CHAPTER 4

PRICE VOLATILITY AND RISK MANAGEMENT IN AGRICULTURE: HEDGING MECHANISM

The preceding chapter of our study focuses on the predictability of price discovery of selected agricultural commodities through futures trading in the national level commodity exchanges. It has been observed there that seasonality and uncertainty, predominant in agriculture, have, *inter alia*, been resulting in volatility in terms of price and quantity. Also, it is pointed out in the previous chapters of our study that the insurance markets have been found to be notoriously bad due to the problems of adverse selection and morale hazard in the agricultural markets. Owing to these reasons perhaps that economists like Stiglitz (1987) and Meier et. al (2000), have come to argue that the farmers face tremendous risks, and, as such, have at best only a limited opportunity to avoid them through insurance markets. It has come to be pointed out that the physical commodities and the financial derivatives are importantly different from each other in that while the holding of the former involves additional cost in terms of storage, insurance and transport, the latter does not. In addition, the agricultural commodities also get affected by changes in assets due to deterioration, loss or change in quality. It is also important to note that the production as well as the consumption of agricultural commodities is driven by the complex factors such as their complementary and substitutability behaviours and issues related to time-lag between production and consumption. It has also been argued that the commodity prices display certain systematic price behaviour which is studied by mean reversion and seasonal price movements. Furthermore, it has also come to be observed by some that in view of the adverse selection and moral hazards related problems in the insurance sector, such insurance schemes have come to be suggested in which payouts are based on the exogenous and easily observable variables that, in turn, are likely to be closely correlated with yields to the producers for their participation in these schemes.

Given this backdrop, the present chapter undertakes to discuss the issue of price volatility and the risk management practices that may be adopted in the event of prevalence of price volatility in the case of the agricultural commodities. Besides, it
also discusses the issues pertaining to the hedging mechanism in commodity markets. With the objective of examining the afore-mentioned issues more intensely, the discussion in this chapter is divided into six sections. While Section I focuses on the issues related to price volatility, in the section that succeeds it, we take up for discussion the impact of globalization on Indian commodity prices. Section III and IV discuss the issues of risk management in Indian agriculture and risk management through hedging respectively. In Section V, the results of our analysis have been presented, while Section VI seeks to underscore a few conclusions on hedging mechanism through commodity markets.

Section I

Certainty equivalent price, in the available literature, is viewed as the perfectly certain price which would yield the same choice in the absence of risk. In a risk-free perfectly competitive situation, both individual and aggregate supply can be expressed as a function of prices and, in particular, a supply response schedule can be drawn describing output as a function of output price, while holding input(s) price(s) as constant. In contrast to this, however, if prices and the production and demand are characterized by greater volatility, then consumers and producers, guided by considerations of realizing smooth production and deliveries and to reduce marketing costs, hold inventories to a much larger extent. In this section, the issues related to the price volatility in agricultural commodities have been discussed.

Issues related to Price Volatility

It is commonly observed that different policies have differential effects on mean prices and on certainty equivalent prices. In view of this, it is quite likely that certainty equivalent price for one farmer may differ importantly from that for another. For instance, while the farmers in the larger region, which is the primary source of a particular commodity, may have a negative correlation between output and quantity and hence a low certainty equivalent price, those belonging to a small region and located far away from the main supply regions may, on the other hand, witness extremely low correlation between output and supply. Furthermore, if the source of variability lies on the supply side and demand is not inelastic, the negative correlation between price and output means that the output market transmits a part of the risk.
being faced by the producers to the consumers. In such a case, the producers’ income variability would be relatively smaller than the output variability. In terms of rational expectation equilibrium, it implies that each farmer correctly forecasts the distribution of prices and chooses the extent or degree of risk of output that maximize his expected utility.

In the meantime, it is not out of context to note that while some studies\(^7\) demonstrate the behaviour of a sophisticated speculator in price variability, others such as by Newberry (1984)\(^8\), for example, comprehend the possibility of retaining market power by a dominant producer even when the market agents are likely to have rational expectations, which culminates into the destabilizing of the cash market and speculation. In addition, an attempt has also been discernible on the part of some scholars\(^9\) to study the power of spot market in futures trading. It has come to be contended in this regard that spot market power creates a moral hazard problem which not only reduces the optimal amount of hedging for those with and without market power, but also renders complete hedging as virtually impossible. The available research studies validate that the futures trade may increase the price volatility in a situation in which the investors in the futures market do not have as good information as participants in the cash market.

It is generally accepted that the changes in volatility affect prices, production and inventories. For example, an increase in volatility can lead to inventory build-ups and thereby raise prices in the short-run, and, it can also result in a decrease in the volume of production\(^10\). In principle, volatility is understood to affect market variables through the marginal value of storage and through the opportunity cost component of the marginal cost. While examining the role of volatility in short-run commodity market dynamics of the petroleum complex, some researchers\(^11\) have observed that the changes in volatility influence market variables only to a limited extent, and volatility, according to this line of thinking, can largely be forecasted on the basis of its own past values.

Commodity prices in general are known to have a high volatility which, in turn, attracts the speculators. While studying the 10-day annualized price volatility of Chicago Board of Trade (CBOT) maize price in Rand Terms and the South African
Futures Exchange (SAFEX) yellow maize price between 18 December 2001 and 18 June 2006, Geyser et. al. (2007) found that it was not immune to the volatility. Volatility is assumed to increase the risk of paying higher prices for a specific commodity, and it also makes the use of derivative instruments to hedge against price risk more expensive.

Yang et. al (2005) examined the lead-lag relationship between futures trading activity in terms of volume and open interest and cash price volatility for major agricultural commodities, namely, corn, soybean, sugar wheat and cotton during the period from January 01, 1992 to December 31, 2001. In order to address the structural changes due to the impact of Federal Agricultural Improvement and Reforms Act 1996, this period was divided into two sub-periods – i.e. the first being upto December 31, 1995 and the second beyond this date. It was found that an unexpected unidirectional increase in futures trading volume led to an increase in cash price volatility for the commodities and there was a weak causal response between open interest and cash price volatility. These findings are generally consistent with the destabilizing effect of futures trading on agricultural commodity markets, which partly explains why the criticisms of futures markets have been historically most potent in respect of agricultural commodities. The studies by Pashigian (1986), Weaver et. al (1990), Chatrath et. al (1996) and Adrangi et. al (1998) also lend credence to such a viewpoint. However, the studies on stock index futures markets undertaken by Chen et. al (1995), Darrat et. al (1995) and Darrat et. al (2002) do not corroborate this view point.

What we wish to emphasize here is that the commodity price volatility is a big problem for commodity-dependent countries and producers. This gets amply evidenced in a study by the International Monetary Fund (2002) which also points out that the commodity prices are highly volatile in the short-term sometimes varying by as much as 50 per cent in a single year. Likewise, in its 2003 study, the Economic Commission for Africa noted that between 1983 and 1997 world market prices for Robusta coffee beans swung between 40 per cent and 195 per cent around the average price of the product under reference. The World Bank Report (2006) further lends credence to such a viewpoint by noting that from August 2003 to March 2004, world...
soybean prices increased by as much as by 74 per cent, i.e., from US$237 per tonne to US$413 per tonne.

In another study (2008), the price volatility is shown to increase over time across a broad range of agricultural commodities. What is worth mentioning, in particular, about this study is its revelation about the number of price shocks that have occurred historically in respect of agricultural commodities. The study reveals that the past about 30 years have witnessed as many price shocks in respect of agricultural commodities as witnessed during the preceding 75 years. It is also shown that low commodity prices will result in lower incomes for the farmers and fewer jobs for workers. It is also found that volatile prices do exert a negative impact on the livelihoods of the poor. In addition, there exists evidence that suggests that the inherent uncertainty of stable prices complicates financial planning and environmental management for commodity-dependent countries and producers, deepening commodity dependence and widening existing inequalities.

The Least Developed Countries Report (2002) reveals that over the long term, prices for primary commodities produced by these countries have been falling relative to the prices of manufactured goods. Between 1986 and 1999, the volume of commodity exports from the least developed countries (LDCs) had increased by 43 per cent. However, the primary commodity producers have to produce more for the same return. In 2001, the United Nations estimated that for every $1 received in aid by sub-Saharan Africa since the 1970s, $0.50 has been lost as a result of these deteriorating terms of trade.

It has come to be maintained that even though the risks facing commodity producers have been partially disguised by strong prices for certain commodities, the basic problem of intense volatility in market prices, however, has not disappeared. Rather, it can be argued that the problem concerning volatility in commodity prices is on account of the imperfect nature of commodity market(s). In this regard, some academic circles contend that if commodity-dependent countries and producers tend to escape the cycle of commodity dependence, which, in turn, has come to be considered vital to wider economic stability and poverty reduction, the predictable incomes become critical. What we wish to underline is that no single policy may be able to
address all aspects of commodity price volatility\textsuperscript{32}. While the price or income stabilization interventions may create their own moral hazards and market distortions, the supply-side constraints such as the limited access to knowledge and poor infrastructure have been found to have an adverse affect on the farm incomes. It is, therefore, important for the policy-makers to tackle the very real risks facing commodity dependent countries and producers in case the international community is indeed committed to reducing poverty.

\textbf{International Scenario of Price Distortions}

In the meantime, it is worthwhile to note that during the financial year 2007-08, the unprecedented increases in the global prices of the major consumption commodities are reported to have taken place on account of rapid increase in income in many countries including India and China. These unprecedented increases in prices caused severe problems for the consumers and governments in the world in that these increases forced the millions of the world’s poor to reduce their daily calorie consumption. While the unpredictable factors accounting for the said price increases included the boost in bio-fuel production beyond planned levels induced by a hike in petroleum prices, the unprecedented extension of the multi-year Australian drought, other regional production problems; the transport cost increases and exchange rate movements together, on the other hand, also contributed importantly to price rises in the global market. The lack of stocks further compounded the matter and contributed towards worsening of the situation on this account. As a consequence, the policy focus got shifted from short-term tactics for crisis management to strategies to manage price volatility and also to assure that the consumers worldwide were not denied access to the grain. The net effect of such a shift in focus manifested itself into a progressive tightening of the aggregate supply-demand balance for major grains in the preceding years.

It is not out of context to observe that in a competitive market, the short hedgers pile up inventory during low price regime and clear them when the prices are higher. As a result the price surges get smoothened. Futures markets encourage storage by short hedgers by facilitating the transfer of price risk to long hedgers (such as grain users) or long speculators, and thereby protecting all participants from counterparty
risk. A particular type of storage policy aims to ensure a minimum consumption level for all. Unfortunately, such an ambitious scheme appears to be infeasible due to resource crunch and lack of purchasing power of the masses in general. Another type of policy might aim at limiting the price volatility by using price band rules to operate international or domestic market stabilization schemes. It is pertinent to mention that even though this type of policy has the advantage of transparency, but the effects on the behavior of prices and aggregate costs of operation are much less straightforward than what they are often perceived to be. Nevertheless, it has been established theoretically and by experience with international commodity agreements that these programmes inevitably fail even if there is no underlying trend in price.

Some international policy thinkers contend that better collection and sharing of information on global grain stocks and production prospects may improve the international response to regional or global shortages as they develop, and help prevent the onset of market panic. Besides, available empirical evidence does not support claims that non-commercial traders have increased the volatility of grain prices. Regardless of this however, one fails to locate a plausible rationale for intervention against long-run non-commercial traders who include index traders in grain futures markets as well.

What follows from above is that the price volatilities in respect of agricultural commodities produced by the farmers do not unduly perturb them, so long as they do not impact their farm incomes adversely. Moreover, with attributes like transparency, sound information and being technology-driven, the participation of various stakeholders in the commodity markets, it is not altogether impossible to effectively cope with the said price volatility. In view of the globalization of Indian agriculture in the post-liberalization era, it is not out of context to study the effect of such developments on the price movements of Indian agricultural commodities. The following Section is therefore devoted to these issues.

Section II

In the preceding section, we have argued that if price volatility does not impact farmers’ income, they are not a worried lot. Also, the participation of various stakeholders with certain necessary attributes makes it possible to deal with the
problem of price volatility in an effective manner. But in view of the fact that Indian agriculture is now developing as a part of the global economy, and Indian commodity markets are getting progressively linked to the rest of the world, how globalization of agriculture impacts the producers and consumer surpluses as also the net social welfare?, is an important question that merits serious probe. Accordingly, this section addresses such issues.

**Globalization and Indian Commodity Prices**

In the wake of ongoing trend towards economic liberalization and globalization, some adherents of free trade have come to argue that while free trade is likely to have important positive impact on net return from production of exportable agricultural commodities like maize and rice; it is likely to have small negative impact, on the other hand, on net return from the importable commodities like rapeseed-mustard. It has further been pointed out that the more liberal external trade has not in general had a beneficial impact on cultivators in India, owing to the patterns in world trade, which have led to volatile and declining crop prices internationally.

Mittal (2004) in his study points out that on account of subsidies-driven ability of foreign producers and inefficiencies in the domestic oil-processing sector in case of edible oils, the Indian products do not compete well with the imports. The oilseeds production in the country, therefore, has been found to face a threat due to inefficiency of processing on the one hand, and on account of transmission of volatility in world prices to the domestic market, on the other. For example, India liberalized its soybean and soyoil import policy in August 1999. This led to dumping of subsidized imports of soybeans on the Indian market. It has been observed that as a result of this policy, prices of the commodities under reference crashed by more than two-thirds within one growing season and millions of oilseed producing farmers lost their market, unable even to recover what they had expended on raising the crop. Further, as a result of successive lowering of tariffs on edible oils first from 65 per cent to 30 per cent, and then further to 15 per cent in 1998 and lifting of non-tariff restrictions, imports soared, and India got transformed from self-sufficiency in the production of edible oils into the world’s largest importer in a short span of five years. As a result, thousands of Indian farmers became deprived of their livelihoods.
In the case of pulses, Sathe et al. (2004) examined the issues related to the opening up of the Indian pulses sector and found that pulses (lentils) imports have not augmented supply to such an extent that there would be a strong, negative relationship between prices and imports of pulses. Though the import duties on pulses have been generally low, the result of our import regime has been such that it has not depressed prices to any significant extent. These findings are a bold pointer to the fact that liberalization of imports has exerted a negative effect on the Indian agrarian economy mainly on account of the huge subsidization of agriculture by most of the developed countries. In plain words, what it essentially implies is that the developed countries have been engaged in disposing off their agricultural exports in India at prices much lower than their respective cost of production due to the imperfect nature of world markets for such commodities. As a result, the higher volatility of agricultural prices in international markets got transmitted to the domestic markets.

In his study on cotton, Hudson (1999) investigated that it is not possible to predict the extent of price fluctuations simply on the basis of the time left for maturity. The study further establishes that the level of futures prices and seasonality effects appeared to be explanatory factors though weather was not statistically important. The lack of geographic concentration in terms of global cotton production also suggests that cotton price volatility may be more responsive to changes in international supply and demand conditions. Thus, the more relevant variables may be derived from the world supply and demand situation.

It is not unimportant to note that during July 2009, the global price of raw sugar had increased to its highest level since March 1981 on account of a widening imbalance between world supply and demand. The hike in sugar prices is a classic market response to a rise in demand for sugar especially in countries such as Brazil where a growing volume is being used as a subsidized source of ethanol and also due to supply shortages caused by low rainfall during the monsoon season in India and China and natural vagaries such as hailstorm and drought affecting supplies from Russia. When demand exceeds supply, the emerging scarcity of the commodities becomes the key factor in driving prices upward. The speculators can cause the price movements to be exaggerated as they trade in the forward markets to buy up the available stocks in the expectation of further price increases.
Sekhar (2004) attempted to assess the implications for food security of the poor through transmission of international price volatility into domestic markets which arises on account of the penetration of the process of globalization in agriculture. The author studied the effect on wheat, rice, groundnut oil, soybean oil, coconut oil, sugar, cotton and coffee and demonstrates that extreme volatility in the prices, particularly of food commodities, adversely affects poor agricultural labourers and those engaged in the unorganized sector because their wages are not index-linked.

The preceding discussion suggests that while the free trade can bring economic fortunes to the farmers growing the exportable agricultural commodities such as maize and rice, this may however not materialize owing to the transmission of high price volatility of international agricultural commodity markets, particularly of food commodities, to the domestic markets. The net outcome may be that incomes of the poor agricultural labourers and those engaged in the unorganized sector, might experience erosion in real terms. In view of such possible eventualities, it is necessary, nay, imperative that the efforts at globalization of Indian agriculture are supported simultaneously with scientific and modern risk management instruments.

Section III

In the preceding sections, we have examined the price volatility of the agricultural commodities, particularly in the context of the on-going debate of agricultural trade liberalization in India. It has been noted that the commodity prices are volatile, and the degree of volatility itself varies over time. Furthermore, it has been observed that the changes in the degree of volatility are capable of affecting the market variables by directly affecting the marginal value of storage as also a component of total marginal cost of production. In India, agricultural risks are exacerbated by the factors such as climate variability and change, frequent natural disasters, uncertainties in yields and prices, weak rural infrastructure, imperfect markets and lack of financial services. These factors not only endanger the farmers' livelihoods and incomes but also undermine the viability of the farm sector and its potential to become a part of the solution to the problem of endemic poverty of the farmers and the agricultural labour. For such reasons, this section takes up for discussion the issues of managing these risks in Indian agriculture.
Risk Management and Indian Agriculture

It is commonly observed that the commodity risk management operations in India are not fully geared to protect margins. Such a contention gets supported by the fact emerging out of a survey wherein it was found that more than 50 per cent of the respondents viewed hedging as a tool to lock-in input costs at a target level while some of them still used market views and expectations of future prices as a trigger of decision-making. Interestingly, more than 68 per cent of the respondents had a hedging horizon of less than three months. This showed that the full potential of hedging to protect long-term business cash flows was not being explored. Furthermore, it was also found that governance of commodity price risk management function is critical to ensure that risk management activities are always consistent with the risk philosophy and risk appetite of the participants. While the concept of commodity price risk management in India has steadily gained ground since the early part of this decade (2000-10), with the increasing volatility and growth in markets, it may now be appropriate for the participants to look at commodity price risk management as an integral part of the strategy to manage the bottom-line. Besides, it is also shown that the hedging programmes undertaken by companies in India are still generally short-sighted in that these seem to be driven to a large extent by market views. To put the record straight, these programmes are not always aligned with the risk philosophy of the companies. Though companies understand the need for hedging and the instruments available, the finer aspects of hedging such as basis risk and timing risk, which can significantly affect hedge cash flows, are often overlooked.

Our analysis in this study corroborates that the vulnerable groups such as the landless labourers, oral lessees and sharecroppers face a variety of risks. These risks, in turn, adversely affect their income streams and ability to build income generating assets. It is not unimportant to underline that the poor do not have an access to formal risk management mechanisms in a rural environment and, as such, manage risks through a wide variety of informal approaches. Some of these approaches are storing of grain, pooling of their small savings and extending credit through thrift, adopting traditional methods of cultivation etc. Although these steps have been undertaken by the poor in small groups, these have, nevertheless, not helped them in mitigating risk altogether. Rather, it has been seen that the informal risk management provides only a
partial coverage in case of systemic losses, making poor producers more vulnerable to extreme poverty and malnutrition. Besides, it also dampens long-term agricultural growth since the informal risk management tools do not help in sustaining growth and improving the standards of living of the vulnerable groups. In view of this, it has now been corroborated that a more formalized risk management in agriculture necessitates a risk pooling mechanism by accessing commodity derivative markets.

Though insurance is believed to address the production risks, the traditional yield insurance schemes have been found to be wanting and hence ineffective in managing the risks of the poor farmers. This becomes obvious from the fact that these insurance schemes, particularly state sponsored schemes, are characterized by historically high payouts and poor penetration rates. A close examination of the National Agricultural Insurance Scheme indicates that it has led to diminishing of the innovations amongst the farmers and resulted in irrational area approach to compensate the losses which, in turn, has encouraged the adverse selection and morale hazards amongst the peasantry. Owing to these deficiencies and the unsustainable role of the State in subsidizing crop insurance, the possibility of crowding out the role of the private sector cannot be ironed out altogether. Accordingly, it has been suggested that weather index based insurance is a more efficient way of dealing with the risks faced in agriculture. For example, in the latter case, the farmers, belonging to a particular area, could purchase rainfall contracts and if the rainfall in an area varies from a set level, varying levels of compensatory payments could be made to the respective farmers depending upon the degree of shortfall of the rainfall.

**Working Group on Risk Management in Agriculture**

It scarcely needs to be overemphasized that the minimum support price (MSP) has, in spite of its limitations, still remained a vital tool in helping farmers and consumers in achieving food security while extending remunerative prices to the farmers for their produce. In view of this, the Working Group on Risk Management in Agriculture for XI Five Year Plan (2007-12) has recommended various modifications which include extending the MSP to all farmers with broader crop coverage. In consonance with the said objectives, the Group advises various measures such as decentralized procurement with adequate provision of funds, creating
revolving fund to ensure timely availability of funds, rationalization of state taxes, price fixation by an expert body, reimbursement based on actual losses incurred, and establishment of better linkages with the growing agro-processing industry.

The fact that the commodity derivatives markets in India had a long history but were recently reintroduced to benefit the farmer from price discovery and to protect him from a situation of adverse price fluctuation, also caught the fancy of the aforementioned group. However, due to the preponderance of small and marginal farmers, their lack of awareness and other restrictions in vogue, the participation of Indian farmers in the commodity futures market has been observed to be negligible. The participation of farmers in the futures market, according to the Group, can be enhanced by allowing banks, cooperative institutions, state marketing federations, Self-help Groups (SHGs), i.e. the aggregators on behalf of the farmers in the futures market. What is emphasized in this regard is that these aggregators have the requisite knowledge and operational skills needed to participate in the futures market, while the individual farmers might, at their own, feel handicapped. It has also been suggested that hedging through options may be permitted since it is more beneficial to farmers in comparison to futures in the sense that options involve one time premium payment, and farmers can gain, if prices move upwards while in a situation of downward moving prices, they get protected against losses. In addition, the Group also recommended enactment of the Warehousing Development and Regulation Bill, 2005, an effective mechanism to take timely measures to arrest violent fluctuations in the commodity prices and permission for trading of weather indices on the commodity exchange platforms. It has come to be emphasized that the appropriate amendment of Agricultural Produce Marketing Committee laws that provide for the participation of the private players would lead to the introduction of improved processes, transparency etc in the said market which would ultimately culminate into substantial gains for farmers. The reasoning that underscores such a viewpoint is that the availability of price information and exchange connected terminals to farmers and creating awareness through campaigns across the country would enable the farmers in realizing the optimum gains from the risk management mechanism through the commodity exchanges.
The preceding analysis suggests that the structured margins in fundamental businesses have become threatened like never before on account of the occurrence of the unprecedented volatility in commodity markets. It is for the first time that the price risk management is being viewed as an all pervasive function touching every aspect of the business cycle. Commodity price risk management is no longer limited to hedging. It is about managing price risk across the value chain. Commodity price risk management in India, to be more specific, is at various levels of maturity, depending on the commodity and the strategic positioning of the players in the value chain. The general attitude towards extracting value from this function has however been lackluster. The Reserve Bank of India has recently relaxed its regulations on hedging in overseas markets by providing the companies with a wider range of options relating to price risk management. Besides, it has also permitted hedging on international exchanges in the case of certain commodities procured or sold locally in the domestic markets. In the context of the foregoing discussion on the internal and external developments and the increased volatility, the use of commodity price risk management as an effective tool in addressing the problems of the poor and vulnerable segments of the Indian farming community imperatively assumes great significance.

Section IV

The preceding sections in this chapter have attempted to capture various aspects of risk management in Indian agriculture. Needless to overemphasize, risk management assumes critical significance in the context of the functioning of the domestic agricultural markets, particularly when these markets are no more insulated from the effects of price volatility in the international agricultural commodity. It is not unimportant to underlie that many participants, including manufacturers using agricultural commodities as raw materials, traders and the farmers also resort to hedging to protect themselves from the risk of potential adverse price changes. In this section, we take up for discussion the issue of risk management through hedging.

Risk Management through Hedging

If the past and ongoing trends are any indication, it seems that alongside the world becoming economically more prosperous, the food price volatility is likely to go up. Also, it has been seen that in the present scenario the government interventions in
agriculture are not going to be effective. Rather in a situation characterized by
government receding, risk management through commodity futures markets and hedge
funds has come to be growingly emphasized in some quarters. In this regard, it has
come to be observed that while commodity futures markets provide early warnings
about future supply-demand imbalances, the hedge funds have the ability to put capital
behind the job of holding buffer stocks. When the futures markets show a high price at
a future date, hedge funds are uniquely able to carry inventories into that future date,
thus smoothing out price fluctuations in the process and vice-versa. The integration
between the world of commodities and financial firms is thus a critical element of the
response to this new world of high commodity price volatility. The recent events have
demonstrated that the world food market is highly integrated. Also, it is not out of
context to point out that through imports, exports and smuggling, Indian food prices
are increasingly integrated with the world prices. In view of this, what is immediately
required is an unabashedly international perspective on production, prices and
commodity futures trading. Accordingly, some scholars contend that in respect of
food, the Indian economy needs to be positioned, and as such also viewed as an
integral and important component of the global economy.

Kumar et. al (2008)\textsuperscript{34}, in their study, demonstrate that price risk management,
using hedging tools like futures and options and their effectiveness, is an active area
of research particularly in the case of India. Furthermore, it is more important to
observe that the hedging decisions based on futures contacts have to deal with finding
optimal hedge ratios and hedging effectiveness\textsuperscript{35}. Traditionally, hedging has been
viewed in terms of taking a position in futures contract which is equal in magnitude
but opposite in sign to the position in spot market. In an emerging market like India
where commodity markets are growing at a rapid pace and derivatives are of recent
origin, it is important to evaluate the hedging effectiveness of derivatives.

That Indian agriculture faces a wide variety of risks, which, in turn, seem to
endanger the livelihoods and incomes of the vulnerable segments of the peasantry, is
a widely known fact. In addition to this, it also seems to undermine the viability of the
agriculture sector and its potential to become a part of the solution to the problem of
widespread poverty of the farmers and the agricultural labour. There is no gainsaying
the fact that agriculture assumes tremendous importance in terms of ushering-in the
much acclaimed process of socio-economic transformation of the rural areas. The national economy, besides generating savings and investments in this grossly under-funded sector, also needs considerable governmental and financial sector interventions for the purpose of ensuring food and nutritional security of the farming community at the household level. Also, the poor development and penetration of various risk management tools in the country represent the huge opportunities for the emerging agricultural insurance and commodity markets to pull the producer farmers out of the poverty trap by insulating them from income shocks and by ensuring that a fair share of the price goes to them.

In the meanwhile, it is important to observe that against the backdrop of the Central Government’s decision to lift ban on futures trade of wheat after a period of two years, Takshashila Academia of Economic Research (TAER) brought out its publication in which it has come to be emphasized that the futures trade not only helps the farmers and traders in price discovery, but also plays an important role in moderating the seasonal variations in farm prices by reducing short-term price volatility. The study also underlines the role of the futures markets in integrating commodity prices horizontally over regions and across the national boundaries as well as vertically for products lines. It further elaborates that the desirable shifts in cropping patterns may be facilitated through futures trade since the futures prices, based on the present market assessment of the anticipated supply and demand, to some extent act as the price forecasts. The futures markets are also assumed to facilitate stocking and production planning for various market functionaries and, as such, the futures prices have been considered as reference prices for physical market transactions in cash and forward contracts, entered either domestically or for overseas export-import business. It is apprehended in some quarters that at times, the futures markets may fail in some commodities for want of proper direction and efficient regulation. Such eventualities, however, do not diminish the economic utility and functions of the commodity derivatives markets.

Section V

In this section, we make use of the data on futures prices and spot prices in respect of four crops, viz., Barley and Mustardseed being traded at Jaipur Centre in
Rajasthan, Sugar M200 Grade at Kolhapur Centre and Cottonseed at Akola Centre (both in Maharashtra). These data have been obtained from the National Commodity and Derivatives Exchange Limited (NCDEX). The information pertains to selected futures contracts spread over the period of four years between 2006 and 2009. It is pertinent to mention that the data for futures prices (F), is the closing daily prices of the respective contracts, while the fair values of the spot daily prices (S) have been calculated as spot price multiplied by exponential (e) to the power of multiple of risk free rate of interest (r) and time (t), implying number of days left for expiration of futures contract. Again, to test departure from normality of the sample series of futures prices and fair value of spot prices, the goodness-of-fit has been measured by Jarque-Bera test and denoted by JB. In this analysis, \( H(FS) \) signifies the optimal hedge ratio between futures and spot daily prices and \( T^* \) indicates the hedging effectiveness which is equivalent of the slope coefficient (\( \beta \)) of the Ordinary Least Square (OLS) regression equation in which changes in spot prices have been regressed on the changes in the futures prices. It is important to mention that (\( \beta \)) coefficient is also the value of the Minimum Variance Hedge Ratio (MVHR) that indicates the maximum possible variance reduction (For further details in this regard, please refer to page 23 to 25 of the present study).

Another important point worth mentioning in this regard is that we have taken into account the varying expiration periods in respect of each futures contract. These expiration periods are denoted by \( C(1) \), \( C(2) \), \( C(3) \), \( C(4) \), \( C(5) \) and so on and so forth. While \( C(1) \) represents the full period of the contract, \( C(2) \) signifies the period beginning from one month after the commencement of the contract till the end of the contract. Likewise, \( C(3) \), \( C(4) \), \( C(5) \), etc. represent other expiration periods of varying lengths. This classification of expiration periods is expected to help us in analyzing the behaviour of the contract as it moves towards the expiration month. Temporal patterns were drawn on the futures prices and the fair values of spot prices along with the corresponding volumes traded in the respective trading centres. As observed earlier, we now take up for examination the futures contracts in respect of Barley, Cottonseed, Sugar M200 and Mustardseed in that order.
(a) Barley Futures Contracts at Jaipur Warehouse

It is important to mention in respect of barley that it is normally a 130- days’ crop which is often sown in the third week of October and harvested in February. In the case of this crop, our analysis considers four futures contracts, viz., March 2007, September 2007, December 2007 and May 2008. It is not irrelevant to point out here that while the March 2007 contract covered 64 days’ time, each of the other three contracts covered the normal period of 183 days. The relatively much shorter time period in the case of March 2007 contract was mainly on account of constrains imposed by the non-availability of the data. The temporal price movements, as shown in Graphs G-4.1 through G-4.8 (based on Appendix Tables A-4.1 through A-4.4) concerning the movements in futures and spot prices in respect of barley point, in an overall sense, towards high price volatility for all the four contracts. A cursory look at the temporal price movements of the futures and spot prices of the afore-mentioned four futures contracts of barley and its volumes traded during the period of such contracts as shown in these graphs point towards the following important points:

(i) The futures and spot prices co-integrate and tend to converge during the expiration week.

(ii) The price variations are relatively higher during the months away from the harvest month(s) of barley. However, the price volatility in the futures markets as well as the spot markets reaches at the minimum level during the expiration week of the contracts and also during the harvesting month of barley.

(iii) In spite of significant increase both in the futures and spot prices, the volumes traded in the exchange remained low during the far-off months from the harvesting season due to the fact that the physical stocks are not available in the markets and the participants were waiting for new harvest to arrive in the markets. After this, the volumes to be traded in the exchange start increasing along with increase in volatility of futures and spot prices due to arrival of new harvest.

A major limitation of graphical analysis as presented above is that regardless of its visual appeal there is obvious a lack of precision and statistical rigour. To lend
precision and statistical rigour to our results, we analyze the information presented in Table 4.1 (based on the Appendix Tables A-4.1 through A-4.4). A closer examination of the results presented in this Table points towards the following:

**Table 4.1**: Computation of Standard Deviation, Correlation Coefficient, Skewness and Kurtosis of the Futures Price and Coefficients of Variation of the Futures and Spot Prices of Cottonseed Barley traded at NCDEX and Jaipur Delivery Centre and Estimation of Jarque-Bera Test. Optimal hedge ratios and Hedging effectiveness during different Periods

<table>
<thead>
<tr>
<th>Period</th>
<th>Futures Prices</th>
<th>Coefficient of Variation</th>
<th>Correlation Coefficient</th>
<th>Jarque Bera Value</th>
<th>Optimal hedge ratio</th>
<th>Hedging effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Deviation</td>
<td>Skewness</td>
<td>Kurtosis</td>
<td>Futures Prices</td>
<td>Spot Prices</td>
<td></td>
</tr>
<tr>
<td><strong>Futures Contract: March 2007</strong></td>
<td>Regression $F = 815.0 + 0.187 \times (S)$ $R^2 = 0.034$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>19.55</td>
<td>0.76</td>
<td>0.17</td>
<td>2.38</td>
<td>2.42</td>
<td>0.51</td>
</tr>
<tr>
<td>C (2)</td>
<td>24.63</td>
<td>0.61</td>
<td>-1.47</td>
<td>2.97</td>
<td>1.22</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>Futures Contract: September 2007</strong></td>
<td>Regression $F = 758.9 + 2.320 \times (S)$ $R^2 = 0.573$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>97.72</td>
<td>1.85</td>
<td>3.01</td>
<td>11.01</td>
<td>10.98</td>
<td>0.96</td>
</tr>
<tr>
<td>C (2)</td>
<td>103.43</td>
<td>1.66</td>
<td>2.10</td>
<td>11.55</td>
<td>10.88</td>
<td>0.96</td>
</tr>
<tr>
<td>C (3)</td>
<td>103.83</td>
<td>1.57</td>
<td>1.46</td>
<td>11.30</td>
<td>10.60</td>
<td>0.96</td>
</tr>
<tr>
<td>C (4)</td>
<td>108.51</td>
<td>1.22</td>
<td>0.15</td>
<td>11.39</td>
<td>10.12</td>
<td>0.96</td>
</tr>
<tr>
<td>C (5)</td>
<td>104.15</td>
<td>0.52</td>
<td>-1.41</td>
<td>10.11</td>
<td>9.45</td>
<td>0.94</td>
</tr>
<tr>
<td><strong>Futures Contract: December 2007</strong></td>
<td>Regression $F = 924.4 + 3.402 \times (S)$ $R^2 = 0.809$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>129.34</td>
<td>-0.78</td>
<td>-1.06</td>
<td>11.48</td>
<td>0.40</td>
<td>0.99</td>
</tr>
<tr>
<td>C (2)</td>
<td>93.19</td>
<td>-1.31</td>
<td>0.42</td>
<td>7.97</td>
<td>13.40</td>
<td>0.98</td>
</tr>
<tr>
<td>C (3)</td>
<td>103.86</td>
<td>-0.10</td>
<td>-0.67</td>
<td>2.54</td>
<td>8.77</td>
<td>0.76</td>
</tr>
<tr>
<td>C (4)</td>
<td>16.96</td>
<td>0.11</td>
<td>-0.42</td>
<td>1.37</td>
<td>2.09</td>
<td>0.31</td>
</tr>
<tr>
<td>C (5)</td>
<td>10.26</td>
<td>0.60</td>
<td>-0.50</td>
<td>0.83</td>
<td>2.11</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Futures Contract: May 2008</strong></td>
<td>Regression $F = 847.4 + 1.781 \times (S)$ $R^2 = 0.880$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>101.16</td>
<td>0.16</td>
<td>-0.90</td>
<td>9.99</td>
<td>4.05</td>
<td>-0.42</td>
</tr>
<tr>
<td>C (2)</td>
<td>87.53</td>
<td>0.30</td>
<td>-1.01</td>
<td>8.45</td>
<td>5.05</td>
<td>-0.62</td>
</tr>
<tr>
<td>C (3)</td>
<td>84.66</td>
<td>0.13</td>
<td>-0.92</td>
<td>8.07</td>
<td>5.09</td>
<td>-0.54</td>
</tr>
<tr>
<td>C (4)</td>
<td>75.36</td>
<td>0.07</td>
<td>-0.65</td>
<td>7.05</td>
<td>4.98</td>
<td>-0.44</td>
</tr>
<tr>
<td>C (5)</td>
<td>66.42</td>
<td>0.11</td>
<td>-0.75</td>
<td>6.09</td>
<td>5.18</td>
<td>-0.32</td>
</tr>
<tr>
<td>C (6)</td>
<td>51.47</td>
<td>0.08</td>
<td>0.38</td>
<td>4.60</td>
<td>5.44</td>
<td>0.02</td>
</tr>
<tr>
<td>C (7)</td>
<td>48.22</td>
<td>0.15</td>
<td>0.39</td>
<td>4.24</td>
<td>4.51</td>
<td>0.91</td>
</tr>
<tr>
<td>C (8)</td>
<td>44.94</td>
<td>1.09</td>
<td>1.14</td>
<td>3.92</td>
<td>4.15</td>
<td>0.94</td>
</tr>
</tbody>
</table>
G: 4.1: Barley Jaipur March 2007
Price Movements Futures and Spot
G: 4.2 Barley Jaipur March 2007
Volumes Traded at NCDEX
G: 4.7 Barley Jaipur May 2008
Price Movements Futures and Spot
G : 4.8 Barley Jaipur May 2008
Volumes Traded at NCDEX
The high values of $R^2$ (i.e., 0.81 and 0.88) in the case of December 2007 and May 2008 futures contracts of barley respectively point towards the potential and attained hedging effectiveness. In the case of September 2007 futures contract of barley, the value of $R^2$ was observed to be 0.57, which, viewed together with the values of optimal hedge ratio (1.03) and hedging effectiveness (0.93) for the full contract period, $C (1)$, also proves that hedging is useful in potential and attained effectiveness for risk reduction.

The values of Jarque-Bera test in the case of all the above-mentioned three contracts were found to be less than 5.99 at 95 per cent of confidence interval. This points towards normality in respect of data distribution of December 2007 and May 2008 contracts. Further, in the case of September 2008 contract, the values for the first two periods, $C (1)$ and $C (2)$, were noted to exceed 5.99. This showed that the futures hedging was more effective during the near months (less than six months) contracts.

The minimum values of the coefficient of variation (10.11, 0.83, and 3.92) for the expiration months in case of September 2007, December 2008 and May 2008 contracts respectively are suggestive of the fact that the participants square-off their position during the expiration months. This is possibly owing to the fact that very few futures get retained till the date of maturity of the respective contracts.

Keeping in view that the barley is generally sown in the month of October and harvested in the month of February, the sudden changes in expiration month of September 2007 futures contract of this particular commodity, the high value of Jarque-Bera (7.38) and negative value of kurtosis (-1.41), seemed to occur due to stock-out position.

Thus, our preceding analysis in terms of graphical and statistical presentation in the case of barley futures amply demonstrates that the hedging is effective when the new crop is likely to reach the market and futures and spot prices tend to converge during such period. Also, as the contracts reach their respective expiration months,
the uncertainty of the price movements gets significantly reduced. To put it pithily, our results indicate that the futures trading of the crop is quite useful for all the stakeholders and its hedging has, to great extent, been effective in mitigating the price volatility. We suggest that the contracts for near-months (less than six months) due to the fact that they are more effective in comparison with those for the far-off months.

(b) Cottonseed Oilcake Futures Contracts at Akola Warehouse

In India, cotton is generally sown in April / May and is harvested after about 180 to 210 days, i.e., during October to November. The information on spot and futures prices and on volumes traded of cottonseed oilcake at Akola in Maharashtra in respect of May 2008 and January 2009 contracts, as considered by us in our present study, is mirrored in Graphs G-4.9 through G-4.12, (based on Appendix Tables A-4.5 and A-4.6), followed by the statistical results in Table 4.2. The following important points need to be noted in particular:

(i) In the case of May 2008 contract of cottonseed oilcake, the futures prices remained above the spot prices for the full contract period, and the volumes of trade were observed to be higher during the 64 to 99 days period of contract than during the periods both preceding and succeeding to said period.

(ii) As against the afore-mentioned contract, the futures prices were observed to be lower than the spot prices in the case of January 2009 contract. This nevertheless apart, high basis was observed in this case during most of the contract period except between 71 to 92 days. This high basis seems to have attracted the participants to trade in the futures markets. As a result, the high volumes of cottonseed oilcake were observed to have been traded in Akola market during the contract period.

In the meanwhile, notwithstanding the above graphical analysis, a close look at Table 4.2 clearly points towards the following results:
Table 4.2: Computation of Standard Deviation, Correlation Coefficient, Skewness and Kurtosis of the Futures Price and Coefficients of Variation of the Futures and Spot Prices of Cottonseed Oilcake traded at NCDEX and Akola Delivery Centre an Estimation of Jarque-Bera Test. Optimal hedge ratios and Hedging effectiveness during different Periods

<table>
<thead>
<tr>
<th>Period</th>
<th>Futures Contract: May 2008</th>
<th>Futures Contract: January 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Futures Prices</td>
<td>Coefficient of Variation</td>
</tr>
<tr>
<td></td>
<td>Standard Deviation</td>
<td>Skewness</td>
</tr>
<tr>
<td>C (1)</td>
<td>18.25</td>
<td>0.15</td>
</tr>
<tr>
<td>C (2)</td>
<td>19.62</td>
<td>0.00</td>
</tr>
<tr>
<td>C (3)</td>
<td>22.70</td>
<td>0.14</td>
</tr>
<tr>
<td>C (4)</td>
<td>17.53</td>
<td>0.77</td>
</tr>
<tr>
<td>C (5)</td>
<td>5.91</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Regression F = 443.2 + 0.202 (S) R² = 0.179

Regression F = 456.5 + 0.197 (S) R² = 0.135
G 4.10 Cottonseed Oilcake Akola May 2008
Volumes Traded at NCDEX
G - 4.11 Cottonseed Oilcake Akola January 2009

Price Movements Futures and Spot

Futures  exp(Spot)
G -4.12 Cottonseed Oilcake Akola January 2009
Volumes Traded at NCDEX
(i) The extremely low values of $R^2$ (0.18 and 0.14) along with very high computed values of Jarque-Bera test in relation to Table value (i.e. 5.99 at 95 per cent of confidence interval) indicate ineffectiveness of the futures trading of cottonseed oilcake for both the contract, i.e., May 2008 and January 2009.

(ii) The values of correlation coefficient exceeding 0.77 for all the periods (except the expiration period in which case it was observed to be 0.38) of May 2008 futures contract supported by the values of optimal hedge ratio (including those more than one) indicated the attained effectiveness in the sense that the relative variance of the hedged position was less than the un-hedged position. This further underlines the importance of hedging as a risk management tool in commodity derivatives.

(iii) We note that in the case of both the May 2008 and January 2009 futures contracts, the values of the standard deviation get reduced in case of near-month contracts, from 22.70 to 5.91 for May 2008 contract and from 24.69 to 12.21 for January 2009 contract. These observations point out that the attained hedging effectiveness was quite significant in the case of futures trading of cottonseed oilcake.

(iv) Also, the coefficients of variation for both the contracts have been found to decline from 5.31 to 1.47 in the case of May 2008 contract and from 5.60 to 2.68 in the case of January 2009 contract. This implied that the price variability seemed to get reduced during the expiration months in the case of both the contracts under reference.

All in all, it can be concluded that the future trading of cottonseed oilcake in the Akola markets was informationally weak, and, as such, it registered high level of volatility, culminating into high volumes of trade following the active participation by the speculators and arbitrageurs.
Having discussed futures contracts in respect of barley and cottonseed oilcake at Jaipur (Rajasthan) and Akola (Maharashtra) centres, we, now, turn our attention to likewise contracts in respect of Sugar M(200) at Kolhapur centre. To begin with, it is not out of context to mention that in terms of profitability, sugarcane is considered to be economically more remunerative in relation to other alternate crops. Besides, the climatic conditions also do not severely constrain the raising of this crop in different parts of the country. Owing to rising demand and supplies of sugar in more recent times, this commodity has tended to grow in importance in the matter of volumes of its trading in the Indian agricultural commodities markets. Though there are various qualities of the product under reference, we have, in our analysis in the present study, included only the Medium variety (M200) of sugar. Our choice in respect of this variety of sugar was partly dictated by the appreciable volumes that got traded at the National Commodity and Derivatives Exchange Limited (NCDEX), but also by the observed significant price variability to this effect during 2008-09. Furthermore, two futures contracts of October 2008 and March 2009 traded at NCDEX in Kolhapur market have been considered in our study for analytical purposes.

The temporal movements of the futures and spot prices of these contracts as also of their traded volumes at NCDEX, as have been captured in Graphs G - 4.13 through G – 4.16, (based on Appendix Tables A-4.7 and A-4.8), indicate the following points:

(i) In the case of October 2008 futures contract, wide variations both in spot and futures prices could be seen taking place, and the spot prices were noted to remain above the futures prices during the entire period of contract

(ii) In spite of high values of basis observed during the first 92 days of the afore-mentioned contract, the volumes traded remained lower during the said period as compared to the rest of the period. The volumes traded after 92 days seemed to have registered notable increase owing to the convergence of the spot and futures prices that occurred during 71 to 92 days of the contract under reference. Again, in the wake of the emergence of the wide basis between the spot and futures prices between 92 and 113
days of this contract, speculative activities and intra-day trading grew notably which in turn resulted into significant quantum jump in the trading of the commodity under reference.

(iii) As against the above, what needs to be underlined in particular in the case of March 2009 futures contract of sugar is that the values of the basis remained at a lower keel in comparative terms. It was possibly due to the existence of uncertainty that coupled with the low values of basis during the first 113 days of the contract that accounted for exceedingly low volumes of trade in the case of this commodity

(iv) Regardless of what has been observed above in respect of March 2009 sugar M (200) contract, there was an important rise in the trading volumes after 113 days. The plausible explanations that seemed to underlie the important growth of traded volumes, in our opinion, could partly be the increase in the price variations in respect of spot prices and partly the contract’s reaching the expiration date. So, genuine traders preferred to hedge in the commodity market.

In addition to the above, the statistical analysis as carried out by us in respect of the above-mentioned two contracts and presented in Table 4.3, points towards the following:

(i) The values of $R^2$ (i.e., 0.55 and 0.65) in the case of October 2008 and March 2009 contracts respectively, do explain the extent of the volatility involved in the two contracts under reference. By implication, these values also indicate the proportion of the volatility that can be eliminated through hedging in respect of the above-mentioned two futures contracts pertaining to sugar M (200).

(ii) Our results point out the high values of correlation coefficient for the October 2008 futures contract (between 0.70 and 0.91) as also, for March 2009 futures contract (between 0.70 and 0.85) in respect of Sugar M (200) commodity. These results point towards the potential effectiveness of the hedging through futures trading in respect of the said commodity.
Table 4.3: Computation of Standard Deviation, Correlation Coefficient, Skewness and Kurtosis of the Futures Price and Coefficients of Variation of the Futures and Spot Prices of Sugar M (200) traded at NCDEX and Kolhapur Delivery Centre and Estimation of Jarque-Bera Test, Optimal hedge ratios and Hedging effectiveness during different Periods.

<table>
<thead>
<tr>
<th>Period</th>
<th>Futures Prices</th>
<th>Coefficient of Variation</th>
<th>Correlation Coefficient</th>
<th>Jarque-Bera Value</th>
<th>Optimal hedge ratio</th>
<th>Hedging effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Deviation</td>
<td>Skewness</td>
<td>Kurtosis</td>
<td>Futures Prices</td>
<td>Spot Prices</td>
<td></td>
</tr>
<tr>
<td>Futures Contract: October 2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>90.36</td>
<td>0.22</td>
<td>-0.84</td>
<td>5.35</td>
<td>9.90</td>
<td>0.89</td>
</tr>
<tr>
<td>C (2)</td>
<td>95.16</td>
<td>-0.08</td>
<td>-0.98</td>
<td>5.61</td>
<td>9.54</td>
<td>0.91</td>
</tr>
<tr>
<td>C (3)</td>
<td>78.35</td>
<td>-0.37</td>
<td>0.08</td>
<td>4.53</td>
<td>7.92</td>
<td>0.85</td>
</tr>
<tr>
<td>C (4)</td>
<td>44.73</td>
<td>0.53</td>
<td>-0.26</td>
<td>3.17</td>
<td>4.88</td>
<td>0.70</td>
</tr>
<tr>
<td>C (5)</td>
<td>40.40</td>
<td>0.15</td>
<td>-1.15</td>
<td>2.33</td>
<td>2.85</td>
<td>0.72</td>
</tr>
<tr>
<td>C (6)</td>
<td>33.73</td>
<td>-0.12</td>
<td>-1.28</td>
<td>1.95</td>
<td>0.95</td>
<td>0.00</td>
</tr>
<tr>
<td>Futures Contract: March 2009</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>80.53</td>
<td>0.77</td>
<td>-0.51</td>
<td>4.04</td>
<td>7.68</td>
<td>0.81</td>
</tr>
<tr>
<td>C (2)</td>
<td>78.58</td>
<td>0.64</td>
<td>-0.76</td>
<td>3.92</td>
<td>8.16</td>
<td>0.82</td>
</tr>
<tr>
<td>C (3)</td>
<td>82.50</td>
<td>0.49</td>
<td>-1.05</td>
<td>4.10</td>
<td>8.09</td>
<td>0.85</td>
</tr>
<tr>
<td>C (4)</td>
<td>82.39</td>
<td>0.15</td>
<td>-1.22</td>
<td>4.05</td>
<td>7.60</td>
<td>0.82</td>
</tr>
<tr>
<td>C (5)</td>
<td>72.31</td>
<td>-0.13</td>
<td>-1.11</td>
<td>3.51</td>
<td>5.61</td>
<td>0.70</td>
</tr>
<tr>
<td>C (6)</td>
<td>61.20</td>
<td>-0.88</td>
<td>0.26</td>
<td>2.92</td>
<td>3.16</td>
<td>0.30</td>
</tr>
<tr>
<td>C (7)</td>
<td>69.34</td>
<td>-0.23</td>
<td>-1.09</td>
<td>3.36</td>
<td>1.00</td>
<td>0.85</td>
</tr>
</tbody>
</table>
G : 4.14 Sugar M Grade Kolhapur October 2008
Volumes Traded at NCDEX

Volume
G: 4.15 Sugar M Grade Kolhapur March 2009
Price Movements Futures and Spot

exp(Spot) Futures
(iii) Our analysis for the said futures contracts of sugar M (200) commodity indicate that the values of standard deviation of the near months futures were lower in respect of October 2008 futures contract (reduced from 95.16 for the longer period to 33.73 for the shorter period) and also in the case of March 2009 futures contract (reduced from 80.53 for the longer period to 69.34 for the shorter period). On the basis of these results, it can be argued that the volatility can be reduced significantly through futures trading of the said commodity, particularly for the near-months futures.

(iv) An interesting observation can be made from the results that the coefficients of variation for the October 2008 futures contract (ranging between 5.35 and 2.33) and also for the March 2009 futures contract (ranging between 4.10 and 3.36) were found to be less than those of the spot prices for the said contracts. These findings lend credence to our earlier conclusion that the combined position (both hedged and unhedged) can mitigate volatility considerably. In addition, it also implies that the futures trading in sugar helps in obtaining anticipated as well as attained effectiveness.

(v) The calculated very high values of Jarque-Bera test in comparison to the Table value of 5.99 at 95 per cent of confidence interval signal towards the departure from the normal distribution of the data. This shows that the administered prices of the commodity under reference control its spot prices and the same do not conform to the market conditions.

What follows from above is that the futures trading of sugar M 200 commodity got informationally disseminated and influenced the hedging instrument (futures prices). However, the administrative control on the spot prices of the commodity did result in some abnormalities in the price movements. The hedging effectiveness was seen due to potential and attained relationship between the two prices.
(d) **Mustardseed Futures Contracts at Jaipur Warehouse**

Finally, as observed earlier in our study, to complete our discussion of the futures contracts of the four selected commodities, we take up for discussion the mustardseed futures contracts at Jaipur delivery centre. It is not out of context to underline the fact that mustard oil has continued to have a major share in production of edible oils in India in that its share remained more than 24 per cent throughout the period falling in between 2004-05 and 2008-09. Regardless of this high share of the commodity under reference, what is disturbing to note in this case is that its share in the total production of edible oilseeds has continuously declined from 31.7 per cent in 2004-05 to 24.5 per cent in 2007-08. It is for such considerations that this commodity has qualified for inclusion in our analysis of futures markets. Our discussion in respect of this commodity hovers around the May 2008 and February 2009 futures contracts. The temporal movements of futures and spot prices in Jaipur market in respect of these two contracts and their traded volumes at NCDEX have been presented in Graphs G – 4.17 through G – 4.20, (based on Appendix Tables A-4.9 and A-4.10). The following points need to be underlined in particular from these graphs and Tables:

(i) In case of May 2008 futures contract of mustardseed, the spot prices remained more or less in tandem with the futures prices. It implies that these two sets of prices moved together.

(ii) The high level of variability, as observed in respect of both the prices during 85 to 120 days of the afore-mentioned contract, gave rise to speculative activities. Accordingly, significantly high trading volumes could be witnessed during this period in respect of the said contract.

(iii) As against this, the higher basis together with the situation of spot prices being significantly higher in comparison to the respective futures prices during the first 99 days of the February 2009 contract of mustardseed resulted into low volumes of trading at NCDEX.

(iv) The convergence of spot and futures prices as seen beyond 99 days of the said futures contract of mustardseed, nonetheless, seemed to contribute towards the increasing volumes that were traded at NCDEX.

Price Movements Futures and Spot

exp(Spot)  Futures
G : 4.20 Mustardseed Jaipur February 2009

Volumes Traded at NCDEX
This apart, for obtaining the deeper insights into the hedging mechanism in case of mustardseed futures contracts, it is worthwhile to look at statistical results as presented in Table 4.4.

Table 4.4: Computation of Standard Deviation, Correlation Coefficient, Skewness and Kurtosis of the Futures Price and Coefficients of Variation of the Futures and Spot Prices of Mustardseed traded at NCDEX and Jaipur Delivery Centre and Estimation of Jarque-Bera Test, Optimal hedge ratios and Hedging effectiveness during different Periods

<table>
<thead>
<tr>
<th>Period</th>
<th>Futures Prices</th>
<th>Coefficient of Variation</th>
<th>Correlation Coefficient</th>
<th>Jarque Bera Value</th>
<th>Optimal hedge ratio</th>
<th>Hedging effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Deviation</td>
<td>Skewness</td>
<td>Kurtosis</td>
<td>Futures Prices</td>
<td>Spot Prices</td>
<td></td>
</tr>
<tr>
<td>Futures Contract: May 2008</td>
<td>Regression $F = 488.8 + 0.491(S)$</td>
<td>$R^2 = 0.357$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>37.24</td>
<td>0.86</td>
<td>0.34</td>
<td>6.91</td>
<td>7.08</td>
<td>0.94</td>
</tr>
<tr>
<td>C (2)</td>
<td>33.78</td>
<td>0.94</td>
<td>0.54</td>
<td>6.14</td>
<td>6.83</td>
<td>0.93</td>
</tr>
<tr>
<td>C (3)</td>
<td>32.40</td>
<td>0.92</td>
<td>0.42</td>
<td>5.80</td>
<td>6.66</td>
<td>0.91</td>
</tr>
<tr>
<td>C (4)</td>
<td>35.56</td>
<td>0.51</td>
<td>-0.37</td>
<td>6.30</td>
<td>6.45</td>
<td>0.93</td>
</tr>
<tr>
<td>C (5)</td>
<td>23.63</td>
<td>0.28</td>
<td>-0.81</td>
<td>4.32</td>
<td>4.25</td>
<td>0.89</td>
</tr>
<tr>
<td>C (6)</td>
<td>24.79</td>
<td>-0.01</td>
<td>-0.82</td>
<td>4.50</td>
<td>4.49</td>
<td>0.89</td>
</tr>
<tr>
<td>Futures Contract: February 2009</td>
<td>Regression $F = 659.2 + 1.010(S)$</td>
<td>$R^2 = 0.607$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (1)</td>
<td>20.39</td>
<td>0.54</td>
<td>0.78</td>
<td>4.04</td>
<td>8.45</td>
<td>0.16</td>
</tr>
<tr>
<td>C (2)</td>
<td>14.40</td>
<td>-0.36</td>
<td>-0.12</td>
<td>2.90</td>
<td>9.27</td>
<td>-0.18</td>
</tr>
<tr>
<td>C (3)</td>
<td>13.10</td>
<td>-0.14</td>
<td>-0.23</td>
<td>2.64</td>
<td>9.91</td>
<td>-0.29</td>
</tr>
<tr>
<td>C (4)</td>
<td>12.53</td>
<td>-0.88</td>
<td>1.57</td>
<td>2.50</td>
<td>8.21</td>
<td>0.27</td>
</tr>
<tr>
<td>C (5)</td>
<td>13.49</td>
<td>-0.76</td>
<td>0.16</td>
<td>2.72</td>
<td>3.44</td>
<td>-0.31</td>
</tr>
</tbody>
</table>
The following observations need to be underlined in particular from the said Table:

(i) The high value of $R^2$ (0.61) in the case of February 2009 futures contract of mustardseed shows that the extent of variation, which can be reduced by hedging was much higher in comparison to that in the case of May 2008 contract in which case the value of coefficient of determination ($R^2$) was observed to be 0.36.

(ii) The high values of correlation coefficients (in the range of 0.89 and 0.94) in respect of May 2008 futures contract of the commodity under reference show that the futures and spot prices for this contract were highly correlated. It implied that it was possible to achieve the potential and attained effectiveness through hedging in the case of May 2008 contract. In contrast, the small values (including negative values) of correlation coefficient, as observed in respect of the February 2009 futures contract, were possibly due to the coinciding of futures contract with the harvesting month of the crop.

(iii) The decreasing values of standard deviation from 37.24 for longer periods to 24.79 for shorter periods in respect of May 2008, as also from 20.39 for longer periods to 12.53 for shorter periods in the case of February 2009 contracts signal towards reduction in volatility in the near-months contracts of mustardseed.

(iv) The coefficients of variation for both the said futures contracts were found to be lower in comparison to those of the spot prices for the corresponding periods. What this seems to suggest is that hedging helps in mitigating the volatility of the spot price movements for the crop under reference.

(v) The estimated high values of Jarque–Bera test in relation to the Table value at 95 per cent of confidence interval (i.e. 5.99), point towards departure from normal distribution of data. Such behaviour can be attributed to different reasons such as the commodity being largely available in the harvesting season, high carrying cost and lack of grading facilities in the spot markets.
These results, thus, indicate that the mustardseed futures markets are mainly used either for speculative purpose or by the extraction units. In addition, its physical deliveries are limited to shorter duration due to lack of storage facilities. Also, in order to make these markets more effective for the purpose of hedging, what is imperatively required is that the mustardseed crop needs to be scientifically graded and standardized before being brought for sale in the spot markets. It assumes considerable significance from the viewpoint of fetching more remunerative prices for high content value seeds of the crop in the spot markets.

It can therefore be concluded from the results of our analysis on selected futures contracts of four agricultural commodities, viz., barley, cottonseed oilcake, M200 sugar variety and mustardseed, that the Indian futures markets are still, by and large informationally weak and unable to influence importantly the Indian spot markets. This is in spite of the fact that over the period of time, the trading volumes having gone up in the national level commodity exchanges. Such increases in the trading volumes have, in large measure, been mainly due to the participation by the speculators. To put the record straight, the Indian commodity markets are being rarely used for the purpose of hedging. This warrants for the need for establishments of standardization and grading units at the agricultural commodities markets so that the high contented produce, particularly of oilseeds and sugarcane, can be sold at more competitive prices. Besides, the price discovery has not led to price dissemination and hence the futures and spot markets in India are functioning independent of each other. Based on these results and observation, the strategy for hedging mechanism through Indian commodity markets may be formulated. The same has been discussed in the following Section.

Section VI

Hedging Mechanism through Commodity Markets

The preceding discussion unambiguously emphasizes that the commodity price risk must be well-managed at the farmers’ level in order to improve farmers’ income and ensure adequate investments in agriculture. Doing so assumes particular importance in developing economies such as ours for the simple reason that small and marginal farmers, often labeled as the vulnerable segment, account for an
overwhelming proportion of the Indian peasantry. It is contended that the futures markets, facilitated by the commodity exchanges, are, besides promoting flexible and profitable agriculture, expected to address most of the challenges confronting the farmers during the pre- and post-production stages. Accordingly, our focus in this section is to discuss the hedging mechanism through commodity markets in India in the light of the results presented in Section V.

The available evidence shows that hedging helps in bringing about significant reduction in price volatility. It has, in retrospect, played a very significant role in ensuring protection to various stakeholders involved in the marketing of agricultural commodities. It has also been contended that but for hedging, the agricultural sector would experience very high volatility which, in turn, might prove to be deleterious in a wide variety of ways. As such, hedging in agricultural commodities has, very rightly, come to be considered as one of the most crucial factors that impact the performance of the agricultural sector of an economy. Besides, it has also come to be observed that following the introduction of hedging, the agricultural sector of quite a number of developed countries has experienced a remarkable growth over the period of time. In fact, hedging has, besides lowering the instability of the farm sector, also brought about far-reaching changes in the farm economy of many a country.

In more recent times, it has come to be growingly emphasized that alongside the provision of farm subsidies, more freedom and opportunities to reach out the national market, expanded trade and a well-equipped kit of financial instruments to manage risk are required to be provided to the domestic farmers for protecting and promoting their economic interests. The farm sector needs empathy and free markets to enable it to demonstrate its irresistible desire for productivity improvement. It is, therefore, more important to reinforce policies that promote economic confidence and growth.

In this regard, what needs to be underlined, in particular, from the viewpoint of the functioning of the hedging market, is that the commodity derivatives have been envisaged as the most effective platforms for the three main participants, namely, speculators, arbitragers and hedgers. The speculation and arbitrage activities are mainly guided by considerations of making a buck due to price differentials by trading in futures and without actual deliveries of the physicals. Speculators earn profits

180
owing to price differentials by trading in the same exchange, i.e., buying futures at lower anticipated prices and selling them at higher anticipated prices at different times. In contrast, the arbitrageurs also earn profit due to price differentials in different exchanges and by trading at the same time, i.e., by buying futures from the exchange where the prices are lower and selling them simultaneously in the exchange where the prices are higher. Speculators are also known as market-makers since their participation in the commodity exchanges helps in providing much needed liquidity to the markets, while the presence of arbitragers in the futures markets ensures restoration of market equilibrium and market efficiency. Though the participation of speculators and arbitrageurs has helped in price discovery and price dissemination, there is, nevertheless, no conclusive evidence as yet regarding if the participation of these two would facilitate or stultify the ploughing back of the profits for the agricultural development.

In contrast, the hedgers assume the short or long positions with the objective of protecting themselves against adverse price movements by selling or buying futures contracts to offset the risk of price volatility in the spot markets. In the commodity markets, the hedgers are the producers which may include farmers, processors or consumers, who hedge their positions against a fall in commodity prices by selling a futures or taking a short position when the futures prices are anticipated to be higher than the future spot prices, while the buyers hedge their positions against a potential rise in the cost of inputs by buying futures or taking a long futures position by anticipating that the futures prices would be lower than the future spot prices.

It is being argued that the commodity trading is often a manifestation of significant volatility in spot prices, which makes it difficult to precisely predict the price movement. Similarly, in case of agricultural commodities, it is pointed out that since the agro-industries depend appreciably upon the farm sector for raw material, it is not unreasonable to assume that high volatility in the prices of such commodities affects their cost of manufacturing as well. As a result, volatile prices make it importantly difficult to maintain flexibility in the matter of planning of the agro-based industries. In such a case, guided by the consideration of mitigating this price risk, the manufacturers may either buy or store the raw material when the prices are low and block some capital in the process and incur cost towards storing the inventory.
Alternatively, they may enter into long-term fixed price contracts with the suppliers and pass on the price risks to their customers. However, it is certainly not easy for the manufacturers to pass on the increase in commodity prices to consumers or customers mainly because in a world becoming growingly more competitive, the manufactures owing to their agreeing to charge the committed sales price of their final products might experience tremendous pressure to absorb the increase in the purchase cost. It can, therefore, be argued that any volatility in commodity prices will have significant adverse affect on their profitability. Even the share prices of such industries will tend to move in the direction opposite to the movement of the commodity prices. It is possibly for the purpose of protecting themselves from the risks of potential adverse price changes in commodities that the market participants have to resort to hedging in the futures of commodity markets by taking an equal and opposite (long or short) position in futures markets against their position being held (short or long) in the cash market.

One may argue that while hedging helps in effecting significant reduction in price volatility, it certainly does not eliminate it completely. It gets evidenced from the fact that it is quite likely that in practice a perfect hedge may not take place in a situation in which the price exposure of a commodity hedge in cash segment is fully covered by the inverse position taken in the futures market due to basis risk. Moreover, prior to the expiration, the basis may be positive or negative due to the strengthening or weakening of basis when the spot price increases more than the futures price or when the futures price increases more than the spot price respectively. Also, it has generally been seen that the asset in which the hedger deals is different from the asset underlying the futures contract used for hedging. For example, the producer exposed to risk in the prices of sunflower oil may use the soybean of futures contracts on the Commodity Exchange to hedge the risk.

It has been concurred that futures price contracts and options on futures can effectively manage price risk. Hedging is one of the most important functions of futures markets. Regardless of this however, most of the hedging activity, in practice, involves an imperfect match between the characteristics of the assets being hedged and the assets underlying a futures contract. The relationship between a cash and future price importantly depends on transaction cost, storage characteristics of the good, the
production and consumption cycle for the commodity concerned and the ease of its short selling. For instance, in the case of grains and oilseeds, the fluctuations in stocks are, in spite of their having good storage characteristics, are caused by the production cycle. The intent of hedging is, therefore, to reduce the risk and cost of large shortages.

It is widely recognized that the farmers face significant risks and have limited scope to avoid them through insurance markets. The farmers are interested in stabilization of their incomes rather than in the prices of their farm produce. Nonetheless, in view of negative correlation between the prices of the commodities and their quantities demanded, an attempt to stabilize prices may actually exacerbate the fluctuations in their incomes. The futures markets have the flexibility in the sense that they enable the farmers to decide about the quantities of their crops intended to be sold by them in the forward markets. It is not impertinent to mention here that the prices which would tend to prevail in the event of price stabilization schemes being in place would be far higher due to higher transaction costs than the prices as are likely to prevail in the presence of the national level commodity exchanges. Owing to these reasons perhaps, the farmers have largely refrained from participating in these markets even in developed countries.

In sum, it can be maintained that the current domestic and international situations have already been such that the traditional system of stabilization of prices, left to itself, may not work effectively. In view of this, it is desired that the farmers follow need-based cropping pattern which is capable of assuring them yield rates of the commodities as also the stable and sustainable income.

NOTES AND REFERENCES

1. Volatility is defined most frequently as the standard deviation of the continuously compounded returns of the underlying commodity with a specific time horizon. It is often used to quantify the risk over that time period and is expressed in annualized terms. It is important to mention that for an agricultural commodity, whose price follows a Gaussian random walk or Wiener process, the volatility increases with time because there is an increasing probability that the instrument's price will be farther away from the initial price as time
increases. However, rather than increase linearly, the volatility increases with the square-root of time as time increases, since some fluctuations are expected to cancel each other out, so the most likely deviation after twice the time will not be twice the distance from zero.


4. The flexibility in the farming system scarcely dwells due to the fact that the farmers are not able to move out from one enterprise to another without much cost if the economic conditions make this shift desirable since in Indian agriculture, which is main occupation of the majority of population and source of livelihood for the small and marginal farmers, the product flexibility, cost and factor flexibility and time flexibility does not exist.

5. Mean reversion implies that the prices as well as returns eventually move back towards the mean or average. This mean or average can be the historical average of the price or return or another relevant average such as the growth in the economy or the average return of an industry.


Volatility directly affects the marginal storage value called marginal convenience yield. When process and hence production and demand are more volatile, consumers and producers hold greater inventories in order to ensure smooth production and deliveries as well as to reduce marketing costs. The total cost of producing a marginal unit of the commodity is defined as the sum total of the direct marginal cost of production and the opportunity cost of exercising the firm’s operating option now rather than waiting for new price information. Volatility thus affects the total marginal cost of production by affecting the size of option premium. The greater the price volatility, the higher will be the value of the opportunity cost.

Robert S. Pindyck, (2001) “Volatility and Commodity Price Dynamics.” *Journal of Economic Literature.* The paper was written while the author was a Visiting Professor at the Harvard Business School, and with financial support from the Massachusetts Institute of Technology Cambridge, Centre for Energy and Environment Policy Research.


Instability in agriculture attributes to the fact that both the supply and demand for agricultural produce are relatively less price elastic as compared to non-agricultural products. Various national level measures and farm level steps to mitigate irregular fluctuations in agriculture have been studied during this research and it has been observed that price is the main consideration for the farmers to decide what to grow. However, the degree of response in terms of price elasticity is quite low for wheat, maize and rice but quite high for jute and cotton. Further, this response is more flexible in Indian context as compared to the developed agricultural economy because certain factors of production like capital; technical knowledge and the managerial skills are less sophisticated and less specific.


23. As per the study on ‘Minimizing the Impact of Commodity Shocks in Africa for Debt Sustainability’ conducted Economic Commission for Africa during November 2003.


An estimated two billion people, nearly a third of the global population, depend on the production of primary commodities like rice, cotton and copper. At the family level, farmers and workers rely on commodity production for the cash incomes they use to pay for food, school fees and healthcare. At the national level, 95 of the 141 developing countries derive at least half of their foreign exchange earnings from commodity exports.

Meanwhile, over the long term, prices for primary commodities have been falling relative to the prices of manufactured goods, making it increasingly expensive to invest in technology and purchase other finished goods. Commodity producers are, in effect, running to stay still. At the same time, consolidation among multinational commodity traders has led to a loss in market power by the major commodity-producing nations. The trends towards increasingly volatile prices, slipping relative prices and shifting power along commodity supply chains have left commodity-dependent countries and producers in a precarious position, grappling with the dual problems of low returns and high risk.


United Nations Conference on Trade and Development, New Delhi, (2008), ”
A rough estimate showed that the average income of the poor farmer was less than one-tenth of those engaged in other activities. Still, in case of drought year, he may not get anything but may lose the little money spent on seed etc. along with his own labour. Experts feel that the agriculture is no more a winning proposition especially when the farmers are able to get handsome returns by selling their pieces of lands. Agricultural growth rate has dropped from 3.2 per cent (1987) and 4.2 per cent (1992) to 1.8 per cent (2005) while the foodgrains production for a decade was stagnant and per capita production had significantly fallen.

But it is not price volatility _per se_ that is the problem rather it is the volatility of national and individual _incomes_ that obstructs long-term planning, drives commodity dependency, widens inequality and leads to environmental degradation.

In India, 60 per cent of the agricultural lands are still at the mercy of uncertain rains and with groundwater dwindling constantly, the farmers suffer from the quantity as well as price volatility. Until the time of harvest, the farmer does not know the fate of his crop. Add to this, the perishability character of various horticultural crops create further uncertainty in income of the peasant community. The post-harvest sales of wheat, maize and paddy on the different farm size situations have been largely due to increase in the level of production of foodgrains. The small and medium group of farmers has been selling most of wheat during the post-harvest period due to their financial crisis. The fact remains that any move of the government to popularize the cooperative marketing societies and for that matter any other institution had limited success until they cater the diversified needs of the farmers. It would not be out of place to underline that a farmer is at risk all the times to come and leaves the same for the new generations. Such risk can be segregated into systematic risk that deals with weather risk and the other is individual risk that differs with each farmer. The degree of risk present in a particular situation depends on not only the level...
of information available but also on the interpretation of the information by the entity and its perception to the future outlook.

A large international grain reserve controlled jointly by national governments to mitigate global food supply crises could economize on stocks and storage costs in providing a globally adequate amount of storage, and help maintain the valuable stabilizing role of free international trade in grains.

The price tends to hover at or near the upper or lower bound of the band (the ceiling or the floor price). The overall effect on volatility, relative to competitive storage, is ambiguous. Release of stocks at the ceiling price smoothes price peaks as long as stocks are available, but anticipation of this discourages private storage as price rises to the ceiling, and suppresses the stabilizing production response to anticipated shortages.


It also has a great deal to do with internal macroeconomic and sectoral policies which have reduced protection to cultivators, caused input prices to rise sharply, made marketing of crops more difficult and exploitative for the direct producers and reduced the flow of institutional credit.


Still, we have the example of Gujarat, the highest producer of oilseeds in the country, which has enhanced its agricultural production by almost one and a half times in the last five years through its multi-pronged strategy and trebled its agricultural productivity through excellent agro-management programmes that include conserving water, soil health care and making vital inputs available to the farmers.

D. Sathe, D. and S. Agarwal, (2004),”Liberalization Of Pulses Sector:


42. Sugar output in India has contracted by more than 45 per cent over the last year and the country is on the point of moving from being a net exporter to a net importer of sugar if measures are taken to limit existing exports to maintain sufficient supplies for the home economy. Global sugar demand will exceed output by as much as 5 million tons in the year through September 2010, according to the International Sugar Organization in London.


44. Ernst and Young (2008), “Commodity Price Risk Management Survey 2008.” The key findings of the survey are (a) maturity of commodity price risk management operations appears to be greater among producers and processors; (b) hedging programs are still generally short-sighted, driven to a large extent by market views and not always aligned with the risk philosophy of companies; (c) while companies understand the need for hedging and the instruments available, the finer aspects of hedging, such as basis risk and timing risk, which can significantly affect hedge cash flows, are often ignored. (d) the instruments used for hedging tend to be plain vanilla and are generally limited to futures and forwards. Companies do not generally explore the use of customized instruments, depending on their exposure profile; (e) companies show an appreciation of the need for oversight. However, little is done to enforce sustainable oversight and governance; (f) cash flows from hedges and underlying exposures are generally viewed in isolation. The definition of position, for the purpose of assessing the underlying exposure, is generally vague. This may prevent holistic performance reporting. (g) mark-to-market remains the single most important measure used for performance measurement and reporting; (h) investment in human resources to manage the function is still fairly low and most commodity price risk management functions are staffed by
less than five persons; (i) operational risk is not perceived as a major issue. This has resulted in less than an optimal level of investment in streamlining operations and putting in place a robust control mechanism (j) there are continuing concerns relating to the accuracy of reporting and accounting for hedging operations.

This alternate approach as compared to the National Agricultural Insurance Scheme may be an effective manner in reducing moral hazard and transaction costs. Innovations in the form of Index-based weather insurance has come up in the past few years to explore possibilities of overcoming some of the deficiencies and are being improved on the basis of the feedback from product pilots.


Also several approaches have been developed to estimate the optimal hedge ratios. Techniques like Ordinary Least Squares (OLS), Vector Auto Regressive (VAR) models and Vector Error Correction Models (VECM) estimate constant hedge ratios while bivariate Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) models estimate dynamic hedge ratios which factor in conditional distribution of spot and futures returns.

Certainty equivalent price is the perfectly certain price which would yield the same choice in the absence of risk. Under riskless, perfect competition, both individual and aggregate supply can be expressed as a function of prices and in particular a supply schedule can be drawn giving output a function of output price, holding input price as constant. Certainty of an outcome is known rarely in case of Indian agriculture while the farmers are known to some extent the probable outcomes with specificity. Six Ps of uncertainty in agriculture are price, production, production technology, political situation, personal factors and peoples’ relationship. While the experts have suggested chief measures such as diversification, flexibility, liquidity, capital rationing and contract
farming to deal with the uncertainty in agriculture, each measure has its own limitation and no measures can be isolated. Serious limitation of diversification is that it can be effective if the prices or yields of the products bear proper correlation. Further, it may lessen the probability of income falling below the critical minimum level but it offers no mechanism to reap large gains, should favourable yield or price obtain in a particular enterprise.

49 The Planning Commission, vide its communication Ref. no. M-12043/13/2006-Agri. Dated 28th June 2006, constituted a Working Group on Risk Management in Agriculture for formulation of the XI Five Year Plan (2007–12), under the Chairmanship of Mr. R C A Jain. The terms of reference of the group include, inter alia, examining the nature and types of risks in agriculture, traditional and modern ways of managing risks and reviewing the efficacy and adequacy of existing risk management instruments (such as minimum support prices, Management Information System, Futures market, Contract farming, National Agricultural Insurance Scheme, etc.) and also suggesting appropriate and farmer friendly schemes for effective management of agricultural prices and production risks.

50 Effects of Futures Markets on Agricultural Commodities (2009).


52 It has also been established through various researches and reports that in India the commodity derivatives markets came into existence because agricultural commodities touch the life and livelihood of the masses living in the rural and urban areas. Further, it has also been recognized that the commodity derivatives allow the participants to transfer risks as distinct from market intervention that seeks to alter the terms of trade to reduce price volatility. It will not be out of context to underline in case of the developing countries like India that the commodity derivatives have witnessed a little participation of farmers or small cooperatives.
For example, the average annual volatility of some of the major commodities has been reported to vary between the ranges of 10 per cent to as high as 25 per cent. The average annual volatility in the prices of Gold has been reported to be between 12-18 per cent while that of silver was 15-25 per cent, cotton was 10-12 per cent and of oilseeds was 15-20 per cent. For many Indian industries, which buy commodities as raw material forms a very high per cent of their turnover and in case of agro-industries, which have been reported to have average aggregate turnover of Rs.65000 crore, the cost of raw material formed as high as 70 per cent of aggregate turnover.

For example consider a farmer, who is cultivating rice and harvests his crop in January, holds his stocks and plans to sell it in May, he may lose if the spot price during May is less as compared to the prices of January and the value of the inventory held by the farmer falls correspondingly.

There are several advantages that accrue from hedging. It stretches the marketing period by allowing a producer to sell the asset much before it is produced at a price that is profitable to him. It permits one to protect the value of inventory. A manufacturing organization typically produces goods for stock in anticipation of future sales. It tends to build up inventory during the periods of slack demand and entails the risk of loss in value in case the price of the commodity goes down. Hedging enables the manufacturer to sell futures contacts that will protect the value of inventory and it also facilitate forward pricing of products as one can lock in raw material costs by buying futures contracts, add processing costs and make forward sales on profitable terms.

Basis is the difference between the cash price and futures price and Basis Risk is observed due to the facts that (a) the asset whose price is to be hedged may not be exactly the same as the asset underlying the futures contract, (b) the hedger may be uncertain as to the exact date when the asset may be bought or sold and (c) the hedge may require the futures contract to be closed out well before its expiration date. It the asset to be hedged and the asset underlying the futures contract are the same, the futures price would converge to the spot price as the maturity date approaches and the basis would be zero.
It has been observed that in case of investment assets such as currencies, stock indices, gold and silver the basis is fairly small since for the investment assets, the arbitrage arguments lead to a well defined relationship between the spot and futures prices and the basis risk exists due to change in risk free interest rate and the asset’s yield in the future which may influence its demand. However in case of consumption commodities like oilseeds, pulses, steel imbalances between the supply and demand and the difficulties associated with storing the commodities may lead to large variation in the basis and result in a higher basis risk.

S. Bandivadekar and S. Ghosh, (2003), “Derivatives and Volatility on Indian Stock Markets,” Reserve Bank of India Occasional Papers, 23, pp. 187-201. Rollover is a special trading procedure involving the shift of one month of a spread into another future month, while holding the other contract month. The shift can take place in either the long or short month. It also means lifting a near future position and re-establishing it in a more deferred delivery month. Also, the movement of position held in one trading month of a contract by trading out of it and trading into the same position in a further dated month.

Strategic rollover hedging can be used as a substitute for missing long-term futures markets and income expected returns in cotton production.

The test for weak form efficiency involves examining whether price changes are serially independent (random walk or martingale process).

India has been the largest consumer of gold but the Indian participants were never able to hedge in the international futures markets due to several reservations and concerns. With the opening of NCDEX, MCX and NMCE evening sessions, all ecosystem partners who are carrying the price risk in the international markets can now react to real time information by selling or buying instead of waiting until the next day. Participants can hedge their price risk in the domestic market transparently on the Indian exchanges. Such type of real time and efficient information has helped in development of spot markets.