesntion in Madhya Pradesh market in the Central Region

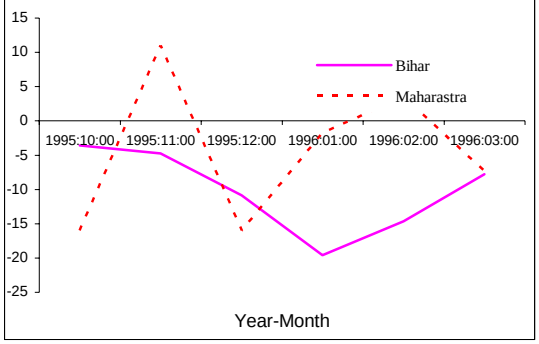
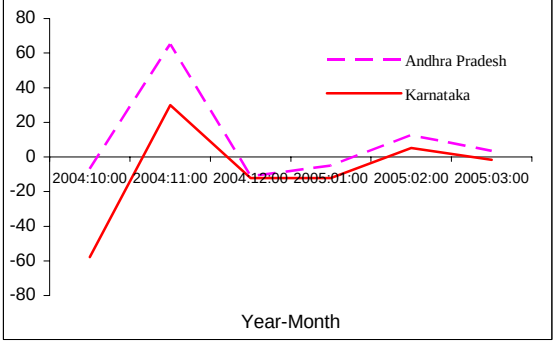
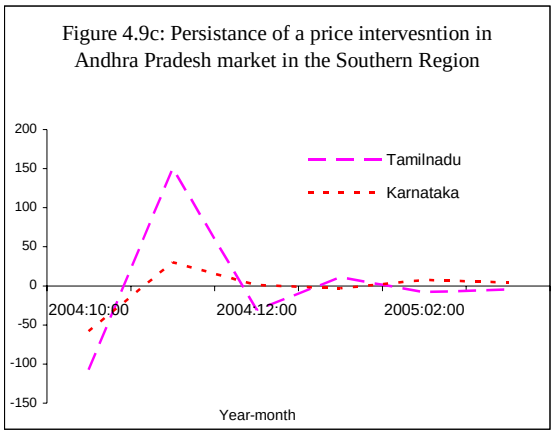
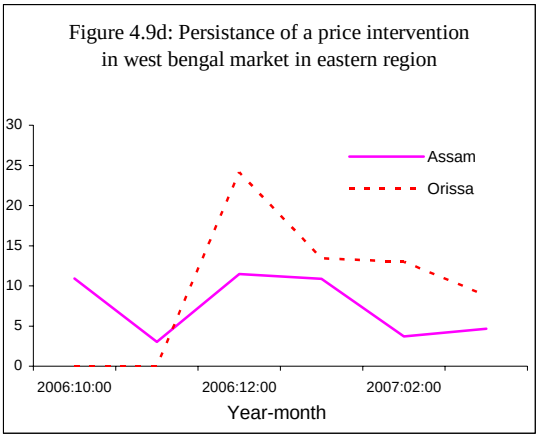
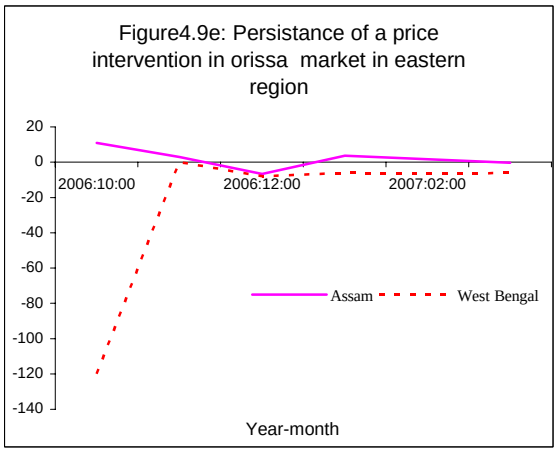


Figure 4.9b: Persistance of a price intervesntion in Tamilnadu market in the Southern Region









4.4.6. Why Uttar Pradesh is not included

In Tables 4.6 (a), (b) and (c) ADF tests for the series used for the analysis are provided. When Uttar Pradesh is also considered the result is not uniform. Except for Uttar Pradesh, the series are found non-stationary at levels and stationary in first difference under all three specifications (Tables 4.13a). For Uttar Pradesh this property holds only when the specification excludes a time trend but combined with the F-test for specification, the ADF test suggests that the series is I(0) and that the time trend requires to be considered. Thus the Uttar Pradesh price series may be driven by a deterministic time trend only. However we continue to consider Uttar Pradesh in the set for the time being.

Table 4.14(a): ADF test (1986:04-2000:03): Central Region with Uttar Pradesh								
States	Level				1st difference			
	Const. only	Const. and trend	No. of Lags	F-Test	Const. only	Const. and trend	No. of Lags	F-Test
Bihar	-0.99	-3.34	1	5.59	-7.61*	-7.59*	1	28.81
Maharashtra	-0.5	-3.61	2	6.52	-12.18*	-12.14*	1	73.69
Uttar Pradesh	-0.97	-4.54*	1	10.15	-7.43*	-7.40*	4	23.45
Madhya Pradesh	0.38	-3.16	1	5.45	-11.58*	-11.62*	1	67.51

If we consider that the price in Uttar Pradesh has a different order of integration, the neighbouring rice growing states Madhya Pradesh and Bihar become non-cointegrated with Uttar Pradesh. However assuming for the time that series are integrated of the same order (excluding the time trend in the ADF equation) we tested for cointegration between Uttar Pradesh on the one hand and the other Central region states on the other in table 4.14 (b).

Table 4.14(b): Pair wise Cointegrating relations between States in States with Uttar Pradesh								
	State/Market		No. of Lags	Trend	AIC	No. of CE	Cointegration coefficient	
	1	2					Value	t-stats
Central Region	Uttar Pradesh	Bihar	1	Yes	17.412	1	-0.488	(-3.11)
	Uttar Pradesh	Madhya Pradesh	1	Yes	17.816	1	-0.304	(-1.07)
	Uttar Pradesh	Maharashtra	2	Yes	18.129	1	0.639	(1.27)
Sample period: Central: 1986:04 2000:03The cointegration equations (CE) are normalized on State 1.								

In Table 4.14© the pairwise error correction mechanism is presented. For Market 2, the signs are not correct for the cases involving Uttar Pradesh. The negative signs could be on account of the actual lack of cointegration with Uttar Pradesh as indicated in Table 4.14 (a) or possibly a simultaneous adjustment to a third state as found in the earlier sub-section.

Table 4.14© : Error correction coefficients of Adjustment of Prices in the Two market cases for central region with uttar Pradesh					
State/Market		Market 1		Market 2	
1	2	Value	t-stats	Value	t-stats
Uttar Pradesh	Bihar	-0.206	(-4.818)	-0.044	-0.979
Uttar Pradesh	Madhya Pradesh	-0.154	-4.449	-0.022	-0.543
Uttar Pradesh	Maharashtra	-0.107	-4.088	-0.100	-2.874
Note: The cointegrating equations are normalized on market-1. *using truncated sample (see table no.4.7)					

The ECM models involving third state adjustments is presented with the inclusion of Uttar Pradesh in the Central region. It is noted straight away that the when Uttar Pradesh is the state of intervention, error correction effect with Madhya Pradesh on the procuring state has a positive sign which implies that the situation will be unstable. Similarly, the error correction response in Maharashtra is counter-intuitive (4.149d). With several signs deviating from expectation the prudence of including the state Uttar Pradesh becomes more questionable.

Table 4.14(d): Error Correction Model of Rice in Central region of India with UP								
	Uttar Pradesh		Madhya Pradesh		Maharastra		Bihar	
	Coefficeint	T-stat	Coefficeint	T-stat	Coefficeint	T-stat	Coefficeint	T-stat
Procuring state is Uttar Pradesh								
ECM								
Bihar	-0.221	-2.311	-0.241	-2.122	0.029	0.213	0.158	1.594
Madhya Pradesh	0.066	0.689	0.243	2.144	0.193	1.430	-0.132	-1.325
Maharastra	-0.057	-1.160	-0.047	-0.805	-0.226	-3.263	-0.069	-1.357
Exogenous								
Diesel price	-0.430	-1.371	0.066	0.689	0.167	0.376	0.041	0.899
Harvest dummy	-12.431	-3.872	-0.057	-1.160	0.111	0.025	-8.082	0.016
Procuring state is Madhya Pradesh								
ECM								
Maharastra	-0.013	-0.272	-0.170	-3.132	0.149	2.247	-0.085	-1.825
Bihar	0.014	0.751	-0.002	-0.090	-0.050	-1.921	-0.057	-3.070
Uttar Pradesh	0.183	4.065	-0.002	-0.041	-0.023	-0.371	0.032	0.719
Exogenous								
Diesel price	-0.415	-1.270	0.246	0.658	0.151	0.329	0.249	0.773
Harvest dummy	-11.474	-3.533	-6.803	-1.825	1.333	0.293	-8.055	-2.513
Note: Sample 1986:04-2000:03								

Conclusions

Indian states are found to present considerable diversity in respect of their balances between demand and supply and few states are found to be dominantly the sources of food surplus. However, the sources of procurement are even more concentrated and interestingly not always associated with the surplus generating status of the state. Thus Andhra Pradesh, Tamilnadu and Orissa, in the category of deficit contribute to public channel purchases and West Bengal which emerged as a marginal surplus in recent times has been a procuring state. The decentralization of procurement may be a part of the process giving rise to states like Orissa in the procuring status and in this case the two measures may not be independent as the deficit itself will be affected by local distribution (consumption) from the procurement.

Examining whether the states as geographical locations are integrated as a market using highly filtered data on prices, considerable discontinuities are found in the market even within three broadly demarcated regions. For example, cointegration was not found between West Bengal and Assam in East, Andhra and Karnataka in the South and between Uttar Pradesh and the other states in the North-Central region. Even after excluding Uttar Pradesh, there appeared to be a structural change in the long run relation of prices between the states Madhya Pradesh, Maharashtra and Bihar.

The long term adjustments of prices between the pairs of states were weak in general. Considering that price in a state may adjust not only to any disequilibrium with another state where the government intervenes but also to the disequilibrium between the latter state and a third neighbouring state as long trading relations exists, it is found that the short run adjustments are also weak and sometimes mutually offsetting. The indirect effect of intervention reflecting a competition with the other radial state for supplying to a preferred converging state is usually stronger than the direct effect. The persistence of the intervention effect varied between states of intervention.

Appendix

Table 4.1A State level data availability for Rice: Variety, markets and comparability

State	Region	Verieties	Markets	Sample period	Average Price (1995-96 to 2000-01)
Andhra Pradesh	Southern	Akkulu/Coarse Akkulu/Coarse /Akkulu Hansa/IR-8	Kakinada, Vijayawada, Nizamabad, Bhimavaram, Bhimavaram, Tadepalligudem, Hyderabad	1985-2005	863.46
Assam	Eastern	Coarse Sali/Sali/ coarse	Guahati, Tihu, Hailkandi	1985-2007	902.10
Bihar	North-central	Coarse/ Coarse Mota	Rachi, Dumka, Jamshedpur, Arrah, Gaya, Jaynagar, Patna, Sasaram	1985-2002	765.66
Karnataka	Southern	Coarse/2Sort/ IR-8	Bellary, Nandgarh, Mysore	1985-2005	955.42
Madhya Pradesh	North-central	Coarse/ Coarse Gurmatia	Raipur, Rajgarh, Jagdalpur, Durg, Bhopal	1985-2000	773.32
Mahar Ashtray	North-central	Coarse /Coarse Gurmatia	Nagpur, Gondia, Chiplun, Poona	1985-2001	810.28
Orrisa	Eastern	Coarse	Balasore, Jeypore	1985-2007	745.33
Tamil nadu	Southern	Coarse	Kumbakonam, Madras, Tirunelveli, Chidambaram	1985-2005	905.40
Uttar Pradesh	North-central	3rd Arwa/Coarse 3rd Gr/Coarse 3rd/Coarse	Azamgarh, Kanpur, Nowgarh, Varanasi, Saharanpur, Dehradun, Lucknow, Allahabad	1985-2005	774.58
West Bengal	Eastern	Coarse/Common	Matiahat, Santhia, Bankura, Calcutta, Coochbehar	1985-2007	823.15

Table 4.2A. : State-wise annual surplus of Rice and Wheat in India (Kg per capita)						
States	1983-84	1987-88	1993-94	1999-00	2004-05	2006-07*
Andhra	-3.09	-42.40	-15.47	-13.39	-26.42	-4.68
Assam	-43.99	-59.82	-27.40	-15.38	-42.27	-70.31
Bihar	-21.70	-39.73	-24.90	-24.74	-94.40	-66.88
Gujarat	-182.53	-63.65	-41.14	-55.82	-24.79	-7.85
Haryana	228.74	212.05	325.25	405.52	343.64	370.65
Karnataka	-18.45	-24.01	-16.83	-14.08	-20.57	-24.99
Madhya Pr.	59.29	20.78	80.75	90.30	-6.78	14.80
Maharashtra	-10.59	-38.46	-31.93	-47.74	-52.66	-51.56
Orissa	-6.93	-30.01	-2.10	-48.22	-15.96	-1.66
Punjab	558.73	660.37	754.71	799.91	741.19	699.07
Rajasthan	-12.49	-78.57	-51.74	-10.01	-25.08	-12.35
Tamil Nadu	-31.29	-29.23	-21.86	-11.74	-53.47	-32.53
Uttar Pradesh	20.99	9.57	45.44	64.61	11.52	33.16
West Bengal	-28.75	-44.13	-9.65	9.94	14.94	13.80
All India	-0.81	-20.39	7.07	15.48	-3.81	8.10
* 2006-07 is a finding from a so called 'thin' sample of the NSS. Source: Computed from data (National Sample Survey Organization,, Ministry of Agriculture and Census of India)						

Table: Share of Rice in Consumption pattern in Indian states (%)						
	1983-84	1987-88	1993-94	1999-00	2004-05	2006-07
Andhra	78.61	80.96	87.75	92.11	91.43	91.18
Assam	94.41	93.36	93.72	93.13	93.63	94.14
Bihar	43.98	56.88	54.97	56.57	53.59	55.48
Gujarat	16.41	17.11	19.82	21.30	21.40	22.12
Haryana	6.77	5.95	7.62	9.60	7.94	11.06
Karnataka	38.58	40.44	45.27	50.09	51.76	55.06
Madhya Pr.	38.73	40.54	40.17	39.85	19.98	20.37
Maharashtra	21.00	22.94	27.79	30.10	30.04	32.84
Orissa	87.05	89.38	93.08	91.34	92.20	91.04
Punjab	7.83	6.60	7.62	7.89	8.60	9.67
Rajasthan	1.95	1.57	2.24	2.26	2.26	3.14
Tamil Nadu	69.63	80.64	88.70	91.62	92.79	92.45
Uttar Pradesh	23.87	23.47	27.62	30.76	30.01	35.85
West Bengal	79.58	87.24	88.10	88.22	88.82	89.13
All india	45.20	48.39	51.80	52.59	52.77	54.58

5. Liberalization of Trade in Agricultural products: How justified are the apprehensions about prices?*

5.1. Introduction

India's decision to open up her trade in agriculture including food grains to the global market aroused vigorous debates, surrounding the issues of food and livelihood securities. Indeed, the possibility of trade induced transmission of international volatility into the domestic prices has been a disturbing thought for most developing countries and has proved to be an impediment in the current Doha round of agricultural trade negotiations. Although the safeguard mechanisms built into the Uruguay Round had demonstrated only limited usefulness ((Pal et al, 2007)), nevertheless, with further cuts in tariff rates in the horizon, apprehensions have mounted to the extent that decisions surrounding the special safeguards have reached a serious deadlock[1]. It is not surprising the India, bestowed with an agricultural sector that employs the largest part of the population would be an audible voice in the debates. The unexpectedness of price movements, especially sharp falls in prices resulting in sudden surges in imports would impose serious difficulties on the farmers who would have to bear the full brunt of a price shock. This chapter aims to put the concerns in their perspective.

To what extent the concern about the effects of trade liberalization on domestic price volatilities, on the frequency of unexpected adverse price movements and on the relation of such movements with import surges is vindicated by experience is the main question explored in this Chapter. In Section 5.2 a background of theoretical expectations and

* This chapter is drawn from an extended paper titled "Effect of Trade liberalization on Volatility: The experience of Indian Agriculture" (Nilabja Ghosh and Sangeeta Chakravarty): presented -in the Fourth Annual International Conference on Public Policy and Management, Indian Institute of Management Bangalore (IIMB) in August 2009.

[1] The developing countries now demand the right to impose temporary measures for insulating their domestic economies from unexpected declines in prices and resultant import surges hurting the producers' incomes. Such measures could potentially open the floodgates of protectionism and may even defeat the process of trade liberalization.

some empirical evidences as available are provided. Section 5.3 looks for the relation between international and domestic price movements in the post liberalization period. In Section 5.3 we use static and econometric techniques based on dynamic adjustments to examine if trade liberalization has marked a departure in the price movement by intensifying volatilities. Section 5.4 further inspects the shocks by their signs to ask if the frequencies of price falls and import surges have become more frequent. Finally in Section 5.5 we mark the comovements of production in India and the world to make a statement about relying on world market for food security. Section 5.6 provides the conclusions of the Chapter.

5.2. Background

Empirical evidences have studies have demonstrated that volatilities of price movements could hurt the growth prospects of developing countries (Blattman et al, 2007, Basu et al, 1992). Yet theory is far from clear about what to expect from trade liberalization (TL). Typically low elasticities of demand and supply of primary articles and the importance of a multitude of different country-level realities in determining the prices could in principle enhance the chances of sharp changes occurring in price movements. On the contrary, with free trade the responses coming from outside the domestic economy could make the domestic demand and supply curves more elastic and in fact reduce price volatilities. Empirical and Simulation exercises with Computable General Equilibrium Models (CGE) suggested that price variability would be reduced by the elimination of distortion by both developed and developing countries (Anderson, 2004, 2005). On the other hand, in retrospect, there is a widespread feeling that the Uruguay Round of multilateralism has not benefited the developing countries (World Bank, 2002, Grimwade, 2004 and Chand, 2002) strengthening the argument for a stranger safeguard mechanism as a precondition for trade liberalization. In particular, computations based on standard deviations have indicated that volatility has indeed gone up in the post-WTO period in India[2]. The CGE models are also criticised for the poor underlying economic theory (Ackerman and Nadal,

[2] The standard deviation of $\log(P_t/P_{t-1})$ over a period is used where P_t is price in period t. Calculated as either intra-year variability or inter-year variability based on decadal average (see Sekhar, 2003).

2004, Ackerman, 2005, Jomo et al, 2008, Kraev, 2005) and their findings are treated with scepticism.

In reality global agricultural market has been highly distorted and vitiated by the politically driven domestic policies of the national governments. In turn this situation has deterred traders from entering the market. Trade in agricultural commodities remained in the hands of a handful of exporting countries and few large corporate houses or state trading enterprises a situation that makes the market even more unpredictable. The rationale behind the Agreement on Agriculture has been to break this cycle of distortion, encourage participation and unleash the benefits of free trade. However, with the current practices of the countries, such a cushioning among a large number of activities could a far fetched expectation and influences of global shocks seeping into the domestic market is a distinct possibility, This could have seriously adverse implications for farm incomes and farm supply responses and also could create severe challenges for the governments in the management of food security.

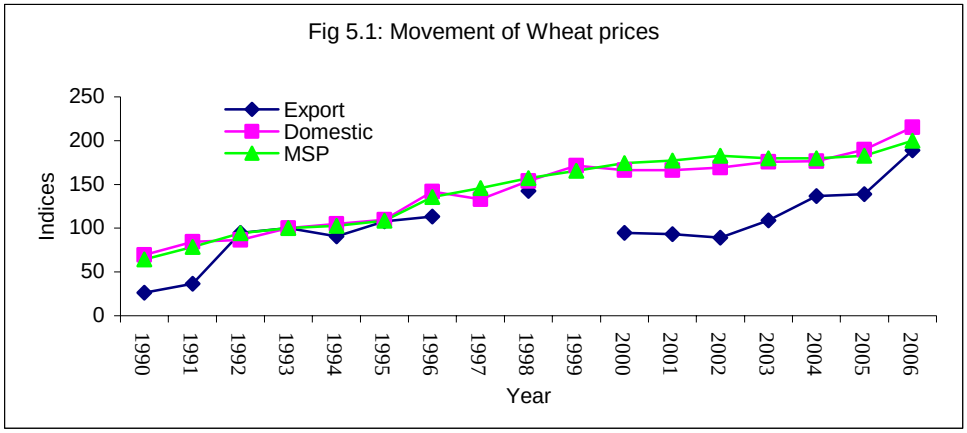
5.3. Role of international prices

Globalization of the agricultural market is meant to align domestic prices with international prices. Although the administered price is also meant to influence the market, the CACP in the liberalized times increasingly factors in international and other parities in setting the MSP and reduces the chances of emitting signals that conflict with the international market. The nexus among the three prices namely the market price, the administered price and the international price in this complex situation will reflect the growing significance of the international market for the domestic one.

Table 5.1 : Correlation coefficient with Prices (Unit values) of Exports and Imports

	Rice-Export	Rice-Import	Wheat-Export	Wheat-Import
MSP	0.10	0.48	0.72	0.28
Harvest Price	0.23	0.41	0.77	0.27

Since the measurement of international prices imposes considerable difficulty[3], unit value of exports or imports computed as the ratio of value to volume of trade is commonly used to trace the direction of international price movements. The choice between import and export prices based on their unit values is also not easy for rice and wheat as both commodities have proved to be importable and exportable at various times. The two unit values are not likely to coincide as import sources and export destinations are at different locations and trading has possibly taken place at disparate times with different countries. Correlation coefficients worked out between the two domestic prices and the international prices for 1990-91 to 2005-06, all prices being expressed as indices with a common base of 1993-94 show that except with the export price of wheat, the correlations are weak. Despite a possible co-movement, Figure 5.1 shows that even in wheat export the international price remains far more unstable than the domestic prices. The coefficients with respect to import and export prices vary for the same crop supporting the expectation that these prices would differ.



5.4. Effect on domestic price volatilities

To what extent the concern about the effects of trade liberalization on domestic price volatilities is justified is a question explored in this section. The problem being related to

[3] Indeed prices differ across ports due to transport costs involved in the transit and the quality of grains also differs in different transaction. Moreover international prices can be highly volatile so that the price is specific to the time of export or import and the global market conditions.

the interests of the producers of agricultural commodities, producer price is relevant. We examine whether trade liberalization has indeed exacerbated the unexpected volatilities of agricultural producer prices in India. The crops studied are rice, wheat, jowar, bajra and maize. The data on wholesale price index for harvest months with 1993-94 as the base covering a thirty-one year period 1975-76 to 2005-06 are taken from Government of India publications of Index of Wholesale Prices in india.

5.4.1. Framework

Agricultural commodities today serve both as assets and products. As assets they are in many cases traded in the commodity and futures markets and are objects of speculations[4] like stocks. They are either stocked for coming times or consumed for current use. Both production and stocking decision is deeply related to expectations and past experiences. The harvest time price is the representative producer price as majority of the Indian farmers are small holding cultivators with nearly no capacity to hold inventories beyond the harvest season. Given this feature, the time period of our analysis is restrained to be annual.

India's regulated regime in agricultural commodities gave way to a more market friendly and open agricultural economy in 1991 when a series of reforms began with the intent to draw Indian agriculture too closer to world prices. The year 1995 saw just a beginning of another period of transformation when India entered the WTO. Domestic reforms continued while other countries over the world also worked for the dismantling of trade barriers as part of the WTO commitments. In view of the long drawn and phased manner of progress, we have chosen a flexible approach to identify the point of departure marking trade liberalization in the period starting from 1991 and continuing up to 2001-02 when the Quantitative restriction (QR) regime based on balance of payments consideration was removed.

[4] Such commodities need to be fairly durable and storable and this condition is satisfied in varying degrees by many agricultural products.

5.4.2. Modelling volatility

The simple standard deviation as a measure of volatility cannot fully convey the degree of risk that in turn depends on the unpredictability of the movements. The risky element of the movement can be quantified only when the component of the movement that is predictable on the basis of available information is factored out. We have therefore specified volatility as the movement of the unpredictable component of the price movement.

The methodology for measuring volatility has undergone significant development. Volatility of a risky asset is typically modelled in the literature on asset markets through the ARCH and the GARCH models (Engle, 1982) and their modified versions, in which past information is used to model and project the mean as well as the variance around the mean price. The degree of deviation of the actually realised value from the informed prediction is treated as incoming news or innovation that becomes part of the information set for making future predictions. These time-series techniques have been used extensively for modelling financial sector time series data which comes in high frequency but in this study we have used the same approach on annual data on agricultural prices for the sample period of 31 years.

We have modelled the harvest period[5] (April to September for wheat and October to February for the other crops) price using the GARCH, EGARCH, ARCHM, GARCHM and EGARCHM models since in this way the expected volatility is also modelled assuming that the econometrician's information set is the set of past prices and innovations. From among the different alternatives, the best model is selected based on relevant diagnostics. Since the ultimate objective of this study is to identify any possible shift in the volatility in price after trade liberalization took place the estimated volatility around the expected value is modelled using a dummy variable to mark a possible departure.

[5] Wheat is a rabi crop grown between October and March. The other crops modeled are kharif crops grown between June and September.

In order to mark this point of shift, if any with a dummy variable method, the basic model is specified carefully following the method laid out by Golsten et al, 1993. A broadest form of the model is presented in equations 1 which represents the EGARCHM model with dummy. For estimating each model we have identified the lags based on the AIC and SBC criteria. For the selected specification in each case we have considered a shift for each year starting from 1991-92 and used a dummy variable (DTLV) for the ensuing years in the variance equation. Thus for a shift in 1995-96 the dummy takes a value of one for all the sample years starting with 1995-96 and zero in other (preceding) years, and for a break in 1996-97, the dummy takes a value of one for the years 1996-97 onwards and so on. In all the variant specifications of the model we then looked at the significance levels of the coefficients of the shift variables. The earliest instance of continued significance of the dummy's coefficient is taken as the break point, taking care that there is no reversion during the post liberalization years. A possible break in the mean equation (DTLM) is also explored. The selected models is further subjected to the Sign and Size bias tests on the errors (Engle and Ng,1993) to make sure that no further asymmetric effects are there.

Mean $Y_t = a0 + a1Yt-1 + a2Yt-2 + a3(\sigma_t^2) + a4(DTLM) + \varepsilon_t$ …… (5.1a)

Variance $\log(\sigma_t^2) = b0 + +b1\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}} - m\right| + b2\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + b3\log(\sigma_{t-1}^2)\ b4(DTLV)$ ……(5.2b)

5.4.3. Results

Since the price series are likely to be non-stationary, their first differences (or returns) are considered as variables for analysis rather than their levels. The EGARCH model largely appears to be the most appropriate in terms of the significance of the coefficients. The model has also passed the size bias and other tests like the ARCH test and the ARCH-LM test. The EGARCHM model has performed better in bajra and maize while the EGARCH

model is selected for the other crops. A significant dummy variable is not found consistent with the best performing models in any of the cases.

5.4.4. Descriptive statistics and static variability

The series at first differences are stationary at 5% level. The mean of the transformed variable is highest for jowar and are positive in all cases. The standard deviations are higher than the means in all cases indicating the possibility of negative absolute price movements. The skewness is positive in all cases except maize and bajra but low in magnitude. The kurtosis is high for rice, wheat and jowar (Table 5.2).

Table5.2: Descriptive statistics of the Prices (First differences) 1975-76 to 2005-06

Descriptive	Rice	Maize	Jowar	Bajra	Wheat
Mean	4.9	5.95	7.2	6.2	6.0
Standard Deviation	6.0	17.2	20.38	21.66	8.1
Coeff. Of Variation	1.21	2.89	2.83	3.49	1.62
Skewness	1.11	-0.11	0.15	-0.07	1.19
Kurtosis	4.14	3.01	5.14	2.79	4.75
Unit root test					
ADF-trend	-3.4	-7.17	-7.1	-6.31	-3.98
ADF-no trend	-3.3	-7.23	-7.47	-6.36	-4.41
Note: ADF statistic at 1% -3.66, 5% -2.96, 1% 2.62.					

In Table5.3 we divide the sample period into two marked as 1975-95 and 1995-05, the divide being synchronized with India's entry into WTO. We first examine if the prices have become more unstable after TL by simply comparing the coefficient of variation (CV) in the pre-TL period 1975 to 1995 and post TL period 1995-05 treating 1995 as the cut-off for simplicity. The CV has increased in all the crop cases conforming to the general finding of increased volatility in post-TL period. To the extent that volatility is the unexpected deviation of prices from their expected value a simple measure of instability proposed by UNCTAD can be used as follows:

$$\text{Instability index} = 1/n \, \Sigma \, [\text{Abs}(P_t - \text{Exp}(P_t))]/\text{Exp}(P_t)$$

Where P is the observed value of the variable and Exp(P) is the expected value as estimated in equation 1(a). Except for wheat the volatility by this measure has increased in the second period over the first though more moderately than indicated by the static measure. The largest increase is in maize where in instability index went up to 7.34 from 2.64.

Table5.3: Instability of Price movements (First differences of Prices)					
1975-95	Bajra	Maize	Jowar	Rice	Wheat
Mean	6.08	5.76	6.68	4.64	4.16
Std.Dev.	15.358	15.38	17.61	4.74	5.56
Coeff. Variance	2.65	2.67	2.64	1.02	1.34
Instability(G)	1.77	2.64	1.33	0.67	2.08
1995-2005					
Mean	7.49	5.6	8.49	5.63	8.11
Std. Dev	30.18	20.37	24.77	7.81	12.83
Coeff. Variation	4.03	3.64	2.92	1.39	1.58
Instability (G)	2.66	7.34	1.95	1.03	1.06
*(G) based on estimated model					

5.4.5. The dynamics of Volatility

While a comparison between two averages indicates a rise in the instability, it is not clear whether trade liberalization marks the switch in the regime. Volatility also has its dynamics, so that it can be modelled using its own past values. In other words, in the GARCH model we propose that like the mean, the variance can also be predicted from the past information. To the extent that trade liberalization is a departure in this dynamics, the past values will not be an adequate set for explaining variance. Using the dummy variable for the point of departure along with the past values will then be the appropriate model where the coefficient of the dummy will be significant to mark its role. Since the exact point of departure is not known, we use an entire period in which the departure is likely to be present and conduct a search process as explained in 5.4.2.

The dummy variable has not been found to be significant in any of the cases. In the case of bajra a dummy for the period starting with 1991 did give a significant coefficient at 5% level for the EGARCH model only but since b_2 became insignificant and the

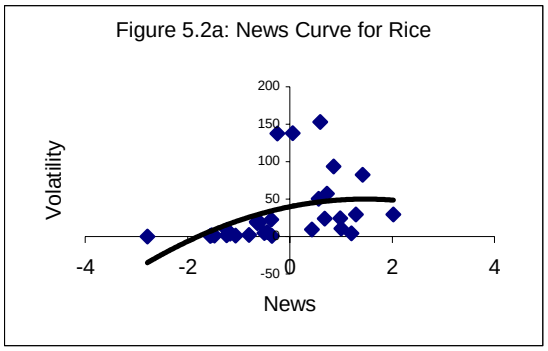
specification failed the sign bias tests, we did not prefer the specification. The EGARCH-M model with no dummy seems to perform the best as the coefficient a_3 is also significant. Similarly, for maize, the dummy specifications with a shift in 1991 both in mean and variance equations worked for both EGARCH and for EGARCH-M models. Though the coefficient of the dummy variable was significant the coefficients b_2 in the EGARCH model and the coefficient b_3 EGARCH-M model turned insignificant in these specifications. We therefore considered EGARCH-M with no dummy as the best. For jowar and rice the dummy specification did not work at all. Only for wheat the dummy variable applied to the mean equation to mark a departure in 1991 worked in the EGARCH model which also performed well.

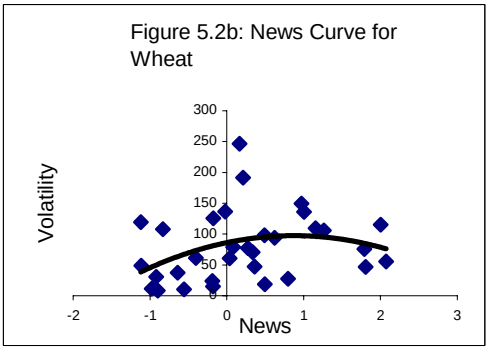
Table 5.4: Models specifications selected by comparison of the diagnostics

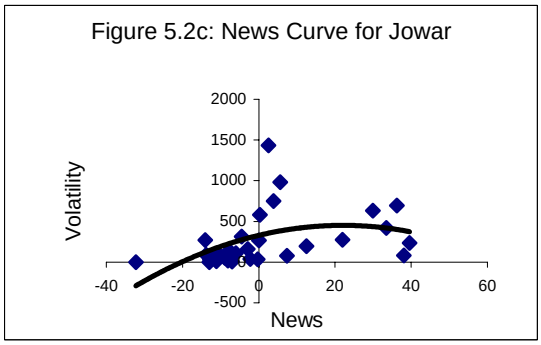
Crop	Model	Shift	Year
Bajra	EGARCHM	NONE	-
Jowar	EGARCH	NONE	-
Maize	EGARCHM	NONE	-
Rice	EGARCH	NONE	-
Wheat	EGARCH	Mean only	1991

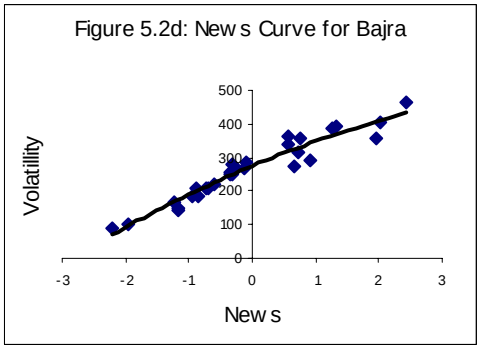
Note: The specifications are provided in Appendix Table 5.1A.

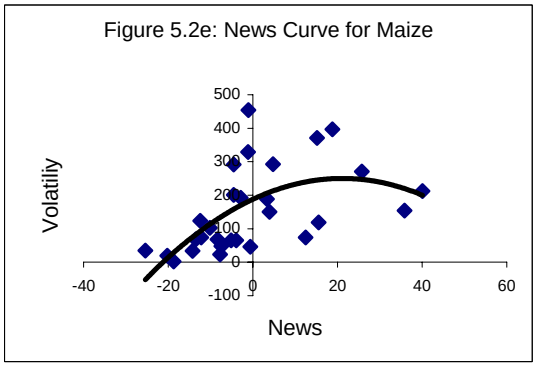
The coefficients of the lagged conditional variance terms are less than one so that volatility is not explosive and those of lagged variables in the mean equations are usually negative suggesting a tendency for cyclical behaviour. The sign of coefficients b1 and b2 is positive indicating invented U-shaped news effect curves. Asymmetric slope effect is suggested in all the case. The plots of volatility against one period lagged shock are presented in Figures 5.2. Which suggest a quicker dampening of negative volatility than positive. In bajra the newscurve even behaves like a standard U-shaped one in the positive axis. Public action of protecting producers may have a role in this behaviour but cannot be substantiated. The coefficient of past volatility on expected returns measured by the parameter a_3 is negative in both cases where EGARCH-M specification is selected signifying a negative risk return relation. A mean shift is suggested only in the case of wheat.











5.5. Price declines and Import surges

The vulnerability of the producers is associated with the concern that prices would plummet unexpectedly in the presence of trade and about the associated influx of cheap imports form the global market. The justification of such concerns would be the found in the increasing frequency of such price falls in the post TL period and the concordance of

such incidences with import surges. We examine the incidence of price falls and import surges in the case of the two major cereals rice and wheat.

The errors obtained from the above modelling represent the unforeseen news or the unpredictability of price movements. We define a significant price decline as a situation when the unpredicted component of the price was at least 30% below its previous three period moving-average value. The unexpected price fall is then also matched with import surges defined analogously as increase of total imports of rice and wheat together by at least 10% over its previous three years moving average value. The cut-off percentages are decided on the basis of average deviations observed[6] in the respective cases. Table 5.4 presents the frequency of shocks in the pre-liberalization and post-liberalization periods. Among the crops wheat has witnessed the least incidences of shocks in either direction. Price falls in rice occurred in as much as 57.9% of the years prior to liberalization in the sample period. The frequency however came down to 33.3% in the following period. However the frequency of positive shocks went up from 36.8% to 50%. For wheat the frequency decreased from 0.53% to 0.33%. The frequency of negative shocks actually declined in all other cases whereas the frequency of positive shocks increased in all cases. Further matching of the price falls with import surges does not yield any cause of apprehension either. While in the pre-liberalization period a considerable portion of the years marked by price falls was associated with import surges, namely, 60% for wheat and 71% for rice although the chi-square test could not reject the lack of association hypothesis in case of wheat, there were actually no years in which low prices led to high imports for both crops. Under the weight of the domestic economy it is more likely that the case for imports arises only out of urgency in times of shortage i.e. when prices rule high.

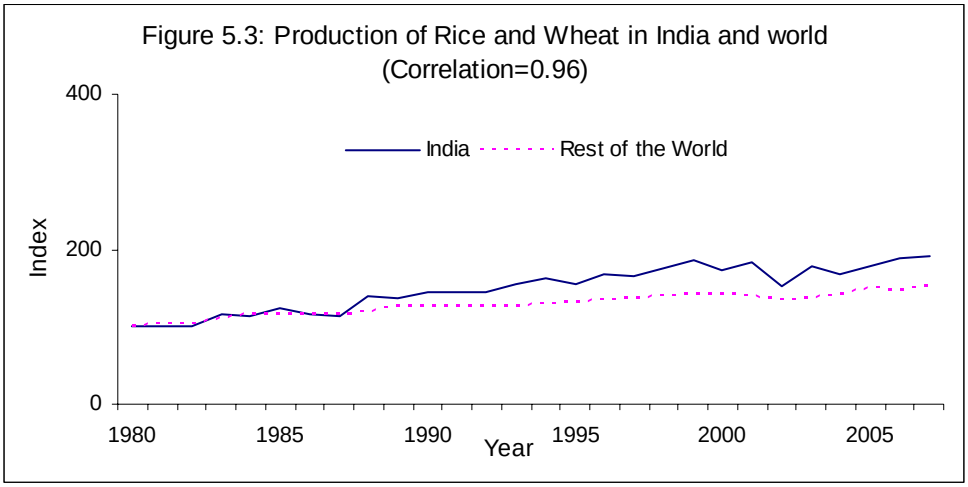
[6] Import surge has been anticipated assuming a 30% fall in price over the last 3 years' averages by FAO (see Pal, 2007).

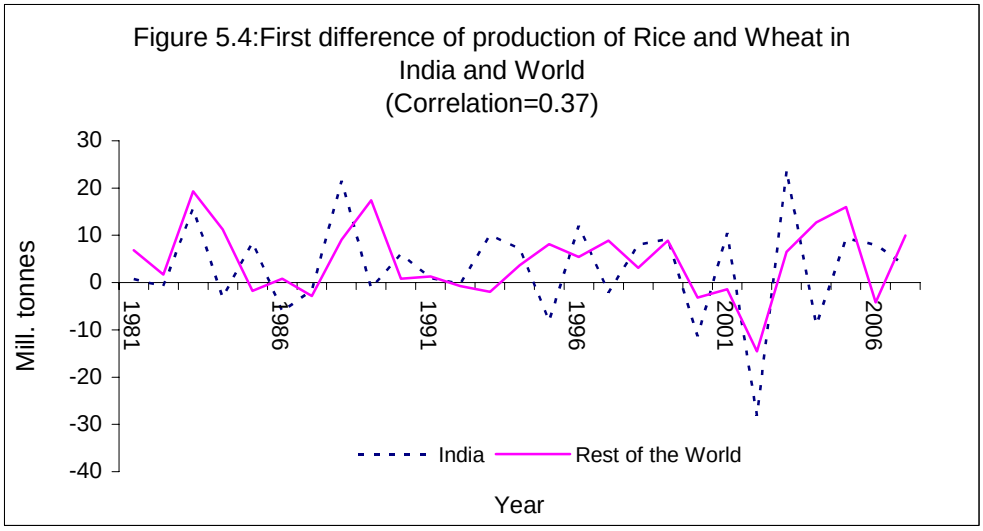
Table 5.5: Frequency(%) of Positive and Negative shocks in Prices					
	Rice	Wheat	Bajra	Jowar	Maize
Price Decline					
Pre-Liberalization	57.9	0.53	77.8	66.7	77.8
Post-Liberalization	33.3	0.33	33	25	41.7
Price Increase					
Pre-Liberalization	36.8	0.26	22.2	33.3	22.2
Post-Liberalization	50.0	0.58	66.7	58.3	58.3
Negatives price shock together with Import surge					
Pre-Liberalization	71	60			
	(4.7*)	(0.93)			
Post-Liberalization	0	0			
	(1.2)	(1.2)			
Note: Shock is defined as estimated disturbance with magnitude of over 30%. Pre liberalization is 1975 to 1995, Post liberalization is 1996 to 2007. Import surge occurs when import exceeds 10% over last 3 year average. Figures in parentheses are Chi-square statistics.					

5.6. Imports as a solution

Although the fears of sudden movements, especially declines in food prices causing distress to farmers are not substantiated fully by our study, the findings in Section 5.5 raise some doubts about the effect of trade liberalization on food security. The possibility that imports may be an option in years of shortage invokes an appealing argument going in favour of free trade over public operations and the essential distinction between food security and food sufficiency. Figures 5.3a to 5.3b trace the movements of production behaviours in India and the world by plotting the indices of production with base 1980-81 for India and the rest of the world to allow comparison of the movements. A remarkable co-movement cannot be missed in Figure 4a, the correlation coefficient being 0.96, The reason could lie in the global meteorological factors and commonalities in technological progress as well as market integration. With such a covariate behaviour of production, dependence on imports for the basic food security of the nation could be dangerous and nearly meaningless for a populated country. Since both production series show trend, there may be a case for correcting for the dynamism. A stationary series obtained by calculating the first differences of the production is then plotted for each case. In this case the correlation is weaker at 0.37 though still this does not warrant complacency. In

particular observe the movements in the year 2002-03 which was one of the worst droughts of recent times.





5.7. Conclusion

Economic theory has unequivocally shown that free trade based on comparative advantages of nations could help to generate efficient production patterns and higher producer incomes. In reality there are considerable apprehensions about free trade, some of them being the inflow of global volatilities, the increasing incidences of price crashes and import surges and the danger of relying on the global market in poor years.

The chapter suggests that even after opening up of the market, international prices seem to share a weak linkage with domestic prices of food in India. Although there has been a rise the instability of prices, how far trade liberalization has caused volatility of prices could not be established. Indeed, after factoring out expected price movements, the unexplained deviations can be explained by their own dynamics and there was no evidence that events occurring in the period of trade liberalization caused a structural shift in the volatilities.Also any negative shock in price tends to die down fast but an unexpected increases in price generates more volatility. When the signs of the shocks are estimated we find that incidences of unexpected declines in food prices that could be deleterious to producers' interests have become less frequent but of greater concern is the increased occurrence of positive shocks with their implications for food security. Further it is also found that imports could hardly be a solution to food security in years of shortage as considerable covariation is found between India and the rest of the world in production performances.

Appendix

The GARCH (p,q) model is expressed as Equations 1a and 1b in which for simplicity p=1, q=1.

Mean $Y_t = a0 + a1Yt-1 + \varepsilon_t$ ….(1a)

Variance $\sigma_t^2 = b0 + b1\varepsilon_{t-1}^2 + b2\sigma_{t-1}^2$ ….(1b)

Although the ARCH and the GARCH models can estimate and forecast volatility of time series data, in practice the standard models are found inadequate in capturing some of the important features of the data. One possible feature that may be missed out by these models is the 'leverage effect', where conditional variance tends to respond asymmetrically to positive and negative shocks in errors. A dummy variable method (Glosten et al, 1993, Zakoian, 1990, Rabemananjara and Zakoian, 2008) and alternatively, a non-linear model called EGARCH model Nelson (1991) are solutions. The EGARCH or the exponential GARCH based on the logarithmic expression of the conditional variability also obviates the imposition of positivity restriction on the variance term (Bollershev, 1986, Patterson, 2000). The EGARCH model in its appropriate specification has been a choice in many cases (Berument and Sahin, 2008) .

The E-GARCH model is presented in Equations 2a and 2b as

Mean $Y_t = a0 + a1Yt-1 + \varepsilon_t$ …(.2a)

Variance $\log\left(\sigma_t^2\right) = b0 + +b1\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}} - m\right| + b2\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + b3\log\left(\sigma_{t-1}^2\right)$ …(.2b)

The asymmetry is captured by including the absolute term (the scaled disturbance minus the mean (m)). The parameter b_2 is a key coefficient which allows the positive or negative sign of the shock to incorporate news for the market over and above its magnitude and constitutes a leverage effect.

Even the EGARCH model fails to address the standard model's indifference to the well known risk-return tradeoffs and the case of a risk premium (Golsten et al 1993). Higher volatility means greater risk for traders and a lower price. If such a period witnesses a rise in the riskiness of multiple assets, a non-negative relation is possible. These possibilities are accommodated by the ARCH-M, GARCH-M or the EGARCH-M models in which the conditional variance or the measure of volatility enters the mean equation as a variable (Engle, Lilien and Robins, 1987). The GARCH-M model (not presented), and the EGARCH-M model (provided in Equations 3a and 3b) incorporate the time varying measure of risk in the mean equation of the relevant model.

Mean $Y_t = a0 + a1Yt - 1 + a3\left(\sigma_t^2\right) + \varepsilon_t$ …… (3a)

Variance $$\log\left(\sigma_t^2\right) = b0 + +b1\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}} - m\right| + b2\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + b3\log\left(\sigma_{t-1}^2\right) \quad \text{……(3b)}$$

Appendix table 5-1A: Estimated equations for volatility with alternative specifications:						
Crop	Rice		Wheat		Maize	
	(EGARCH)		(EGARCH)		(EGARCH-M)	
	Coeff	Zstatistic	Coeff	Zstatistic	Coeff	Zstatistic
Mean Equation						
a0	4.11	39.49	1.384	2.396	15.17	19.5
a1	0.16	2.61	8.65	4.59	-0.66	-7.98
a2					-0.31	-4.46
a3					-0.02	-40.69
a4						
Year of shift			1991			
Variance Equation						
b0	2.65	6.99	0.47	1.80	4.69	9.15
b1	-1.61	-3.37	-0.59	-2.10	-1.63	-3.47
b2	0.87	4.05	0.39	1.97	0.87	4.73
b3	0.57	18.08	1.02	27.25	0.35	20.02
b4						
Year of shift						
Log likelihood ratio	-82.97		-102.85		-115.81	
Note: For parameters in all Tables 1-1A to 1-6A see equations 4 in text. Parameter b_4 corresponds to the dummy for TL.						

Appendix table 5-2A: Estimated equations for volatility with alternative specifications:								
Crop	Jowar		Bajra		Cotton		Groundnut	
	(EGARCH)		(EGARCH-M)		(EGARCH)		(EGARCH)	
	Coeff	Zstatistic	Coeff	Zstatistic	Coeff	Zstatistic	Coeff	Zstatistic
Mean Equation								
a0	11.58	15.05	45.26	4.99	5.03	10.25	10.23	20.09
a1	-0.21	-9.71	0.02	0.1	-0.16	-2.60		
a2	-0.6	-8.29	-0.04	-0.21	-0.29	-4.41		
a3			-0.14	-24.04				
a4								
Year								
Variance Equation								
b0	5.87	6.52	4.66	34.39	2.94	5.21	4.28	9.03
b1	-2.46	-2.72	-0.22	-1.65	-1.73	-2.88	-1.81	-3.25
b2	1.21	9.81	0.35	2.71	1.11	7.34	0.48	2.13
b3	0.26	20.31	0.19	261.5	0.64	17.64	0.34	8.27
b4					0.66	2.89	1.37	4.60
Year					1999		1997	
Log likelihood ratio	-116.13		-129.16		-113.60		-118.87	
Note: For parameters in all Tables 1-1A to 1-6A see equations 4 in text. Parameter b_4 corresponds to the dummy for TL.								

6. Futures trading and the possibility of Speculation*

6.1. Introduction

Regardless of all the debates that surround methodologies of modeling price expectations, real life operators in agricultural commodities are left to their own instincts and devises in coping with price uncertainty in the market. The problems faced by the farmers and traders will be accentuated when the government retreats and when the varied events unfolding in different foreign countries begin to have a say on what the prices would be. The government permitted a futures market to operate for select agro-commodities including food grains for risk management. Futures-trading however still remains shrouded in doubts, especially for its possible role in fuelling inflation. In this chapter we review the experience of futures trading in food items in India with a critical perspective.

6.2. Background

Methods for estimating price expectations treated past experiences as the key input and methods remained tied to what was the current fashion in the world of modeling in general till it was discarded. The naïve cob-web model of micro-economics based on a one-period lag memory, the more sophisticatedly dynamic and by far the most influential adaptive expectations model (Nerlove, 1958), the time-series based models rooted in the Box-Jenkins approach leading autoregressive methods like the ARIMA (Naryana and Parikh, 1981), more contemporary approaches such as the GARCH and the VECM are milestones in the course of the development of this subject. While past values are important in most formulations attempts were made to marry the time-series techniques

* This chapter draws from two papers (i) "Volatility and Price Discovery in Indian Wheat Market" authors – (Nilabja Ghosh, Sangeeta Chakravarty, Shailesh Kumar) included a Book *Effects of FUTURES MAKETS on Agricultural Commodities* edited by Madhoo Pavaskar and published by TAER 2009 and (ii) "Agricultural prices and Futures trading: Interactions and the transfer of News" (Sangeeta Chakravarty and Nilabja Ghosh) presented in Seminar Commodity derivative markets opportunities and challenges in ISID Campus, New Delhi 110070 on October 30, 2009 and included in (Pavaskar edited) book (Commodity derivative market).

with theory and to recognize that farmers could be informed of the current reality. The rational expectations formulation of Muth (Muth, 1961) and popularized by Lucas(1980) was applied in agriculture (Sheffrin,1983,Aradhyula 1987, Ghosh and Neogi,1995) and the recent use of the VAR models also recognize the place of theory although past information remains supreme. The risk market can be another way of making available more scientific and objective assessment of possible price movements.

The case for a risk market is strengthened by the advancements made in information technology that facilitates the harnessing of a large mass of information. Elsewhere, the financial markets world-wide witnessed revolutionary developments on the institutional front although the evolution till now is far from complete. How judicious it would be to integrate agriculture with the developments in information science and financial engineering and what would be the appropriate way of doing so are questions that naturally came up in the days of liberalization.

6.3. What are derivatives?

A derivative, also known as a 'contingent claim', is a financial instrument whose value depends on the value of other more basic underlying variables. Usually a derivative is an agreement to buy or sell an asset at a certain time in the future for a certain price. In its simplest form it could be a contract in which the parties simply agree to undertake the transaction. This is the Forward contract which expires when the transaction takes place and no other parties are involved in the market. The price decided is the forward price that incorporates the expectations of the buyer and the seller. When the same contract is traded so that the commitment for transaction is transferred to newer parties it becomes a futures contract. The futures is a derivative that is traded in an exchange that provides a mechanism for bringing the buyer and seller together through auctions and giving the two parties, unknown to each other, a guarantee that the contract will be honoured. A third development is the contract represented by an option. This contract signifies a right but not an obligation to sell the product at the stipulated time and price. Various other possibilities of financial engineering are there leading to a fertile literature in financial

mathematics (Hull, 1997, Sengupta, 2005) but since the operations of the risk markets have themselves till now been associated with further and even more catastrophic risks, the development is far from comprehensive and has not been found entirely advisable for Indian agriculture.

6.4. Harnessing information through the Futures market

A futures contract is a standardized contract, traded on a futures exchange, to buy or sell a certain underlying instrument at a certain date in the future, at a specified price.The price of the derivative changes over time with changing expectations keeping in pace with world wide changes in market conditions and facilitated by the state of the art information technology. The futures contract is referred to by the specified delivery month. The futures exchange specifies the amount of the asset, the product quality, and the delivery location. The future date is called the delivery date or final settlement date. The pre-set price is called the futures price. The price of the underlying asset on the delivery date is called the settlement price. Several such contracts are traded up to many months in the future. Futures prices are regularly reported in the financial press. The electronic portal used by the institution allows a fair auction to take place by electronic matching of demand and supply in a more systematic way than traditional exchange trading involving long and painful waits in trader's pits and complex manual signals and open outcries.

Economic theory has always grounded its concept of a competitive market on the free flow of information. In real life, information is either in short supply or is asymmetric and a perfect competition in practice remains elusive. The development of the electronic computer, the ground-breaking rise of the internet connectivity and the advancements in computing methods went hand in hand with the innovations in financial engineering and the rise of the institution of futures trading. It is a form of trade that potentially harnesses all possible information available in the market by the effective use of all the methods of modern connectivity of information processing. Farmers even in the erstwhile primitive

rural settings today are offered communication facilities to trade in the markets[†]. The futures market is one such institution that provides an objectively indicative price determined by the informed transactions of a large number of players who might include traders and farmers. Thus Indian futures trading exchanges are potentially powerful links in the country's integration with the world market. While opening up a window of opportunity this integration also threatens to import international speculative forces.

6.5. Futures trading for farmer's benefit

The futures price can be seen as an informed and rational prediction of the price that could be realized at various points in time in the future. These time points are also known as expiry dates of the contracts.

$$P^t_0 = E(p_t/I_o) \ldots\ldots\ldots (6.1)$$

In equation (1) futures price P for time t and prevailing at time o is the mathematical expectation of price p at period t, conditional on the current level of information I_o. The futures price for a given t will change overtime as new information flows in keeping with transitions in agro-economic and geo-political situations. Thus equation 1 shows the futures price as the mathematical expectation of price, conditional on the information available at the time and this is equated with the sum total of the subjective expectations of the different market actors assuming that such actors are informed. Thus information is the crucial input that makes future price an appropriate indicator for price movement. As information improves, the degree of deviation of actual prices is likely to come down and only the unforeseen turn-outs of events can be the residual sources of uncertainty.

How does futures' trading help farmers? It is often argued that the farmers in India who have little capacity to wait for higher prices and very limited access to complex

[†] Other institutional measures to make farmers and other operators more informed also continue. The emergence of modern government, semi-government and privately owned innovative marketing channels through the reformation of regulated market norms and the government's own efforts to use the print and electronic media as well as portal like to AGMARKET are aimed at information dissemination.

information of the larger market can rarely gain from the market. However lack of participation does not rule out their chances of benefiting. To the extent that the information on the ruling futures prices is made available to farmers, the farmers benefit from price discovery. While the duration of the contract is important and the contract length of food grains is limited by storability considerations, prices based on short duration contracts can nevertheless help farmers in striking forward deals although not in planning production. Secondly, the futures prices help to even out seasonal price differences and sustain the demand from traders who operate in the futures market. However, the potential benefits can only be realized to the extent that the futures market effectively gleans information on market fundamentals and passes the correct signals.

6.6. Futures trading in India and the fear of Inflation

The origin of futures trading is not clear. Probably it had evolved naturally as a practice in human being's search for a way to manage their economic risk. Aristotle mentioned a person called Thales who entered into contracts with olive growers that were very similar to modern futures. The first futures exchange in the world was possibly the Dojima Rice Exchange in Japan established in 1730 to meet the needs of the samurai. In 1848 the Chicago Board of Exchange was established and exchange traded forward contracts known as futures were listed in 1864. Barely a decade later in 1875 futures trading in cotton began in a formal way in Bombay although informally and under various colloquial names similar indigenous practices had prevailed earlier.

Futures trading, world-wide has been associated with the fear of speculation. In a situation already marked by shortage, futures trading could intensify the problem. The colonial government therefore continuously regulated (Pavaskar 1985) and sporadically banned the trading in India at various times. With the World War II breaking out the trading was banned altogether under the Defence of India Act in order to ensure that supplies reached the troops on the warfront. Independent India's government did not have any reason to change the attitude as shortage continued in the food economy. Futures trading was allowed only in a limited number of agro-products and a Forward Market Act

was passed in 1952 leading to the creation of a Forward Market Commission (FMC) to regulate the market. Since 1966 the government decided to control the market for essential commodities through intense interventions and futures-trading was therefore completely banned. However even though the exchanges went out of business, informal trading in futures continued (Sahadevan, 2002[i]). The FMC's job was therefore more of policing illegal futures trading than to regulate. The fear of inflation was so ingrained with the prospect that since 1950 there have been as many as five committees in India, starting with the Shroff committee that looked into the prospect of futures trading. In1980, the Khusro committee recommended resumption of futures trade only in select commodities (cotton, jute, potato etc.). The pronouncements of the Kabra (expert) Committee on forward markets, in 1990 was the landmark development in recent times that led to the revival of futures trading in present times. The Committee recommended the strengthening of the FMC and also advised certain amendments of the existing Forward Contracts (Regulation) Act 1952 but the lack of unanimity among the experts is amply clear even in this Report. In 2003 the Govt. of India rescinded all previous notifications which prohibited futures trading in a large number of commodities and set the stage for a resumption of futures market in a regulated manner.

The policy change that followed the Kabra Committees' report, was consistent with the other measures of market liberalization both in the domestic and global markets. An enlarged futures market was proposed for hedging the risk and uncertainty that were inevitably associated with the opening up of the agricultural product market and for minimizing the "wide fluctuations in commodity prices" (Sahadevan, 2002). There was immense interest on the part of the traders that futures trading be permitted legally.

The FMC gave recognition to three national exchanges as the first tier of regulation. These were: National Commodity and Derivative Exchange (NCDEX), Mumbai; National Board of Trade (NBOT), Indore; Multi Commodity Exchange (MCX), Mumbai; and National Multi Commodity Exchange (NMCE), Ahmedabad. Earlier, trading in agricultural derivatives took place typically among small groups of dealers known to one another; whereas the new system, based on various terminals and computerized matching

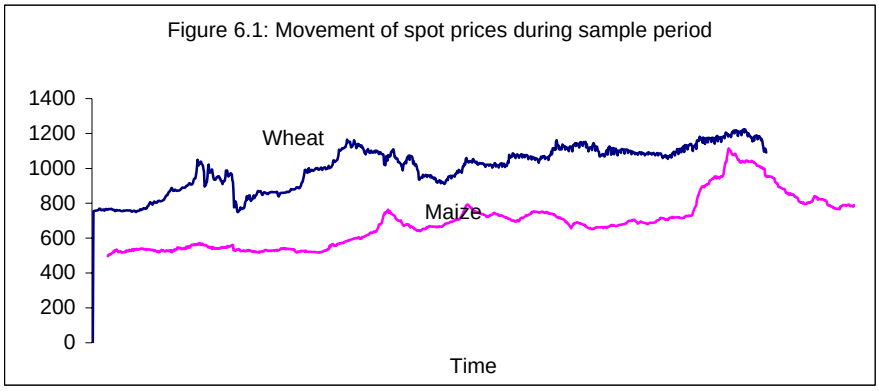
systems, meant a break with the earlier non-transparent price discovery mechanism. The development of the system and the regulations that evolved were modeled on the fashion of the stock market and SEBI in particular (Economic Survey 2004). The trading of wheat on the Chicago Board of Trade (CBOT) possibly testifies that such a practice was indeed suitable provided scientific standards, warehousing transportation, and communication were available in a competitive market. Various agricultural commodities were added to the list of traded items, including essential food items, such as rice and wheat. Besides, NCDEX has pioneered the concept of polling prices from the *mandis* through authentic agencies, and these prices contribute to the statistical database of the economy.

6.7. Data

The data used in this study consists of daily reporting of the National Commodity & Derivatives Exchange Limited (NCDEX) taken from the website *www.ncdex.com*. Two agricultural food grain commodities wheat and maize, that have had a futures market in the recent past in India are studied. Rice could not be taken up for study as trading was thin and data is inadequate. The periods covered in the samples were June 2005 to August 2007 for wheat (traded in Delhi market) and January 2005 to April 2009 for Maize (traded in Nizamabad market). Thus the data set is fairly updated and as much recent as availability allowed at the time of estimation.

Futures price is not reported on holidays and so the immediately previously reported price is assumed to continue till a new interest is declared. Similarly multiple prices if reported within a day are averaged to generate daily data. We have considered both *High* and *Low* prices registered in a day and averaged the two to obtain a single indicative futures price. Further, the futures prices relate to individual contracts with differing maturity times and these contracts overlap but do not run concurrently except for a brief span of time. For analytical convenience we have considered not only each contract separately but for the modeling purpose, the contract with the nearest maturity at each point of time is employed giving a series of (near) futures prices. Thus the futures prices

in our series do not obviously relate to a single contract and in fact transit from the first contract to the latest through the series of intervening contracts.



The plots in figure 6.1 show that prices have a rising tendency and suggest the presence of stochastic trend. An ADF test given in Table 6.1 finds that spot prices (SPP) and futures (near) prices (FNP) both have unit roots but the returns measured as Returns (X) = $\log(X_t/X_{t-1})$ are stationary. The ensuing analyses are therefore done with the returns data. Comparing the spot and futures prices (at Returns), table 6.2 finds that FNP are lower than the SPP by a small amount except for maize in which case they are almost same. The 'backwardation' behaviour[‡] discourages us from believing that the futures price has led the spot price upwards. All the values are positive suggesting positive movements of prices. The distributions are non-normal, the skewness at the average being negative, indicative of gains being more plausible than loss, but the kurtosis risk i.e., chances of occurrences of extreme values is as usual high.

Table 6.1. Unit root test for spot prices		
ADF statistics	Wheat	Maize
At Level	-2.002224	-1.300461
At Returns	-16.28671*	-11.16726*
* Significant at 5% level.		

[‡] A backwardation starts when the difference between the forward price and the spot price is less than the cost of carry over.

Table 6.2. Descriptive Statistics of Prices				
Crops	Wheat		Maize	
Statistics	SP	FN	SP	FN
Mean	0.000418	0.000342	0.000359	0.000361
S.D	0.011935	0.015244	0.006504	0.012758
Skewness	-2.762425	-1.568795	-0.223451	-0.151771
Kurtosis	27.30788	34.43133	10.29346	14.52777
J-Bera	14809.96	23780.26	2867.715	7142.221
Prob.	0.0000	0.00000	0.00000	0.00000

6.8. Merits and apprehensions: Examining the truth

Despite a clear intuitive rationale for the efficiency enhancing impact on a market characterized by uncertainty, real life experiences have not proved the worth of futures trading to dispel the deep suspicions that surround the futures market. Nowhere is the dilemma more compelling than in the case of agricultural commodities, in which political economy factors intensify the sensitivity of the issue.

This analysis studies the price movements of two dominant farm products in India that have been traded on the exchange and seeks to disentangle some of the complex inter-relations that possibly tie the open market and the futures market with each other. Time-series econometric methods using the GARCH model that takes account of the information set presented from past experience form the basic tool of analysis.

Rising prices have been a source of discomfort in the Indian polity from the middle of 2005. Whether movements in the international market and speculation in the wider market may have had a role besides factors like the diversion to bio-fuels are not clear. Moreover, demand for food in India is expected to increase with the reduction of poverty even as production has shown indifferent performance. Nevertheless, the role of the domestic futures market could not be absolved. The Sen Committee appointed to investigate the matter could come out with no conclusive result nor with a specific suggestion for the withdrawal of a ban that was imposed on trading in Rice, Wheat, Urad and Tur. Prof. Sen however in his end note inferred that futures trading can 'obviously' affect market price since this impact is what the futures market is all about. The ban was lifted in 2009.

The futures trade may not have been operating in an efficient way (Ghosh, 2009) especially in view of the obsessive monitoring and near-immobilizing regulations that hardly allowed the market to function by its principles. In a well performing futures market where futures prices are regularly used by the physical the market functionaries for reference, the correlation between the prices in the futures and the physical market is expected to be strong (Pavaskar, 2008). We have calculated the correlation coefficient between the two daily prices (spot and futures) for each futures contract and since a considerable degree of variation was noted across contracts, in Table 6.3 the distribution of the number of contracts is only provided, categorized by the correlation coefficients. It is interesting to note that negative correlation between the futures and the spot prices constituted the largest class of contracts in maize and a considerable share (about 22%) in wheat. The frequencies are relatively thin in the two lower brackets marking correlation coefficients varying from 0 to 40% but concentration is reasonably high on the two brackets 60 to 80% and 80 to 100% especially in wheat. It was also noted that in the case of maize high correlation recorded in any contract period was frequently followed by a contract period that showed little or even negative correlation. In wheat over 18% of the contracts recording high correlation (coefficient over 0.6) were followed by low (less than 0.2) correlation and in the case of maize this share exceeded 50%. This suggests that panic and systematic interferences could have restrained the functioning of the market and was responsible for this poor performance.

Table6.3 Distribution (%) of Total number of Contracts in Correlation (%) classes

	<0	0-20	20 -40	40 -60	60 -80	80 -100	Total	60 -100 Followed by <20
Wheat	21.74	8.70	8.70	13.04	21.74	26.09	100 (23)	18.18
Maize	41.18	9.80	1.96	15.69	17.65	13.73	100 (51)	56.25

Notes: Figures in parentheses are total numbers of Futures contracts. The last column gives the %share of contracts showing correlation above 60%.

One expects the futures price to incorporate more information on market fundamentals than available normally through past experience. To the extent that futures price itself is guided purely by the news brought in by the movements of past prices there is little

additional gain and the likelihood of speculation is exacerbated as the response of the futures price (ideally) also feeds into the actual price potentially setting up a price spiral.

In the ideal case

$FP_{ti} = E_t(SPP_i / I_t)$……. (6.2)

Where FP_{ti} is the futures price in i-th contract at time t and SPP_i is spot price of i-th period , I_t is the complete information set at time t, E_t is the expectation function at time t for a future event and the contract is denoted by its maturity time.

To the extent that FP adds more information than what is available to the agents normally, say represented by a subset $ISUB_t$,, the futures market is useful in making the market more efficient. This is the function of price discovery. Further, if the futures price FP is itself determined by the same information subset, it is in effect a result of the same price dynamics and has limited usefulness. The complexity of the issue is well recognized in the financial literature in which derivative prices, especially in equities, have been modeled and analysed with attention to information transmission between the derivative and the underlying markets (Alphonse, 2000), Kenourgios, 2004, Bose, 2007).

Trading volume may incorporate relevant information on market,(Floros and Vogues, 2007). One appealing rationale for this hypothesis is that the volume of transactions in futures market could be a measure of the speed of market evolution (Clark 1973) and perhaps reflects on the arrival process of new information that could be either sequential or complete. In the former case expectations and thereby responses could be diverse among the players (some traders adjust their expectations up and others down) leading to active trading.

6.9. Modeling of prices

The behaviour of prices is described by the modeling of the usual statistics related to the first two moments namely mean and variance. We have used the standard GARCH model for describing price movements (Engles, 1982, Engles et al, 1993, Bollershev 1986). In the absence of the futures market, the information subset ISUB may be visualized to be the set of past prices so that

$ISUB_t = [P_{t-1}, P_{t-2}, P_{t-3}, , P_{t-k}\}$ and the mean equation is

$$P_t = \alpha + \Sigma [\beta_i P_{t-i}] + \varepsilon_t \ldots\ldots \qquad (6.3a)$$
$$i = 1, 2 \ldots k$$

For the GARCH model the variance equation is

$$h_t = \omega + \Sigma \alpha_i \varepsilon_{t-i}^2 + \Sigma \gamma j h_{t-j} \qquad (6.3b)$$
$$i=1, 2, \ldots, m \qquad j=1, 2, \ldots.n$$

Where ε_t is the error or innovation (Patterson, 2002, Chakravarty, 2007).

Agricultural prices are expected to have seasonal movements depending on the distance from harvest time. Dummy variables for all the months (less one) of the year are used in the equations. On observing the coefficients, the turning point month (where coefficients change sign) is treated as the base in the reported equation. The lag lengths (memory) are decided using the AKAIKE criterion and the t-statistics after subjecting each specification to a test of residual ARCH effect and checking the Q-statistics of the squared residuals. Since non-normality is observed in the ordinary residuals, heteroscedasticity corrected equations are estimated to report the robust standard errors (Bollershev et al 1992) in all cases.

Finally, for each equation sign bias tests are conducted to satisfaction on the standardized squared residuals (Glosten, Jagannathan and Runkle (1993)). The selected specifications and estimates are provided in Appendix Table 6A.

6.9.1. Results

Wheat price is impacted by 8 lags in the mean equation and 3 lags of ARCH terms in the variance equation. The month dummy coefficients showed that prices peak in January (before harvest), remain low and again rise from November. In Maize, the GARCH (1,1) model performed best with three past values appearing in the mean equation. The seasonal behaviour is different from wheat, there being two peaks one in December-January before rabi harvest and the other in May-June in the kharif growing season. It may be recalled that maize is grown both as a kharif and rabi crop in different parts of India and the bi-modal distribution may be on account of this.

6.10. The Effect of Futures Trading

Since in an efficient market, without futures-trading traders would any way make use of all available information for their buying and selling decisions, the institution of futures–trading would add value to the efficiency of the market only if it provides additional information for market functioning. We examine the impact of futures trading by considering the effects on both price changes and its volatility and by considering also trading volumes apart from the futures-prices as a parameter.

We first ask if the futures price adds more information to the information subset already available. If the futures market conveys nothing extra to the agents trading will not be very useful. This test looks at the significance of the lagged futures prices in the mean and the variance equations. We also look for the effect of trading volumes on the market and the validation of such an effect would reflect on the process of information dissemination and the speed of market evolution as it moves towards equilibrium.

SPP_{ti} = f($ISUB_t$, $FNP_{t-1,}$ FNP_{t-2}…) …….. (6.4a)

SPP_t =f($ISUB_t$, $FNP_{t-1,}$ FNP_{t-2} , $FVOL_{t-1,}$ $FVOL_{t-2...}$)…..…… (6.4b)

Equations are estimated with and without the variables indicating futures trading namely FNP_t and $FVOL_t$. The Z-statistics of the coefficients of equations with futures prices are presented in Table 6.4. The lagged futures price movement has a positive pressure on price movement but in maize the pressure is also on price volatility. In case of wheat two lags in futures prices are significant variables. Trading volume has a negative effect on price volatility in case of maize. The double harvest may have a role in this confusion and indecision among traders reflected in the volatility.

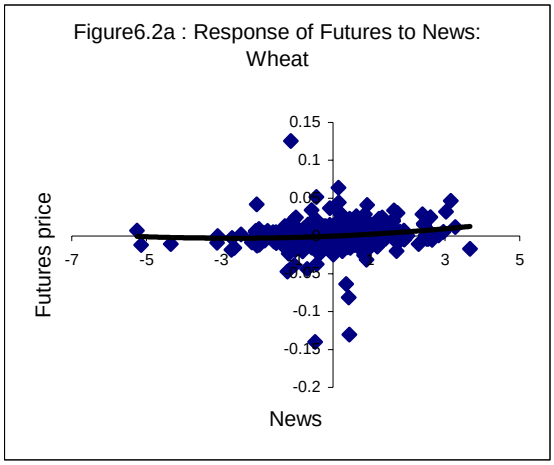
Table 6.4. Z-statistics in Equations with Futures Prices as variables

Using future prices in mean equation	Wheat	Maize
FNP(-1)	3.3794 **	5.165**
FNP(-2)	2.5557**	
Using FNP in variance equation		
FNP(-1)		8.186**
FNP(-2)		
Using Trading volume in mean equation		
Vol(-1)		
Vol(-2)		
Using trading volume in variance equations		
Vol(-1)		-3.598**
Vol(-2)		
** Significant at 1%.		

6.10.1. The effect of Spot market dynamics

To the extent that the futures prices signal the current market developments by their own merit, they act as a medium of information transfer rather than the reason for the price movement even if the results is inflationary. If on the other hand, the futures price responds to news signified by the spikes or deviations in spot market price movements and in turn transmits the information to future spot market prices, the meaningfulness may be eroded and the implications may be cause of apprehension. In India, futures-

trading has been blamed for fuelling speculation and inflation which could mean that any inflationary expectation could be scaled considerably by the futures trading activities. Figures in 6.2 plot the futures prices against the lags of the standardized residuals or the 'news' estimated from equation 4. Interestingly, deviation from the expected value of price movement in either direction has tended to positively impact the movement of futures price though the rise of the curve is rather sharp in the positive axis relative to the negative shocks. A statistical test for a possible asymmetry becomes necessary.



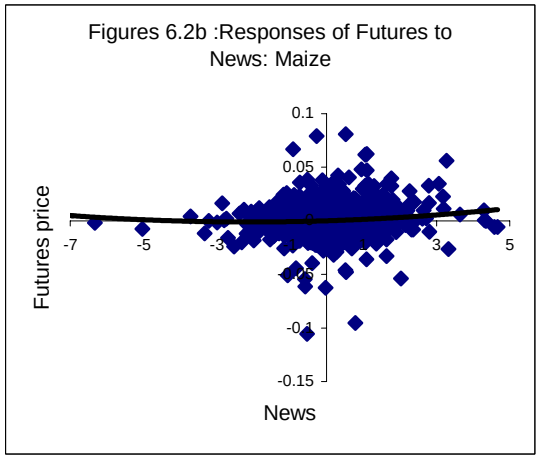


Table 6.5 The effect of carried over news on Futures prices: T-statistics of Positive and negative residuals of previous day

Crop	Wheat (Equation excluding Futures)	Wheat (Equation including Futures)	Maize (Equation excluding Futures)	Wheat (Equation including Futures)
e+	2.915**	2.389*	3.794**	3.595**
e-	0.070	1.934*	-0.448	0.399

We enquire if the news of unexpected positive (positive) price movements could differ from the case when the news is negative by estimating the following equation:

$$FNP_t = a_0 + a_1 e_{t-1}^{-} + a_1 e_{t-1}^{+} \quad \text{.....} \quad (6.5)$$

Where (a) $e_t^{+} = 0$ if $e_t < 0$ or $e_t = 0$ and $e_t^{+} = e_t$ otherwise and (b) $e_t^{-} = 0$ if $e_t > 0$ and $e_t^{-} = e_t$, otherwise are innovations at time t, (see table 6.5). Both the equations that have the futures variables in them and those that do not are used for generating the shocks and the

t-statistics of the coefficients for positive and negative signed shocks on futures prices are reported. Asymmetry of behaviour is marked in all cases of news transmission but with important differences. For wheat and maize positive innovations in prices have positive and significant effect on the futures prices but when innovations are negative, neutrality is largely marked thus indicative of a possible speculative nexus with price rise.

6.11. Comparisons with post-Futures Ban situation

Wheat futures-trading in wheat was banned in February 2007 owing to suspected inflationary impacts on the economy though trading continued for a while in existing contracts. This allowed us to have a comparative view of pre and post banning situations. While the whole period of sample covers June 2005 to April 2009 we consider separately two sub-periods, one when active futures trading took place June 2005 to April 9th, 2007 and the other when futures trading remained suspended April 10th, 2007 to April 2009. The terminal points of the samples take account of the financial year, the contract date and the availability of the data. We look at the signs of the coefficients of lagged prices on current prices and ask if futures-trading has intensified the effects through inflationary expectations through transmission of price shocks. For wheat we find a positive effect at lag 1 in the sub-period of active trading as compared to a negative effect of the previous day's price movement. Such a sign change is also observed at lags 5 and 8. Further we also estimate the equation for the whole period but use a dummy variable for the sub-period when trading was permitted. The effect of the trading is found positive on the mean and negative on the variance. Thus the ban period could be associated with steadily rising price. Part of this effect could be accounted for the access to news on international market that the institution facilitated.

Table 6.6. Wheat prices in the whole sample period and sub-sample period of futures trading				
	Whole period		Sub-period	
	With dummy variables (N=1165)	With no dummy variables(N=1 165)	With Futures trading FT(N=565)	Futures trading was banned (N=600)
Mean equations				
Lag1	-0.102**	-0.079*	0.191**	-0.317**
Lag2	-0.006	0.003	-0.068	-0.70
Lag3	-0.065	-0.05*	-0.127**	-0.078*
Lag4	-0121**	-0.115**	-0.061	-0.147**
Lag5	-0.116**	-0.115**	0.039	-0.134**
Lag6	0.298**	0.32**	0.101*	0.387**
Lag7	-0.108**	-0.104**	-0.112*	-0.054
Lag8	-0.053	-0.058**	0.047	-0.11*
Dummy for futures trading				
Mean equation	0.0011*			
Variance equation	-0.000*			
Note: * Significant at 5%, ** Significant at 1%,				

6.12. Concluding remarks

The relation between the futures market and the spot market in determining prices is a subject of considerable complexity because of the close and profound interactions between the two markets. The time series analyses of data on two food crops traded in futures market confirm the positive effect of future trade on price movements. Thus the analysis infers that futures-trading does have a value addition effect on market.

However these results do not necessarily suggest that futures market only makes the underlying more efficient. The movements of the futures prices themselves indicate a strong and asymmetric feedback from the underlying markets raising a classical case of speculation when a situation of rising prices leads to expectations that prices would increase further and the consequent market responses that not only help to realize the

expectations but also have further spiraling impact. In this case futures market is not necessarily adding any new information to the market but only processing the available information in an uninformed and biased way.

Thus, while the institution of futures trading has the potential of making the market more efficient by helping farmers discover price and hedge risk, serious attention needs to be given to enable the market acquire information from a broader spectrum in an objective manner and the players need to process such information efficiently too. The futures market is not the only market based option and can be further reinforced by the development of scientific research based Market advisory services. It may be noted that the subject of forecasting has made impressive strides in Econometrics and Statistics. Evaluative studies have shown that professional advisory services using scientific methods on effective marketing, participation in derivative trading and seasonality of sales heave succeeded in helping farmers to 'beat' the market (Cabriniet al., 2007).

Appendix

Table 6.1A. Models of Prices behaviors		
	Wheat	Maize
Mean equations		
No. of Lags	8	3
Constant	0.0007	-0.001
Dummies		
Jan	.004*	0.002**
Feb	-0.002	0.0006
Mar	-0.002*	0.002*
Apr	-0.004*	0.001*
May	-0.001	0.002**
Jun	0	0.003**
Jul	0	0.002**
Aug	-0.001*	base
Sep	base	0.0003
Oct	0.002*	-0.002
Nov	0.002*	0.0008
Dec	0	0.002*
Variance equations		
No. of ARCH lags	3	1
Cont.	0	0
AIC	-6.58137	-7.42
SBC	-6.47195	-7.34
Log L	3822.453	4790.38
Model	GARCH(3,1)	GARCH(1,1)
ARCH LM test (F-statistics)		
Lag 1	0.736957	0.12
Lag 2	0.428565	0.32
Note: * Significant at 5%, ** Significant at 1%, F-statistics in ARCH LM test are insignificant at 1%.		

7. Managing production risk through Market: Crop insurance*

7.1. Introduction

Agriculture is recognized to be much more risk-prone than most other activities. A substantial part of the risk in this occupation arises because the activity is conducted in conditions exposed to nature, unprotected from the vagaries of the weather. Good farming practices and early warning for timely corrective measures are the best possible ways available for risk management. Even so, agriculture remains to be a risky operation and a case for a risk market is strong.

While trading in risk in the free market may be motivated simply by its commercial appeals, the governments of nations usually become active in promoting insurance for agriculture. This is both because risk in agriculture is associated with many grave implications that are adverse to the society at large and because several hindrances come in the way of a market for risk from forming by free market forces. In this Chapter we review the results of the government's effort in providing multiple peril yield insurance to farmers in a market compatible way and in the process understand the how demand for insurance is determined. Theoretical issues are discussed in section 7.2 and 7.3, Section 7.4, 7.5 and 7.6 present the case of crop insurance in India and its financial performance. In Section 7.7 and 7.8, the measurement of yield risk is considered and the appropriation of the threshold yield as a parameter is assessed in this context. A mode for univariance demand is presented in Section 7.9 which helps to understand the responses to the parameters of the contract and 7.10 makes observations on the constraints to the success of the scheme.

7.2. The need for Crop Insurance

Farmers customarily undertake various measures to protect against and cope with risk. Some of the methods used by the farmers are ex-ante and relate to productions decisions such as the use of low yield varieties of seeds, staggering of planting time, fragmentation and scattering of plots to diversify the exposures, intercropping, crop diversification, share cropping, reduce the quantum of purchased inputs. Most of these strategies have negative implications for efficiency. Diversification, the most dominant strategy, prevents farmers from the reaping the benefits of specialization and includes less lucrative products in the choice basket. Admittedly, a few methods like conservation of soil moisture, drainage, integrated pest management, development and application of suitable irrigation technologies help to reduce risk while having superior effects on productivity and sustainability.

Ex-post methods of coping, adopted after the occurrence of the unfavourable event are not only distressful for the farmers themselves (Mellor, 1969) but they can also mean difficulties for other members of society. The visible effects of such risk management practices could be dissaving and debts, loans taken under distress at high interest rates, liquidation or sale of land and animals, mortgage of assets, search for off farm employment and migration to cities. The farmers would compromise on their expenditure on consumption that reflects on nutrition, health and children's education. Distress migration leads to the disruption of their normal social life and causes congestions in urban areas. In extreme cases farmers may sell their farm lands and exit from agriculture.

No government can be blind to the distress of the large section of people involved, nor the short term and long term consequences of risk on production and macro economic stability. Agricultural risk therefore translates to budgetary support, such as through drought or flood relief, debt forgiveness, interest waivers. All this has developmental and political costs. Worse, since lending to farmers becomes risky, the banks are hesitant to extend credit to agriculture, which becomes resource starved and stagnant. The long term effects of risk are formidable (Jodha, 1978). The shock of a one time unfavourable event

on the farmers' resources and the general aversion developed in banks towards providing farm credit have staggered effect on agriculture forming a vicious loop.

Insurance basically is trading in risk and in principle could be governed by demand and supply forces since it has a utility for those who are affected by risk. However experiences in other countries and India's own experience on a limited scale have shown that a market for insurance is not readily formed due to several specific features characterising agriculture. With this understanding the government has taken up the role of facilitating the formation of new and appropriate institutions for agricultural risk to be traded by market rules. With this end the National Agricultural Insurance Scheme was launched in 1999-00 whereby farmers can pay a price as the premium for coverage of their risk to the insurer and in turn be liable to claim an indemnity as damage in case the crop fails to deliver a guaranteed yield.

Agriculture has been found to be afflicted by several common perils some of which could be quite devastating. The events lead to complete or partial crop loss for farmers who have invested their meager resources in the project. The events identified as threats also vary among regions and countries[1]. Some of the common perils to which crop production is a victim in India are (i) droughts, floods, untimely rainfall or dry spells, (ii) hail-storms, winds, thunder storms, frosts, (iii) pests, diseases, insects. Broadly there are three ways in which a successful crop insurance scheme can contribute to the agricultural sector.

***** This chapter draws on a joint work with Yogesh Bhatt of the same department and is under further development as a paper

1 For example, droughts are common in Africa and in parts of India while Hurricanes are common in America and windstorms in the Caribbean islands. The Pacific islands are prone to volcanoes and earth-quakes. Tsunami affects the Asian countries. If global warming is realized as projected and is not reversed, the frequency of extreme events will go up making agriculture more risky.

Stabilization of income

Any bad year in terms of crop production can throw cultivators, many of whom cultivate small holdings and are resource poor to start with, into indebtedness and destitution. Thus crop insurance by offsetting the damages caused by a one time event helps to stabilize incomes of farmers over time.

Efficiency

Farmers try to reduce their risk exposures by avoiding crops and technologies that present uncertainty even if they are lucrative in normal circumstances. Similarly, being risk averse (Binswanger, 1978, 1980), they diversify the cropping-pattern, include safe but less profitable crops in the basket thereby losing the advantages that may come from specialization. Their resource use decision is subject to their perception of risk and diverges from the one that is dictated by optimality consideration (Ahsan, Ali and Kuren, 1982). Insurance, by covering the risk could induce farmers to use resources optimally.

Rural credit

Crop insurance can partially act as collateral, in which the insurer pays the indemnity directly to the lending bank in the event of crop loss. Apart from reducing the risk of the lender and protecting the health of the institutions, crop insurance by helping to recover loans maintains the credit eligibility of the borrower regardless of any short term contingency.

The usefulness of a crop insurance scheme gained relevance in context of the current reality. In the past, state intervention in the form of subsidies, minimum support prices and a multitude of controls on the market successfully helped Indian agriculture to tide over the challenges, embrace a new technology and provide farmers the incentive and support for production. Market liberalization the regime was expected to leave farmers exposed to a much more uncertain environment and to cope with their own vulnerability

to natural events. Protection and support to that extent are no longer an option in today's scenario. Crop insurance could be an important instrument for protecting farmers against risk and also in encouraging credit flow to agriculture. It is equally pertinent today that the crop insurance product should be consistent with market principles and the scheme should be financially viable. Thus the government's role would ideally be as a facilitator or at best an initiator guided by an infant industry argument for creating an unformed market and not one of a subsidiser to the venture.

7.3. What keeps the market for crop insurance from farming

The essence of insurance lies in the possibility of pooling risk from a large number of similarly exposed individuals, and a commercial insurance company that buys part of the farmers' risk is an institution that can determine what price to charge for the risk. This helps the insurer to fix the premium on coverage. The company collects premiums from all participants and indemnifies the loss makers. However, agricultural insurance as a market instrument faces severe limitations.

The emergence of a market for crop insurance has been slow in most countries. Farmers' participation is poor and private enterprises have not shown interest. In fact, government support has been important where ever an insurance scheme existed. The failure of the market to build up is usually attributed to several problems, adverse selection being the foremost among them. Other possible problems include covariate risk (the same event afflicts large numbers of clients), mismatches between demand and supply prices (farmers cannot afford the premium or in other words, the demand and supply do not match at any admissible price), huge administrative cost involved (especially for information collection and monitoring) and moral hazard (the insured farmers take less care of the crops than they would otherwise have).

7.3.1. Adverse selection

Adverse selection arises because the clients have more knowledge about their own distribution of probable losses than the insurer. For a multi-peril insurance, assigning probabilities of loss at the farmer level to determine the acturially 'fair' premium rates is a nearly impossible task. An insurer is compelled to charge a premium based on an average measure of risk, which would mean that the less risky farmer has to pay a relatively high premium rate while a more risky farmer is charged a low premium. As a result more risky members will purchase insurance in greater proportions than persons with less risky profiles generating an imbalance between the premium revenues and the indemnity payments. If the investor reacts by raising the premium rate, the still less risky among the participants will drop out and the financial performance of the company will deteriorate further. Adverse selection can be combated by collecting better and farm level information and efficient risk classification but all that requires enormous cost and effort.

Some of the easier solutions to overcome adverse selection are enumerated below.

(a) Compulsion: Making participation in a crop insurance programme compulsory is a way to overcome the over-riding problem of adverse selection. Yet, compulsion is a coercive measure, should be supported by state authority and so it is not market consistent. It may be resisted.

(b) Linkage with bank loans: This is a way of imposing selective compulsion where participation becomes compulsory for all those who borrow from the banks. Besides ensuring a larger and more balanced pool, this linkage has two other advantages (a) prevents loan defaults from undermining the banking business and (b) economizes on administrative cost by entrusting banks with the duties of managing premium collection and claim disbursal as a marginally additional burden over the loan business. The compulsion may be justified as an additional condition so that the farmer has an option of not agreeing to participate. On the other hand it makes institutional borrowing more costly and discourages farmers.

(c) Area level assessment: This is an alternative to the usual individual based insurance in which the premium and loss assessment are determined at a suitably aggregated level. This level has to be decided on the basis of homogeneity so that all farmers in an area unit will have similar if not identical risk profiles. This eliminates the need for information at the farm level since the area level information will do[2].

(d) Index based Products: Index based products are easier to handle as indemnities are triggered by an easily observable, measurable and independently verifiable extraneous event such as a particular temperature or rainfall. This approach suffers from basis risk and has a less broad based appeal. Due to microclimatic differences and the quality of information, the individual's risk may not correspond with the index.

7.4. Crop insurance in India

In India the multiple peril crop insurance programme has a long history (Mishra, 1996) and the evolution was marked with doubts and disruptions[3]. The experiences of other countries having crop insurance provided enough discouragement to the venture (Hazell Valdes, 1985, Hazell, Pomareda and Valdes, 1986). Outside India insurance against a single peril[4] was not unknown in Europe and U.S.A in the 18th and 19th centuries but multiple peril insurance is a relatively new concept and evolved in the 20th century in most countries. USA and Japan have two of the oldest crop insurance programmes. After the initial hiccups, the market for crop insurance in India started evolving due to the forces of demand and supply and with active inspiration of cooperative societies in the 1970s but an innovative area-yield insurance scheme, developed by Dandekar and the General Insurance Corporation (GIC) was piloted in limited areas India in 1979-80,

[2] The area yield insurance not only operates at the aggregate level but also pools diverse regions (units). Thus it reduces problem of covariate risk and the possibility of moral hazard as indemnities are determined by the aggregate rather than individual performances. The main drawback of this solution is the failure to attend to individual or idiosyncratic risks.

[3] The (Expert) Committee under the Chairmanship of Prof Daram Narain advised against launching the scheme in view of the cost involved and the availability of other ways of achieving the purpose.

[4] Insurance against frost in Europe and against windstorm in USA were other such early examples.

leading to a more ambitious scheme known as the Comprehensive crop Insurance scheme (CCIS) being initiated in 1985-86. The CCIS grew in size and expectedly gave way to a national level, extensive and sufficiently flexible insurance scheme named as the National Agricultural Insurance Scheme in the rabi season of 1999-00. The NAIS was initially implemented by the GIC that helped in its formation but in 2003 the task was handed over to an autonomous organization called the Agriculture Insurance Company of India Limited. The NAIS started with limited government support but was expected to become viable and commercially independent within a span of time. The scheme is multiple-peril type but offers comprehensive insurance to yield losses due to a few named risks mentioned

7.4.1. Parameters

The NAIS is mostly an area based[5] scheme although on an experimental basis for localized calamities is given. The unit of insurance is an 'area', the demarcation of which is made on the basis of homogeneity. The unit is to reach the gram panchayat level in three years[6].

Insurance is pooling of risk. Crops differ in their vulnerability to different events raising the case for diversification even without insurance. The NAIS covers food crops (cereals,

[5] The area-yield insurance (AYI) is a design to circumvent many of the difficulties that foil the insurance market (Skees and Reed, 1986, Miranda, 1991). Risk is pooled not from individual farmers but from various groups of farmers or 'areas' and indemnity is assessed uniformly at the area level. The concept of an 'area' is based on the possibility of sufficient homogeneity existing within the unit so that the majority of the farmers in the unit are likely to encounter a loss simultaneously and the risk exposure of a representative farmer will be similar to the average risk of all the farmers in the area. The farmers receive indemnities at the same rate when the area yield falls short of its normal regardless of their own losses. The indemnity is calculated based on the contract size and the yield shortfall and no payment is made when the area level yield is above the normal level. It is to be recognized that homogeneity is a elusive idea and the possibility of basis risk when the individual suffers a loss even as the majority do not, cannot be ruled out. Ideally, the individual's yield shortfall should be attended to, but AYI offers only a second best solution to the individual based scheme.

[6] At present the unit could be a Taluk, Hobli or Panchayat given the minimum area to be 500 ha., 200ha. And 100 ha. Respectively.

millets and pulses), oil seeds certain annual commercial/Annual horticultural crops. The set of commercial and horticultural crops have been enlarged over the years. The larger the number of crops more varied is the pool but the availability of adequate past (10 years) yield data is a basis for the choice of crops. A requisite number of crop cutting experiments (CCE) are required during the season. Today the scheme also covers various categories of farmers including tenants and share croppers and both loanee and non-loanee farmers.

While an area based scheme can reduce the chances of moral hazard and covariate risk from coming in the way, adverse selection is a problem that is hard to solve. It is also not a complete solution. In NAIS compulsion is linked with credit so that insurance is mandatory only for all farmers growing notified crops and availing seasonal agricultural operations (SAO) loans from financial institution. All other farmers growing notified crops can also opt for the scheme voluntarily. The NAIS also extends to all states and UTS but without compulsion. The states opting for the scheme will however have to take up all the crops identified for coverage and will have to continue for a minimum period of three years.

The NAIS is a yield insurance and covers not the unfavourable events but their outcome. In other words, if the yield of a crop falls below a specified level only then a loss is deemed to have incurred. To determine the specified minimum yield, a threshold needs to be calculated based on past information. Further this threshold will be compared with the actual yield recorded in the area in the current period to assess the loss incurred if any. Information on crop yield on a regular basis and at a sufficiently micro level becomes essential for the conduct of the scheme. The area based scheme is effective in economizing on this investment on information making farmer level actual yield information irrelevant.

7.4.2. Threshold yield

Using last ten years data of crop yields, areas are assigned levels of indemnity (LOI) at 90% and 80% and 60% and thereby classified into three risk groups namely, low risk, medium risk and high risk. The threshold yield (TY) of a crop in the unit is the moving average based on past three years yield in case of rice and wheat, and five years on case of others, multiplied by the state LOI. If the actual yield per hectare of the insured crop in the area based on the CCE falls short of the specified TY, then all the insured farmers growing that crop in the defined area are deemed to have suffered a loss.

Indemnity= [(TY- actual yield)/TY] of area X sum insured of farmer

7.4.3. Premium

The premium rates are basically the prices for insurance and in a situation of competitive equilibrium they should reflect the marginal utility from coverage whereas from the suppliers' side they should take account of the cost of insurance which includes the cost of risk. However, for food grains and oilseeds the premium rates in India are far from market determined. Indeed the maximum bounds are fixed by the government based on welfare criterion. Part of this imposition can be justified because coverage is mandatory for farmers who borrow from institutional lenders. Premium rates are fixed at 3.5% for Bajra and oilseeds, 2.5% for other kharif crops, 1.5% for wheat and 2% for other rabi crops. For commercial crops the rates are necessarily actuarial. These rates are high sometimes exceeding 10% (for cotton it is around 42% in Rajasthan, 10% -15% in Karnataka and 11% I Tamilnadu, for groundnut it is 11% - 12% in Karnataka). The scheme foresees a transition to the actuarial regime but the actual rates shall be applied at the option of the states. Fifty percent subsidy on premium was initially allowed in respect of small and marginal farmers but this was to be phased out and at present 10% subsidy is given on the premiums paid by them, borne by the central and state governments jointly.

7.5. Penetration and financial success

Crop insurance constituted only 2.7% of the gross domestic product from agriculture of India and 9.5% of the gross cropped area and 10% of the farmers in the country are covered (GOI, 2004). The achievements are modest but Table 7.1 indicates a progressive tendency. A seasonal bias towards the kharif season and a high share of loanee farmers in the pool are matters of concern. The claim to premium ratio is still high but its decline over the year is a sign of improved of financial viability.

Table 7.1: Performance of crop insurance in India

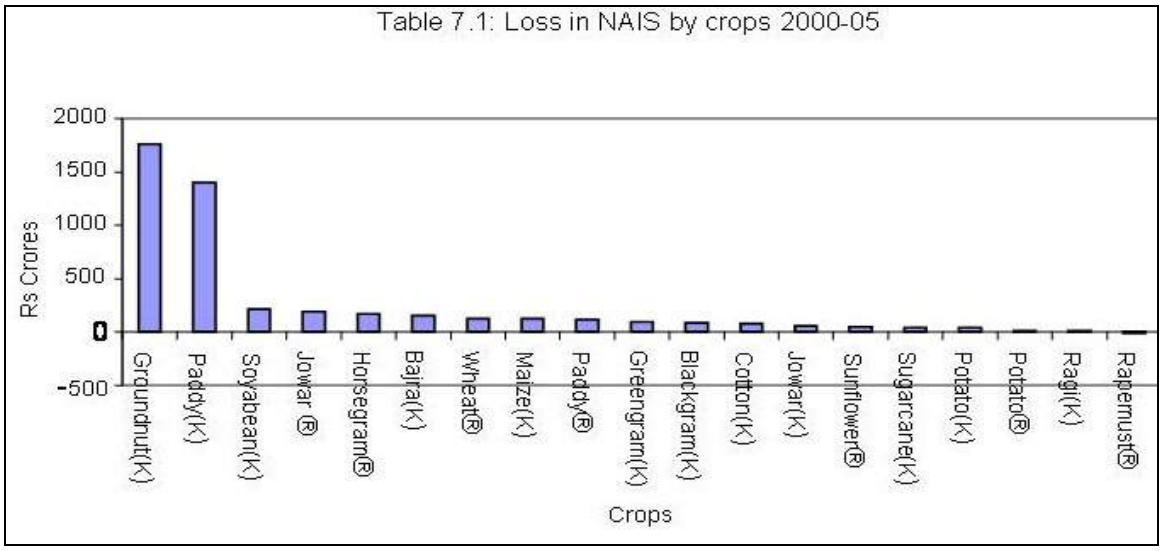
Year	Claim/ Prem (Cum)	Sum Insured			Insurance intensities		
		Total	Non-loanee	Kharif/ Rabi	Sum/ hect	Sum/ farmer	Area/ Farmer
		000Cr	%	Ratio	Rs	Rs	Hect.
2000	5.47	8.51	1.95	4.31	5208.46	8100.17	1.56
2001	3.50	9.00	4.02	5.01	5613.20	8449.08	1.51
2002	4.33	11.27	11.88	5.13	5758.38	9316.87	1.62
2003	4.04	11.16	14.40	2.66	5930.47	9008.65	1.52
2004	3.50	16.94	6.98	3.49	5721.34	10447.99	1.83
2005	3.27	18.59	5.56	2.67	6696.70	11112.65	1.66
2006	3.37	21.30	NA	2.26	7801.07	11892.26	1.52
2007	3.21	24.47	NA	2.28	8696.82	13270.48	1.53
2008	3.44	26.67	NA	1.42	10042.92	13925.29	1.39
Average	3.79	16.43	7.47	3.25	6829.93	10613.71	1.57

Note: Claim/premium is cumulated over years. NA-Not Available

Table 7.2: Loss in Crop insurance over the years Total

YEAR	Loss	Sum insured	Area insured	Farmers insured	Small farmers insured
	Rs crores	Rs crores	Mill. Hectares	Mill.	Mill.
2000	1047.44	8506.07	16.33	10.5	6.97
2001	266.43	8999.97	16.03	10.65	7.15
2002	1648.89	11269.24	19.57	12.1	8.19
2003	802.34	11163.62	18.82	12.39	7.68
2004	663.96	16944.70	29.62	16.22	10.37
2005	843.47	18582.97	27.75	16.72	10.28
2006	1680.7	21301.46	27.31	17.91	NA
2007	1039.79	24474.18	28.14	18.44	NA
2008	2807.43	26671.65	26.56	19.15	NA

The financial viability of the scheme indicates the success of crop insurance as a market driven product. The financial performance is measured by the loss which is the excess of pay-outs in claims over the revenue from premiums. If insurance can be viewed as temporal pooling of risk i.e., over the years losses in some years are made up by surpluses[7] then as Table 7.2 shows, the NAIS has incurred losses in all the years of its existence in 2000-01 to 2005-06, showing no signs of a temporal balance. The total absolute loss was highest in the year 2002-03 which was severely affected by climatic conditions and suggests that a catastrophe caused by one year's climatic conditions could take many years of normal performances to offset its effect.

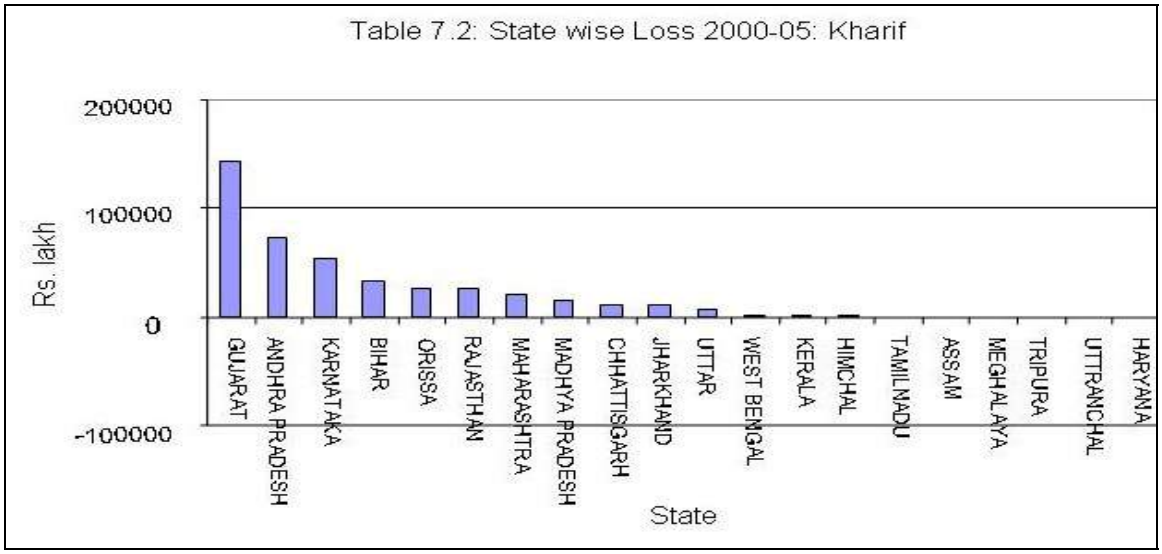


Note: K and R in parentheses stand for kharif and rabi seasons respectively.

Figure 7.1 shows that majority of the crops have generated losses and Groundnut in kharif season is found to have generated the largest loss to the NAIS followed by kharif paddy. Ideally one would like to see both loss making and surplus generating crops but the basket of crops insured has not contributed towards risk pooling at the given parameters of the scheme. Similarly we also find that there is little effective pooling

[7] The receipt will in general be expected to exceed the payments in good years and fall short in poor years when a large number of farmers claim damages. In principle, over a number of years the average receipt will ideally converge with the average expenditure.

across states as none of the states has generated a surplus. This is probably related to adverse selection but since it is fairly easy to classify the states by their risk profile, this can be corrected by appropriate pricing. It may be noted that Punjab the most agriculturally advanced state has not yet agreed to participate and Haryana was a late entrant and its participation rate is low. Gujarat, Andhra Pradesh and Karnataka lead in terms of their contribution to losses.



7.6. Classification by irrigation endowment

Although risk involves an element of unpredictability, irrigation endowment is recognized as a crucial determinant of risk in agriculture that is observable and can be a most obvious parameter for risk classification. For analytical convenience we have classified the thirteen major states into three categories Highly irrigated (HI), Medium irrigated (MI) and Low irrigated (LI) . HI is represented by states with irrigation intensity exceeding 50%, MI by states with irrigation intensity between 30% and 50% and states with irrigation intensity up to 30% are classified as LI. Going by official data 2002-03 we have classified the States covered by crop insurance The irrigation based categorization has little to do with proximity and geographic location as apparent in table 7.3

Table 7.3: Irrigation endowments of States with Crop insurance in three Categories 2002-03						
	HI (>30%)		MED (30%-50%)		LOW (<30%)	
	Name	Irrigation	Name	Irrigation	Name	Irrigation
1	Uttar Pradesh	70.3	Rajasthan	39.9	Madhya Pradesh	25.6
2	Bihar	57.5	Andhra Pradesh	39.2	Karnataka	24.5
3	Tamilnadu	50.5	West Bengal	36.7	Orissa	21.8
4			Gujarat	31.4	Himachal Pradesh	
5					Maharashtra	18.1
					Assam	5.5
Note: Irrigation = Net irrigated area/Net sown area (%). Source: Agricultural Statistics at a Glance 2005.						

Table 7.4: Crop insurance and Shares of State-groups in all India totals 2003-04							
	Sum	Sum	Small/ marginal	Cropped	Irrigated	FGOLS	COM
State groups	Insured	Insured	Holdings	Area	Area	Area	Area
	Rs/Hect.	%	%	%	%	%	%
High Irrigated	266.76	10.84	43.76	23.8	39.47	25.21	19.06
Medium Irrigated	861.59	43.49	20.98	29.56	27.16	28.18	34.20
Low Irrigated	651.47	45.6	32.84	40.99	22.32	39.86	44.79
Note:. FGOLS= Foodgrains-oilseeds, COM=Commercial. Source: AIC, Agricultural census 1995, Agricultural Statistics at a Glance							

Table 7.4 classifies three states in the highly irrigated category (HI), four in the medium (MED) and six in the lower irrigated class (LOW).

The medium irrigated category of states claims 29.6 % of cropped area of the total but 44 % of the sum insured and has the highest sum insured per hectare. The high irrigated category has a small 11 % share of coverage compared to its 24 % share in area and its 44 % share of small farmers in the country.

7.7. The Measurement of risk

That the coefficient of variation (CV) can be considered as a measure of risk is widely accepted and is implicitly recognized by India's insurance scheme the NAIS[8]. Associated with this is a tacit assumption that yield rates are normally distributed. The presumption of normality has been widely questioned in literature [9](Day, 1976). Although this proposition has inspired much investigation in literature (Moss and Shonkwiler, 1993, Nelson and Preckel, 1989), empirical studies have not generally been able to reject the normality hypothesis in practice.

The normality test is complicated by the usual nature of agricultural data. A time-series data of yield rates often used for analysis usually incorporates a time trend reflective of the secular progress of technology. Without suitable de-trending, the distribution will also reflect this trend. Tests such as the Wald-Wolfwitz run method Day, 1976, Chi-square test (Dandekar, 1976, (Rustagi, 1988) have been used to establish normality but not all of them corrected for the trend. Just and Weninger (1999) emphasised that for a normality test it is critical to deal with the random component only and so elimination of the deterministic component is a prerequisite and used a polynomial time function to isolate the random elements but using rigorous statistical tests, they could not rule out normality. Day's own experiments were also said to have been weak in rejecting normality.

To study the yield distributions we have detrended the yield rates of Kharif crops using linear time trend equations estimated over the period the years 1973 to 2005 for each irrigation based categories and for the aggregate sample. Since this period overlaps with a period when the effect of the agrarian technology generating the so called green

[8] The Level of Indemnity or LOI which is an input for the calculation of the threshold yield takes account of the coefficient of variation of yield over the last 10 years.

[9] One rationale provided for conjecturing a skewed distribution is that too much or too little rain or heat during any of the critical periods of plant growth such as sowing, germination, flowering and harvest, is sufficient to reduce yield drastically though ideal weather prevailed in the other periods. Thus common sense suggested that 'less than average yields' cases are more likely than 'greater than average' yields cases. Similar reasoning can also be found to favour a reverse argument.

revolution faded out, the trend is likely to encounter a structural change. The presence of structural breaks was examined using the Chow tests. Since the trend curves have indeed shifted in most cases between 1996 to 2001 and such shifts are likely not to be unobserved by the operating farmers, the trend equations need to incorporate these structural changes in order to obtain the random and unpredictable components around the expected values. As an example we can consider an upwardly moving series that has shifted downwards at a given point of break. If we fail to take account of the shift and measure the deviations around the linear and unbroken trend the distribution, even when normal, would tend to include a high proportion of large negative values typically projecting a positively skewed yield distribution which would be actually misleading. The trend equations at the aggregate level using flexible break points, based on data of crop yields over 1973-74 to 2005-06 are presented at the all India level in Table 7.5.

Table7.5: All India Time trend of crop yields with a break

Variable	Con.	time	time*dummy	Adj-R2	DW	F-stat	break
Ricekh	914.3	32.5	-7.4	0.86	2.50	6.1	2000
Ricerb	1820.5	44.6	-5.8	0.91	1.60	10.7	1998
Wheat	987.1	52.0	-7.8	0.96	2.3	18.6	1997
Maize	818.5	35.6		0.86	2.2		
Groundnut	683.3	9.2		0.23	2.7		
Soyabean	308.8	29.4	-8.2	0.61	2.6	5.3	2000
Tur	701.0	0.29	-0.7	-0.61	1.7	1.5	2000
Sugarcane	49909.6	840.3	-329.3	0.71	1.9	9.7	2000
Potato	10626.0	309.8	-39.8	0.82	2.1	3.1	2000
Cotton	104.8	4.34	1.6	0.86	1.7	19.2	2000

A positive time trend is noted for all the crops and a structural slow down detected in all but two cases at the all India level and nine at the irrigated regions. These detrended series are shown to be stationary by a simple ADF technique. One way of determining the degree of skewness of a data is to compare the numerical value for "Skewness" with twice the "Standard Error of Skewness" and the distribution is marked as significantly skewed only if the skewness is high enough. The risk measured both in coefficient of variation and skewness along with the J-B- test of normality are summarized in table 7.6. The signs of skewness of crop yield distribution were found to be dominantly negative. However there are only 5 cases out of the 40 estimated relations in which the skewness is

considered significant of which two are marginally so. Out of this there are two border line cases. When the normality test is done only 4 cases are identified as non-normal[10]. However, the coefficient of variation exceeds 0.1 in as many as 19 of the cases and most of these cases coincide with those noted for their skewness. Thus although it appears that there is a case for examining the distribution on a case by case basis, a broad association of risk with the coefficient of measure may not be unjustified.

7.8. The threshold and the Lower Band yield under yield dynamics

The determination of the threshold yield (TY) is critical in the crop insurance design. A threshold yield so low that it is rarely touched the actual yield in practice would imply that farmers would not be able to claim indemnity for successive years despite the continuity of premium payment. The meaningfulness of the TY for the farmer's decision to participate would depend greatly on what the farmer considers as a meaningful threshold. The threshold yield in India is usually criticised to be not high enough to mean any advantage for the farmers and it has been recommended even by a review committee to revise the formula in order to arrive at a high enough threshold yield to make participation rewarding.

Table 7.6 High Variation and Non-Normality of Crop yield

Irrigation→	HI	MED	LOW	All
Coefficient of Variation	Rice-Rabi, Soyabean,Tur, Maize,Cotton, Groundnut	Soyabean,Tur, Maize, Cotton,Gound nut	Rice,Kharif,Soyabea n, Tur(Arhar),Potato,Co tton, Groundnut	Soyabean, Cotton, Groundnut
Skewness^{+}	Tur,Groundnut, Sugarcane			Sugarcane
Skewness^{-}	Potato		Rice-Rabi	
J.B Statistics (Normality)	Groundnut, Sugarcane		Rice-Rabi	Sugarcane

Crops considered: Kharif Rice, Rice rabi, Wheat, Maize, Groundnut, Soyabean, Tur, Cotton, Sugarcane and Potato.

[10] Kurtosis is another feature of a distribution that needs to be checked when testing for normality and indeed it is important in most investment decisions on financial assets. In the present case kurtosis did exceed 3 in a number of cases. However a high kurtosis does not rule out symmetry, which is a justification of measuring the coefficient of variation around the mean.

The threshold is built upon a premise that the normal yield can be calculated purely by averaging the past yield rates. In a case of yield dynamics, it is normal to project the yield into the unknown future, especially when the progressive farmer incessantly perseveres to stretch the limits. A moving average of the past yields is inadequate to capture the movement. For example a normal yield of 200 obtained by averaging three consecutive realizations of 100, 200 and 300 would be no different from one obtained from unchanging realizations of 200, 200 and 200. The formula makes no distinction between a stagnant and a dynamic situation and in fact can prove to be a disincentive to progress. Formulas such as the average of a few best yield realizations of the past and exclusion of drought years from the calculation may be closer to the notional normal in practice but yet be theoretically inadequate in a dynamic situation.

Table 7.7: Comparison between Estimated Threshold and a Lower band Yield rates (average of 2000-01 to 2005-06)

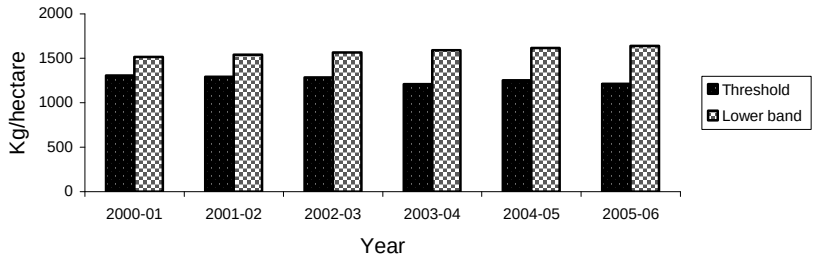
Region	Proportion	HI	MI	LI	All
Rice kharif	TY/(Y'-n.σ) (where n =1)	0.94	0.7	0.78	0.8
Rice rabi	TY/(Y'-n.σ) (where n =1)	1.47	0.86	0.93	0.88
Maize	TY/(Y'-n.σ) (where n =1)	0.79	0.75	0.75	0.74
Groundnut	TY/(Y'-n.σ) (where n =1)	1.1	0.78	0.73	0.74
Cotton	TY/(Y'-n.σ) (where n =1)	0.79	0.74	0.62	0.65

Note: TY= threshold yield, Y'= Trend yield, σ= standard errors of estimate

To make an assessment we have generated TY of major crops at the sate level using the threshold formula and the LOI values employed officially by the NAIS. The values so obtained are compared with a notional worst case scenarios given by the lower band value in our trend equations. When a deviation of one standard error is considered around the estimated trend value in general the TY is found to be lower than the lower band. The exceptions are in cases of rabi rice and groundnut in HI region. In the case of rice the threshold is only 80% of the lower band and is also low in the case of maize and groundnut and lowest for cotton. Although farmers' assessment is subjective, the threshold level by this demonstration appears to be too low in relation to the probability

of occurrence of the event. The figures given in Table 7.3 are computed averages over the years 2000-02 to 2005-06, the comparison is largely consistent.

Figure 7.3: A Comparison of the Threshold yield with the Lower band Yield using one stndard deviation for Kharif rice



7.9. The Demand for Insurance

An empirical model aimed at investigating the possible behavioral responses of farmers in insuring against risk to different relevant factors is presented in this section, we have considred the major kharif crops paddy, maize,cotton and groundnut for the exercise. Together these crops constitute over 70% of the total sum insured. Risk has been treated differently in literature and decision taking has been explained variously when the outcomes are probabilistic. The expected utility theorem is the most widely used model of behaviour under uncertainty (Pope and Ziemer, 1984) in which the expected utility rather than the profit that is maximised[11]. The mean variance analysis usually compares the two moments of the probability distributions across the relevant cases. In a typical mean variance analysis a decision D2 is preferred over decision D1 if a comparison of the expected values and the variances shows that $E_1 >= E_2$ and $V_1 <= V_2$ and one strict inequality holds where E is t he expectation and V is the variance. Under certain conditions the mean variance analysis coincides with the expected utility

theorem. In fact non-normality would be a violation of the consistency between the two approaches. Real life decision makers often act according to rules of thumb, habits or

[11] The expected utility approach was first postulated by Bernoulli and a set of axioms that were considered reasonable were shown by Von Neumann and Morgenstern to be sufficient for the validity of the theorem.

neighbours' and specialist (extension) advice rather than to optimality rules. Bounded rationality is a standard criticism to optimization based explanations. A more relevant and balanced approach probably for the Indian case where agriculture is dominated by small farmers for whom the penalty of risk is severe, is the safety first approach (Charnes and Cooper, 195) in which disaster is avoided. In this case the farmer may be hypothesized to optimize her objective function subject to the condition that her income does not fall below a certain minimum. Viewed from a different perspective the farmer may try to protect certain past attained income level.

We assume that there can be two conditions of production beyond control, Good and the Bad. The farmer invests in anticipation of a good condition prevailing (this may relate to weather or other factors) but also takes care of any contingency by way of insurance though he has to incur a premium cost. He takes insurance such that in the possible case of a bad condition, the indemnity from insurance is able to balance his loss of revenue (from that expected by him in the normal circumstance) leaving him with a minimum security balance of δ. In other words the farmer maximizes his expected returns subject to a minimum assurance of income.

A simplified model can be postulated as

$$\text{Max } [P_G R + P_B(R-L+c(X))] - p(X) + \lambda(R-L+c(X) - \delta)$$

Where R is the farmers' notion of what his returns would be under normal (Good) conditions and may be considered as a function of resources used and past experience. L is the notion of the shortfall possible in returns from R in case the conditions do not turn out to be normal. Like R the shortfall L may also be considered to be determined by the resources used and the past experiences of

losses. The Return functions under either condition will have the usual properties of concavity. The coefficients P_G and P_B are the probabilities of the prevailing conditions being Good and Bad respectively so that $P_G+P_B=1$. This of course is a simplified representation and can be extended as a probability distribution among a multitude of

production states. X is the insured amount that interests us, p is the premium function. In the La-Grangian expression the expression, λ is the La-Grangian multiplier and within the parenthesis is the constraint which says that the indemnity c(X) and the returns under the Bad condition must be equal to a minimum required for sustenance given by δ. The coefficient c is the parameter for indemnity that may in reality be derived by various formulae incorporated in the contracts. The minimum security δ is given by the actual social realities and may in practice be positive as well as negative when the farmer is willing to undertake a part of the liabilities (repayment of agricultural loans, consumption expenditure etc.) from his own resources, relief payments or informal loans.

Maximising and solving for X in the above equation we have the following equation that describes the demand for insurance.

$X= f(p, c, P_{G,} \delta, R, L)$

In the empirical model we specify the following we aim to explain the sum insured per hectare of cropped area. The premium (or price of insurance) rate is reported as a proportion on the sum insured paid as premium though the proportion may vary over crops and regions and be higher for larger sums covered (i.e., progressive). The premium rate is obtained as the weighted average of the subsidized premium rate of the small farmers and the applied rate of the others with the share of small farmers under coverage used as the weight. The claim parameter of the design of policy is actually a formula that depends on the threshold yield. The threshold yield is calculated by applying the official formula to the state level data. We presume that the farmer compares the threshold with some realistic norm to assess their gain from the insurance scheme. Assuming that farmers have reasonably short memories the threshold is compared in relation to the past three years' experience. We compare the threshold yield with the minimum yield that farmer has experienced in the recent times. The response to premium charge may depend on the risk perceived by the farmer so that a more risk exposed farmer may reduce coverage to a lesser extent than a less exposed farmer if the premium rate goes up i.e., the sensitivity to premium rate changes is different. The risk is measured by the coefficient of

variation of yield. A minimum safety parameter δ is unobserved. At one extreme, δ can be assumed to be zero so that the farmer is viewed to cover his expected loss by the indemnity received. However the monthly per capita expenditure of rural people (MPCE) can be considered as a possible determinant of the unobservable δ in which case the farmer protects a minimum income that is the average in the area. The MPCE is found to be insignificant under all specifications. A time variable tries to capture a possible trend coming from greater information propagation.

We have pooled all the crop-state-year cases of insurance adding up to a number of 209 cases for an OLS regression. Each case is considered to be a unit of decision making in financial terms and is treated as an observation. Thus no distinction is made between the crops, states or years since the decisions are essentially considered to be purely financial. The dependent variable is the sum insured per unit of cropped area in value terms. The explanatory variables include the (i) average premium rate (PRMRATE), (ii) the Threshold yield measured (deflated by) in relation to the minimum of previous three year's yield rates, (iii) Yield of the crop of the previous year (deflated by) relative to the maximum yield recorded in the last three years (RELYLD), (iv) the proportion of small farmers (SMMF) (v)e irrigation endowment of the state as an alternative and known insurance, (vi) dummy variables for three irrigation based categories treating one of them as the base, (vii) Rainfall in July (June was tried also) and (viii) in a second specification an interaction term has been considered to mark the risk sensitivity of the price response of insurance demand. The dependent variable is the sum insured per cropped area in the state and being a value is deflated by the wholesale price index of all commodities. The estimated equation selected on the basis of the parameter signs and significance is as follows:

\

Table 7.8: Estimated regression equation for Demand for crop insurance (Pooled)						
	Specification without risk		Specification with risk		Specification with risk with time	
PRM	-0.22	-0.67	-1.87	-2.3	-1.86	-2.29
JULRF	-0.0002	-2.48	-0.00015	-2.33	-0.0002	-2.35
DMID	0.11	4.47	0.11	4.25	0.11	4.26
DLOW	0.08	3.34	0.08	3.45	0.08	3.46
TYMIN	0.01	0.45	0.01	0.65	0.01	0.65
SMMF	-0.0005	-0.59	-0.0003	-0.39	-0.0003	-0.33
RELY	-0.11	-2.54	-0.08	-1.84	-0.83	-1.86
PRM*CV			0.1	2.22	0.096	2.2
DTIME					0.002	0.36
C	0.18	2.02	0.15	1.64	0.14	1.54
R-adj^2	0.19		0.2		0.2	
Note: CV=RISK measured by coefficient of variation. PRM=premium rate, JULRF= July rainfall, DMID=dummy for medium irrigated, DLOW=Dummy for low irrigated, TYMIN=Threshold yield/Minimum yield in last 3 years, SMMF=%Small farmers, RELY=Last year yield/Maximum of 3 year mean (at current price), DTIME=Dummy for Year, Sample 2000-05.						

The effect of premium rate on the demand for insurance is found negative but insignificant in the first specification but when interacted with risk the effect is significant.

7.10. Concluding Remarks

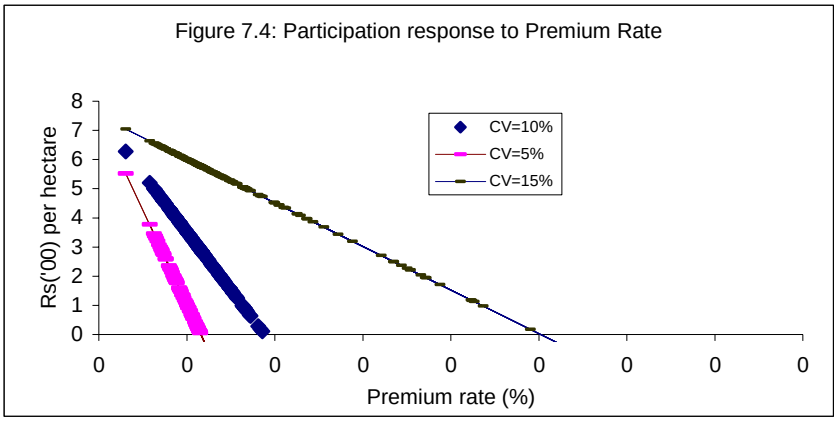
Crop insurance, despite the government's active support has proved to be a losing proposition even after several years of the launch of the national level scheme. The reasons would probably be faulty design and poor risk pooling due to inadequate participation that could also be linked to the design. This study shows that much is wrong in the design of the scheme.

The rigidly constrained and largely uniform prices in case of cereal and oilseeds crops despite their vulnerability to risk as opposed to high premiums in cases of commercial crops have created an uneven ground where market has very little role in shaping the prices. On the contrary, the threshold yields that in principle could be less rigid because

of their link to the actually revealed uncertainties in nature also serve little purpose by failing to recognize that farmers invest to achieve higher yields and take coverage with the hope that their probable losses will be realistically indemnified. Indeed, it appears that the applied formula could be fixing thresholds at levels way too low to make any meaning.

The demand function worked out does confirm that thresholds have not played a significant role in deciding participation. A greater concern is that despite the support the result suggests that being a small farmer does not increase a farmer's chance of participation. Even the insignificant role of time speaks poorly of dissemination. In fact recent experiences (bounded memory) and rainfall (permitted delays) is important factors in drawing participation. Although the demand is negatively related to the price, the response is different between cases with differing risk exposures. The findings would suggest that the scheme does deserve a critical review for making the threshold more rationalized and meaningful and the price more demand determined, flexible and sensitive to changing situations at the crop, region and even temporal levels. Unless this is done insurance will remain to be a simple indication of credit intake from institutions and even a discouragement to that and the statistical system will be undermined by pressures to simulate a meaningful insurance for farmers interest.

Figure 7.4: Participation response to Premium Rate



Appendix

TABLE7.1A: TIME TREND OF CROP YIELDS WITH A BREAK IN TREND FOR THE THREE REGIONS							
CROP		C	T	T*D	R2	D.W.	Break
RICE KHARIF	R HI	869.2 (16.7)	42.4 (13.0)	-11.4 (-4.4)	0.86	1.7	2000(12.2)
	R MED	1125.2 (29.9)	39.32(20.33)		0.93	2.1	
	R LOW	826.6 (15.8)	22.1 (6.53)	-8.92 (-3.40)	0.58	2.8	1999(5.97)
RICE RABI	R HI	1037.4 (7.3)	79.3 (8.9)	-29.4 (-4.1)	0.72	0.81	2000(9.7)
	R MED	1888.9 (46.3)	49.9 (18.9)	-4.83 (-2.36)	0.95	1.83	1999(2.7)
	R LOW	1685.8(18.68)	25.5 (4.34)	-8.26 (-1.81)	0.39	1.83	1999(7.5)
SOYABEAN	R HI(1)						
	R MED	157.9(0.88)	41.1 (4.42)	-11.2 (-2.3)	0.47	2.4	2000(5.5)
	R LOW	328.3 (3.43)	28.1 (5.64)	-8 (-3.07)	0.59	2.5	2000(4.8)
TUR(ARHAR)	R HI	1107.9 (-0.21)	-0.20 (-0.07)		-0.03	1.3	
	R MED	326.2(9.2)	11.05 (4.99)	-3.21 (-1.8)	0.46	1.5	2000(7.7)
	R LOW	606.4 (20.4)	1.14 (0.75)		-0.01	2.13	
POTATO	R HI	10864.6(19.24)	284.3 (9.81)		0.75	2.1	2000
	R MED	13645.6(20.99)	484.5(10.63)	-171.47(-5.1)	0.81	1.78	1997(13.7)
	R LOW	5798.5 (14.6)	169.5 (6.84)	-61.8 (-3.08)	0.6	1.5	2000(9.4)
MAIZE	R HI	661.5 (11.82)	38.27(13.33)		0.85	1.8	
	R MED	763.7 (8.35)	33.8 (7.22)		0.61	2.3	
	R LOW	1264.5 (18.24)	15.34 (2.50)	10.15 (2.32)	0.77	1.65	1992(2.8)
COTTON	R HI	213.5 (12.2)	3.09 (2.85)	-1.89 (-2.14)	0.16	1.2	2000(2.5)
	R MED	151.7 (11.3)	5.59 (4.12)	-0.5 (0.43)	0.44	0.97	2000(20.4)
	R LOW	73.1 (1.2)	3.2 (7.8)		0.65	1.85	
GROUNDNUT	R HI	707.3 (10.7)	25.7 (5.8)	-6.2 (-1.8)	0.59	1.37	1998(14.9)
	R MED	689.0 (7.0)	6.93 (1.08)	0.82 (0.17)	0.03	2.48	1999(3.1)
	R LOW	603.8 (15.26)	12.35 (4.82)	-5.86 (-2.95)	0.4	2.1	1999(4.8)
SUGARCANE	R HI	42979.6 (21.6)	954.1 (7.41)	-326.7 (-3.2)	0.66	2.2	1999(5.6)
	R MED	62111.9 (37.8)	333.4 (3.95)		0.31	1.8	
	R LOW	68572.8 (26.5)	420.2 (2.4)	-161.1(-1.23)	0.13	0.87	1998(18.7)
WHEAT	R HI	1090.1 (28.04)	50.5(21.4)	-0.43 (-4.1)	0.96	2.15	1997(15.9)
	R MED	1296.6 (26.82)	49.86(14.72)	-7.31 (-2.94)	0.93	2.5	1997(4.6)
	R LOW	669.5 (19.8)	37 (17.5)	-9.24 (-5.4)	0.92	2	2000(14.9)
(1) Not grown to any significant extent.							

Table Table 7.2A: Dickey-Fuller test Statistics for Stationarity of Yield rates (de-trended)				
Crops	HI	MI	LI	POOLED
Kharif Rice	3.40	4.97	4.95	4.18
Rabi rice	2.68	4.13	3.59	2.93
Wheat	3.63	3.28	5.71	3.38
Maize	3.73	4.19	3.75	4.31
Groundnut	3.18	5.80	3.35	
Soyabean	5.08	3.54	3.12	3.55
Tur	5.46	2.00*	3.30	6.25
Cotton	4.44	4.38	3.92	4.48
Sugarcane	5.50	3.22	3.60	5.17
Potato	4.75	3.53	3.64	4.71
Note: ADF test with lag one is conducted. Critical values are 10% -2.6, 5%- 2.9.				

8. Marketing revolution, movements in Wholesale and Retail prices and Outcome effects*

8.1 Introduction

Market forces operate through the institutions that make up the market and that translate the forces into price signals. These signals decide how resources are allocated to agriculture and to activities within agriculture. The price movements are also a clue to whether the producers gain in the market although they have to be weighed against the fact that farmers also buy inputs and they are consumers themselves. Prices are also a double edged sword. Higher prices can cause hardship to consumers and generate hunger and malnutrition. Rising prices beyond a level could not mean sustainable gains to the farmers. An ideal marketing system will create a system in which farmers will receive favourable prices, and escape the pains of distress selling even while consumption levels are protected. While it may sound utopian, a practical balance between the producer price and consumer price is usually sought. The spread between what the producer gets and what the consumer pays is a measure of all the transaction or storage costs either in transport, intermediate commissions or monopoly profits, wastage and inefficiency and in an ideal case is minimised by an efficient market.

In this chapter, keeping in background all the policy and institutional changes that swept over the food market in recent times, we trace the behaviour of prices and their possible impact on production and consumption till mid-2000. In section 8.1 we model the behaviour of prices of select crops using a GARCH model and appropriate dummy variables to capture the seasonality and exogenous variables to account for extraneous but known effects. We also to ask if any change has taken place in the price behaviour after liberalization. We have argued in the preceding paragraph that price movements do not represent a zero-sum game and the producer's gain can also turn to the consumer's gain

* The chapter is done in close collaboration with M. Rajeshwor of the same department and may be further developed in future.

while a producer will not necessarily gain from the consumer's loss in the longer run. While for producer the price data of interest pertain to harvest months only the use of data recorded at reasonably high frequency helps to bring out the nature of inter-temporal movements of prices, impinging on the interests of both sets of agents i.e., consumers and producers. In section 8.2 we ask if the price movements have gone in favour of farmers. This is viewed in different ways. The direction of the movement of relative prices, farmer's returns and seasonality are assessed to mark the possible changes in the post-liberalization period. In section 8.3 a view is taken whether market changes acting through prices have brought about significant turns in production patterns and finally section 8.4 the changes in the crucial outcomes in the food situation and consumption standards in the country are examined.

8.2. Emerging Market Channels

If there is any one aspect of the food economy that has experienced a revolution it may safely be said that it is marketing. While the spirit of liberalization as well as the assurance of self-sufficiency helped to dispel the suspicions about the motives of private traders in the market, the marketing revolution possibly has drawn more from the developments in electronic communication and information technology than privatisation. It was not the intent as much as it was the innovative ways of effecting marketing of agricultural produce that seem to be the most remarkable feature of the development. A simple view of the market chain would be as follows:

Farmer → Wholesaler → Retailer → Consumer

although there may in practice be a number of traders and processors discharging different functions in each of the links. Also although in domestic marketing the last links consist of the retailer (often the street vendor) facing the consumer, in reality the link may even be truncated at the terminal (wholesale) market and the passage through a retail market becomes unnecessary.

The APMC Act in India has played a key role in shaping the way that transactions in the market took place. The regulated market (RM) created by the state was intended to be a democratically functioning institution formed with the purpose of promoting fair, competitive and organized ways of conducting transactions under the supervision of the representative marketing committee. Thus the objective was neither to eliminate private participation nor to frustrate market forces. Early evaluations of the system were generally favourable (Arya, 1993). The transaction had to be conducted in the premises of the RM for effective supervision and licensing kept the functionaries under observation. Fair market determined price discovery was achieved through open auction or closed bidding. Information on prices was supplied to participants through notice board or loud speakers. The RM provided modest infrastructural facilities like storage and transportation. The RM's conduct was checked by supervision from higher level. The change in regime inspired serious rethinking on the performance of the system where it was discovered that the results were rarely as intended. Some of the consequences that actually went against the spirit of competition were as follows: (1) with the system of permits and licenses, monopolistic power grew among the privileged participants who actively kept new operators with enterprise from entering the market. This was a case of entry barrier. (2) The requirement of bringing all produce to the RM for sale and go through the prescribed process generated unnecessary hassles of transportation, storage, spoilage all of which added to the cost and widened the margin between consumer and the producer price. There was no provision for sale to take place at the farm-gate or in the processing centre, factory or directly to the consumers. This impaired the free movement of goods and was inefficient. (3) The system was highly inflexible and created a long chain of possible intermediation with commission agents, traders and middlemen, wholesaler, miller and the retailer or the vendor as links between the producer and the consumer. A parallel link of course was the public intermediation in market. Many of the functionaries in the marketing chain may have been superfluous. (4) With liberalization, the marketing system needed to respond to globalised tastes both in the country and outside and with public resources being inadequate an intense need of the hour was to invite investment and entrepreneurial talent. The rigid system created by the regulated marketing was incapable of rising to the occasion.

A key idea behind today's marketing is to exploit the varied and growing demand for consumer goods especially among the urban middle class. With social structure changing towards nuclear families, professional men and women having limited time and open minds to experiment and switch in their diets, modern marketing opens up a broad arena of options of food products based on quality, value addition, nutrition and packaging. The marketing system is expected to pass on a due portion of the gains to the actual producers i.e., the farmers. This can be achieved though bringing the producer and the consumer closer to each other in order to narrow the gap and efficiently transmit the messages on production and demand.

The change in the marketing system came through the same APMC Act which rose to the occasion through legislation. Flexibility was greatly enhanced to allow experimentation with new channels and organizations. The innovations were to make optimum use of what the information technology has offered. Some of the outstanding elements of the marketing system that are observable today are mentioned below.

8.2.1. Organizations and Channels

Efforts to bring the farmer and consumer closer are on through organizational overhauls. In the ideal case there is Direct trading in which the producer sells to the consumer:

Farmer → Consumer

This is yet a practice of insignificant share[†] in the market. The requirement of bringing the produce to the RM is dispensed with, licensed traders no longer have a monopoly and other kinds of organizations including corporates have found a place in dealing directly or indirectly with the farmer. Even foreign companies are permitted to invest up to a specified level as collaborators in order to bring in finance and know-how to the system. Innovative channels of marketing include such links as the terminal market dealing with

[†] Rythu Bazaar, Apni Mandi and Uzhavar Santhaigal are examples.

exports, contract marketing, group or cooperative marketing. In the contract farming system there is a buy back understanding leading to risk sharing, access to improved inputs and technology and assured sales. However how far this arrangement will benefit the food growing farmers especially the small farmers growing food crops is in doubt. Sales in the futures market through advance agreements is a powerful way of risk management. However availability of storage space, access to information and eagerness of small farmers are prerequisites that still cloud the performance of the system besides the widely known political resistance on grounds of inflationary fears. Group marketing is an efficient method in which farmers in unison get substantial bargaining power besides enjoying some economies of scale arising from access to high quality inputs, arrangement of transportation and market intelligence.

8.2.2. Information portals and the rise of e-trading

Information is a major source of power in today's economy and provision of high quality information to small farmers in order to negotiate effectively in the market is a responsibility of the government. One of the visible endeavours is the creation of the network called the AGMARKET under a central sector scheme of the Directorate of Market Intelligence. The project was to link all the wholesale markets numbering over 7000 for collecting and disseminating information on prices (minimum, maximum and modal), market arrivals, standardised grades and varieties as also on market charges, margins, laws and market research. In the private sector a model was set by the e-Choupal of the private company ITC in its agri-business division. The forum offers farmers all the information, products and services they need to enhance productivity, improve their price realization and cut transaction cost. Farmers can access the latest local and global information on weather, farming practices and prices at the village itself in their regional language. The Choupal provides information on suitable inputs and sells them at the door step. Thus, agricultural marketing is transformed by the information technology by both public and sector endeavours.

Internet connectivity as well as developments in software technology has made electronic trading possible in the absence of direct physical contact. Besides, the electronic portal offers a way of conducting fair matching of demand and supply to determine competitive prices as never before. E-auctioning is widely practiced in financial and other markets especially in the futures market where physical exchange of goods are not always required in the transactions. This may however be of use in physical marketing for farmers in coming days

8.2.3. Retail Chains

The rise of retail chains including super market is another revolutionary development in food marketing. This is also an organizational revolution in which the organized corporate body procures goods in bulk, administers necessary processing and packaging of outputs to the products and offers a wide choice to the consumers in terms of product nature and quality. The economies of scale offered by the model are immense and could in effect reduce the price to consumers as also improve the farmers' share in the rupee. The system with its physical presence in most states and even most countries also economises on transaction costs including sales taxes since physical movements conducted by the same commercial agency (e.g., procurement centre to depots or depots to outlets) do not constitute sales. A major contribution of organized retailing could be its ability to offer the consumer a wide variety of the same product if necessary including branded products from their own sources or other manufacturers. However retail chains have encountered considerable political opposition and many states are yet to accept them. The main concern arises form their potential to replace smaller traders, retailers and vendors and cause serious threat to people's livelihood. Their potential to source from global supply chains also expose farmers to excessive competition and a threat of downward pressure on prices that might hurt farmers.

8.2.4. Farmers in the emerging market

Although the changes taking place in agricultural marketing hold promise there are several reasons for caution and doubt and whether the farmers will gain cannot be said with conviction. One main reason is that they now can face a much more formidable force in a large organised and even corporatised body whose bargaining strength can be immense. In case a multinational company is involved the value chain will be linked with the global market in various ways which could open new pastures in market and technology but also import unfavourable competition from outside the country. In the case of contracts, violation of contracts is possible backed by judicial power that money and experience of resourceful operators can buy. Experiences in other countries have shown that the new market channels have not eliminated middlemen and commission agents and farmers have suffered from high rate of rejection on grounds of quality (Singh, 2010). Asymmetry of information will always be a disadvantage for the small farmers.

In these circumstances the farmers too have to arm themselves to face the challenge and bring out the best. At the outset the choice of the channel with a thorough understanding of the implications is a basic requirement. Contracts have to be signed with prudence. To shorten the value chain with the consumer the farmers must get themselves more trained in some of the elementary operations of adding value so that cleaning, grading, packaging and some of the processing can accomplished on farm. The farmers must keep themselves informed of market practices, prevailing prices, laws, standards and possible price movements. Group marketing is suggested as a useful option in this regard. Acting in groups will bring bargaining strength in the market as well as economise on many of the costs such as of market surveys and legal services.

Since all these tasks are complex themselves, there may be a case for promoting professional advisory services to farmers. Such services could work on commercial principles and use scientific methods to supply economic, political, technical and judicial advice to farmers. However, interlock or collusion between these defensive services and

the marketing organizations may defeat the purpose as objectivity and independence are important.

8.3. Behaviour of food prices in India and the impact of liberalization

The temporal behaviour of a series usually covers the trend, the seasonal patterns and the residual unexplained movements. For commodities produced in agriculture the seasonal pattern is of special relevance. The seasonality has adverse implications for both producers who sell at harvest at low prices and consumers who also buys in other months at high prices. While trading in a competitive market is expected to even out the seasonal differences by temporal transfer of grains through storage, government too has a serious role in ensuring that farmers get remunerative prices and the consumers have access to affordable food at all times.

Table 8.1 presents inter-year and intra-year ratios for two time periods marking the pre-liberalization and the post-liberalization periods. In all the crop cases the average inter-year variation of prices based on both annual average of all months and the average based only harvest months are given. The overall price variations and price variations that are relevant for farmers are compared. Since the inter-year ratio based on the harvest price is in all cases of higher magnitude than that based on annual prices in the second period, it is apparent that farmers gained from the price rise. In the pre-liberalization period, the inter-year ratio of harvest prices was higher than that based on annual prices only for bajra and maize, was nearly same for rice and was lower for jowar and wheat. The same ratios have uniformly declined in the second period but in all cases the ration was higher for the harvest prices. Contrastingly, except for bajra and maize the fall in inter year ratio of production reflects the poor growth in the food grain production in the second period.

Table 8.1: Variation of Prices and Production					
		Average Price variations			Production variation
		Inter year		Intra-year	Inter-year
		Annual average	Harvest months	Annual	Annual
	Rice				
	Period 1	1.087	1.088	1.117	1.029
	Period 2	1.054	1.055	1.074	1.025
	Jowar				
	Period 1	1.116	1.108	1.260	1.016
	Period 2	1.062	1.067	1.146	0.993
	Bajra				
	Period 1	1.098	1.107	1.287	1.093
	Period 2	1.064	1.069	1.197	1.132
	Maize				
	Period 1	1.095	1.098	1.279	1.036
	Period 2	1.053	1.060	1.175	1.068
	Wheat				
	Period 1	1.080	1.079	1.202	1.039
	Period 2	1.062	1.065	1.130	1.022
Note: Inter-year variation is ratio of current price average to one year lagged value. Intra-year is the ratio of maximum to minimum price recorded during the year Period 1 = 1980-81 to 1995-96. period 2= 1996-97 to 2009-10. Financial year April to March is considered.					

The behaviour of price is studied more comprehensively by modelling both its average movement and its unexplained residuals using time series econometric techniques as explained in Chapter 5. The GARCH model was found to perform the best in all cased. The data used was monthly nominal price indices at base 1993-94 and since the data was non-stationary it was preferable to specify the dependent variable as the log of the ratio of the nominal prices. The specification uses the lag values of the dependent variables, relevant dummy and exogenous variables as explanatory inputs. Dummy variables for the months (all except one where the turnaround takes place) are used as variables to capture seasonality of the data. At the first stage Ordinary Least Squares (OLS) estimates are made for three different periods i.e., the pre-liberalization, post-liberalization and the whole period and table 8.2 provides some broad findings. Using the whole period regression, September appears as the period of lowest price recorded in jowar, bajra nd maize. For rice the minimum comes in December shortly after the harvest is under way and for wheat the minimum price rise is recoded in April i.e, soon after the marketing

season commences. However comparing the two regressions for the pre and post liberalization periods the peak points have shifted back by a couple of months in wheat and by three months in case of rice.

Table 8.2 : Seasonal pattern of Prices based on Ordinary least Square estimation					
	Bajra	Jowar	Maize	Rice	Wheat
1980-95					
Max	November	December	January	July	January
Min	September	September	September	December	April
1996-09					
Max	December	December	January	April	November
Min	September	September	September	December	April
1980-09					
Max	December	December	January	July	January
Min	September	September	September	December	April

While modelling the variances simultaneously in the GARCH model (table 8.3) , we find largely the same peak points as in the OLS except for wheat in which the maximum is recorded in November instead of January emphasizing the pattern found in the second period in the OLS equation. The conditional variance is maximum at the beginning of the harvest period for rice and wheat and minimum in the immediately preceding period. Rainfall in the growing season reflecting the production possibility is of no consequence to the price movement in the mean equation giving credence to the food management in the economy but a good rainfall can increase the price volatility in the case of bajra. It is recognized that changes in diesel price could affect product prices through its effect on transportation cost. The coefficient of the variable (specified as the log of the inter-year ratio) is found generally insignificant. However, the effect is positive and significant in rice and positive though not significant in wheat. The dummy variable used for post liberalization years (DUM96=1 if year is 1996-97 to 2009-10 and 0 otherwise) is found to have a negative effect in the mean equation uniformly though significant only for bajra and rice. However the impact is also negative in the variance equation except for rice. Thus the estimates suggest that rice price has declined over time but with greater volatility in the post liberalization period. Wheat price may have lost dynamism but gained stability.

Table 8.3: Seasonal pattern of Prices based on GARCH model (With Dummy 96)					
	Bajra	Jowar	Maize	Rice	Wheat
Mean					
Constant	0.03 (0.38)	-0.10 (-1.48)	-0.09 (-0.91)	0.00 (-0.03)	-0.04 (-0.89)
Rainfall	-0.01 (-0.59)	0.01 (1.41)	0.01 (0.46)	0.00 (-0.12)	0.01 (1.37)
Oil price rise	-0.06 (-1.09)	-0.04 (-0.97)	0.07 (1.64)	0.02 (2.32)	0.02 (1.38)
Dum96	-0.01 (-3.48)	0.00 (-0.53)	0.00 (-1.20)	0.00 (-2.69)	0.00 (-1.11)
Lags (No.)					
Max	December	December	January	July	November
Min	September	September	September	December	April
Variance					
Constant	0.00 (-2.11)	0.00 (-0.21)	0.00 (0.98)	0.00 (0.16)	0.00 (0.90)
Rainfall	0.00 (2.47)	0.00 (1.35)	0.00 (-0.13)	0.00 (1.39)	0.00 (0.83)
Dum96	0.00 (-3.21)	0.00 (-3.76)	0.00 (-0.73)	0.00 (1.48)	0.00 (-1.40)
Lags (No.)					
Max	March	August	September	December	April
Min	May	September	March	November	March
ARCH					
Source: Computed. Note: Figures in parentheses are t-statistics.					

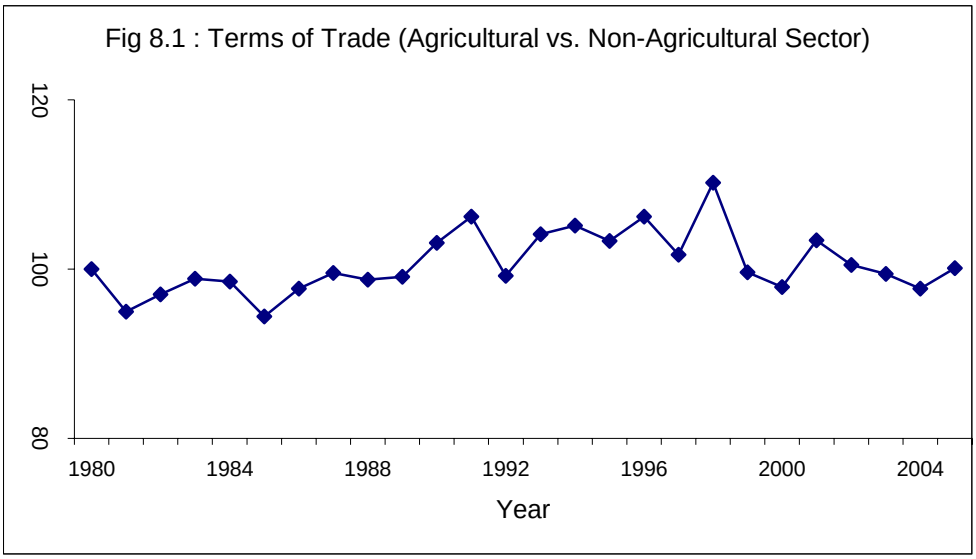
8.4. Have Farmers gained from Food price movements

The implications of the slow down in the growth of prices for the producers' interest can only be judged in context of the movements in prices of other commodities that farmers pay for.

8.4.1. Terms of Trade

The terms of trade (TOT) presents a way to measure the attractiveness of agriculture as an occupation. Indeed, an adverse terms-of-trade between agriculture and the rest of the economy may once have been a tacit policy to squeeze out surplus for the sake of

industrial development[‡]. Subsequently it was recognized that TOT also has an important role in determining supplies in agriculture by inducing investment and technological changes. The measurement of the TOT became an important subject (Thamajarakhi, 1969, Mitra , 1977, Kahlon and Tyagi,) and TOT came to be treated as a terms of reference for setting the administered prices. Figure 8.1 plotting the terms of trade statistics provided by the CACP shows that the TOT did improve in favour of agriculture following the launch of the SAP but the phase continued up to 1998 but fell soon after and did not fully recover except in 2001. The averages given in Table 8.4 show that the TOT increased by an annual rate of 0.58% during the period 1980 -95 but fell at the rate of 0.38% per annum in the period 1996-2009.



8.4.2. Real Prices

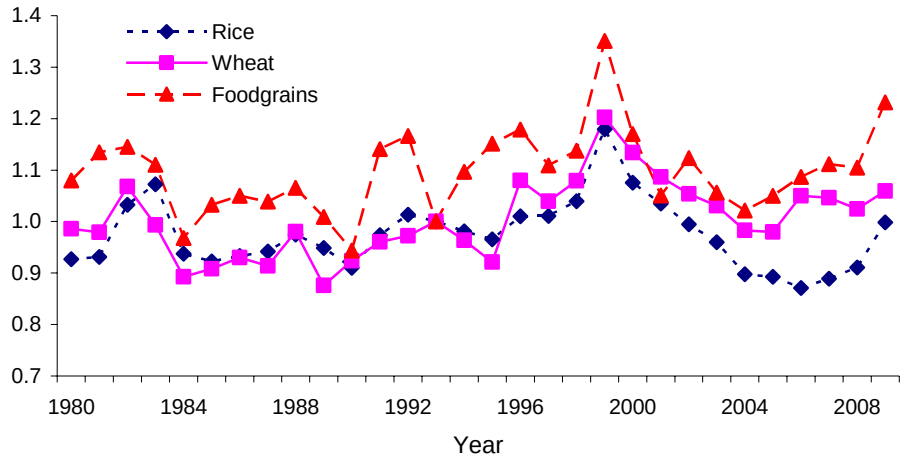
The growth rate of prices in agriculture can be compared to other prices to understand how adverse it has been for the producers. Deflated by wholesale price index of all commodities (WSPA), the price series for rice, wheat and all five foodgrains have been plotted in Figure 8.2. The movements fail to confirm any improvement in the farmers' gains especially in case of rice. Comparing two pre and post liberalization periods (table

[‡] Whether agricultural prices were intentionally kept low or whether prices were historically low even at that point or PL480 was an international move to depress prices.

8.4) the growth in rice price is found have been higher than the WSPA is the first period but in the second period WSPA grew faster but the situation improved for wheat and all food grains. This is important as farmers too have to buy their provisions and inputs.

The price of the main farm input fertilizer however grew at a slower pace than crop prices. In view of the price rice witnessed in the 2000s decade we examined a possible change in the tendencies within this decade. A period 2002-03 to 2009-10 and a sub-period 2005-6 to 2009-10 are compared (Table 8.4). The statistics for the sub-period clearly marks a reversal, as the growth rate of prices were found higher in the sub-period for all the reported crops compared to the whole period in 2000s, only fertilizer being a departure. The growth rate in respect of all commodities was higher at 5.44% compared to 5.15% but the shift was more significant for the food crops especially for rice.

Figure 8.2:Deflated prices of foodgrains



8.4.3. Farm incomes

Farm incomes depend on crop prices, yield rates and also cost of raising the crops. A highly dynamic crop yield could offset (as also possibly be responsible for) a slow rise in prices through its impact on revenue. The cost of cultivation would depend on the technology as well as the prices of inputs but some of these inputs are not actually

purchased in the market. A key constituent of these inputs is the family labour invested in crops. While it is nearly impossible to discern the opportunity cost of such labour, much depends on how farmers perceive their own contribution as an input. The inclusion of the farm family's labour at imputed wage rates vastly inflates the cost for justifiable reasons. The Ministry of Agriculture reports the cost of cultivation of principal crops and its constituents and calculates various measures of farm profit.

Table 8.4 Average Growth rates (%) of Prices and Terms of trade

YEAR	Rice	Wheat	Maize	5Crops	Fertilizers	All Commodities	Terms of Trade
1980-95	8.63	8.07	8.80	8.52	6.10	8.30	0.58
1996-09*	5.07	6.15	5.70	6.11	4.24	5.35	-0.38
2002-09	3.11	4.05	4.82	4.90	2.71	5.15	-
2005-09	5.09	5.93	7.01	7.05	2.36	5.44	-

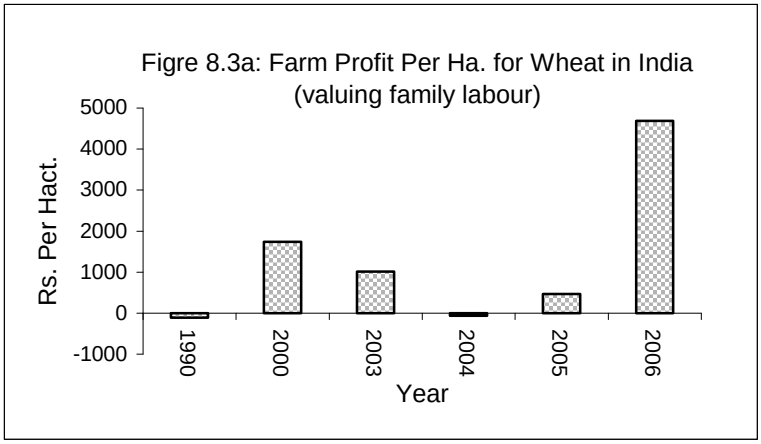
Note: Simple arithmetic averages of annual growth rates are reported.
Terms of trade data available up to 2005-06 only. * 2009.

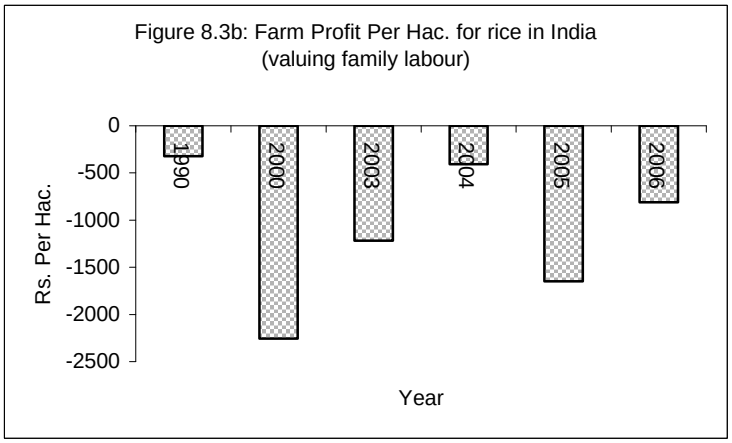
When the cost of family labour is included, rice is found to be unprofitable in India in all the years covered in the sample but wheat has been profitable in most of the years[§] as seen in Figures 8.3. Table 8.4a showing profitability measured as the ratio of revenue to cost suggests that rice is only marginally profitable even after excluding family labour from the cost , and has not shown a distinct sign of improvement.

Table 8.4a: Ratio of Revenue to Cost (Excluding family labour).

	1990	2004	2005	2006
Rice	1.06	1.17	1.09	1.14
Wheat	1.00	1.10	1.13	1.32

[§] The decline in profitability of wheat in 2004 was on account of excessively high temperatures in north India in the germinating season leading to poor yields.





8.5. Retail price movements

Retail price is the price actually paid by the ultimate consumer in the country and it is in most cases, the last link in the chain that starts with the farmer. The retail price is shaped through the additions of mark-ups on the price that farmer gets, such mark-ups including transport and storage costs at every stage, processing, cleaning and grading, wastage and margins appropriated by various middle men and the taxes. If this were the only channel of price formation, the wholesale price reflecting the upstream market would be the only determinant of the retail price. The wholesale market being closer to the producer in the chain than the retail market, WSP is directly linked to the price that the producer gets. The producer price being reflective of the cost of inputs and farmers' incomes, the retail price in this case is a reflection of supply side factors in of the market. Yet retail price

also gleans important information from the demand side of the market and passes it off upstream to the producer price. In this way the farmer get the message of what the consumer wants in the market. However retail prices are also influenced by local taxes and have limitations on instantaneous upward adjustments. To the extent that the consumers' choice is important in the market the retail price is important in deciding the wholesale price, Thus both wholesale trade and retail trade have important interactive role in assembling critical market information that leads to the determination of competitive prices

	Institutional factors		Institutional factors		Institutional factors	
Cost of inputs →	---------→	Wholesale price	→ --→	Retail price	←-----←	Consumer Price
Farmer's income						

In table 8.5 Granger causality tests are conducted between retail prices collected for various states and corresponding wholesale prices of rice. The data on average monthly consumer prices (denoted here as 'retail' prices) for select markets[**] are reported by the Ministry of Agriculture. . These prices are averaged at the state level and at the all India level in this study. Since both series i.e., the wholesale prices (WSP) and the Retail prices (RTP) at the state level suffer from data discontinuities, a uniform sample cannot be adhered to for a complete analysis. Based on common samples of continuous monthly data availability of both price series, Granger causality analysis is made with a lag of two months. These results say little of the actual causation but only reveal the relation of one price with the past values of the other price. No causal effect is found between the two prices in any direction in Maharshtra and Madhya Pradesh. The hypothesis that the RTP does not cause the WSP is rejected at a significance level of 1% only in Andhra Pradesh and at 10% in Bihar, Karnataka and Uttar Pradesh. Causation is not indicated in Tamilnadu and Orissa besides Maharshtra and Madhya Pradesh. Similarly the lack of

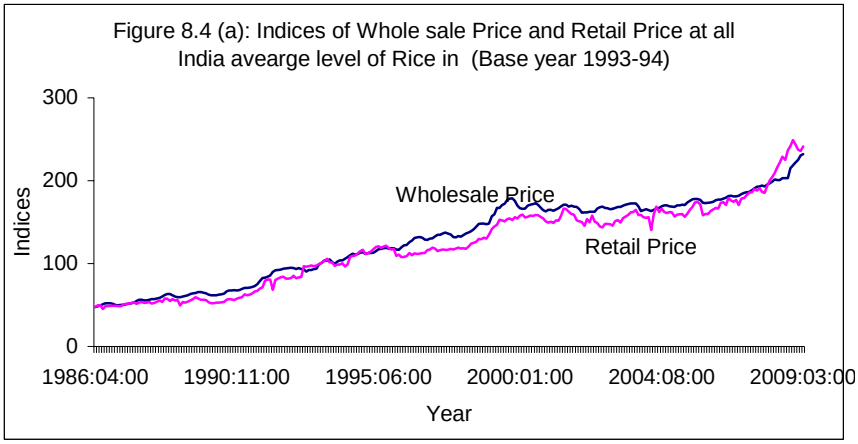
[**] Care is taken that retail prices are reported for the same variety of a commodity for which the wholesale price is reported even though the reporting agency is different. The markets in towns are preferably located where the lower middle class population is concentrated and it is inclusive of sales/purchase taxes. The Labour Bureau, Ministry of Labour is entrusted with the task of collection at the national level, the NSSO also collects from select regions and the DES, Ministry of Agriculture collects daily and weekly data from about 90 and 215 centres respectively. The retail prices are used for computing consumer price indices and cost of living allowances.

Granger causality of RTP by WSP is rejected in Andhra Pradesh, Karnataka, Orissa, Tamilnadu though at 10% level and no causality is found in Bihar and Uttar Pradesh besides the two states. Thus restrictive forces acting within specified short term ranges possibly operate at both ends to limit price movements in the short run. Retail price may be influential in the price determination at 1% level only in one out of the 8 states (Andhra Pradesh) but the evidence of an influence of the wholesale price on retail price is weak.

Table8.5: Granger Causality Test for Whole sale Price and Retail Price of Rice in India

	F-Statistic	Probability
Andhra Pradesh (1993:04-2005:03)		
Retail Price does not Causes Wholesale Price	6.81**	0.00
Wholesale Price does not Causes Retail Price	4.22*	0.02
Bihar (1997:04-2000:03)		
Retail Price does not Causes Wholesale Price	4.81*	0.02
Wholesale Price does not Causes Retail Price	0.79	0.46
Karnataka (1992:04-2005:03)		
Retail Price does not Causes Wholesale Price	3.00*	0.05
Wholesale Price does not Causes Retail Price	3.54*	0.03
Maharastra (1999:04-2001:03)		
Retail Price does not Causes Wholesale Price	0.82	0.46
Wholesale Price does not Causes Retail Price	0.31	0.74
Madhya Pradesh (1992:04-1999:03)		
Retail Price does not Causes Wholesale Price	0.66	0.52
Wholesale Price does not Causes Retail Price	1.03	0.36
Orissa (2002:04-2007:03)		
Retail Price does not Causes Wholesale Price	0.93	0.40
Wholesale Price does not Causes Retail Price	2.55*	0.09
Tamilnadu (1996:03-2005:03)		
Retail Price does not Causes Wholesale Price	2.32	0.10
Wholesale Price does not Causes Retail Price	2.69*	0.07
Uttar Pradesh (1992:04-2000:03)		
Retail Price does not Causes Wholesale Price	2.82*	0.06
Wholesale Price does not Causes Retail Price	1.93	0.15

Note: Granger causality test with two months lag is conducted. **1% and * 10% significance.



Price rise of food grains are usually of greater concern in terms of inflation than other items. As such they have reasonably high weightage (15% for Food articles, 12.45% for Rice) in the wholesale price index of all commodities (WSPIA) of the country whose movements are used to calculate the inflation rate. However the WSPIA includes prices of other items like intermediate and industrial goods. What is more relevant for political consideration is the Consumer price index (CPI) computed for various groups of people in the country because it is the movement of the CPI that determines the cost of living of the citizens. A fast rising CPI is expected to cause hardship for the 'common' people who are deemed important in political considerations. Obviously food has a primary place in this index (the weightage of Rice in CPI is 12.5%). The WSPIA is calculated after taking account of the WSP of various commodities and likewise the CPI is the weighted average or the consumer or retail prices. As in the case of individual commodities the two price indices too are expected to have mutually causal interactions.

Although comovement is inevitable, the graphs in Figures 8.4 plotting the two price series with respect to rice and all commodities show differing patterns. While in the case of all commodities the WSPIA has moved slower than the CPI (for urban no-manual employees) in the 1990s and 2000s, for essential commodity rice, the retail price has moved slowly relative to wholesale price with periods of market correction. The pattern may have reversed in 2007.

Figure 8.4(b): Index of Whole sale Prices of All commodities (wspia) and Consmer Price indices of Urban Non-manual Employee(cpi-une) in India (Base year 1993-94)

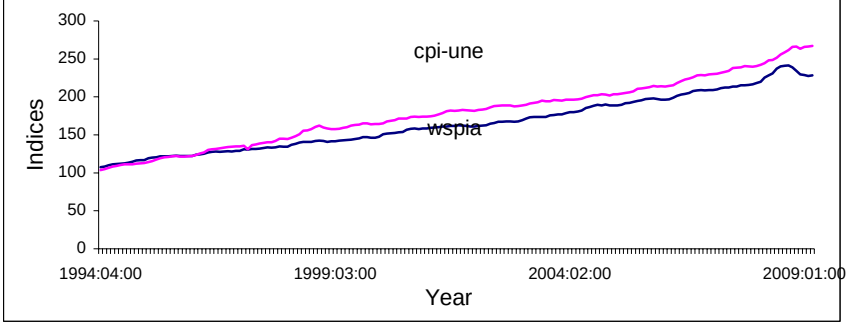
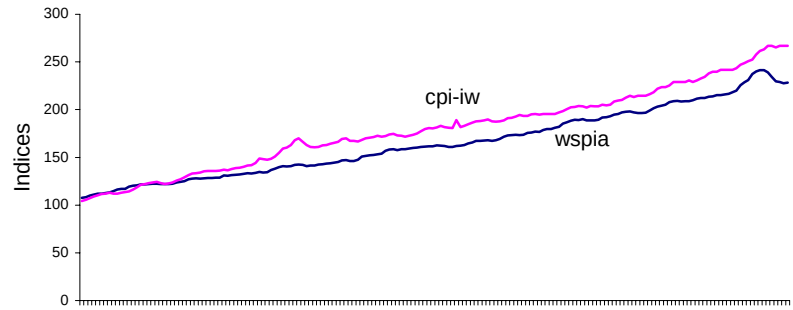


Figure 8.4(c): Indices of Wholesale Price of all Commodities (wspia) and Consumer Price Indices of Industrial Workers (cpi-iw) in India



The wholesale price is nevertheless not an adequate representation of farmers' gains and a comparison with the producer price if possible would be more meaningful. The farm-gate price (FGP) is the price that the farmer actually receives for the produce and net of all transport charges leading to the market. We have used the data collected in the scheme Cost of Cultivation of Principal crops by the Ministry of Agriculture to derive the farmers' price. This price is obtained as the ratio of the per hectare value of output to the yield per hectare and averaged over the reported states. Since the cost of cultivation data are based on surveys conducted in the major states the availability is restricted in time and coverage. So comparison over time can be made depending on concurrent availability of data. The three prices for states Andhra Pradesh, Uttar Pradesh and West Bengal in Table 8.6 suggest that when farm-gate price (necessarily harvest period),

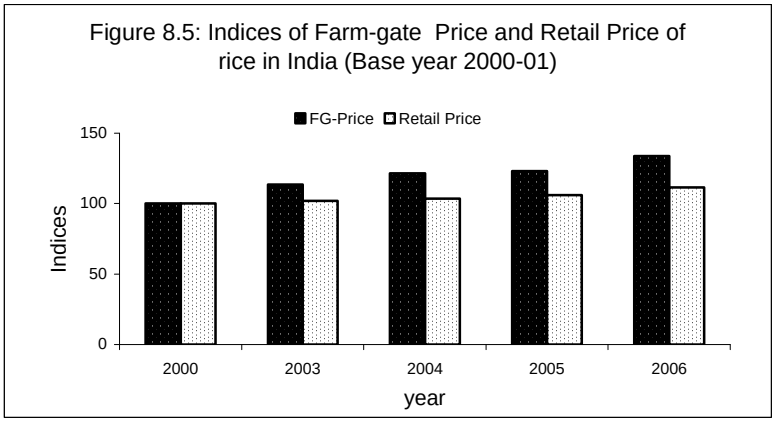
Wholesale price in harvest month October and Retail price in October are compared the gap is far wider in the first link at the upstream market ranging from 61% to 115% than in the downstream link between the retail and wholesale prices recorded in October. In the last column the entire gap between farmers' price and the peak period retail price that consumers pay are compared. The price variation ranges from 100% to nearly 200%.

Table 8.6 : Rice Prices at different stages in Three producing states

States	Farm-Gate (FGP)	Wholesale (October)	Retail (October)	Retail (Peak)
Uttar Pradesh				
2000	425	821 (93)	917 (12)	917 (116)
2004	542	957 (77)	1000 (4)	1300 (140)
2005	564	992 (76)	1300 (31)	1150 (104)
Andhra Pradesh				
2000	511	938 (84)	1050 (12)	1250 (145)
2004	591	950 (61)	1075 (13)	1175 (99)
2005	594	1048(76)	1250 (19)	1350 (127)
West Bengal				
2000	425	913 (115)	1200 (13)	1600 (276)
2004	534	950 (78)	-	-
2006	588	1030 (75)	1600 (55)	1750 (198)

Note: Figures in brackets are between WSP and FGP in the case of Wholesale price, RTP and WSP in the case of Retail price (October). Figures in the parenthesis in the last column are percentage difference between FGP and the peak RTP recorded in the year.

Since 2000-01 the growth in farm-gate price is faster than in the retail price in all years as seen in plots at the all India level (average of all reported states) in Figure 8.5. However this does not mean that farmers' income has increased by that much as comparison with cost of cultivation had shown that this rise could be on account of input costs. For three rice producing states however the result is different. In percentage terms, between 2000 and 2005, the increase recorded by the farm gate price was significantly more than its margin with the WSP. The margin between the WSP and the RTP however has increased by more than the F-G price in Uttar Pradesh and Andhra Pradesh and nearly equally in West Bengal. Thus cost of cultivation and the farm gate price as well as correction at the retail level are more responsible for recent price rise than forces at the wholesale level.



8.5.1. Diversity of Retail prices

Retail price of packaged product is set by the manufacturer's policy. Usually the package contained printed information on either the retail price (local taxes extra) or a maximum retail price commonly known as MRP (all taxed included) but since 1990 the law has required that all packaged food products contain certain essential information such as manufacturer's name and address, manufacturing data, expiry or 'best before' date and the MRP in a clearly visible printed form Under the Weights and Measures (Packaged Commodities) Rules. It is an unfair trade practice for any dealer or trader to charge a price under any pretext that exceeds the MRP. Under the Consumer Goods (Mandatory Printing of Cost of Production and Maximum Retail Price) Act, 2006, certain guidelines have been provided so that the consumer can not be charged over to the maximum price printed on the goods. The MRP is set high enough to cushion all possible local taxes and margins. The MRP is the maximum retail price allowed for that commodity and is not the actual price and a retailer can well reduce his margin built into the MRP so that the actual price could be about 10-15 per cent lower than the MRP. Taxes would include Central sales tax (Union), State sales tax (state) , Entry tax (state), Octroi (municipal or gram panchayat authority), luxury tax (state). The wide variations of taxes often make it difficult for consumers to comprehend their rights although for any violation the consumer is protected by the Consumer Protection Act 1986. Also prices variation is imposed by product differentiation via branding and across different types of stores.

Whenever the prices increase due to enhanced tax rates or a rise in cost, the old stocks would sell under the notified MRP only and revision of price will apply to new stocks.

Food products are however sold in various possible forms, packaged or loose, branded and differentiated by quality as well as minimum quantity and with different degrees of processing. These diverse forms allows consumers a range of choices and freedom to purchase based on the quantum of requirement, preferred quality, readiness for use and economy. This leads to variation of retail prices for the same product. Retail distributors too vary in the range of options they offer. Usually the organized retailers are expected to provide greater options to consumers although they are likely to sell more of branded and high value products. A small survey was conducted for this study across different categories of retailers. The survey area was Kamlanagar in North Delhi and the retail outlets covering organized private retail outlets[††], organized and non-profit government outlet[‡‡] and a small private grocery store[§§], all the outlets lying within a radius of 5 Km. The information collected at a particular time (8th April 2010 4 pm to 7 pm) are

†† The organized sector outlets were the following. (i) a unit called 'Big Apples belonging to the group Express Retail Services Pvt. Ltd, claimed to be Delhi's first ever company owned Fruit, Vegetable and Grocery retail chain. The 125 crore company's direct tie-up with farmers in Haryana, Rajasthan, Himachal Pradesh and Uttar Pradesh, provides consumers with uninterrupted and qualitative product supply every single time. Big Apple in a matter of one year has spread all over Delhi. The store is open from 7 am to 11 pm. (ii) Reliance Fresh belongs to Reliance India Limited which started with the launch of a unit in Hyderabad in 2006. They operate in small to medium sized stores expected to serve customers residing with 2-3 Km radius and intend to source products directly from farmers. The retail stores sell both branded products and their own products and use a label of their store and work from 9 o clock in the morning to 9 oclock at night. Both retail units are thus part of larger retail chains, are profit oriented and sell fresh food and grocery.

‡‡ Central Govt. Employees Consumer Cooperative Society Ltd. popularly known as Kendriya Bhandar was set up in 1963 in pursuance of Union Cabinet decision as a welfare project for the benefit of Central Govt. employees and public at large. It is functioning under aegis of Ministry of Personnel, Public Grievances & Pensions, Govt. of India and was registered with Delhi Registrar of Cooperative Societies. Subsequently, it was registered with Central Registrar of Cooperative Societies, Govt. of India as a Multi State Consumer Cooperative Society in September, 2000. Kendriya Bhandar is into following business activities:- Retailing and Institutional sales of grocery, consumer and household items, sales of Stationery items,f Medicines and allied items. It is the largest Consumer Cooperative Society in the country. Being a Welfare organization, items are reasonably priced by adding nominal margin to meet administrative and other expenses. A large variety of branded products are available. Quality standards are normally higher than PFA. Products pass through stringent laboratory testing. The unit is open from 10 am to 6 pm and is closed on Wednesday.

§§ This is a small shop run by the owner with the help of family members and a couple of casually employed personnel.

presented in Table 8.7. No particular pattern is evidenced in this investigation. The widest range of option in rice is available in the Reliance-fresh and the family owned store and the welfare directed public store provides the least option. Both the organized and unorganized sector private stores sell branded, loose and packaged rice although the two organised sector store differ with the store Big Apple providing less option. Price options are more in the kirana store followed by Reliance and the former sells rice even at cheaper rates than others. In the case of wheat (atta), options are few. All the stores sell only branded and packaged products and only Kendriya Bhandar has offered two different brands at the time of investigation. The impression gained is choice of the outlet depends much on the proximity to consumer's residence and the time of closing of the store. Customer service is important but the organized sector units encounter managerial problems. Home delivery is possible only when the quantum of purchase exceeds a critical minimum. All stores suffer from lack of assured manpower.

Table 8.7: Ranging of Choices in product, volume and prices available to Consumers in retail stores

	Reliance-Fresh	Big-Apple	Kendrya-Bhandar	Kirana-Ramesh
Rice				
No. of Types	4	2	2	5
Branded	Yes	Yes	Yes	No
Loose	Yes	No	No	Yes
Packed	Yes	Yes	Yes	Yes
Weights(packaged)	1 Kg	1Kg	1Kg, 5Kg	Rs 50-1Kg
Processed	Yes	no	No	Yes
Price options	Rs 23, Rs 36, Rs 40 Rs 60,	Rs 110, Rs120	Rs 65, Rs 90, Rs50	Rs16, Rs 22, Rs 25, Rs 32, Rs50
Wheat (Atta)				
No. of Types	1	1	2	1
Branded	Yes	Yes	Yes	Yes
Loose	No	No	No	No
Packed	Yes	Yes	Yes	Yes
Weights(packaged)	5Kg	5Kg	5Kg, 5Kg	10Kg
Processed	No	no	Yes(dalia Rs 17.50/500gm pack)	Yes(dalia Rs30/1Kg pack)
Price options	Rs109/5Kg	Rs 110/5Kg	Rs86/5Kg, Rs90/5Kg	Rs 150/10Kg

Note: Based on a quick survey of four stores in Kamla Nagar, Delhi at a particular point of time.

8.6. Prices as incentive

Whether price movement help to determine choices of crops depends on how far prices act as incentives for farmers. Given that cultivation is a highly resource specific activity it may not easy for farmers to switch between crops in response to price signals. In that case the price movements and price policies could have little implication for food supplies and food security in the country. Further, allocation of limited acreage among crop could be more strongly influenced by non-price factors such as weather and input availability. Although price responses of area under food grain crops are typically envisaged to be low, the strong theorization and empirical evidences supporting the farmers' rational behaviour even in underdeveloped countries (Scultz,1964, Krishna,1963) had motivated the government in intervening in the market.

Table 8.8: Price Elasticity of Acreage (Estimate for sample period (1980-81 to 2006-07)

	Coefficient	t-statistics
Rice kharif	0.14	3.27
Rice rabi	0.61	2.14
Wheat	0.16	3.40
Bajra	0.44	3.29
Jowar kharif	0.22	3.78
Jowar rabi	0.15	1.25
Maize	0.11	1.93

Short run supply elasticises of food grains has been shown to be generally varying from 0.1 to 0.6 in various studies (Krishna and Chibber, 1983, Bapna, 1981, Sharma et al, 2002) and possibly reflecting the resources sensitivity of crops. The elasticises provided by the scholars are estimated with data from 1960s or 1970s up to 19980s or 1990s. We have attempted to estimate supply response functions in logarithmic forms with the updated data in the period of our concern 1980-81 to 2006-07. We considered both price and non price factors of major foodgrain crops where price is price expectations based or past harvest price and provided the price elsticities in table 3. The price responses are however significant and positive in all cases but are low in general (not more than 0.6), those for bajra and rabi rice being the highest.

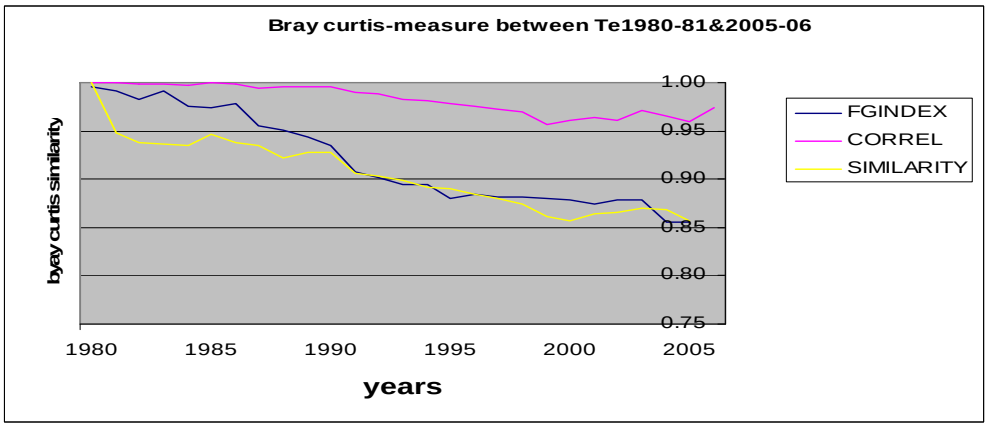
Whether the changes in the market has led to a shift in the cropping pattern chosen by the farmers can be represented by the Bray Curtis Similarity formula,

The Bray Curtis Distance (d) Formula being

$$d_{ij} = \sum_{k=1}^{n} \frac{\left| x_{ik} - x_{jk} \right|}{\left(x_{ik} + x_{jk} \right)}$$

Where x is any attribute. In this case x_i is taken as proportion of area given to a crop k (Rice, Wheat, Maize, Jowar and Bajra are the crops) in the year j where the reference year is 1980-81. Correlation coefficients of crop shares with the reference year in respect of the sample years are also computed. Also, since the crop of our interest is in the food grain group, the area under food grains expressed as indices with the reference year as the base is also considered. The plots in Figure 8.5 show significant divergence in the cropping pattern as depicted by the similarity index and the correlation coefficient and the food grain area has also come down however all the curves seem to have bottomed in about the mid 2000s.

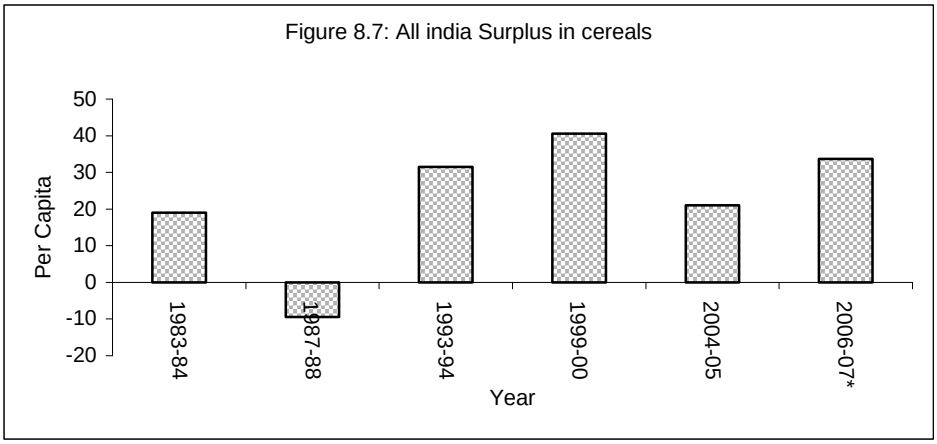
Figure 8.6:



The final assessment of all the changes lies in the results. Food being an essential item production. Consumption and the deficit all carry important information of the performance of the market. Figure 8.7 affirms that a positive improvement in surplus generation occurred in the 1990s but sustainability of the surplus is not borne out in the

2000s. However food security continues to be the onus of the few northern states in the country although there is a sign of the southern region to join ranks.

Figure 8.7: All india Surplus in cereals



9. Conclusions

Liberalization of market was associated with the expectation of a radical recreation of the market structure, the institutions and the character of public policy. India's experience in the 1990s and 2000s with regard to the food grain sector, paints a perceptibly different picture. The understanding of the impending paradigm that was defined by the aspirations of the time was fashioned under a particular set of circumstances that created the context. That the circumstances had their own dynamics and could not be treated as independent from the process itself was perhaps less emphasized. In retrospect it seems that liberalization is a process that can only be driven by anticipations and adaptations rather than convictions. Theory, hypotheses and policy all need to be subjected to continuous monitoring and reformulation as new evidences surface. The course taken by the liberalizing market has been jagged at every step and sometimes mislaid amidst the forces of circumstances.

9.2. A General Summary of Findings

The image acquired from the set of studies conducted in this report on the food economy of India is not easy to categorize in black and white. On the one hand, the market that emerged from 1991 onwards can be described as one that was significantly different from what existed for centuries not merely in terms of attitudes and rhetoric but also admittedly in practice. Many of the changes are more in the nature of revisions rather than transformations, sensitive to the shifting conditions of time, most important of which was the perception that the scarcity era had ended. The rise of certain institutions with the active patronage of the State will possibly go down as a contribution of the era. Although time will bear out the whole truth, special mention needs to be made on the modes of product marketing as an outstanding achievement in institution building. On the other, the transitions marked in the market structure raise a case for redefining if not doubting the concept of liberalization. Many of the outcomes anticipated from liberalization failed to realize, such as the retreat of the State from the market and the adequacy of the so called

free market in determining prices, transmission of market signals across an integrated market, emergence of agriculture as an economic power, consumers' triumph and the genesis of many successful market driven institutions especially those related to risk.

The major findings in this report about the food market are as follows:

(1) The government and its price policy continue to hold a decisive place in the food market.

(2) Food production remains concentrated in a limited surplus generating regions of the country. The dispersed nature of the deficit states and especially the poorer sections living in these states probably make food distribution an extremely complex as well as important function in the country. The adequacy of the market of doing this task needs rightly to be questioned. Even proximate distribution within a surplus state may not be taken for granted as trading direction follows demand that is shaped also by purchasing power and geography.

(3) There is considerable spatial discontinuity in the market generated by local surpluses, geographical barriers, artificial restrictions on trade flows and the locational significances of states in respect of trade flows so that public intervention concentrated in space can have uneven implications on prices in surrounding regions. Also trading potentials with different states have mutually offsetting effects resulting in only limited net effect on surrounding states.

(4) The space given to international trade has undoubtedly expanded with liberalization, revealing India's comparative advantage. Trade has not generated any significant escalation of volatility with adverse implications for farmers' livelihoods as feared. Instances of sharp and unpredicted price rises have been more frequent than price falls.

(5) Various institutions compatible with the principles of market are actively in operation though there remains considerable scope for their refinement especially in regard to risk management. The derivative market has not been immune to faulty processing of information giving rise to speculation and the political

constraints of pricing and designing has kept crop insurance from serving as a viable market instrument.

(6) The period of liberalization is marked by movements in prices which have not been unambiguously beneficial to farmers. The movement of nominal prices have been upwards on a secular level and become more predictable and seasonal unevenness has narrowed. Yet no conclusive sign of improvement of the real prices and the terms of trade has been marked towards agriculture, nor was there any perceptible improvement of profitability of farming. Prices are peaking sooner than they did before liberalization. The choice of crops to cultivate is sensitive to price incentive and the declines in price relatives of food crops are associated with a changing cropping pattern and diversion from food grains.

(7) Retail prices are known to respond to movements in the farm-gate and the wholesale prices but retail prices themselves gather important information from the consumer's side and transmit it backwards. Thus the mutual interdependences of the prices at different levels are important in matching supply and demand. However, the data does not always show that retail price has been influential in price formation. Also the gap between the farm-gate and the wholesale prices appears to be wider than that between the wholesale and the retail prices and upstream factors including the cost of cultivation and middle-mens' commissions are probably more responsible for food price rise than down stream or demand side factors. The gap between the farm-gate price and the peak retail price in the year however could be as wide as 200%.

9.3. Transitions in Indian Agriculture

The course of a planned liberalization and the expected impacts are contextual. Indian agriculture was subjected to liberalization at a time when India successfully underwent the treatment of the green revolution and the perception was widely held that she had emerged from the centuries old fear of food scarcity. This relief provided the confidence to allow several flexibilities such as relaxed regulations and experiment with new ideas unrestrained by the fear of shortage. The reforms in other sectors in the market and the

eagerness towards market principle showed by the rest of the world were added privileges. The experience of the two decades highlights the fact that every phase is as transient as the preceding and the subsequent ones and how important it is to have a flexible, dynamic and open minded system in control. This section summarizes India's experience in agriculture and food market by categorizing three broad phases of recent post-liberalization history.

Period 1: 1995-96 to 1999-00

On the natural front, this period was privileged. A series of favourable monsoons aided the country's agricultural performance for more than a decade until the last year of the period. The structural reforms were showing positive signs and the terms of trade was moving in favour of agriculture. The minimum support prices and the issue prices were hiked up as a part of the adjustment process and to bring down subsidies in particular. The very existence of Food Corporation of India (FCI), the large public sector body which was the apex agent of the government in the food market was questioned to start with. Nevertheless it continued to manage food grain operations of the government despite criticisms, one of the justifications given being its ability to cater to remote areas in which traders would not venture. There was however a search for possible ways to bring down its cost of operation. Decentralization and even limited privatization of procurement and the targeted public distribution system (TPDS) were steps to make public operations much more specific, economic and effective but also perhaps more difficult. Surplus stocks were disposed of by open sales in the market by a market compatible method for stabilizing prices.

Meanwhile domestic reforms of the market continued. The regulations under the Essential Commodities Act and the Agricultural produce Marketing Act were either relaxed or eliminated. The method of determining support prices was reviewed and greater emphasis was attached to the objective of inter-crop parity and international price movements than generating greater production to ensure that distortion is not imposed on the market. Since under the new paradigm food sufficiency was no more a vital issue any

more, diversification to high value agriculture and processing triggered through market signals and infrastructural support was an objective of primacy. On the external front the scene was favourable and India showed clear signs of competitive advantage in respect of rice as predicted by economists. Quantitative restrictions could be retained by India on BOP grounds. The liberalization was on its expected course.

Period 2: 2000-01 to 2004-05

This period opened with a positive note when the National Agricultural Policy was announced in July 2000. While aiming at a 4% per annum growth rate the policy envisioned a demand driven agriculture in which 'growth was sustainable technologically, environmentally and economically'. It emphasized the following policy instruments consistent with liberalization, namely (a) removal of distortions of incentives, (b) improvements of the terms of trade of agriculture with manufacturing (c) the reform of domestic and international marketing strategy in order to ensure a favourable economic environment and (d) to provide nutrition security to the people.

The period however was to show features which were quite distinct from the earlier one. For one, an indifferent performance of monsoon and thereby crop performance in 1999-00 was followed by a worse one in 2000-01 and after a brief reprieve in 2001-02 India witnessed one of the worst droughts of the decade in 2002-03. Even 2004-05 was not too good. In all these years, agricultural growth remained poor if not negative. The successive hikes in the MSP and the Issue price for distribution to the 'Above poverty line' (APL) category had helped to improve the terms of trade and reduce subsidies but the policy began to reveal its darker side. Procurements that remained open ended had increased as it was more attractive to sell to the FCI but with the prices in the PDS becoming too high, consumers were discouraged from lifting from the public outlets. The pricing strategy had naturally crowded out the private traders and the onus fell on the government to distribute the acquired grains that by-passed the free market channel. The experience was educative in revealing the State's limitation in distributing food to a large country. In a far different situation the same lesson was learned by the government in

1974 when food trading was nationalized. The situation described as one of 'plenty' amidst shortage left large sections of people unfed and mal-nourished while the grains were rotting in public storages. The government was compelled to dispose of the excess grains through open sales and through exports both conducted tragically at subsidized prices which meant wastage of public resources and a loss of electoral popularity. Not surprisingly also, it generated a significant outcry among intellectuals and activists who likened it to 'mass murder'. The crisis brought out by a national policy all but uncovered the importance of household level food security as never before.

The crisis situation evoked a number of direct and indirect responses from the government. Among them was the attention given towards improvement of stocking such as the technological development of the Cover area and Plinth (CAP) system, creation of silos, fumigation and quality monitoring methods. A number of innovative food distribution programmes were launched that made good use of the stocks while targeting the most vulnerable. While the significance of food as an essential entitlement of citizens was already being highlighted in literature at this time especially following Amartya Sen's celebrated works on famines and food security, the real life experience and its political implications in India in the period provided reinforcement to the recognition of food security at the household level as a national objective.

On the external front too, the scene was not as rosy. International food prices were not as buoyant as before even when India struggled with the unmanageable surpluses. The Quantitative restrictions had to be removed in 2001-02 due to easing of the balance of payments problem. The WTO too meanwhile was making little headway especially since the Seattle meeting of 1999 and food security was among the issues that came in the way of a consensus from emerging.

Period 3: 2005-06 onwards

The present period further showed that neither the situation in period 1 nor those of period 2 were there to stay and transitory each phase was. The period marked a growing

concern for the lack of dynamics shown by agriculture in India as also for the ecological damages inflicted by the earlier period of growth. An added feature during this period was the incessant rise on food prices both in the domestic economy and the world economy that could not be ignored any longer. That the specter of food shortage was a part of history was no longer a forgone conclusion and the same apprehensions that marked the erstwhile scarcity driven food economy began come back again. At every step, the concerns of food insecurity began to qualify State policy, generate political uproar and aroused caution and misgivings about the new institutions that ran on market principles. Food management with market liberalization became a much more complex task for the government than ever before.

With the trimming of the public stocks the traders however came back but generated a competition between the State and the private sector pulling up prices. Speculation was a matter of concern, especially related to the futures trading in grains permitted in the early 2000s as part of the market liberalization. Consequently this practice was banned for wheat in 2006 and a Commission was assigned the task of looking into the futures market's role in fuelling inflation. Later however when the report revealed no conclusive evidence the ban was revoked in 2009. Even in the international market speculation was becoming important as the market for trading in risk gained ground. At the same time reforms taking place in various countries and the decoupling of subsidies in U.S. along with the U.S. Farm bill 2002 led to changes in global food production. It was noted that diversion of grain area towards bio-fuel elsewhere was also exerting a pressure on food prices. The financial crisis added to the woes. Even the uneasiness about the impending climate change is playing on the expectations. Meanwhile, members of WTO were still struggling to arrive at a road ahead and the negotiators would have much to learn from the experiences of the post 1995 years.

In India the concern over household level food insecurity continues to gain primacy even as food prices rise. The public distribution programmes is not considered sufficient for the purpose and a National Food Security Act is expected. This enactment will probably accompany a redefinition of the measure of poverty which will widen the inclusion. Since

the bill would imply that food security is legally binding, this will further increase government's responsibility. To fulfill its commitment it is also imperative for the government to have ready access to grain. For this the government's presence in the market as a purchaser and the physical availability of grains through higher productivity are both important in the scenario.

9.4. Results from the Studies in the Report

The status and development in food market is investigated in this report through a number of studies on various aspects related to liberalization of the market. The following are the conclusions noted in the different studies of the report:

9.4.1. Role of Government and Administered prices

Economic liberalization in agriculture was launched clearly with the intention to give market forces a greater say in determining prices in times to come. This leads one to expect that the government will retreat from the market leaving the space to the forces of demand and supply, that market will be more open to foreign trade and that the government administered MSP will lose its power to influence the market price.

Tracing the course of history in Chapter 3 many of these expectations are found unfulfilled. Public operations in relation to domestic production have intensified over time and the MSP remains to be decisive in drawing supplies away from the free market channel. The market price is significantly influenced by the MSP with an elasticity of 0.24 in case of rice and 0.54 in case of wheat. The MSP has hardly remained as a floor price and its relative magnitude over the free market price has a decisive say on how much food will reach the commercial channel vis a vis the public channel. The government has become a strong player in the market competing with the traders for supply.

The persistence of the government has not however crowded out international forces. The share of foreign trade in domestic production has increased, signifying greater openness to the global market and India's emergence as a net exporter on the average does suggest the possibility of a competitive advantage though such an advantage itself is a dynamic and contextual issue. Imports in times of shortage and exports in good times often lead us to expect a substitutable relation between foreign trade and public stocking for temporal balance. The data however suggests that trade does not necessarily reduce the volume that is held in public stocks possibly because the information, available in public domains becomes an influence on trading direction and stocking strategy is autonomous and policy driven. Despite the possibility of imports and India's gain in share in world trade, the weight of domestic production is still paramount. Between rice and wheat, rice has gradually gained more significance both in public operations and in trade.

The failure of liberalization to consummate itself in terms of the State presence could be on account of the increased pressure on the government to ensure food security especially of the vulnerable sections as well as the slow down in the production performance relative to demand. To the extent the government averts manipulation of prices and coercive tactics, and if the purchases can be conducted as a demand driven process, the liberalization could be viewed as one where the government is itself a trader bargaining for low prices rather than a scheming intervener. A broader version of this view would be a market where traders include a collective of those marked as vulnerable, i.e., for whom adjustment to price rises would mean human deprivation and such a collective could be represented by the government or a cooperative and organized group. Needless to say that while the vulnerable group's representative body too plays by market rules, the cost is borne by the society at large in view of the externality and vitality properties of the commodity in question. An alternative could be a cash transfer policy (Kapur et al, 2008) in which the vulnerable consumers are handed over the cash equivalent of the support given at present in lieu of the food and the decision is left to them how to spend it. This strategy however may not assure that food will be physically accessible, economically affordable and voluntarily purchased.

9.4.2. Price transmission

While the presence of the government could in principle be defensible in a free market, the transmission of undistorted price signals in a market bound by sub-national political strategies of segmentation and barriers can hardly be in sync with the concept in any form. Thus even if the government bargains in the market to make purchases to feed its public channels, the path must be clear for farmers from any part of the country to bring their supplies for sale to the public agency at the price offered so long as it makes commercial sense. In such a case the physical goods as well as the price signals will flow smoothly across space and competition will decide which producers gain in the market. This is particularly true because the government procures from pockets often identified as of surplus. Traditionally, this had served the twin purposes of protecting the farmers with a minimum support and in raising adequate supplies for distribution. Agriculture is a state subject. In a market that was stifled with regulations, the states had been guided by their own political interests to set up various blockages against the free flow of products across borders.

Looking for possible trading directions in Chapter 4, the Indian states are found to present considerable diversity in respect of their balances between demand and supply and few states are found to be dominantly the sources of food surplus. However, the sources of procurement are even more concentrated and interestingly not always associated with the surplus generating status of the state. Thus Andhra Pradesh, Tamilnadu and Orissa are in the category of deficit but contribute to public channel purchases and West Bengal which emerged as a marginal surplus generator in recent times has been a procuring state. The decentralization of procurement may be a contributor to the process in which procurement is used for local distribution. In this case the procurement and deficit may not be independent as the deficit itself will be affected by local distribution.

We looked at spatial dimensions of rice price taking care that the data represented comparable location, time and variety. Examining whether the states as geographical

locations are integrated as market we found considerable discontinuities in the market even within three broadly demarcated regions. For example, cointegration was not found between West Bengal and Assam in East, Andhra and Karnataka in the South and between Uttar Pradesh and the other states in the North. In the North even after excluding Uttar Pradesh, there appeared to be a structural change in the long run relation of prices between the states. The long term adjustment of prices between the pairs of states was weak in general. Trade relations among multiple states are a complex process. Price in a state adjusts not only to any disequilibrium with another state where the government intervenes but also to the disequilibrium created between the intervention state and other neighbouring states with which the reference state has a trading relation. It is found that the short adjustments are also weak and sometimes mutually offsetting and the persistence of the intervention effect varied between states of intervention.

9.4.3. Trade liberalization

Economic theory has clearly shown that free trade based on comparative advantages of nations could help to generate efficient production patterns and higher producer incomes. In reality free trade has raised considerable apprehensions, some of them being the inflow of global volatilities, the increasing incidences of price crashes and import surges and the danger of relying on the global market in poor years.

Chapter 5 suggests that even after opening up of the market, international prices seem to share a weak linkage with domestic prices of food. Although there has been a rise the instability of prices how far trade liberalization has caused volatility of prices could not be established. Indeed, after factoring out expected price movements, the unexplained deviations can be explained by their own dynamics and there was no evidence that events occurring in the period of market liberalization caused a structural shift in these volatilities. When the signs of the shocks are estimated we find that incidences of unexpected declines in food prices that could be deleterious to producers' interests have become less frequent suggesting that concerns about farmers' livelihood are over-emphasized. Of greater concern is the increased frequency of the occurrence of positive

shocks with their implications for food security. Further it is also found that imports could hardly be a solution to food security in years of shortage as considerable covariation characterizes production performances in India and the rest of the world.

9.4.4. Futures trading

Trading in derivatives is a much debated policy issue. The futures market and the spot market are known for their close and profound interactions while determining prices. The time series analyses of data on two food crops traded in futures market confirm the positive effect of future trade on price movements in Chapter 6. Thus the analysis infers that futures-trading does have a value addition effect on market.

However these results do not necessarily suggest that futures market only makes the underlying market more efficient. The movements of the futures prices themselves indicate a strong and asymmetric feedback from the underlying markets raising a classical case of speculation when a situation of rising prices leads to expectations that prices would increase further and consequent market responses that not only help to realize the expectations but also have further spiraling impact.

Despite the developments in theoretical realms of economics, farmers are left to their own devices and instincts to cope with price risk. With liberalization in the market the impact of uncertainty could be severe in terms of welfare and efficiency. The government has been supporting farmers with a public information system that harness the developments of computer and internet technology. While information of prices can help farmers immensely in bridging currently information gaps, it does not help significantly in overcoming the uncertainty of future movements of prices. Financial engineering worldwide, has been attempting to address this aspect by pooling a large set operators in the market who are willing to share the risk and eliciting objective values of price expectations from the market.

Thus, while the institution of futures trading has the potential of making the market more efficient by helping farmers discover price and hedge risk, serious attention needs to be given to enable the market acquire information from a broader spectrum in an objective manner and the players need to process such information efficiently too. It is important not to depreciate the potentials that the institution clearly embodies but to identify and address the weaknesses of the functioning of the market. The futures market is not the only market based option and can be further reinforced by the development of scientific research based Market advisory services. It may be noted that the subject of forecasting has made impressive studies in Econometrics and Statistics. Evaluative studies in other countries have shown that professional advisory services on effective marketing, participation in derivative trading and seasonality of sales heave succeeded in helping farmers to 'beat' the market (Cabriniet al., 2007).

9.4.5. Market for Crop yield insurance

With liberalization, the government is expected to withdraw from many of its roles designed to protect farmers from various forms risk. These include regulated prices, subsidies, loan waivers, prudential norms in the banking sector. This creates a case for insurance in which farmers can cover their risk in the market. The government has taken effort to build up a commercial entity for trading in risk in a market consistent way. While government has been supporting the move both administratively and financially, the long run vision was about a commercially viable venture for fair insurance and the build up of a vibrant market for production risk. The government's effort was directed to this effort despite the global disillusionment over crop insurance.

In Chapter 7 the data on insurance at the state level showed little sign of successful risk pooling across time, state or crops leading to losses in all years. Effective pooling would be contingent on the width of participation in the programme and in the designing of the scheme in terms of rational parameters such as the price. Despite offer of subsidies to small farmers the participation at the overall level is poor and a more successful state like Punjab has not joined. In India's NAIS, the price paid by the farmer is the premium

which in the case of food crops neither market determined nor decided by acturial considerations. A more flexible incentive for participation could be the threshold yield, a specified yield level below which the farmers are liable to obtain indemnity for losses. Given the threshold the farmers will weigh the probability of a loss in relation to recent experiences and their projection of the future. However the formula used for computing the threshold yield is also rigid as determined by official consensus rather than real life state of nature and a simple calculation at the state level suggests that they could be too consistently low to be meaningful. The yield is found to be largely normal with only a few exceptions that raise a case for more detailed examination. The demand for insurance viewed as a purely financial decision is found to be unaffected by the threshold yield as expected, but the premium is influential though the premium sensitivity is affected by the risk in the crop-state case. This is a sign of adverse selection in which a rise in premium rate will lead to greater drop in participation among the less risky. Participation is less attractive in irrigated states and among the small farmers.

9.5. The Special Case for Food grains

The following factors separately or together would help to build a special case for the food market in the path to liberalization:

(1) Food is a commodity for trading like any other only beyond a certain point only. At the basic level and for each individual regardless of his or her identification as poor by current definitions in fashion, food is a public good (deprivation of a section of people beyond a level is socially repugnant and distressful to others, can have law and order as well as political implications and has inter-generational and human capital issues for the country) and also embodies the fundamental right of human being to live a healthy life (any deprivation at that level may in principle be no different from other violations like homicide). While there are medical disagreements on what constitutes the basic requirement for each individual, it is clear that up to that level the market rules in which the players perform by adjusting their consumption become meaningless at least in a negative direction. Market rules in the case of food and any other essential item begin to perform only after a crucial threshold.

(2) Ambiguities are extensive in the concept of a free market and especially surrounding the role of the state in free market. It is reasonable to perceive of a player called State which is an embodiment of a collective of all those individuals whose responses to price changes in the market would mean deprivation. Thus in this model the market behaves by its own rule except that the poorest ones act in unison and via a medium which is the State. While the State ideally should make no premeditated effort to drive the prices in any direction for any purpose, representing a large (and hopefully declining over time) size of the demand in the market it rightfully possesses considerable bargaining power in the market to influence the price. In principle the effected price would be exactly what it might have been if the lowest rung consumers had the adequate purchasing power to choose their quantum of food over and above the minimum threshold. In an otherwise efficient market, this price would be enough to provide farmers with the correct signal to direct their resources.

(3) Finally, market is an evolutionary mechanism where the ineffective or unviable elements will be mercilessly wiped out and the doors will be open to new ideas and innovations. This calls for a continual evaluation of the emerging institutions through research both in the public and private domain. A critical outlook is even more necessary where government's own resources are tied since this inhibits the market itself to realize and correct the error. In cases where the private sector itself is the initiator and investor, sometimes profits do not bring timely and unbiased signal of its performance especially when social returns are involved. This weakness may be addressed not by frequent recourse to legislation or severe regulations but by encouraging objective and transparent evaluations at various levels to socially expose the performances. The private players in particular need be conscious of the importance of their reputation, their social responsibility and their long run viability and be persuaded to join the process of evaluation and self-correction in a unprejudiced manner.

9.6. Policy implications

While we argue for a legitimate place of the government as another player in the market acting on behalf of the vulnerable sections and to ensure the fulfillment of basic requirements that need not fall in the domain of market functioning, the food management should not act as source of a premeditated manipulation of the market price. With the uncertainty in international and domestic price movements, beating the market could be an elusive task despite rigorous calculations for any official agency.

9.6.1. Continuing pre-eminence of Public policy and the Need to question the MSP

There is a need to redefine the concept of liberalization especially to accommodate the place of government in the set up. We found that public food price policy continues to play a dominant role in deciding market price movements even in today's regime and determine the space given to private traders. Even if the government continues to be an important player, there is immense need for caution in public pricing policy. It needs to be recognized at the outset that the central idea behind a liberalized market is to minimize the chances of distorting the prices. The precise function of setting the MSP needs to be questioned. Prices if driven by the preordained movements of the MSP should not only incorporate supply side information including the cost of cultivation but how far they heed the demand side factors (including the implicit demand of those without adequate purchasing power) deserves attention.

9.6.2. Political imperative of Food security

The lasting and in fact growing presence of the government in the market for food is possibly the conspicuity that food insecurity and its manifestations such as starvation and malnutrition have gained in recent times. With growth and prosperity marking the economy at large, the presence of hunger even in a limited ambit becomes visibly too contrasting and is politically intolerable.

9.6.3. Rationale for Public presence in the market for food

Should public presence be acceptable in conjunction with liberalization? The logic of free market and the WTO's strategy have been widely criticized for treating food as any other commodity. True food is a basic need and so it can become a tradable commodity only beyond a certain point. Below a critical threshold level, adjustments in food consumption along a demand curve would mean denial of a minimum requirement for life and severe suffering so that the demand curve in that range becomes inadmissible politically. The State's role to ensure the basic sustenance becomes imperative and independent of the market. Also food has properties of externality that likens it to other public goods. Starvation and malnourishment in society is repugnant to all in the society and could cause political and economic instability in the system.

9.6.4. State representing a Collective of the Vulnerable

In a market where price is determined by demand and supply, the presence of the State can be viewed as a collective of the vulnerable people where the purchasing power behind the demand curve is that of the society's (pooled through taxes). Alternatively, this is the notional purchasing power that could be handed over through a possible cash transfer. In this case the price of food will respond to the demand of a large section of currently deprived lot who could compete for the food in the market if they had the requisite purchasing power. The government becomes the realizer of this latent demand.

9.6.5. Allow Price signal transmission to provide incentive

The above visualization could lead us to believe that the price rise generated by the expanding demand unleashed by public commitments would create the right incentive for producers to invest in agriculture. Provided, that there is no supply side bottleneck, such a plan will be fruitful if the price signal reaches all farmers evenly. Artificial and natural barriers to movement need to be removed so that any farmer irrespective of location can

respond to the demand and gain from the opportunity. This will not only help to disseminate the price signals but also prevent inequity caused by local intervention.

9.6.6. Overstated fear of international trade

Our result showed that trade liberalization has not particularly exposed farmers to unpredictable price movements, especially of an adverse nature. While unpredictable price movements or volatilities are found to have increased over time, an autoregressive process is noted and there is little evidence that events in the period of trade liberalization are associated with a shift in the volatility.

9.6.7. Futures trading has its problems

The futures market is not devoid of its informative value and therefore may be potentially efficiency enhancing for the market. However a question arises about how the market processes existing information. Futures trading has possibly processed price information in a biased way so as to pass over positive shocks to the future thereby potentially creating a spiral of price rise Our results suggests a classical case of speculation when a positive price movement further raises the possibility of price rise by playing on expectations. Wheat prices showed a positive though steady movements in times of futures trading.

9.6.8. Alternate ways to price risk management

The government may try to promote alternate institutions such as professional market advisory services to counsel the farmers based on scientific techniques. Forecasting methods have developed in Econometrics and other disciplines and farmers may gain from such advance forecasts.

9.6.9. Price rise rather than price fall as Shocks

We also found a remarkable asymmetry in the tendency in price movement. Although price movements are found rather steady in the post liberalization period, food prices have tended to reach remarkable heights more frequently in the trade-liberalized period than in earlier times. Futures price responded to positive price movements but seemed neutral to negative shocks. There appears to be a mechanism to mitigate negative movements that could be the government price (MSP) policy but on the other end government has less control. Some caution needs to be attached to positive price spikes.

9.6.10. Making a toothless market for Crop insurance

The crop insurance is allowed to develop as a market based instrument for risk management in agriculture but yet, the strategy hardly allows the market principles to drive it. It is throttled by the state that imposed pricing ceilings on food items and so there is no flexible price movement to which demand or supply adjusts. The threshold yield could be another variable to which demand can adjust but the rigidity and the lack of dynamics in the formula make it quite meaningless. If crop insurance is to continue in a meaningful way, a serious rethinking on the parameters (premium rate and threshold yield) is unavoidable.

9.6.11. Did Farmers gain?

Revolutionary developments have occurred in marketing thanks especially to the rise of electronic computers and the internet technology and the possibilities of e-trading being opened up. Although nominal prices have increased steadily and the marketing revolution has the potential to improve the farmers' gains and narrow the spread between producer and consumer prices, in real terms prices have not shown a clear improvement. The farmers have not gained significantly in real terms. Profitability has also not improved. Although sporadic instances of sharp price rises causing hardship to consumer are noted,

the movements in food prices relative to other goods including agricultural inputs provide no comfort for the farm front.

9.6.12. Retail and Wholesale prices

The food market is generally divided into several links making up a complete chain in which different intermediate sellers and buyers meet to connect the actual producer and the consumer. The retail market has an important place in transmitting demand side information into the chain so that such information passes down to the producer. Thus wholesale and retail market both provide information that leads to the determination of price. The study shows a weak bi-directional link so that the retail market and its pricing process (exorbitant margin in the maximum retail price and monopolistic forces) may have had a less significant role in price formation than expected. The role of the consumer revolution is not borne out.

The margin between the farmgate and the wholesale price is historically much wider than that between the wholesale and the retail price probably reflecting the relative difference in market power. At the all India level retail price moved slowly relative to the wholesale price followed by periods of market correction when growth is faster. Since 2000-01 the growth in farm-gate price is faster than in the retail price in all years. However this does not mean that farmers' income has increased by that much as comparison with cost of cultivation had shown that this rise could be on account of input costs. For three rice producing states however the result is different. In percentage terms, between 2000 and 2005, the increase recorded by the farm gate price was significantly more than its margin with the WSP. The margin between the WSP and the RTP however has increased by more than the F-G price in Uttar Pradesh and Andhra Pradesh and nearly equally in West Bengal. Thus cost of cultivation and the farm gate price as well as correction at the retail level are more responsible for recent price rise than forces at the wholesale level.

9.6.13. Transient Phases: The concern for food security remains

The history of the last two decades makes it is amply clear that no situation could be taken for granted and a sustainable policy towards liberalization can only be one that is sensitive to the exigencies of time and is equipped with its checks and balances. Scarcity of food has been a restraint on India's food policy for more than a century but shortages could be as much as concern in coming years as could be abundance. India's food prices are driven both by the factors emanating in the large domestic economy and those coming from the global economy. World prices have witnessed a rising tendency in recent times and could remain high in the near future as projected by FAO. The energy crisis has become inextricably associated with the food problem owing to the development of new technological possibilities. Countries that have generated food surplus especially the USA and the EU have been diverting land use towards addressing the need for clean fuel. The concern over global warming has only made this shift more attractive. The search for biofuels would be a factor to contend with in coming years and the possibility of diversion in response to price movements cannot be ruled out within the country.

9.6.14. Facilitate Supply response

While prices are a potent instrument for correcting food scarcity over time, in reality supply bottlenecks in the developing world have come in the way of supply responses. Responses to the price peak observed in 2007 have been observed to be weak. Responding to price for correcting the supply imbalance may not be easy in India in the absence of a technological breakthrough. Domestic factors such as population growth and poverty reduction programmes are added factors within the country that would tend to drive the price in the positive direction, affecting food security in the process and defeating the programmes. Given this outlook, governments' strategies must have a balanced approach to price movement without creating distortion in either direction.

Food security will continue to be a most important. Short term conditions of abundance should not create complacency. The public role of the government in meeting the food

requirements of the poor creates a demand pressure in the market in the right direction. However it is extremely important to facilitate the farmers' response to the signal by a supply side policy

References

1. Abauf, N. and Jorion, P. (1990), "Purchasing power parity in the long run", *Journal of Finance*, Vol. 45.
2. Ackerman, Frank (2005), "The Shrink Gain from Trade: A Critical Assessment of Doha Round Projection ", GDAE Working page no. 05-01, Global Development and Environment Institute.
3. Ackerman, Frank and A.Nadal (2004): "The Flawed Foundation of General Equilibrium ": Critical Essays on Economic Theory London.
4. Ackerman, Karen Z. and Praveen M. Dixit, (1999)"An Introduction to State Trading in Agriculture", Economic Research Service, U.S. Department of Agriculture, Report No. 783..
5. Ahsan, Sayed M., Ali A. G. Ali and N. John Kurian (1982), 'Towards a theory of Agricultural Insurance', *American Journal of Agricultural Economics*, No. 64.
6. Alphonse Pascal (2000), Efficient price discovery in stock index: Cash and future market, *Journal of futures markets*, No.19,pp-911-930.
7. Anderson Kym and Anna Strutt (1996), "On measuring the Environmental Impact of Agricultural Trade liberalisation" in M.E. Bredahl, Nicole Ballenge, John C. Dunmore and Terry L. Roe (ed) *Agriculture, Trade and the Environment; Discovering and Measuring critical Linkages*, Westview Press, USA.
8. Anderson Kym and W.Martin (eds.) (2005) Agricultural Trade Reforms and the Doha Development Agenda World Bank, Washington.
9. Aradhyula, S.V.(1987);' Rational Expectation and policy Modelling: The case of Wheat in India.". *Journal of Policy Modelling*, Vol.9,No.4.
10. Arya, Anita (1993), *Agricultural Marketing in Gujarat*, Concept Publishing Company
11. Askari and Cummings (1975) "Estimating Agricultural Supply response with Nerlove model: A survey" *International Economic Review* Vol. 18 (2)
12. Bapna, S.L (1981): Aggregate Supply Response of Crops in a developing Region, Sultan Chand and Sons. New Delhi.
13. Bathla ,Seema (2004), Agricultural Market intervention Policies: Trends and Implications in a new Regime, Occasional Paper-34, National Bank for Agriculture and Rural Development, Mumbai.
14. Bathla ,Seema (2009): Market Integration of Agricultural Commdities : An Analysis of Selected Cereals, Oilseeds and Horticultural Crops' reports submitted by Centre for the Study of Regional Development School of social Science, Jawaharlal Nehru University New Delhi.
15. Binswanger Hans P., (1978), " Risk attitudes of Rural Households in Semi-arid Tropical India" *Economic and Political Weekly*, June.
16. Blyn, G. "Price series correlation as a measure of market integration" Indian journal of Agrl Economics 28 (1973) 56-59) (Harris, B. There is a method in madness poor is it vice versa? Measuring agricultural market performance food research institute studies 17(1979)

17. Bollershev,(1986), Generalised Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics*, No. 31, pp-307-27.
18. Bollerslev, Tim and Jeffrey M. Wooldridge (1992) "Quasi-Maximum Likelihood Estimation and Inference in Dynamic Models with Time Varying Covariances," Econometric Reviews, No. 11, pp- 143–172.
19. Bose Suchismita (2007) "Contribution of Indian Index Futures to Price Formation in the Stock Market", Money and Finance February.
20. Boyce, James. K. (1987): Agragarian Impasse in Bengal : Institutional constraints to Technological change, Oxford.
21. Chakravarty, Sangeeta (2007) "Changing Pattern of Stock Volatility in India" *The Indian Journal of Economics*,Part 4 Vol. lXXXVII.
22. Chand Ramesh (2002), WTO, Trade liberalization and Indian Agriculture, Mittal Publications, New Delhi.
23. Clark Peter K, (1973) A subordinated Stochastic process Model with finite variance for speculative prices, *econometrica,* vol. 41, No1. January
24. Cummings, Ralph W.J (1967) ,Pricing Efficiency in the Indian Wheat Market , Impex India, New Delhi.
25. Dandedar, V.M. (1976)," Crop insurance in India", *Economic and Political weekly June*
26. Dev, Surajit (2006), 'Domestic terms of Trade in a Three-Sector Framework' Analysis for All India and States, *Economic and Political weekly,* April 29.
27. Economic Survey (2004) ,Government of India, Ministry of finance, Department of Economic and Affairs Economic division
28. Engle, Robert F. and Victor K. Ng (1993) "Measuring and Testing the Impact of News on Volatility," *Journal of Finance*, Vol. no.48, pp- 1022–1082.
29. Engle, Robert F. and Victor K. Ng (1993) "Measuring and Testing the Impact of News on Volatility," *Journal of Finance*, vol. 48,pp- 1022–1082.
30. Engle, Robert F. and Victor K. Ng (1993) "Measuring and Testing the Impact of News on Volatility," *Journal of Finance*, vol. 48, pp-1022–1082.
31. Engles R.F. (1982), Autoregressive conditional heteroscedasticity with estimates of U.K. Inflation, *Econometric*a vol. 50, Pp. 987-1008
32. Floros Christos and Dimities Vogues (2007) Trading volume ad retunes relationship in Greek stock index futures market: GARCH vs GMM Intenational research journal of finance and economics, 12.
33. Food and Agriculture Organization (FAO) of the United Nations (2009),'The State of Food and Agriculture', Rome.
34. Gonzalez-Rivera, Gloria and Steven M. Helfand (2001) ' The extend, Pattern, and Degree of Market Integration: A Multivariate Approach for the Brazillian Rice Market' *American Journal of Agricultural Economics*, Vol 83, No 3 ,pp. 576-592.
35. Ghosh and Guha-Khasnobis, 2007). "Measuring the Efficiency of Targeted Schemes: Public Works Programmes in India", in Basudeb Guha-Khasnobis, Shabd S. Acharya and Benjamis Davis(ed) Food Security: Indicators, Measurement and the Impact of Trade Openness,Oxford.

36. Ghosh Nilabja, Sangeeta Chakravarty and Shailesh Kumar (2009), "Volatility and Price Discovery in Indian Wheat Market: Was the Futures Market to Blame?" in Madhoo Pavaskar (ed) Effects on Futures markets on Agricultural Commodities
37. Ghosh, Nilabja and Chiranjib Neogi (1995): " Supply Response of Foodgrains and Policy Actions: A Model with Rational Expectations Hypothesis " *Indian Journal of Agricultural economics*, L(2) April June: pp. 135-152.
38. Glosten, L.R., R. Jagannathan, and D. Runkle (1993) "On the Relation between the Expected Value and the Volatility of the Normal Excess Return on Stocks," *Journal of Finance*, 48, 1779–1801.
39. Glosten, L.R., R. Jagannathan, and D. Runkle (1993) "On the Relation between the Expected Value and the Volatility of the Normal Excess Return on Stocks," *Journal of Finance*, 48, 1779–1801.
40. Gonjalo Jesus and Clive Granger (1995): " Estimation of Common Long-Memory component in Cointegrated systems " *Journal of Eussiness & Economic Statistics* Vol 13, No. 1 pp. 27-35.
41. Government of India (GOA), (Various), *Agricultural Prices in India*, Ministry of Agriculture , Government of India.
42. Government of India (GOA), Directorate of Economic and Statistics, Ministry of Agriculture. Website: *dacnet.nic.in/eands.*
43. Government of India (GOI) (Various) : *Indian Labour Journal* Vol.28, Labour Bureau Ministry of Labour, Government of India.
44. Government of India (GOI) (Various), *Cost of Cultivation of Principal Crops in India*, Directorate of Economics and Statistics, Ministry of Agricultue.
45. Government of India, (GOI), Ministry of Statistics and Programme Implementation. website: www.mospi.nic.in.
46. Grimwade, Nigel (2004), "The GATT, the Doha Round and Developing Countries" in Homi Katrak and Roger Strange (ed) The WTO and Developing Countries, Palgrave Macmillan, New York.
47. Gulati, A. Sharma, K. Sharma, S. Das and V. Chhabra (1994) Export Commodities names of Affiliated Agricultural Commodities, New Delhi, NCAER.
48. Hazell, P., and Valdes A. (1985*), 'Is there a Role for Crop insurance in Agricultural Development?'* International Food Policy Research Institute, Food Policy Statement No. 5, IFPRI, Washington D.C.
49. Hazell, P., Pomareda C. and Valdes A. (1986) Crop insurance for Agricultural Development: Issues and Experience, Johns Hopkins University Press, Baltimore MD
50. Hull, J.C.(1997) Options, futures and other derivatives, prentice Hall international inc.
51. Hurd,J. (1975), " Railways and the expansion of markets in India: 1861-1921", Explorations in Economic History 12.
52. Jayasuriya, Sisira, Jae H. Kim and Paramod Kumar (2007), International and Internal Market Integration in Indian Agriculture: A study of the Indian Rice Market, paper presented at the 106th Seminar of the EAAE.
53. Jodha (1978), "Effectiveness of Farmers' adjustment to Risk*" Economic and Political Weekly*, June 1.

54. Jomo, K.S., Rudiger Von Arnim (2008), Trade Liberalization for Development Who Gain? Who Loses? , Journal, *Economic & Political Weekly*, Vol. X L III no. 48.
55. Just,Richard E. and Quinn Wninger (1999)," Are Crop yields normally distributed?" *American Journal of Agricultural Economics*,vol. 81(May).
56. Kahlon, A. S. and Tyagi, D.S (1983):Agrucultural Price Policy in India. New Delhi.
57. Kahlon, A.S. and M.V. George (1985): " Agricultural Marketing and Price policies" New Delhi.
58. Kainth G. S. (1982) "Foodgrain Marketing System in India- its Structure and Performance", Associated Publishing House.
59. Kapur Devesh, Partha Mukhopadhyay and Arvind Subramanian (2008) "The Case for Direct Cash Transfers to the Poor" Economic and Political Weeky, Aprl 12.
60. Kenourgios, Dimitris F. (2004): Price discovery in the Athens Derivative Exchange" *Economic and Bussiness review*, Vol.6. No. 3.
61. Kraev Egor (2005): Estimating GDP Effects of Trade Liberalization on Developing Countries, London.
62. **K**rishna R., (1963), "Farm supply response in India-Pakistan: A case study of the Punjab region", Economic Journal 73.
63. Krishna, Raj and A. Chibber (1983): "Policy Modelling of a Dual Grain Market: The Case of Wheat in India", Research Report, No.38, International Food Policy Research institute, Washington D.C.
64. Kumar Pramod and R. K. Sharma (2003): "Price Integration and Pricing Efficiency at the Farm Level: A Study of Paddy in Haryana", *International Journal of Agricultural Economics*, Vol. 8 (2).
65. Lele Uma J. (1967): "Market Integration", *Indian Journal of Farm Economics*, Vol. 49.
66. Lucas, Robert E., Jr.(1980) "Rules, discretion, and the Role of the Economic Advisor," in Rational Expectations and Economic Policy, edited by Stanley Fischer. Chicago: National Bureau of Economic Research.
67. Maddala, G. S and I. M. Kim (1998), Unit roots, cointegraion and structural change, Cambridge University Press.
68. Mellor (1969),'The Subsistence Farmer in Traditional Economics' in Clifton R. Wharton (ed) Subsistence Agriculture and Economic Development, Frank Cass and Co.
69. Mishra, Pramod K (1996).: Agricultural risk, insurance and income: A study of the impact and design of India's comprehensive crop insurance scheme.
70. Moss, Charles B. and J.S. Shonkwiler (1993) , Estimating Yield Distribution with a Stochastic Trend and Non-Normal Errors" American Journal of Agricultural Economics,75 (November).
71. Muth, J. (1961), "Rational Expectations and The theory of Price movements", *Econometrica*,vol. 29.
72. Narayana N.S.S and K.S. Parikh (1981), Supply response and Acreage Allocation IIASA (RR-81-1)
73. National Sample Survey Organisation (NSSO),(Various), *Household Consumer Expenditure and Employment situation in India*, Ministry of Statistics & Programme Implementation, Government of India.
74. National Sample Survey Organisation (NSSO),(Various), *Level and Pattern of Consumer Expenditure in India,*, Ministry of Statistics & Programme Implementation, Government of India.

75. Nelson, C.H. and P.V.Preckel (1989) ," The Condition Beta distribution as a Stochastic production function", *American Journal of Agricultural Economics* ,vol. 71(may).
76. Nerlove M. (1958) The Dynamics of Supply: Estimation of Farm Supply Response to Price, Baltimore, Maryland, Johns Hopkins University Press.
77. Nerlove M. (1958) The Dynamics of Supply: Estimation of Farm Supply Response to Price, Baltimore, Maryland, Johns Hopkins University Press.
78. Pal, Parthapratim and Deepika Wadhwa (2007), "Commodity price volatility and special safeguard mechanisms", *Economic and Political Weekly*, 3rd February.
79. Palaskas T. B. and Hariss White B. (1993): "Testing Market Integration: New Approaches with Case Material from West Bengal Food Economy", *Journal of Developmental Studies.*
80. Patterson Kerry (2002) An Introduction to Applied Econometrics: A time series approach, Palgrave.
81. Patterson Kerry (2002) An Introduction to Applied Econometrics: A time series approach, Palgrave.
82. Pavaskar Madhoo, (1985*) Saga of the Cotton Exchange*, Bombay Popular Prakashan
83. R.Rabemanan Jara, J.M. Zakoian (2008): Threshold Arch Models and Asymmetries in Volatility, *Journal of Applied Econometrics*, vol. 8no.1 (jan-mar., 1993), John Wiley & Sons.
84. Ravallim M. (1986): "Testing Market Integration", American Journal of Agricultural Economics, Vol. 68 (1).
85. Rustagi, Narendra K.(1988)," Crop Insurance in India', B.R. Publishing Coperation.
86. S. S. Acharya (2001): "Domestic Agricultural Marketing Policies, incoutries and Integration", in S. S. Acharya and D. P. Chaudhari (ed) Indian Agricultural Policy at the Crossroads, Jaipur: Rawat Publications.
87. Sahadevan, K.G. (2002)" Sagging Agricultural Commodity Exchanges" in Economic and Political Weekly July 27.
88. Samuaelson, P. (1952) : "Spatial price equilibrium and linear programming " American Economic Review ,42. pp. 283-303
89. Schultz T.W. (1964) *Transforming Traditional Agriculture*, Yale University Press, London
90. Schultz, T.W,(1964), *Transforming Traditional Agriculture*,Yale University Press, London and New Haven.
91. Sekhar C.S.C 92003) 'Volatility of Agricultural Prices-An analysis of major International and domestic market', Indian Council for Research on International Economic Relations, New Delhi. Workking Paper No. 103
92. Sekhar, C.S.C and Shailesh Kumar (2008): "Agricultural Market Integration in India –An explanatory analysis of Select Commodities' unpublished Paper presented in the seminar the future of Indian Agriculture"Technology and Institution " at the September 2008 in Institute of Economic Growth.
93. Sengupta Ambar N. (2005) Pricing Derivatives: The Financial Concepts underlying the Mathematics of Pricing Derivatives, Mc Graw-Hill.
94. Sheffrin Steven M.(1983), Rational Expectations, Cambridge.

95. Singh,Sukhpal and Singla, Naresh (2009),*Fresh Food Retail Chains in India: Impacts on Small Primary Vegetable Producers and Traditional F&V Retaileres,* Reports submitted to Ministry of Agriculture Government of India,Centre for Management in Agriculture (CMA) , Indian Institute of Manangement (IIM) Ahmedabad.

96. Takayama ,T. and Judge,G.(1971) : "Spacial and Temporal Price Allocation Models. Amsterdam:North-Holand.

97. Thamarajakshi, R.(1977): Role of Price Incentives in Stimulating Agricultural Production in a Developing Economy, in: D. Ensminger, Ed., *Food Enough or Statvation for Millions*, TMH Publishing Company, New Delhi.

98. Tyagi,K.K, S.C. Agarwal and S.P. Bhardwaj (2005),*Mannual on Agricultural Prices and Marketing,* Indian Agricultural Statistics Research Institute (ICAR).

99. Virmani Arvind and P.V. Rajeev (2001) excess food stocks and procurement policy planning commission working paper No. 5 (2002)

100. Viswanathan and Meenakhi (2007), "The Changing Pattern of Under-nutrition in India: A Comparative Analysis across Regions" in Basudeb Guha-Khasnobis, Shabd S. Acharya and Benjamis Davis(ed) Food Security: Indicators, Measurement and the Impact of Trade Openness,Oxford.

101. Von Mises, Ludwig (1996) *The Government and the market, Intervention and the Foundation of Economic Education.*

102. Wilson Edgar J. (2001): "Testing Agricultural Market Integration" in S. S. Acharya and D.P. Chaudhari (ed) Indian Agriculture at Crossroads.

103. World Bank(2002), Global Economic Prospects and the Developing countries2002: Making Trade work for the World's Poor, Washington D.C.

104. Zakoian, J.M. (1990) "Threshold Heteroskedastic Models," manuscript, CREST, INSEE, Paris.

Referee's Comments on the Draft Report

This report on market structure is quite exhaustive, covers variety of issues and attempts a very contemporary subject. The report is compiled in nine chapters. The first four chapters deal with the role of public versus private sectors in foodgrains marketing. Chapter five and six deal with trade liberalization of agriculture and futures trading. The succeeding two chapters discuss risk factor and crop insurance and price volatility while last chapter presents the concluding remarks. The report makes the usual attempt on the subject with a number of interesting observations and research findings. The report is rich with the use of quantitative techniques like Arch and Garch models, cointegration and error correction methods that are used appropriately to draw some useful conclusions. The following errors and omissions were, however, observed in the detailed analysis and corrections if not all, few of them will help tremendously improving the quality of report.

Detailed comments:

1. Page 50: Figures too small to be legible, scale should be enlarged.
   Response: This is done.
2. Figure numbering needs to be corrected as Figure 4 and 5 discussed in the text at page number 52 not contained in the chapter.
   Response: Figures are renumbered appropriately.
3. Page 56: Table 3.2: Stock*-what does* stand for?
   Response: Corrected
4. Page 68:The surplus and deficit states should be calculated based on total foodgrains including the coarse cereals and pulses as most of the deficit states (in the Western and Southern India) grow more coarse cereals or pulses instead of wheat and rice.
   Response: In the revised report we have considered Rice as the relevant crop for assessing the surplus/deficit status of states in foodgrain. The justification is provided in the footnote of the Page 67.
5. Cointegration analysis in Chapter 4 ought to be revised using panel cointegration that have the advantage of large degree of freedom and thereby has more robust results. The author can use advance version of Eviews for panel cointegration that is user friendly. Author can refer to Jayasuriya Sisira, Kim Jae and Kumar Parmod, 2007. "International and Internal Market Integration in Indian Agriculture: A study of the Indian Rice Market," 206th Seminar. October 25-27, Montpellier, France 7935, European Association of Agricultural Economics.
   Response: As the referee noted in the above paper the technique is suitable for large dimension data and also has its limitations. Since the dimensions considered in this chapter are not large for any region, the panel cointegration method does not seem suitable at this point. I have read the paper with interest and may consider applying the method when extending this work for a possible publication.
6. Page 104: For ARCH and GARCH models wholesale price index for harvest months with 1993-94 as the base has been used. It is difficult to understand why

author has used monthly prices during the harvest period only. If the intention is to capture farm gate prices then Farm Harvest Prices that are easily available should be better option.

Response: The wholesale price index data at the all India level is by far the best quality data available and is therefore used for the analysis which is also conducted at the national level. The averaging of market level prices and filling up gaps that exist over the entire the sample period in the data will undermined the reliability of the results.

7. Page 129: Footnote 2 missing
   Response: This is addressed.
8. Page 55: Indemnity = [(TY-actual yield/TY] of area * sum insured of farmer. I think the formula should be (TY-actual yield)/actual yield instead of TY. The author is advised to recheck the formula.
   Response: Checked.
9. Page 164, sixth line from the below: unchanging realizations of 100,100 and 100. It should be 200,200 and 200.
   Response: Corrected.
10. Page 171: The analysis of 7.9 is too technical and complicated for the general reader. If the author adds one paragraph of concluding remarks in the end, summarizing the results in short would help the layman to understand the analysis better.
    Response: Conclusions added.
11. Page 187: The TOT increased at 0.58 percent during 1995-96 to 2005-06 but fell at the rate of 0.38 percent in the period 1995-96 to 2005-06. The rate in the first period probably is 1980-81 to 1995-96, author kindly check.
    Response: Corrected.
12. Page 196: Table 8.6: Figures in parenthesis in the last column are not clear
    Response: Clarified in the notes to the table.
13. The report needs editing as draft contains spelling mistakes. An editorial check may be useful to improve verbal presentation.
    Response: Author edited.