An introduction to market-based instruments for agriculture price risk management

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Contents

Preface

As compared to the industrial sector, agriculture is exposed to many more unpredictable risks and uncertainties. Through the supply chain, from the stage of production to marketing, agriculture performance is highly dependent on many exogenous variables. Crop output and productivity are highly susceptible to uncontrollable factors like climatic disruptions, natural hazards, pest attacks etc. In course of storage and transportation, physical risks like pilferage and deterioration can result in a considerable loss of value. Trading level risks of non-delivery and counter party default also reign high. In many countries, faulty and distortionary government policy incentives have resulted in agriculture planning being highly unresponsive to market demand.

While the undercurrents of the long term secular decline of commodity prices have impoverished many developing countries, scourges of short term price volatility manifest in many ways. Revenue uncertainty not only threatens the livelihoods of the agriculturists but limits farm credit, trapping them in vicious cycles of low investment. The 'commodity problem' has been rightly described as a combination of declining terms of trade (commodity prices rising less rapidly than those of manufactured) and price volatility[1].

Commodity price risk management is not a new idea. The failure of international efforts like stabilization funds and international commodity agreements in stemming commodity price fluctuations has been well known. Loss of safety nets on account of global free trade and changes in domestic agricultural policy has only added to this vulnerability. This paper focuses on the use of *'market'* based instruments for managing agriculture price risk. Market based mechanisms essentially entail shifting risks to entities who are in a better position and more willing to bear them. Being market based, they could also externalize risks outside the country. Their success does not hinge on government treasuries and in some cases could allow governments to disengage from costly and counterproductive policies.

While it is not the subject of this paper, it must be touched that some of these instruments effectively serve as an alternate agri-marketing system, providing a market, price, agri-infrastructure and can be of relevance in many strategic agri-planning decisions. It should also be mentioned that farmers do not necessarily have to use these instruments to benefit from them. Even basic market reading and access to the disseminated prices can boost their bargaining power towards getting market linked prices. Most of the instruments introduced in this paper have an old history and are actively traded in many markets. It is unfortunate that lack of awareness and know-how amongst developing countries has limited their widespread use and lagged critical benefits to developing countries.

This document is designed to acquaint the reader with these market-based instruments. The subject holds relevance for any entity associated or impacted by the integrated areas of agriculture marketing and financing. It is hoped that this paper would help the readers better appreciate the advantages of managing risks through markets, giving them a clear understanding of the underlying mechanisms to begin any thought process in applying these instruments to better manage their price risk. The potential of applying these price risk management instruments to enhance agriculture marketing and financing is innumerable. While case studies are enumerated to aid the reader's understanding and appreciation of these instruments, this paper does not tread on the application of these instruments.

[1] Page and Hewitt, 2001.

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I. Introduction

1. Commodity price risks

Over the last two decades commodity prices have been more volatile than the prices of manufactured goods. Commodity price uncertainty whether caused by government policy, foreign exchange rates, climatic disasters, or political/civil instability is inherent in commodity markets.

Price volatility leaves a farmer uncertain whether he will receive a high price or a low price at the time of sale. The problem is, however, not limited to how much cash a farmer receives for his harvest. Every investment decision a farmer makes during the crop cycle is a difficult one as he doesn't know whether he will be able to pay back the loan for the investment (labor, fertilizer, equipment & repairs, etc.). The expected commodity price, prices of competing crops and government programs play an important role in determining the area to be planted. Uncertain prices pressurize a borrower's ability to repay and thus make agriculture financing a risky proposition for financiers. In the absence of appropriate risk-management instruments, financiers are reluctant to finance traders with such risks and their inherent cash-flow problems. Often, they will raise interest rates to cover uncertain risks, or simply refuse to provide credit at all. As a result, it is not surprising that a lack of price risk management is one of the foremost reasons why poor farmers stay poor.[2] Farmers' associations too may run similar risks: if they advance their members credits which are to be reimbursed through future deliveries of crops, they run the risk that, at the moment that the crop is sold, prices could have fallen to levels too low to enable loan reimbursement.[3]

From a macro-perspective, price volatility can be devastating: more than 50 developing countries depend on three or fewer leading commodities (such as coffee, sugar cane, cotton, wheat, maize) for at least half their export earnings. The prices earned on international commodity markets impact the government's fiscal revenue, public expenditure, foreign reserves and its creditworthiness and are thus of prime importance to the domestic economy.[4] An IMF report (2003) emphasises fluctuations in world commodity prices and terms of trade to be the most important external shocks that would affect the macroeconomic performance and external balances of developing countries. For commodity dependent countries their debt servicing is also closely linked to commodity prices. Commodity risk management has the potential of simplifying governments' budgetary planning, improving budgetary control, and avoiding the need for crisis management on account of unforeseen revenue shortfalls.

In several African countries price liberalization and marketing reforms brought about a collapse of the marketing boards which resulted in the fall of forward markets supported by them. Forward transactions are important to producers as they secure a price in advance of harvest, reducing their exposure to market price fluctuations, enabling producers to adjust their use of inputs.[5] Although it is impossible to completely eliminate the impact of these

[2] World Business Council for Sustainable Development, 2004.

[3] UNCTAD., *Farmers and farmers' associations in developing countries and their use of modern financial instruments, 2002.*

[4] World Business Council for Sustainable Development., 2004.

[5] UNCTAD, *The impact of changing supply-and-demand market structures on commodity prices and exports of major interest to developing countries*, TD/B/COM.1/EM.10/2, 1999

structural factors, the instruments of risk management introduced in this paper allow participants in the physical commodity markets to transfer some of the price risk to others (for instance other physical market participants, or perhaps investors/speculators), who may have an opposing view on the future direction of the market (Euronext Liffe).

Chapter I highlights the failure of historical efforts at stabilizing prices and introduces the market-based approach which poses unchallengeable alternatives. Chapters II examines four important instruments of commodity price risk management: forwards, futures, options and swaps. A systematic description is provided of the essential concepts and the risk management mechanisms which underlie these instruments. The paper also briefly looks at some insurance based products which can be used to manage price risk. A previous paper by the author[6] has covered innovative agricultural insurance products and their alternatives, as financial tools for yield risk management. The concluding Chapter III summarizes the mechanisms and provides some recommendations of caution to the users of these instruments and makes some suggestions to policymakers towards encouraging the use of these instruments.

2. From a stabilization approach to a market-based approach

A. Stabilisation approach

Over the past half century, the international community and governments have attempted to manage commodity price risks by stabilizing price volatility or making the price distribution less variable through market interventions. Key amongst these mechanisms were compensatory mechanisms, stabilization mechanisms and international commodity agreements, which are briefly reviewed below[7].

IMF established the **Compensatory Financing Facility** in 1963 to help member countries cope with temporary export shortfalls caused by exogenous shocks by making available non-concessionary credit. The European Community offered its own compensatory financing scheme, STABEX, for the purpose of stabilizing export earnings (STABEX) of the agricultural sector in the African, Caribbean and Pacific (ACP) states. By their very nature these schemes were designed to provide financial assistance for the adjustment to external commodity price or volume shocks, rather than provide a tool for *ex ante* price risk management (Varangis, Larson 1996). Many of the schemes failed because they were based on administratively set benchmarks which required large resource transfers in years of low prices. These administrative prices were often the outcome of political bargains and failed to reflect market fundamentals. With limited borrowing capacity and generally un-hedged exposures to price risk, the stabilization programmes were difficult to maintain when payments were required over consecutive years (International Task Force on Commodity Risk Management 1999).

In developing countries, **domestic price stabilization** was targeted through marketing boards who tried to regulate and manage supply through national stockpiles and buffer stock schemes. But even if they were to be used for their stated objectives, commodity stabilization schemes would still not have been effective because of the way commodity prices typically behave;

[6] Kang (2005)

[7] For the history and functions of these international financial mechanisms, see International Task Force on Commodity Risk Management (1999).

most commodity prices revert eventually to their mean – a requirement for a stabilization fund (or a buffer stock scheme) to be viable – but only very slowly, with an average reversal time measured in years, not months. As such, a commodity stabilization fund has to be very large to be effective or the country needs to have ample access to foreign borrowing. But a large fund is not feasible for domestic political reasons and sovereign risk generally prohibits the necessary access to foreign borrowing. Because a small fund is not effective, there is little scope for countries to stabilize domestic commodity prices through foreign borrowing when the fund's resources run out. An additional problem with domestic price stabilization schemes is that they redistribute the risks within the country (usually from producers to the government) rather than diversify them outside the country to entities better able to bear such risks (Varangis, Larson 1996).

Major **International Commodity Agreements** (sugar (1954), coffee (1962), cocoa (1972), natural rubber (1980)) were initiated under the auspices of the UNCTAD aiming to influence world prices by employing instruments of buffer stocks and export quotas.[8] The unsatisfactory performance of the commodity agreements had to do with: conflicting interests between producing and consuming members; inadequate financial resources; failure to account for changes in production and consumption patterns; and failure to adjust unrealistic price goals in the face of persistent price declines during the 1980s and into the 1990s. By 1996 no agreements remained with price stabilization components. These agreements ran into difficulties because they tried to maintain not only stable but also high prices, because of disagreements among members, and because of lack of discipline (Varangis, Larson 1996).

B. Market-based approach

As the poor performance of stabilization schemes became more evident, academics and policy-makers began to distinguish between policies that try to change price distribution either domestically or internationally and policies that used market-based solutions for dealing with market uncertainty.[9] They turned to policies that emphasized risk management instead of efforts to manage agricultural markets.

As an example, in 1994 the internal and external marketing of cotton was liberalized in Uganda. The cooperative unions, burdened by large debts, were forced to sell most of their ginneries to the private sector. At least two of the cooperative cotton unions overcame their problems by taking a more proactive role in marketing. These unions, the North Bukedi Cotton Company and the Lango Cooperative Union, started using these instruments and had brokers and commission agents who communicated vital information on a daily basis. They first used their access to risk management markets to be able to guarantee minimum prices to their farmers.[10]

The key advantages of market-based instruments over price stabilization schemes are elucidated below[11]:

- Unlike facilities like the international commodity agreements and government buffer stock schemes which tried to manage price volatility by influencing the price, market

[8] For the decline of and the lessons from these international commodity agreements, see Varangis, Larson (1996) and International Task Force on Commodity Risk Management (1999).

[9] Concerning the theoretical and empirical studies which contributed to a change in thinking from price stabilization to risk management, see Larson et al (1998) and Varangis et al (2002).

[10] Peter K. Ngategize, *Use of commodity risk management and collateralized finance by farmers' associations in Uganda* (mimeo), UNCTAD, 1997.

[11] Adapted from Varangis, Larson 1996

based instruments provide certainty of future revenues (or expenditures) and thus assure the user of concrete cash flows;

- Market-based instruments rely on market prices rather than administrative prices thus shifting risks to viable financial markets who are better able and willing to assume risks. For developing countries having no such market, commodity derivative instruments shift the risk to traders or speculators in industrialized countries, who are willing to take the price risk. In most cases, they cost less than government price intervention programs;

- Commodity derivative instruments can improve the terms of commodity financing. They can be used to lock in future revenues and assure the lender that these revenues will cover repayment of the loan. Thus, they can increase the creditworthiness of the borrower. This is especially important for the recently liberalized commodity sub-sectors, where the quick establishment of credit flows is crucial to the success of reform;

- Commodity futures markets remain the most efficient price formation mechanisms, providing reliable benchmarks for physical trade. Because a wide group of participants can use the market, each participant brings into the price formation process the information possessed about future demand and supply conditions. In contrast to cash markets, futures markets are highly transparent, yet anonymous, making price manipulation more difficult;

- Another important benefit of exchange-traded instruments is the low cost of executing transactions, liquidity, and also standardized requirements regarding quality, quantity, delivery dates, etc.

It should be mentioned that these markets are not a panacea for farmers' problems - they do not exist and are never likely to exist for all commodities, and can give only temporary reprieve from a secular fall of prices. They can also be very complex and difficult for small farmers unless they are well organized and trained. Nevertheless, enabling access to these markets could greatly help developing country farmers improve their lives, particularly as the vast majority of them can now cope with these price risks only by avoiding "risky" investment decisions, relying on their meager savings and adjusting their consumption – at the best, inefficient solutions, and often locking them in a vicious cycle of poverty.[12]

[12] UNCTAD, *Farmers and farmers' associations in developing countries and their use of modern financial instruments, 2002*

II. Instruments for commodity price risk management

Price risk hedging instruments introduced in this paper can be categorized under the umbrella of 'derivatives'. A derivative is defined as an instrument whose value depends on the value of an underlying variable. While this definition may not be fully comprehensive at this stage, derivatives can perhaps be better understood as financial instruments based upon a common 'forward pricing' strategy, which involves setting the price, or a limit on price, for a product to be delivered in the future. As a basic example, a commodity derivative is an instrument which permits one to buy or sell the commodity (the underlying) at a future time, at a price which is tentatively fixed today. Common underlying products in derivatives are: stocks; currency; bonds and commodities. Further, derivatives could also be classified on the basis of the markets where they are available. There are two broad categories here: a) the standardized instruments which are traded on commodity exchanges (here the key derivative instruments are 'futures' and 'options'); and b) over-the-counter (OTC)[13] instruments which are privately negotiated (here the key derivative instruments are 'forward contracts' and 'swaps').

Commodity exchange (see Annex 1 for a list of key commodity exchanges)[14] is a financial market where different groups of participants trade commodity-linked contracts, with the underlying objective of either trading the commodity or transferring exposure of commodity price risks. Organized commodity futures exchanges have existed for more than a century. Exchanges have traditionally been defined by "pit" trading through open outcry environment where traders and brokers shout bids and offers in a trading pit or ring. More recently most exchanges have adopted electronic trading platforms where market participants post their bids and offers on a computerized trading system. In its origin and simplest form, the OTC market resembles the traditional forward trade in **c**ommodities: a direct interaction between two companies, in this case client and "intermediary" (with the intermediary being a bank, a trading house or a brokerage firm)[15].

1. Forward contract[16]

A. Forwards

A forward contract is an agreement between the seller and buyer to deliver a specified quantity of a commodity to the buyer at some time in the future for a specified price or in accordance with a specified pricing formula. Thus, the terms and conditions of the forward contract are usually specific to each transaction.

Three essential concepts in using forwards: Firstly, given that no cash transfer occurs when the contract is signed, this means that the seller of the commodity is obliged to deliver the commodity at maturity, however the buyer does not have to pay money upfront (except for transaction fees).

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[13] OTC is the market or transaction arranged bilaterally between two parties without the participation of an exchange. Prices in OTC markets are set by dealer trading rather than the auction system of most organized exchanges (Moles, Terry 1997).

[14] Also see, Leonela Santana-Boado and Adam Gross., *Overview of World's Commodity Exchanges*, 2006, (UNCTAD) for a very comprehensive overview of the status of commodity exchanges.

[15] UNCTAD, A survey of commodity risk management instruments, 1998

[16] This section was largely drawn from the website of RMA, USDA (http://www.rma.usda.gov/pubs/rme/fctsht.htmal), Harwood *et al* (1999), and Stasko (1997); an authoritative paper by UNCTAD, Farmers *and farmers' associations in developing countries and their use of modern financial instruments, 2002;* and the risk management resources available at Cargill agri horizons.

Second, since the sole guarantee that a forward contract will be honoured is the reputation of the two parties entering the agreement, there is an inherent credit or default risk: the counterpart of the forward transaction may fail either to deliver the commodity or to pay the agreed price at maturity.[17] Third, forward contracts are primarily merchandising vehicles, whereby both parties expect to make or take delivery of the commodity on the agreed upon date. It is difficult to get out of a forward contract unless one gets the counterparty to rescind the contract.[18]

B. Price risk management using forwards

The general mechanism would be for a producer or trader who holds (or purchases in the spot market) a certain commodity to insure against adverse price movements by selling the same amount of that commodity in the forward market at the negotiated price. There could be many modalities in working out this forward price and other terms of the contract. In this case, he would take a "short position" in the forward market (when a person buys forward or futures contracts, that person is said to have gone "long" or to be holding a "long position"). When the forward contract matures, the trader sells the commodity at the specified price, thereby avoiding the risk of a price decline in the intervening period.[19] One disadvantage of the forward contract for a producer is that the seller is legally bound to deliver a given quantity of a commodity on or before a specified date. If production falls short of the contracted quantity, the seller is required to purchase a sufficient amount of the commodity from another source in order to satisfy the contractual obligation.

Types of forward contracts:[20]

As forwards are negotiated contracts, various possibilities arise in structuring them. Broad elements which guide the structuring of a contract are: the basis for pricing, flexibility over timing the pricing; flexibility over timing the receivables; ability to participate in favourable price movements etc.

Fixed price contract: Fixed price (or "flat price") contract is one of the most common types of forward contract. In a fixed-price forward contract, the farmer commits himself to delivering at an agreed time a certain quantity of commodities of a specified quality. Normally, the farmer is only paid on delivery, although this type of contract can also be used as to obtain pre-harvest financing. Premiums and discounts may be established for the produce that does not meet specified quality standards. The farmer carries the opportunity risk of losing potential gains when market prices rise.[21]

Price-to-be-fixed contract: Price-to-be-fixed (PTBF) contracts, also called "executable orders" (in sugar trade) or "on call" contracts (in cotton trade), are the most common form of

[17] UNCTAD, A survey of commodity risk management instruments, 1998
[18] CFTC.,The Economic Purpose of Futures Markets, 2005.
[19] UNCTAD, A survey of commodity risk management instruments, 1998
[20] For detailed notes on the merits, demerits and mechanism of each of these forward contracts, see http://www.cargillaghorizons.com/cah/cahpublic.nsf/pages/basis?OpenDocument
[21] If the producer locks in a price with a fixed price contract, the buyer usually protects himself by using the futures market. If a grain merchant enters into a number of fixed price contracts with soybean producers, he will sell an approximately equal amount of futures. If he does not do so, he would be left open to the possibility of heavy losses in the event that the commodity's prices falling. Such hedging mechanics in the futures market will be elaborated in the next section.

export contracts for commodities from Latin America, and are also very common in Asia; although still common, they are relatively less used in Africa. Unlike other forward contracts where the used reference prices are commonly futures market prices, in this case, the seller (or the buyer, in case of processors, importers or end-users) has the active ability to fix the prices at the moment which is deemed most opportune.

Deferred pricing contract: Deferred pricing (or "delayed pricing", "price later", "no price established") contract provides that the farmer delivers the commodity and transfers ownership on the contract date, but maintains control over when it is priced. This contract allows the seller to separate the pricing decision from the delivery one. The risks of storage are passed to the buyer at the time of delivery and the contract may also be used as a substitute for storage when storage is unavailable. The price may equal the elevator's bid price or an adjusted futures price at a time selected by the farmer. While this gives the farmer the opportunity to benefit from price rises, he also retains the risk that prices will fall between the time the contract is entered and the date on which the sales price is determined. This is one of the most widely used instruments for small farmers, especially where there is an established level of confidence in the buyer.

Deferred payment contract: Deferred (or delayed) payment contract specifies the price to be paid and transfers ownership upon delivery while postponing payment. This contract may also offer farmers tax advantages by deferring income from the sale of a commodity to the next tax year as a tax-saving strategy for the current year.

Minimum-price contract: This forward contract is similar to a fixed-price forward contract, except that it guarantees a minimum-price with an opportunity to participate in future price gains. From the farmer's side, this eliminates an important risk factor; and the incentive to default on the contract is less than that with fixed-price contracts. On the other hand, the buyer (elevator or packer) can also hedge the assumed risks by taking opposite positions. The farmer can be required to pay a certain price to avail this benefit. In practice, the vast majority of farmers in developing countries have no access to forward contracts that contain this kind of price risk management component. For example, a recent study of coffee marketing in several coffee-producing countries[22] found that, except in Guatemala, very few growers were able to sell coffee forward, and if they could, it was often at very high implied rates of interest (because buyers discount the price they offer to take into account performance risk).

Reference-price forward contract: This form of forward contract uses reference prices, at times futures prices, but more often average export prices of a country to price forward contracts. On delivery, farmers are paid automatically the price of the day, or period, when they make their delivery. This type of arrangement is quite common in contract farming and outgrower/nucleus estate systems. It is also the basis for the standard pricing formula for most developing country sugar producers, who receive a fixed percentage of the sales prices of their sugar.

[22] Panos Varangis and Robert Simmons*, Study of Marketing and Trading policies and systems in selected coffee producing countries*, Common Fund for Commodities, 2000.

Some proprietary forward contracts offered by Cargill Aghorizons

Pacer™ contract pays the average of the daily market closing prices over a set period of time.

Pacer Accumulator™ contract establishes the futures reference price by pricing an equal portion of the grain every day during the specified pricing period at the higher of (1) a selected futures floor price or (2) the daily futures settlement price – up to a maximum Target Price. Results are then accumulated and averaged.

Pacer™ Ultra contract establishes a futures floor price at or above market levels allowing one to participate in the upside through an average in which no averaging points are below the floor level in the average.

For more details and other schemes see,
http://www.cargillaghorizons.com/cah/cahpublic.nsf/pages/us?OpenDocument

Note: Two other important forward contracts: 'basis contract' and 'hedge to arrive contract' are explained in the following section.

2. Futures[23]

A. Futures

Futures contracts were invented as a way to standardize forwards. In its simplest sense a futures contract is a standardized forward contract which is exchange traded. Thus it should be emphasized early that a future is not a stock or a commodity but can be thought to trade like a stock. The buyer (seller)[24] of a futures contract agrees, like in a forward contract, to purchase or sell a specific amount of a commodity, security, currency, index or other specified item on a stipulated future date. However there need not be an actual sale or purchase of goods at the stipulated time. Most of the times futures contract are closed by making an opposite transaction (offset), i.e., the buyer of a future sells the future some time before the expiration of the contract. It should be noted that futures pre-determine an approximate price but the effective cost of purchase or sale may vary as per market conditions.

Futures, unlike forwards, are standardized and traded on exchanges. For example, this means every soybean contract traded on the Chicago Board of Trade is for 5000 bushels, every gold contract traded on the New York Mercantile is for 100 troy ounces and for a specific grade. While both forwards and futures perform the same economic function of ascertaining cash flows, futures are a significant improvement as they provide liquidity and a performance guarantee on account of being exchange traded. The standardization enhances liquidity, by making it possible for large numbers of market participants to trade the same instrument.

[23] For this and the next section on 'options' a book titled *commodity futures and options* by George Kleimnman has been referred to.

[24] The buyer of a contract who agrees to receive the item is said to be in a long position, and the seller who agrees to deliver the item is said to be in a short position. The origin of 'long' and 'short' comes from the buyer's situation that he is buying more than he is selling so that his working stock of the item increases (i.e. becomes 'long'), and the seller's situation that he is selling more than he is buying so that his working stock of the item becomes depleted (i.e. runs 'short'). (Pass et al 2005).

Trades amongst the members are settled through the exchange's clearing house who guarantees the credit risk, i.e., in the eventuality of either the buyer or seller defaulting in their obligations, the commodity exchange would make good.[25]

B. Essential concepts

Margins: Another difference between trading futures and forwards is that because futures are commitments to trade in the future, actual delivery and payment are not required until the contract expires. However, both buyers and sellers are required to make a good-faith deposit called 'margin' with their brokerage firm to ensure their respective commitments. The margin is typically a small percentage of the value of the trade. Thus in trading futures the entire sum of the trade does not have to be paid while entering the transaction. There are various kinds of margins. It should be noted that while margin payments are not a true cost (one gets back the margin deposit at the end of the trade plus any profits or minus any losses), commissions or brokerage charges comprise transaction costs. Here another integral concept is 'marking to market'. At the end of each day, a trader's margin account is adjusted in line with the closing price of the futures contract – a process called 'marking to market'. Gains and losses on futures contracts are credited and deducted on a daily basis. For example, a increase in wheat prices would be credited to the margin account of the futures buyer and deducted from the margin account of the futures seller.

Selling short: Selling short refers to selling a futures contract. For the beginners of derivatives this concept may appear a bit strange. Can one sell futures without owning the commodity today? A beauty of these instruments is that as trading entails buying and selling a commodity in the future, it is equally easy to either buy or sell in the futures market. In fact one need not own the commodity at all as positions can be closed by the trading mechanism, i.e., by taking an opposite trade.

Settlement of futures: Settlement of a trade refers to the various mechanisms by which an existing or open position can be closed. This can be done in three ways: by reversing the open position (off-set); by taking physical delivery of the asset; or by cash settlement.

Futures are most commonly settled by closing out the open position, i.e., without making or taking delivery of the underlying commodity. In general, futures markets are used to manage or "hedge" price risk (the mechanism is explained later) and not as a means for acquiring or disposing of the underlying commodity. This category of participants who trade (any instrument) with the objective of managing price risk and not that of speculation are called hedgers. There are also several other reasons why hedgers rarely take or make physical delivery against futures: futures delivery grade may not be the same as that which the hedger needs or produces; futures delivery location may be inconvenient or unsuitable for the hedger; futures delivery date may not match the hedger's timing for delivery or receipt of the commodity.

In case the position is not closed out before the expiry date, positions could either be physically delivered or cash settled (this could also depend on the exchange's policy and could vary across commodities). Delivery refers to taking physical possession (for a future's buyer) or making delivery (for a future's seller) of the underlying commodity. Typically less

[25]Note sophisticated instruments like Exchange for Risk (EFR) transactions provided by an exchange permit the holder of a forward (or other OTC product) to unwind its position on the exchange, effectively converting the forward into a future. Parties to an EFR transaction have to be the same parties to the OTC transaction. See, CBOT for a primer on EFR Transactions.

than 2% of the total volumes in traded futures markets result in delivery. In comparison cash settlement does not entail any physical transfer of the commodity; the futures holder either receives or pays the difference in futures prices. For example, if a corn buyer purchases a two month corn futures at $3/bushel and in two months at the time of delivery the price of the contract rises to $3.4/bushel, under cash settlement the futures buyer receives the difference of $0.4 per/bushel.

Reading futures: Standardised elements of a futures contract are: quantity of the underlying commodity; quality of the underlying commodity; settlement date for the trade; units of price quotation and minimum price change. Some familiarization with newspaper quotes should help understand futures better.

Extract of a commodity futures quotes from 'The Wall Street Journal'[1] showing the previous day's futures trading.

Tuesday, Aug 4 1998								
Month	Open	High	Low	Settlement	Change	Lifetime high	Lifetime row	Open Interest
CORN (CBT) 5000 bu; Cents per bu								
Sept	213	215	212 ¾	212 ½	-	301	212 ¾	87 790
Dec	220 ½	222 ½	220 ½	212 ½		212 ½	212 ½	157 619
Est vol 50 000; vol mon 64 988; Open Interest 245 409								

Trading information of two corn futures contracts traded on the former day on the Chicago Board of Trade (CBT) is shown above. The **contract size** is 5000 bushels of corn, i.e., on buying one futures contract of corn one buys 5000 bushels of corn.

The **months** reflect the months in which the contract expires.

The first three numbers in each row show the **opening price, highest price** and the **lowest price** achieved in trading during the day. The opening price represents the prices at which contracts were trading immediately after the markets opened. High and low refer to the maximum and minimum prices that were attained in course of the trading in the day.

Settlement refers to the average of the prices at which the contract traded immediately before the end of the trading session. This price is important as it is normally used for marking to market the trade. Change reflects the change in settlement from the preceding day.

Lifetime low and lifetime high refers to the highest and lowest prices achieved in the trading of this particular contract in its lifetime.

Open Interest (OI) is an important indicator. It refers to the total number of contracts which are outstanding. Thus it is the sum of all the long positions or the sum of all short positions. A seller and a buyer combine to create only one contract. Therefore, to determine the total open interest for any given market we need to know the totals from either of the sides. OI measures the flow of money into the futures market. OI along with price data can be used to confirm price trends of the markets. For example an increase in open interest along with an increase in price is said to confirm an upward trend. Similarly, an increase in open interest along with a decrease in price confirms a downward trend.

The last line shows the estimated **volumes** of trading in contracts of all maturities for the day and the volumes of the previous day. Volume represents the total number of shares or contracts that have changed hands in a day. It also shows the open interest of all maturities in the previous day (Monday).

C. Price risk management using futures

Futures are an important tool for price risk management. It is important to recognize that hedging through futures does not necessarily improve the financial outcome; it reduces risk by making the outcome more certain. The underlying principle is that given that cash and futures prices generally move in the same direction, by taking an opposite position in the futures market (farmer hoping to sell 3 months later sells futures today and buys back the futures 3 months later), the profits (loses) of one market can offset the losses (gains) of the other market. It should be noted that in such a case the futures markets are not being used to buy or sell the commodity but to hedge price risk.

Price risk management for the commodity seller: Farmers or merchants who own a commodity can protect themselves from a decline in commodity prices by selling a future or taking a short futures position. (In lay terminology, the logic of the mechanism can also be understood as taking today a position in the futures market that would be taken after a few months in the physical market). When the commodity is actually sold in the market, the short position which was taken in the futures markets is closed out by buying it on the exchange. As futures and spot prices generally move together, losses (gains) in the physical market will be partially offset by gains (losses) in the futures market.

Example: At the planting time in April, a corn producer hopes to secure the selling price of the expected yield of 15 000 bushels in the harvest period. At that time the six month corn futures contract (October contract) is trading at $2.50 per bushel. He decides to hedge the entire expected yield by selling three April corn futures contracts on the Chicago Board of Trade (CBOT) at a price of $2.50 per bushel (the standard contract size of a CBOT corn futures contract is 5 000 bushel).

At the harvest time the October futures falls to $2.00/bushel and local cash prices fall to $1.88/bushel. The producer offsets his futures position by purchasing back three April corn futures contracts making a profit of $0.50 per bushel. He sells the corn in the physical market to the local elevator at the cash price. The corn producer's effective selling price, ignoring transaction costs, works out to $2.38 per bushel ($1.88 plus $0.50).

In case futures prices rise to $3.50 and local cash prices to $3.38, the producer makes a loss of $1($2.50 less $3.50) in the futures market. He sells the commodity for $3.38 in the cash market, again ignoring transaction costs, his net sales price works out to $2.38 ($3.38 less $1). In either of the conditions his revenue does not change and is constant at $35 700 (see below). Thus by hedging with futures, the producer could avoid revenue fluctuation resulting from adverse price movements. In <Table 4>, the producer's hedging outcomes are summarized.

<Table 4> A corn producer's hedging example

	When futures price rises	**When futures price falls**
Revenue	(+) $7 500, profit from futures trading (sell 15 000@$2.50 and buy 15 000 @ $2.00) (+) $28 200, sale to the local elevator Total revenue: $35 700	(–) $15 000, loss from futures trading (sell 15 000@$2.50 and buy 15 000 @ $3.50) (+) $50 700, sale to the local elevator Total revenue: $35 700
Sale	Futures gain $0.50	Futures loss – $1.00

price	Cash sales price $1.88 Net sales price $2.38	Cash sales price $3.38 Net sales price $2.38

Price risk management for the buyer: Commodity buyers can protect themselves from a potential rise in input costs by buying futures or taking a long futures position. When the commodity is actually purchased in the market, the long futures position is closed by selling it on the exchange. As futures and spot prices generally move together, losses (gains) in the physical market would be partially offset by gains (losses) in the futures market.

Example: In May, a wheat-importing government wishes to lock in its future cost of wheat which is to be purchased in August. To protect itself against prices being higher than the existing futures price of $140 per ton, it buys August futures at $140 per ton. In case August wheat futures rise to $155 per ton in August, the government gains $15 per ton ($155 less $140 per ton) on closing out the futures position. Given that futures and cash prices move in the same direction, let's assume that cash prices also rise to $155. The government purchases wheat at $155 per ton in the spot market. The cash price of $155 per ton and the profit of $15 on the futures position, results in a net purchase price of $140 per ton. Note, this results in the effective futures price that was trading in May.

Now consider the case where August wheat futures fall to $130 per ton in August. The government loses $10 per ton on the closing out of the futures position. Let's assume that the cash price of wheat falls to $128 per ton. The government purchases wheat at $128 per ton in the spot market. The cash price of $128 per ton plus the $10 per ton gain in futures results in a net purchase price of $138 per ton. This effectively results in a cost price which is lesser than that of May futures.

Basis risk: As seen in the above example, hedging does not guarantee that the profit or loss in the futures market will fully offset the loss or profit in the physical market. This is the so-called "basis risk". Basis is defined as the difference between spot and futures prices. Thus the expected purchase or sales price in hedging with futures can said to be the sum of the futures (when the futures contract is purchased) price plus the basis at the time of closing out. Basis may arise because of numerable factors: the specific physical commodity to be hedged may not have the same price development as that of the standardized futures contract; the markets to which a company exports are not necessarily the same as those where futures markets are located; price developments on the customer market can be different from those on the futures exchange; the quantity to be hedged may not equal the underlying contract; and, moreover, the relation between futures prices and spot market prices can be temporarily disturbed, for example by attempts to manipulate the market or by technical squeezes caused by a shortage of supply.[26]

The basis is important in that it is the single major factor that will affect the outcome of a hedge. In essence, the hedger is speculating on a basis change rather than a price change. However even though prices vary greatly from year to year, the basis typically does not change dramatically and generally can be predicted based on historical patterns. Basis risk can improve or worsen the hedger's position. In case of a short hedge strengthening of the basis, i.e., where spot prices are greater than futures prices, would improve the hedger's position while weakening of the basis would worsen his position. In case of a long hedge,

[26] UNCTAD, A survey of commodity risk management instruments, 1998.

strengthening of the basis, would worsen the hedger's position while weakening of the basis would strengthen his position.

Forward contracts based on futures:
(After being familiarized with futures, it would perhaps be easier to understand these forward contracts which are based on futures)

Basis contract: (Fix price later, Unpriced or Basis Fix contract): A basis contract is another type of a deferred pricing contract. There are two elements to this contract: futures value of the commodity and a pre-determined 'basis'. The price of this contract is determined by applying a specified "fixed" basis to a particular futures price, usually when desired by the farmer. For example, a contract may, state on July 1 that a farmer sells a specified quantity for November delivery at 0.20. (The November 1 cash price less a set basis 20 cents, or the November 1 futures price plus a set basis 20 cents). Thus, the farmer has eliminated the "basis" part of price risk, but has retained the risk of futures prices. Sellers generally use the Basis Contract when the basis level is attractive but overall prices are unattractive because of low futures prices. Since the basis tends to be most narrow when futures levels are low, most sellers use the Basis Contract when they are confident that the futures price will go up.

Hedge-to-arrive contract (No basis established contract): Hedge-to-arrive (HTA) contract is opposite to the basis contract. It fixes the futures price but leaves the basis level to be determined at a later date (usually no later than the date of delivery). When a HTA contract is agreed, the buyer of the commodity immediately sells futures consistent with the time that the seller agrees to make delivery of the physical commodity. In this way, the futures price is locked in. No matter whether prices subsequently rise or fall, the seller's cash price will be based upon the price of the futures position initiated by the buyer. When the seller delivers the physical, the buyer will determine the cash price by adjusting the locked-in futures price by the basis that prevails at that particular time. In other words, the basis is variable throughout the life of the contract. The seller eliminates futures price risk with a HTA contract but assumes basis risk. When a producer believes that the basis will narrow, he might use this type of contract. Since the futures price is established in the contract, any gain or loss to the producer will be on the basis. This contract enables farmers to lock in a favourable futures price when the basis is unfavourable. However, the risks for the provider of these instruments can be very difficult to manage, many US cooperatives lost major sums of money in the late 1990s when they were unable to maintain the margin requirements of exchanges, necessary to continue covering these contractual arrangements with producers.

Long term hedges (issues of rollover) and futures markets:
Consider the way longer-term hedging operates. A sugar mill seeking a two year hedge on sugar prices would ideally wish to buy a two year futures contract. However, in practice the contract could be traded only for a period of one year on the exchange or could be illiquid in the far-end contracts. In such a situation the sugar mill could buy the one year contract which is liquid, close (off-set) this contract when it nears maturity and buy another longer term contract. This is called a rollover and this effectively helps him buy a two year contract. However in undertaking any rollover operations, attention should be paid to the relation between futures prices in the various expiry months. This relation can have major implications for those wishing to use futures to hedge long term positions.

When prices of "further-out" (further expiry month) futures contracts are trading higher than the futures contracts maturing earlier, markets are said to be normal or in "contango" or

carrying a charge. For instance, when March cotton futures trade at 53 hundred-weight/lb, (ct/lb) April cotton futures at 59ct/lb, May cotton futures at 66 ct/lb etc. markets are said to be in contango. This is easy to understand as futures prices are to reflect the cost of carry .i.e., costs of storage, interest rate on investment, loss on account of loss of weight or deterioration in quantity etc. However commodity markets also display the reverse pattern, where "near month" contracts trade higher than distant month contracts. Such commodity markets are said to be inverted or in "backwardation". For instance in a backwardation market March cotton futures would trade at 65 ct/lb, April cotton futures at 62 ct/lb and May cotton futures at 58 ct/lb. Backwardation can be attributed to the convenience yield, the value of having a commodity at one's disposal as there may be benefits of holding the commodity physically that are not obtained by holding a futures contract. Backwardation could also be due to perceived or real near term shortages which in turn could be due to weather havocs or due to a contract maturing in the peak season.

As mentioned above whether a market is in backwardation or contango has major implications for those wishing to hedge further-out positions, and to some extent for commodity processors. Consider the case of a soybean processor (seller) hoping to sell futures contracts in a market which is in backwardation. The processor sells futures at a forward date. When this contract nears maturity he would close it by buying the same contract and would take a new position by selling futures in a distant month. This process is called rollover. Under conditions of backwardation the processor would be paying a higher price for the nearby contracts that it buys (to offset) than it receives for the further-out contracts it sells (the new futures short position). He thus makes a loss every time he rolls over the contract. What is worse, this loss is, in theory, unlimited, because it depends on the scarcity of the commodity on the spot market. In practice, regulatory authorities normally impose a backwardation limit, but this can still be very high. Markets which are in backwardation are thus difficult markets for hedging longer-term price exposure, at least for sellers of the commodities concerned.[27]

D. Indirect benefits of commodity futures[28]

Price discovery: An important function of futures markets is to reveal price information about expected cash markets. Because futures are an anonymous exchange, prices quoted on futures exchanges are widely accepted and used as references prices for the underlying commodity. This is known as price discovery. Two significant applications of price discovery are explained below:

Price discovery in production planning: Futures prices represent the best estimates of well-informed traders at a given point of time, reflecting the current expectations of the market regarding the spot prices that will prevail in the future. Therefore, futures provide strategic information which help in estimating the profitability of different commodities. Essentially when futures price levels cover both fixed and variable[29] costs of a commodity, production is likely to be profitable. If it covers variable costs, but not fixed costs, loss is minimized by producing the commodity. If it does not cover variable costs, producing the commodity is likely to be a loss making proposition. (Harwood *et al* 1999).

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[27] For more see, UNCTAD; A survey of commodity risk management instruments, 1998.
[28] This section was largely drawn from Apostolou, Apostolou (2000) and Alizadeh, Nomikos (2005).
[29] Variable production costs are those costs, such as for seed, fertilizer, custom work, and rent for land or storage space, which vary with the level of output. This contrasts with fixed costs, such as interest and depreciation on buildings and equipment, which must be met regardless of the level of output (Harwood et al 1999).

Price discovery in storage planning: The price of storage offered by the market is indicated in the carrying charge. Carrying charges can be understood as the cost to hold a commodity and are reflected in the storage and interest costs. Carrying charges can exist in the futures (spreads) and in the basis. Farmers can profitably store crops after harvest if their own storage costs are lower than the market price of storage which is indicated in the spread or basis. Then by selling a future they could receive the higher market prices and pay their lower storage costs. Futures also help in making spaced out purchases avoiding storage hassles of large cash purchases.

Reference prices: Futures prices reflect the current expectations of the market regarding the level of spot price that will prevail in the future. Futures prices that are "discovered" in the competitive, open auction market of a futures exchange provide cash market participants a reliable measure to price spot and forward contracts. A survey conducted in the mid-1990's amongst Nebraska producers revealed that of those using basis contracts, 49 percent indicated the use of this tool to price 75-100 percent of their crop. In another survey in four states (covering producers of cotton, maize, soybeans and wheat), it was found that except in the case of cotton, 79 to 87 % made indirect use of futures and options markets (through the pricing clauses in their sales contracts). In the case of cotton, the figure was 38%.30

Agriculture infrastructure: The infrastructure of commodity exchanges can play an important role in enhancing the competitiveness of agriculture markets. Requirements for reputed warehouses, scientific storage systems, stringent delivery standards, quality monitoring systems and robust telecommunications, etc. can play an integral role in modernizing agriculture.

E. Participants in commodity futures

Based on the motive of participation, those engaged in commodity futures can be grouped into three key categories: a) hedgers who actually face price risk and hope to limit this by participating in the futures markets; b) fund managers who seek to diversify the risks of their portfolios by investing partially in a weakly correlated asset class like commodities; and c) the speculators who hope to profit from the fluctuations in commodity prices.

Hedgers can further be categorised into three user classes: producers, consumers (with processors) and traders.

Farmers/Producer associations: By including futures trading in a marketing plan, a producer can ascertain cash flows and offset potential losses from falling commodity prices. To illustrate, a farmer who thinks the price of corn may decline by harvest time can sell corn futures early in the season. If prices decline, a profit in the futures contract will compensate for the lower price received for the harvest.

Consumers and processors: Many bulk purchasers of agricultural commodities require price risk management tools to help stabilize input prices. To illustrate, a popcorn manufacturer who thinks that the price of corn is going to rise or a biscuit manufacturer looking to buy

[30] See Joy Harwood, Richard Heifner, Keith Coble, Janet Perry and Agapi Somwaru., *Managing Risk in Farming: Concepts, Research and Analysis*, Economic Research Service, United States Department of Agriculture, 1999.

wheat a year later could benefit from input price management strategies. Consumers concerned with price fluctuations for agricultural inputs commonly use a buying hedge (buy futures) to manage that price risk.

Traders: are important participants in the futures markets. Traders, like exporters, often buy goods from producers before they sell these goods, or they may sell the goods before buying them. As commodity production is seasonal, restricted to a few months and consumption spread over the year, this creates price uncertainty for traders. The existence of a futures market stems this uncertainty and thus encourages the trader to buy commodities in the surplus or marketing period, i.e., when goods arrive in the market. As they rush to buy stock when it arrives in the market, they support the price, potentially boosting producer returns. Another important role is that of market making, as traders use futures markets for hedging risks of purchases and sales they enhance the liquidity of the market.

Portfolio managers: Passive asset managers like pension funds, mutual funds, insurance and investment companies tend to allocate at least 5% of their portfolios to commodities. Allocating part of their portfolio to commodities makes their overall portfolio returns less volatile. Commodity portfolios exhibit negative correlation to bonds and stocks. A study[31] of the seven stock market crashes since 1970 reveals that commodities have yielded positive returns in most of those periods. The diversification benefit tends to increase when the returns of the commodities have a high average standard deviation and exhibit low inter-correlation. In recent years, bond portfolio managers have increasingly used commodity instruments as a hedge against inflation.

Speculator: is one who does not produce or use a commodity, but risks his or her own capital trading futures in the hope of making a profit on price changes. While speculation is not considered to be one of the economic purposes of a futures market, speculators improve the functioning of markets by providing liquidity[32]**.**

3. Options

A. Options

Options can provide the seller of a commodity the assurance of receiving a minimum selling price and the buyer the assurance of paying a maximum purchase price (they are thus like an insurance). In addition to the above insurance, options are attractive as they could permit the buyer of an option to participate in favourable price movements. Thus, options can be used to provide 'downside protection' while retaining some degree of 'upside potential'.

So, what is an option? Buying an option contract gives the holder or buyer of the option the right (note, there is no obligation) to buy or sell a specified quantity of a commodity (also called as the "underlying") for a specified price on or before a specified date in the future. It is common practice in grain trade calls and puts to refer to options on futures (i.e., the futures contracts are the underlying; this product is detailed later in the section).

Options can be both exchange-traded and privately negotiated or 'over-the counter' OTC (like forwards). OTC options (more common in currency markets) have the obvious flexibility in

[31] Philippe Ithurbide and Vincent Chaigneau., SG, Product fever: what can commodities bring to portfolio diversification?, 2005.

[32] Liquidity refers to the ability to buy or sell an asset quickly and in large volume without substantially affecting the asset's price. A high level of liquidity is a key characteristic of a good market for a security or a commodity. (Downes, Goodman 2003).

providing a customized contract but have the inherent disadvantages of illiquidity, counter party risk, higher costs. While the core risk management principles are common for the two, this section elucidates mechanisms of exchange traded options (i.e., standardized ones) which are more commonly used in commodity markets.

As compared to futures and forwards, using options is a different proposition. There are two basic types of options: 'call' options and 'put' options.

Call options give the buyer of the call option (said to be long call) the *right* to *buy* the underlying commodity at a specific price (exercise price). The seller of the call (said to be short call) has an *obligation* to deliver the commodity on the exercise of the option.

Put options give the buyer of the put option (said to be long put) the *right* to *sell* the underlying commodity at a specified price (exercise price). The seller of the put (said to be short put) has an *obligation* to buy the commodity on the exercise of the option.

B. Essential concepts

Option premium: Option premium represents the cost of buying an option, it is a non-refundable payment that the buyer of an option pays to the seller at the time of buying of the option (note, futures contracts require margin payments). An important difference between trading futures and options is that in futures markets, the futures price is traded (like cash markets), while in trading options, it is the option premium which is traded.

Strike price / Exercise price: This refers to the specified price for which the underlying commodity may be purchased (in the case of a call) or sold (in the case of a put). The premium could depend on a wide range of variables like the price of the underlying commodity, volatility of the underlying, strike price, time until expiration, risk free interest rate.

Settlement of options: Options can be exited in three ways. The first way is to off-set the trade by taking an opposite position. In doing so the option buyer sells the option. This can be done by the buyer or seller of the option. The second way is to exercise the option. Here the commodity is physically bought or sold through the exchange. Only the option buyer (call or put) has a right to do so. Based on the rules of exercise, options can be of two styles: American options and European options. An American-style option may be exercised anytime prior to its expiration. A European-styled option may be exercised only on the expiry date. The third way to exit is to do nothing, allowing the option to expire.

Reading options: Understanding the following trading data of an option on a May corn futures as traded on CBOT should enhance the reading of option markets.

Chicago Board of Trade (CBOT) Corn Options on futures (extract)

Cents/ bushel	Strike	Last	Net Change	Open	High	Low	Close	Settl	Prev. settle	Hi/lo limit
Put	260'0	24'1	0'2	25'2	25'2	24'1	24'1	24'1	24'3	44'1 4'1
Put	280'0	41'7	0'3	43'4	43'4	41'7	41'7	41'7	42'2	61'7 21'7
Call	160'0	78'6	-'5	78'6	78'6	78'6	78'6	78'6	73'6	98'6 58'6
Call	200'0	38'6	+4'6	-	-	-	38'6	38'6	34'0	58'6 18'6
Underlying Contract Price:238'6 (06May Future)										

One CBOT Corn futures contract is for 5,000 bushels

Strike in the second column represents the strike price for which the Call or Put option can be bought. 260'0 or 260 cents is read as $2.6.(The fourth digit is to be read as 1/8 cent/bushel, thus 170'4 would be read as $1.7 $^{1/2}$($1.7+4/8 cent)).

Last refers to the last traded price and change captures the price movements. Note that except for the strike price all other prices are that of the option premium.

The next three columns show the **opening option price, highest option price**, **lowest option price** and the **closing option price** achieved in trading during the day.

Settlement refers to the average of the prices at which the contract traded immediately before the end of the trading session. Settlement price is important as the 'marked to market' price is based on this. Change reflects the change in settlement price from the preceding day.

Hi and Lo limits refer to the range in which options can trade in a day. It indicates the highest and lowest price that options can take in a given day.

C. Price risk management using options:

It is commonly explained that a seller of a commodity would hedge risks of falling prices by buying a put option. This guarantees him a minimum selling price. However the seller's contractual status, i.e., whether he has an existing contract (ex: a contract farming arrangement) in the spot market which assures a minimum price could also influence his strategy. When a seller or buyer has a contract farming type arrangement which guarantees a fixed price, options would not be used to get a minimum price assurance as this is already assured in the physical contract. In this case options would then be used to get flexibility to profit from favourable price movements. Thus, in such a case the seller of a commodity would buy a call option which would yield profits in the eventuality that prices rise. The following enumerations should further clarify the above idea:

Seller risk management when there is no existing physical contract assuring a minimum price[33]*:*

A cocoa farmer is concerned about falling market prices and chooses to protect himself by buying a 'put' option. He buys a put option expiring in 3 months, having a strike price of $800 at a premium of $10. This gives him the right to sell a standard batch of cocoa at an agreed price of $800. Three months later at harvest time, cocoa prices fall to $770 per ton and the put option is trading at a price of $25. The farmer has two alternatives. He could exercise the option, delivering cocoa at $800 per ton at the stipulated warehouse and realise a net price (less premium costs) of $790 per ton. Alternatively, if he does not wish to deliver the cocoa he could sell the put option (close/offset his position) at a profit of $15 ($25-$10), effectively getting a selling price of $785($770+$15) per ton. If cocoa prices rise to $825 per ton, he will let his option lapse and sell the cocoa at the higher market price.

Seller risk management when there is an existing physical contract assuring a minimum price:

In the above example consider a case where the cocoa grower has a contract farming agreement with the chocolate manufacturer whereby he has agreed to sell the standard batch of cocoa at a fixed price of $800 per ton. Three months later cocoa prices in the market increase to $840 which results in an opportunity loss of $40 per ton for the grower. If the farmer had bought a call option it could have helped the farmer participate in the upward price movement. He could yield some gains by simply closing out his call option which would have gained value on account of rising cocoa prices. (The price of the underlying is the key determinant which guides the price of an option. When market prices rise, call options gain value, i.e., the price of the option premium increases and when market prices fall, put options gain value)

Put options enhance terms of credit

Rabobank, with the International Task Force, has conducted pilots for coffee in Nicaragua, Uganda and Tanzania. The period of coverage ranged from one to six months consistent with physical transactions. 250 farmers in Nicaragua, 450 in Uganda and a few thousand in Tanzania have benefited from the scheme. All initial transactions were put options and premiums ranged from 2-9% of the strike price. Rabobank executed most of these ITF transactions. Many thousands of African farmers, making up the membership of one specific large cooperative, saved half of their traditionally paid lending fee of 18%. Another major result of hedging was that local banks extended credit to counterparts they had refused before.

World Business Council for Sustainable Development, 2004

Buyer risk management when there is no existing physical contract assuring a maximum cost of purchase[34]*:*

A chocolate manufacturer concerned about rising cocoa prices seeks protection by buying a call option, which gives him the right to buy a standard batch of cocoa at an agreed price of $800 per ton after three months. This option costs $10 per ton. Three months later, cocoa prices in the market rise to $820 per ton and the call option is trading at a price of $17. Like the cocoa farmer he has two alternatives before him. He could exercise the option, buying wheat at $800 per ton at the stipulated warehouse and pay a net cost (plus premium costs) of $810 per ton. Alternatively, if he does not wish to take delivery, he could sell the call option (close/offset his position) at a profit of $7 ($17-$10) giving him an effective cost of $813 ($820-$7) per ton. If market prices

[33] This example was drawn from Pass *et al* (2005).
[34] This example was drawn from Pass *et al* (2005).

fall to $780, the chocolate producer does not exercise the option and is free to buy cocoa at the favourable market price.

Buyer risk management when there is an existing physical contract assuring a minimum price:
In the above example consider a case where the chocolate manufacturer has a contract farming agreement with the cocoa grower whereby he buys the standard patch of cocoa at a fixed price of $800 per ton. Three months later cocoa prices fall to $780 and the manufacturer faces an opportunity loss of $20 per ton of cocoa to be purchased. If the manufacturer had bought a put option it could have helped him participate in the downward price movements. The manufacturer could yield some gains by simply closing out his put option which would have gained value on account of falling market prices.

Using put options as minimum support prices: The use of put options can provide an alternate procurement mechanism for the Government. Put options can provide farmers not only with a minimum selling price but with a much better market determined MSP. The use of market based mechanisms does not distort market prices. An evident hitch in any such program would be the resistance of the farmers to bear the costs. As an intermediary step, the government could consider paying or sharing the cost of the premium.

Case: ASERCA Mexican

ASERCA programme of the Mexican government facilitates hedging through option futures

The Mexican programme administered by the government department ASERCA (Support Services for Agricultural Marketing Agency) was created in 1994 to facilitate access by farmers to futures and futures options contracts traded on the Chicago, Kansas City, New York Board of Trade and the Chicago Mercantile Exchange. The stated purpose was to help producers to reduce risk related to adverse agricultural price movements and thereby motivate them to increase production.

Mechanism: Under its provisions, growers may acquire commodity futures, futures options and synthetic options contracts with a fifty per cent federal subsidy on option prices. Both call and put options are eligible although in practice almost all of the contracts outstanding are put options on futures (referred to as futures options). When gains are realised from exercising the option, the farmer's initial share of the option premium is reimbursed. The authorities then recoup up to the full amount of the initial subsidy with any remaining profits remitted to the grower. The scheme has become increasingly comprehensive in terms of the crops eligible for hedging and its approved budget for the years 2002-3 was approximately $U.S 22.5million

The scheme is available to qualifying producers and exporters with the rules for qualification seeking to ensure that the motive for participation is crop hedging rather than speculation. Although some rolling of futures and futures options contracts is permitted, for instance, the nine-month limit imposed on the hedging period reflects the objective of risk management on a crop by crop basis. With paperwork between the scheme and the futures exchanges administered through the central offices in Mexico City, farmers deal directly with the scheme's regional subsidiaries where monitoring seeks to ensure that the volumes hedged do not exceed the anticipated crop. To limit further the potential costs of the premium subsidies, farmers are required to purchase option contracts with a strike price at, or closest to, the prevailing futures price.

The Spanish name of the scheme is 'Subprograma de apoyos directos a cobertura de precios agricolas'. See http://www.sagarpa.gob.mx and http://www.infoaserca.gob.mx

See, *Futures for farmers: Hedging participation and the Mexican corn scheme*; Snowden, P N and Benavides, G; Lancaster University Management School Working Paper 2005/007

Using put options as minimum support prices: The use of put options can provide an alternate procurement mechanism for the Government. Put options can provide farmers not only with a minimum selling price but with a much better market determined MSP. The use of market based mechanisms does not distort market prices. An evident hitch in any such program would be the resistance of the farmers to bear the costs. As an intermediary step, the government could consider paying or sharing the cost of the premium.

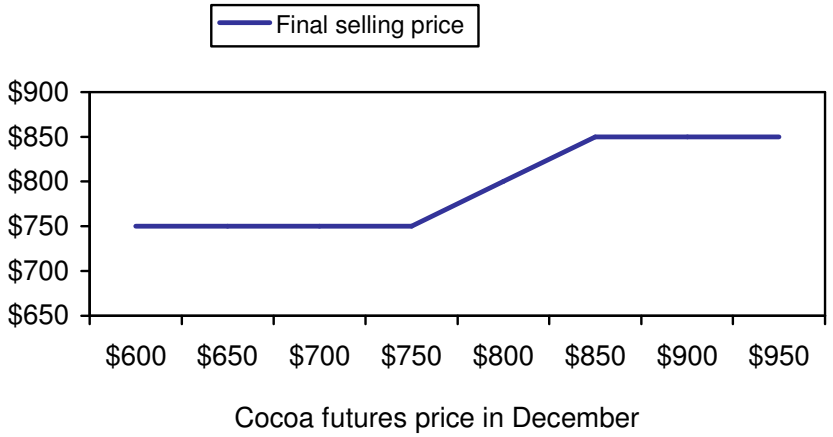
Hedging strategies with options: Innumerable trading strategies can be created with options and futures. Strategies which are speculative should be distinguished from those useful for hedging. One key hedging strategy is the 'fence' strategy which reduces the cost of the

options and also range bounds the returns i.e., the option buyer no longer has the potential to earn unlimited profits:

Fence strategies with options: A hedging strategy arrived by buying a put and selling a call or buying a call and selling a put results in a fence. The "fence" combines two of the simple ('outright') trades to constrain the price effects at extremes – limiting the costs associated with price movements in one direction while at the same time giving up some of the benefits of price movements (The Institute for Financial Markets 2003). In this trade, the premium received for selling an option offsets the premium paid for buying an option. Two fence strategies for sellers and buyers of a commodity are illustrated below:

Example: Fence strategy for the commodity seller - Buying a put option and selling a call option
This spread trade of buying a put option and selling a call option can be used by the producer/farmer who wishes to hedge the risk of falling commodity prices. Suppose a cocoa growing farmer buys December Cocoa 750 put at $21 and, at the same time, sells December Cocoa 850 calls at $21(i.e., he receives $21). Thus, at any given point the farmer has the right to sell his cocoa futures $750. If the buyer of the call exercises the call, the cocoa farmer has the obligation of selling the cocoa futures at $850. Therefore, this trade ensures that the farmer is protected between the two limit prices of $750 and $850, as shown in <Figure 3>. As a result of the offsetting of the two premiums, the trade cost is zero. While writing options can lead to unlimited loses, in this case it is important to recognize that the seller of the call (the farmer) owns the commodity i.e., he writes a covered call. Thus he does not face the eventuality of being forced to buy at a higher price in the market to fulfill the delivery obligations.

<Figure 3> Result of hedging with 'fence'



Example: Fence strategy for the commodity buyer - Buying a call option and selling a put option
A coffee processor is concerned over rising prices of coffee. He caps his costs by undertaking a fence strategy. He buys a November 925 call at $13 (premium paid) and at the same time, sells a November 800 put at $12 (premium earned). Thus, at all times the processor has the right to buy the coffee at $925. If the buyer of the put exercises his put, the processor has the obligation of buying the coffee at $800. Thus with the help of the two trades, the processor is protected between the two limit prices of $925 and $800. The cost of entering this trade is $1 (difference between the premiums paid and earned) to the processor.

Supply chain intermediation in pooling price risk

Institutional intermediation can be critical in enabling small farmers benefit from these instruments. The following two cases are illustrative of the role supply chain partners can play in facilitating access to risk management. The first case shows how a coffee cooperative in itself uses derivative markets to offer minimum price guarantees and advance additional payments to their members in return for a fixed fee. In the second case, a grain processing company in Poland was able enhance the marketing and pricing flexibility of farmers while assuring them a minimum selling price.

Options enhance credit: Coffee cooperative plays aggregator in Costa Rica

FEDECOOP, the apex organization of coffee cooperatives in Costa Rica, uses commodity derivatives to hedge the price risk faced by coffee farmers. Coffee farmers receive a first payment from the millers when they deliver their coffee, and subsequent payments throughout the crop year as millers sell the coffee to exporters. Because millers cannot recover money from the farmers in case coffee prices fall below the first payment and given the high volatility of coffee prices, millers are only willing to advance about half the expected price as an initial payment. Thus millers offer a minimum price guarantee (an option) to the farmers. Several millers have managed to advance more than three quarters of the expected price by purchasing put options to insure themselves against a decline in coffee prices. The cost of the option is deducted from the payments which are to be made to the farmer. Millers that offer this option to farmers have attracted business since farmers like the price protection. Thus when farmers access commodity derivative markets indirectly, an exporter, trader, or farmer association can absorb (or aggregate) the price risk from many smallholders and hedge the exposure in the derivative markets.

Risk management imbibed in marketing contract: Grain processing company in Poland

Central Soya, a grain processing company in Poland, has introduced a risk management instrument for local producers. While Central Soya agrees to purchase grains, producers can opt to fix (call in) their price and receive payment at some future date. Central Soya guarantees that they will receive a price no lower than the price on the day of delivery. In that sense, Central Soya's contract works as a put option. By delivering and not fixing their price, producers can take advantage of the increase in price later in the season (they can spread their sales), and also have price protection as prices cannot drop below those on the day of delivery. Without this system, producers would either have to sell at harvest when prices are usually at a seasonal low or store and sell later, thus incurring storage costs. For Central Soya, the delay in payment means savings in the cost of financing its purchases. Producers can also use the Central Soya contract to obtain financing from banks.

See Plantos Varangis., and Dont Larson, 1996, *Dealing with commodity price risk uncertainty*, World Bank.

Hedging with options vs. futures: An interesting question arises - of the two popularly exchange traded instruments, options and futures, which would be more suitable for developing countries? While entering a futures contract only requires payment of an initial margin (no explicit cost) futures can potentially generate large and uncertain losses on the

settlement or closing of the futures position. In the case of options there is a permanent entry cost but after paying the one time premium there are less cash-flow problems because there is no risk of unexpected margin calls. Further the cost of purchasing options can be minimized by adopting suitable trading strategies. Thus, given the cost and cash flow certainty in using options, they may be more suitable tools for developing countries.

D. Other option properties:

If a hedger decides to minimize price risk by hedging with options, the first question arises is at what strike price. Options are termed "in-the-money," "at-the-money," or "out-of-the-money" depending upon the relation between the strike price and the price level of the underlying contract.

- 'At the money' option is one that would lead to a zero cash flow to the holder if exercised immediately, i.e., the price of the underlying commodity equals the option's strike price.

- 'In the money' option is one that would lead to a positive cash flow to the holder if exercised immediately, i.e., the price of the underlying commodity is more than a call option's strike price and less than a put option's strike price.

- 'Out of the money' option is one that would lead to a negative cash flow to the holder if exercised immediately, i.e., the price of the underlying commodity is less than the call option's strike price and more than the put option's strike price.

The purchase of an in-the-money, at-the-money, or out-of-the-money option depends on the level of price insurance desired. While an-in-the-money option offers more price insurance (a lower price ceiling for a processor), the premium paid is higher.

Another related concept is intrinsic and time value of an option. Intrinsic value reflects the amount by which an option is in-the-money, thus it is the difference between the exercise price of the option and the underlying commodity. Anything paid for an option in addition to its intrinsic value is time value. Time value refers to the money that buyers are willing to pay for the possibility that the intrinsic value of an option will increase over time. Time value of an options contract shrinks as the expiration date approaches, with less and less time for a major change in market opinion there is a decreasing likelihood that the options contract will increase in value.

E. Options on commodity futures

Options on futures require delivery of the underlying *futures* contract (and not commodity) on the exercise of the option. In agriculture markets, options often refer to options on futures. For example the underlying for the wheat option traded on CBOT is the wheat futures contract.
On exercising a call option on futures, the buyer of the option acquires a long position in the futures contract and a cash amount equal to the difference between the most recent futures settlement price and the strike price of the option. If a put option on futures is exercised the option holder acquires a short position in the underlying futures contract and the difference between the strike price and the most recent futures settlement price. Options on futures are more attractive than options when it is cheaper or more convenient to deliver the futures contract than the commodity. They assume more importance in spot markets which are fragmented (John C. Hull; Options, futures & Other Derivatives).

4. Swaps

A. Swaps

Swaps were developed in the OTC market as long-term price risk management instruments. A commodity swap contract (or simply 'swap') obligates two parties to exchange a floating price for a fixed price (or vice versa) for a given amount of a commodity at specified time intervals. In other words a swap is an agreement between two parties - the hedger and the hedge provider - in which the hedger (a commodity user or producer) agrees to pay a fixed price and receive a floating price for a specified volume of a commodity over a specified period. In general, commodity users pay a fixed price and receive a floating price, while producers do the reverse, paying a floating price and receiving a fixed price.[35] In a swap with two parties, there is typically a consumer and a producer of the commodity, and a bank or any other financial institution who acts as an intermediary. A swap agreed directly between a consumer and producer and not through an intermediary has the advantage that the intermediary carries risks associated with the performance of the swap. Commodity swaps have been more used in the oil industry.

B. Essential concepts

Settlement: Swaps are settled periodically on a net basis. Swap transactions do not entail physical delivery of commodities. Depending on whether the prevailing market price is above or below the predetermined price, one party would make a payment.

Costs to a swap: Entering a swap typically does not require the payment of a fee. There is no periodic margin calls as in futures or any initial cost outlay as in the case of options. However because of the high counterparty risk in the swap transactions, banks may require upfront cash collateral to cover a predetermined level of risk exposure.

Key advantages of swaps:

Operational benefits of swaps: As a commodity swap is a pure financial transaction, it has the advantage of allowing the producer and consumer to hedge their price exposure without directly affecting their commodity production, distribution or procurement activities. The hedge seeker has no obligations to deliver the commodity to the bank. Thus the price risk is separated from the physical risk.

As instruments of risk management swaps offer a simple method of managing price risk that do not involve detailed understanding and access to the currency and futures markets. Swaps can also provide protection against exchange rate movements by allowing the transaction in the currency of one's choice. Since a swap is a one-time negotiation, no major periodic decisions have to be made and they do not require constant monitoring. Swaps do not involve hassles of exchange traded brokerage and margin calls; this makes them more convenient tools of price risk management. These are some key factors which make swaps easier tools of risk management for developing countries.

Long-term risk management: Unlike futures and options, swaps were developed to meet the relatively long-term price risk management needs and are generally available in the over-the-counter market (that is, they are negotiated and not exchange traded). A key advantage of swaps is that they allow market participants to improve their cash flow predictability beyond one to two years; futures for agricultural commodities by contrast are traded only for twelve to eighteen months (Faruqee, Coleman 1996).

[35] Derivations vol 3., Global financial products group of Nesbitt Burns, Bank of Montreal, Harris Bank.

C. Using swaps for price risk management

Fixed-floating swaps are the most basic swaps available in any commodity or financial market. This swap obligates two parties to exchange a floating price for a fixed price (or vice versa) for a given amount of a commodity at specified time intervals. The fixed price is determined by the bank and the reference price could be based on an agreed futures contract, an index or a reference price quoted in a price guide.[36]

Example of a consumer swap: The agency of a wheat-importing government enters into a long-term contract in which the exporter agrees to sell 250 000 tons of wheat every six months over the next five years. The agency wishes to lock in the dollar costs at the time the contract is signed. The agency enters into a commodity swap contract with a bank. The fixed term for the swap is $130 per ton and the floating rate is to be based on the spot rates which would prevail at the time cash flows are exchanged. Thus, the importer agrees to pay the bank a notional (notional because the above sums are not really exchanged) sum of $32.5 million (250 000 tons*$130 per ton) every six months for the next five years. The bank in return agrees to pay the exporter a notional value based on the spot price of wheat which would prevail on the day that the bank receives its payment from the importer. The difference between the above two notional cash flows is settled every six months between the two parties of the swap contract. Note, that in exchanging these cash flows the importing agency is transacting with the bank and not the exporter. If the spot prices of wheat rise to $132 in the spot market, the importer receives 500 000(2*250 000) from the bank. This compensates the importer the increased cost of $2 ($132 less $130) he incurs in the spot market. In this way a commodity swap locks in a price of $130 per ton for the importing agency.

Example of a producer swap: A wheat farmer would like to receive a fixed price for 300 tons of wheat over the next two years. The variable leg of the swap is based on the closing price of the USD wheat futures contract on the CBOT on the pricing date, converted to AUD based on the USD/AUD exchange rate. The bank calculates the fixed price which is to be paid to the farmer as $200. If the reference price falls to $190, then on the payment day the bank pays the farmer the difference between the fixed and reference price, i.e., $3000 ($10*300). This payment compensates the loss in selling wheat at the reduced market price. If the reference price rises to $220 the farmer would have to pay the difference, i.e., $6000 ($20*300), effectively netting $ 200 under both conditions.

It is possible to integrate an option clause in the contract to permit the producer to profit from price rises, but in the case of commodities this is often prohibitively expensive due to the premium costs of longer-term options. These costs can be partly mitigated by selling options to the bank or by other clauses which give up part of the benefits on prices increasing beyond a certain level.

Swap markets: For some agricultural goods, the existence of liquid and well established futures markets limits the need for swaps (as positions on the futures market can be rolled over to create a "synthetic swap"). However there is a major technical barrier to the rapid development of swaps for producers. This barrier lies in the fact that the prices to be used in swaps are difficult to determine when they are based on the prices of futures contracts that are

[36] See the Commonwealth Bank product brochure on agriculture swaps for more details; http://business.commbank.com.au/PDS/Agricultural%20Swaps.pdf

in backwardation most of the time and where the level of backwardation is highly volatile. When one covers a swap with a consumer by rolling over futures, backwardations provide profits (as a counterparty, the intermediary would be notionally selling the commodity to the consumer. The intermediary would in turn cover this position by taking an inverse position, i.e., buying a future. Rolling over such a position, would entail selling the near month and buying the further-out month which is trading at a lower price), while contangos result in losses; in the case of a swap with a producer the opposite is the case.[37] Thus, under conditions of backwardation, swaps with consumers are much easier to offset by futures transactions than are swaps with producers.

5. Insurance

As seen in other instruments, the essence of the risk management instruments is risk-sharing, like it is in insurance. However agriculture insurance is more commonly used for non-market related perils like crop losses from climatic disasters, pest attacks etc[38].* Application of insurance in managing price risks is more seen in revenue management and under contract farming arrangements. Price insurance is more effective for those products for which objective price data is available. To avoid moral hazard and adverse selection problems, loss assessment should be based on a reference price (futures price, spot market price) which cannot be influenced by the farmer.

Revenue insurance: Revenue insurance was designed to provide comprehensive protection – not just yield or price protection. It covers sharp drops in expected revenue, which may result from yield or price declines or a combination of the two. Farmers are compensated when any combination of harvested yield times the harvest price results in insurance revenue that is less than the revenue guaranteed. The genesis of revenue assurance is found in the need for the private sector to fill the gap left by a reduction in the government financial safety net. The following revenue insurance plans provided by the Risk Management Agency of the USDA[39] are illustrative of the potential ways in which revenue insurance can be provided:

Group Risk Income Protection (GRIP) - GRIP makes indemnity payments only when the average county revenue for the insured crop falls below the revenue chosen by the farmer. i.e., the insured is paid in the event the county average per acre revenue falls below the insured's county trigger revenue. The trigger revenue is calculated by multiplying the GRIP price by the expected county yield and then multiplying this by 90, 85, 80, 75, or 70 percent (based on the chosen protection). The GRIP price is the average CBOT futures price for the five business days prior to March 1.

Adjusted Gross Revenue (AGR) - insures the revenue of the entire farm rather than an individual crop by guaranteeing a percentage of average gross farm revenue, including a small amount of livestock revenue. The plan uses information from a producer's Schedule F tax forms, and the current year's expected farm revenue, to calculate the policy revenue guarantee.

Crop Revenue Coverage (CRC) - provides revenue protection based on price and yield expectations by paying for losses below the guarantee at the higher of an early-season price or the harvest price.

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[37] For more see, UNCTAD; *A survey of commodity risk management instruments,* 1998.

[38] For more about insurance, refer to my previous paper ("Innovations of agricultural insurance products and schemes" (2005) under press). The paper also explains two products for managing livestock price risk: Livestock Risk Protection (LRP) and Livestock Gross Margin (LGM).

[39] See http://www.rma.usda.gov for details on the policies.

Income Protection (IP) - protects producers against reductions in gross income when either a crop's price or yield declines from early-season expectations.

Revenue Assurance (RA) - provides dollar-denominated coverage by the producer selecting a dollar amount of target revenue from a range defined by 65-75 percent of expected revenue.

While the state provides subsidy in the above mentioned schemes, another model in managing costs could involve payment of part premium by the input vendors who could in turn be reimbursed from the sales revenue.

Price insurance through Contract farming: Contract farming arrangements, where farmers are contracted to produce as per the procurer's requirements can have in-built price insurance through the pricing clauses of the contract. As an example, in the cotton sector in India (Chennai) procuring mills are purchasing cotton at the higher of the fixed or market price. If the mill fails to procure the quantity agreed upon, the federal procurement agency purchases the rest at the market price subject to the minimum declared price of the government. The above contracting model effectively provides price insurance as given by an option. In yet another model, the company may enter into a contractual arrangement with the producer and guarantee a price for the purchase of the product under agreed conditions or even guarantee a minimum level of revenue on a per acre basis.

The major drawback of price insurance is high correlation of prices which is associated with a high degree of systemic (i.e. non-diversifiable) risk. Generally, systemic risk can be dealt with more effectively using derivatives products such as options, futures and swaps (essentially, any price insurance policy can be replicated with a long put option strategy, the strike price of the option being a trigger level of insurance and the option price i.e. premium being a premium of insurance). Thus, the availability of price insurance may also depend on the availability of derivatives markets where the insurers can dispose of the excess risk due to high correlation of price risk or on the availability of sufficient reinsurance capacity (Alizadeh, Nikos Nomikos 2005).

III. Summary and conclusion

Forward pricing instruments like futures, options, or forward contracts do not prevent or reverse a persistent deterioration in commodity prices, or sudden spikes in prices, but if used correctly they can effectively serve farmers and agro-businesses as a tool for smoothing out short-term (within the year) price fluctuations. This chapter summarizes the market-based price risk management instruments and offers some recommendations for the users and policy makers.

1. Summary of the market based price risk management instruments

Forward contracts allow the seller or buyer of a commodity to set the price of a given quantity in advance through privately negotiated mechanisms. Forward contracts are customized, giving the negotiator flexibility over the quality, quantity and time of the transaction. Various types of forward contracts are discussed. Key amongst these is the 'price-to-be-fixed' (PTBF) contract where the seller has the ability to fix the prices at the moment deemed most opportune. 'Deferred pricing contracts' allow the seller to deliver a commodity at one period of time but permit the price to be fixed at a later date. One type of deferred pricing contract is the 'basis contract', which fixes the basis at the time of delivery, but leaves the futures price open. 'Hedge to arrive' contract works opposite, it fixes the futures price leaving the basis open. 'Deferred payment contracts' allow delivery and pricing to occur at one period of time, but actual payment to take place at a later date. This is especially advantageous for tax purposes. The 'minimum price contract' guarantees a minimum-price with an opportunity to participate in future price gains.

Futures contracts are like forward contracts but standardised and exchange traded. There are two ways in which they could be used for risk management. In the first mechanism, firms planning to buy or sell in the physical market can instead trade on the commodity exchange. On the expiration of the contract they would have to either give or take delivery thus locking in a tentative price (they are subject to the risk of price movements between the period when the contract is entered and closed). In the second (more commonly used) mechanism the buyer or seller in the physical market takes an opposite position in the futures market. As cash and futures prices move in the same direction, the losses/gains in the physical market get compensated by the gains/losses in the futures position.

Options are a useful price risk management tool for agricultural producers. Their function is similar to insurance. They can limit the option buyer's downside while assuring gains from any favourable price movements. There are two basic types of options: puts and calls. A put option provides a commodity seller protection from falling prices. In the eventuality of falling prices, the option buyer has the right to sell the commodity at the higher than market price. Similarly a call option provides a commodity buyer, protection from increasing prices. In the eventuality of increasing prices, the option buyer has the right to buy the commodity at the lower than market price.

Swaps are multi-period price-fixing contracts. A commodity swap is an agreement whereby a floating price for a commodity is exchanged for a fixed price for the same commodity over a specified period for a defined volume. The floating price is normally the prevailing market (spot) price for the asset and the fixed price is the price which is negotiated and agreed before the initiation of the swap contract. Swaps are pure financial instruments where no exchange of

physical goods takes place. This feature distinguishes swaps from futures and options contracts, where making or taking delivery of the physical commodity is always an option before the agriculturalist.

Insurance in agriculture has essentially looked at providing protection from perils of crop failures. Revenue insurance, which provides protection against both falling prices and crop yields, offers a comprehensive solution before farmers. Price insurance is also being applied under contract farming arrangements.

2. Recommendations for encouraging the use of market-based price management instruments

A. Recommendations for users:

Prior to trading price risk management instruments, especially futures and options, the user must consider all possible means in which they could be used to manage price risk. Here three possibilities arise:

- Futures and options can be traded directly to either hedge risk or trade the commodity on the exchange;
- The price information can be used for pricing physical contracts; and
- Access to the price dissemination systems can be used as a reference for negotiating fair prices. The implicit benefits of market intelligence, especially to enhance the bargaining power of small farmers should be well recognized.

In making any such decision, the user must critically examine existing technical capabilities and availability of resources for sustained access to these markets. The current commodity derivative markets are based on large volumes, and to access derivative markets, sizable infrastructure (hardware, know-how, capital, market information, etc.) is necessary. In some cases, the costs of accessing these instruments (margin calls in 'futures' and premiums in 'options') and the minimum trading units may prove to be a bit prohibitive for small farmers.

Farmers can benefit from all of these to a much larger extent if their farmer organizations and their agro-businesses effectively use them, i.e., if some form of intermediation is available. Governments could also intermediate for small farmers, as was exemplified in Mexico's case.

A paper[40] by UNCTAD extensively discusses models and case studies in intermediation by farmers' associations. Intermediaries like farmers' associations are in a formidable position to reach out to their members. They can provide risk management functions and also facilitate access to risk management markets.

Towards facilitating risk management, the farmers' associations can play a key role in the area of risk management education. At the foremost they can make the farmers understand the advantages of managing price risks through market-based instruments. Further they could increase awareness of issues which are integral in participating on exchanges. The quality requirements of the exchanges, consequences of defaulting on contractual obligations, available means to redress grievances etc are a few examples. They could also partner with

[40] UNCTAD., Farmers *and farmers' associations in developing countries and their use of modern financial instruments,* 2002. *This paper(with many case studies) is dedicated to the issue of how farmers associations can facilitate price risk management in developing countries.*

other expert organizations to conduct comprehensive training and simulated workshops towards enhancing subject know-how. As a second step they could build strategic partnerships which could potentially reduce the cost of using these instruments, open avenues for obtaining easier financing, etc.

Toward providing risk management functions, they can provide small farmers with the benefits of an assured price and hedge this risk by selling a future or buying a put on their own account. Alternatively they can play the role of a broker, aggregating the requirements of small farmers and transacting on their behalf. They could also intermediate by arranging forward contracts for the farmers.

Choosing a brokerage firm and broker: As futures and options are traded only through registered brokerage firms, as a first step, a brokerage firm would need to be selected. Although brokerage firms are closely regulated by the financial supervisory authorities, it is important to be careful in choosing a brokerage firm and an individual broker (Barrie 2002). The following criteria serve as a mini-check list in choosing an appropriate broker:

Disciplinary record: The brokerage firm should be of the highest moral integrity. "Moral integrity" means that they should have a track record of transacting with their customers in a fair and equitable way. One can check this with a regulatory association who keeps records about the registered brokers and brokerage firms.

Length of time in business: Many brokerages go out of business in the first five years of operation. Therefore, attention should be paid to their period of existence (5 years is a comfortable benchmark). It should also be ensured that the same firm has not been doing business in another name.

Services: The most important service to the customers is quality research and information. The research department should produce nightly reports, recapping the trading day's events and news. There should be in-house expertise in fundamental research as well as technical analysis.

Broker: Having decided upon a firm, a trader should then move to deciding on an individual broker in the firm. The broker's job is to handle and execute his orders, keep him informed of potential news, and to advise him on risk management. The trader should make sure that the broker has a thorough understanding of all commodities – or at least the ones he is specifically interested in.

B. Policy recommendations:

Notwithstanding the effectiveness and advantages of derivatives for price risk management, farmers' use of market-based instruments for hedging is limited in developing countries. It is estimated that less than two percent of the volume of futures and options instruments is attributed to developing countries.[41] There are a number of reasons given to the low participation of agricultural producers:

- Domestic security nets by way of policies of price support and direct subsidy;
- Lack of awareness and know-how of these instruments; further there may be barriers of technology or telecommunications which hinder further access;

[41] FAQs released from the International Task Force (ITF) on Commodity Risk Management in Developing Countries, available on the ITF website (http://www.itf-commrisk.org/itf.asp?page=47).

- Costs of trading (margin deposits and option premium) may restraint access to small-scale producers;
- Minimum size of contracts traded on organized exchanges often far exceed small and medium-sized producers' annual quantity of production;
- Regulatory policies may pose restrictions on the trading of such products;
- Sellers of such instruments, generally international banks and brokerage houses, are often unwilling to engage with a new and unfamiliar customer base of small-scale producers.

Governments can play a significant role in providing a conducive environment to the instrument providers and their customers (farmers, traders). Here are some specific policy recommendations to governments for encouraging the widespread use of price risk managements:

Training and capacity building:
An important barrier to using these market instruments is a general lack of familiarity with their strategic uses. Further there are misconceptions about hedging being the same as speculation and policymakers are often unaware of the costs of risk management in terms of foregone higher revenues. Therefore, stakeholders (including producers, traders, and government agencies) must undertake sufficient training and capacity building to gain a very thorough understanding of risk management procedures, including the operation of derivative markets and their use for hedging, before they become clients. Capacity building initiatives must not neglect the intermediary institutions (especially, cooperatives, banks and other financial institutions, and local traders) who are in a position to aggregate demand of individual farmers to enable risk management instruments of a minimum size to be traded on international markets (World Bank 2004a).

More flexibility in the provision of put options:
An objection expressed by farmers to forward pricing instruments is that while they are concerned about extremely low prices, they do not want to foreclose the prospect of above-average prices. This makes farmers a natural candidate for using put options where they have the flexibility of gaining from favourable price movements. However farmers face many obstacles in using them:

- Grade specifications and quality parameters applicable in delivering contracts might not match that of the produce
- At the foremost there may be regulatory barriers which prevent the use of these instruments.
- Expiration dates and specifications tied to the contracts may not match their cropping cycles
- Accessibility is a critical issue. Small farmers might not have the scale to trade the minimum contractual lots of the exchange
- Limited capital may pose a problem in paying premium costs
- Technical issues like pricing options, trading strategies etc. involved in trading options are complex and may discourage many users

For those obstacles, some special considerations can be given by the instrument providers (financial supervisory authorities and exchanges). For example,[42] the Commodity Futures

[42] These examples were cited from Gardner (2000).

Trading Commission (CFTC), assuming federal regulatory authority over all commodity futures markets in U.S., introduced a pilot program in "agricultural trade options", which permits any registered merchant to offer option contracts to farmers for delivery to that merchant, with any strike price, expiration date, delivery conditions, and up-front premium that the merchant and farmer find mutually acceptable.

For mitigating the farmer's burden of premium, the largest U.S. grain merchant, Cargill, Inc., demanded that the rules for trade options permit producers to write "covered calls", an example of which is a "Min-Max" contract that assures producers that they will receive no less than a pre-negotiated floor price in exchange for agreeing to receive no more than an offsetting ceiling price. The Min-Max contract has the essential characteristics of a "fence"[43] consisting of a simultaneous purchase of a put and writing a call.

Use of derivative markets for price or income support programmes:
In addition to risk mitigation for farmers and agribusinesses, derivatives can be used governments for addressing macro level price instability. Compared to government price stabilization programmes, the use of commodity derivative instruments by the government has the following advantages (Varangis, Larson 1996):

- Less expensive to manage and operate;
- Consistent with the international trade agreements (WTO, etc.);
- Provide producers with benefits comparable to traditional programmes;
- Market-neutral as premiums are established in open markets.

The U.S. and Canadian governments have implemented pilot projects that use commodity-derivative-based instruments to provide participating producers with an alternative to traditional farm income support programmes.[44] The use of market-based risk management alternatives by governments should be a transitory step from which the private sector develops price hedging instruments with the government remaining involved only until such private sector alternatives develop. Thus, the sequence is from traditional government farm price support programmes to ones where the government uses market-based hedging tools to the evolution of the private sector in directly hedging price risks.

Use of derivative markets for stable revenues:
At the government level, revenues and/or expenses (through export taxation, or income and expenditure taxes) which are dependent on commodities (oil, metal or agricultural), can be better secured from using commodity derivative markets. If revenues unexpectedly decline due to a fall in commodity prices, the government needs to either cut expenditure or run a deficit and borrow in the international markets. Commodity price hedging in the derivative markets can minimize the unpredictability of their foreign exchange revenues.

[43] See Option strategy for hedgers in 3. Options, Chapter II.

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<Annex1>

Key agricultural commodity exchanges in the world[45]

Exchanges	Location & date of establishment	Agri-Products
Commodity exchanges in North America		
Chicago Board of Trade (CBOT)	Chicago, U.S.A.; 1848	Corn, oats, rough rice, soybeans, soybean oil, soybean meal, wheat
Chicago Mercantile Exchange (CME)	Chicago, U.S.A.; 1874	Milk, butter, cheese
Kansas City Board of Trade (KCBOT)	Kansas City, U.S.A.; 1856	Wheat
Minneapolis Grain Exchange (MGE)	Minneapolis, U.S.A.; 1881	Hard red spring wheat
New York Board of Trade (NYBOT) *	New York, U.S.A.; 1998	Cocoa, coffee, sugar, pulp, cotton, FCOJ (frozen concentrated orange juice)
Winnipeg Commodities Exchange (WCE)	Winnipeg, Canada; 1972	Canola, western barley, feed wheat
Commodity exchanges in South America		
Bolsa de Mercadorias & Futuros (BM&F)	São Paulo, Brazil; 1985	Sugar, ethanol, coffee, soy, corn, cotton
Mercado a Término de Buenos Aires (MATba)	Buenos Aires, Argentina ; 1907	Wheat, corn, sunflower seeds, soybean
Rosario Futures Exchange (ROFEX)	Rosario, Agrentina; 1909	Soya, wheat, maize
Commodity exchanges in Europe		
Budapest Commodity Exchange (BCE)	Budapest, Hungary; 1989	Corn, feed wheat, wheat
Euronext **	London, Paris, Amsterdam, Lisbon & Brussels; 1998	Cocoa, robusta coffee, white sugar, feed wheat, milling wheat, rapeseed, corn, potatoes
Warenterminborse Hanover AG (WTB)	Hanover, Germany; 1998	Potatoes, wheat, brewing barley, rapeseed
Commodity exchanges in Africa		
Johannesburg Stock Exchange (SAFEX)	Johannesburg, South Africa; 1995	Maize, wheat, sunflower seed, soybeans
Kenya Commodity Exchange (KACE)	Nairobi, Kenya; 1997	Cereals, dairy products and cotton

[45] Also see, Leonela Santana-Boado and Adam Gross., *Overview of World's Commodity Exchanges*, 2006, (UNCTAD) for a very comprehensive overview of the status of commodity exchanges.

Commodity exchanges in Asia		
Agricultural Futures Exchange of Thailand (AFET)	Bangkok, Thailand; 2001	Rubber, rice, tapioca starch
Bursa Malaysia Derivatives Berhad	Kuala Lumpur, Malaysia; 1980	Crude palm oil, crude palm kernel oil
Dalian Commodity Exchange	Dalian, China; 1993	Soy beans, soy, corn
Multi Commodity Exchange of India (MCX)	Mumbai, India; 2003	Cereals, pulses, fibre, spices, plantation crops, oil seeds
National Commodity & Derivatives Exchange (NCDEX)	Mumbai, India; 2003	Cereals, pulses, fibre, spices, plantation crops, oil seeds
National Multi-Commodity Exchange of India (NMCE)	Ahmedabad, India; 2002	Cereals, pulses, fiber, spices, plantation crops, oil seeds
Tokyo Commodities Exchange	Tokyo, Japan; 1984	Rubber
Turkish Derivatives Exchange (TurkDex)	Izmir, Turkey; 2004	Cotton, wheat
Shanghai Futures Exchange (SHFE)	Shanghai, China; 1999	Natural rubber, long-grained rice contracts
Zhengzhou Commodity Exchange (ZCE)	Zhengzhou ,China; 1990	Wheat, cotton, sugar

*New York Cotton Exchange (NYCE), oldest commodity exchange in New York, founded in 1870 by a group of cotton brokers and merchants merged with the Coffee, Sugar, and Cocoa Exchange in 1998 and created NYBOT.
**Europe's first cross-border grouping of stock exchanges and derivatives markets, formed in 2000 by the merger of the stock exchanges of Amsterdam, Brussels, and Paris. In December 2001, Euronext acquired the shares of the London International Financial Futures and Options Exchange (LIFFE) and was renamed to Euronext.liffe. In 2002, it merged with Lisbon Stock Exchange.

Annex 2: Brief history of market-based instruments of price risk management

The origin of modern exchanges (where futures and options are traded today) goes back to the 19th century in the United States when businessmen started to organize market forums to make the buying and selling of agricultural commodities easier. In 1849-50, CBOT started offering a **"to arrive" forward contract** which permitted farmers to lock in the price and deliver the grain later for the future delivery (on arrival of the ship).

As trading of forward contracts increased, the Board decided that standardizing those contracts would streamline the trading and delivery processes.In the mid-nineteenth century, **futures markets** developed as an effective means of managing price risk and overcoming counterparty risks. Trade in these "tradable" forward contracts became centralized in organized commodity futures exchanges, where contract performance was guaranteed by a clearinghouse collecting margins, rather than by individual traders or a trading house's "good name". Everyone could henceforth secure future prices without any real risk of counterparty default. Agricultural commodities (grains) futures started trading at the Chicago Board of Trade (CBOT) in 1865. Meat and livestock futures contracts were introduced at the Chicago Mercantile Exchange in 1957. Some developing countries have also a long history in commodities futures trading. During the late 1800s the Buenos Aires Grain Exchange traded futures in grains. In India, futures trading was first introduced on the Bombay Cotton Exchange and the Bombay Oilseeds & Oils Exchange as early as 1921 and 1926, respectively.

With increased government intervention and more interventionist policies in commodities markets which had prevailed since the 1940s, a decline came in the use of commodity risk management instruments, especially in developing countries. It is ironical that the development of markets for price risk has often been hampered by policies designed to address shortcomings of markets for price risk or other development strategies. For example, buffer stock schemes designed to provide multi-period price smoothing sometimes led to larger-than-expected inventories and ultimately became unsustainable, though in some cases they were successful in reducing volatility – at least temporarily. In addition, domestic stabilization programmes decoupled domestic prices from international markets. Futures and other risk management markets shrank or sometimes disappeared as a result. In a similar way, brokerage houses and associated regulatory laws and institutions were not needed in countries where marketing boards mandated farm-gate prices country-wide.

Trading ceased on the once thriving exchanges like the grain exchange in Argentina, the cotton/oilseeds exchanges in India, and the cotton exchange in Egypt. The disappearance of the Liverpool Cotton Exchange in the 1960s can be attributed to the commitment of the United States government to purchase cotton at a fixed price. It was not until the 1980s when the failure of price stabilization schemes and the adoption of market liberalization policies improved opportunities for the development of markets for commodity risk management products. Indeed, most of the current futures exchanges in developing countries started after

1980. Consequently, the rise in global markets for risk management instruments is in part to a changing approach to commodity problems by developed and developing countries.

The origins of the principles of **options** can be traced to pre-biblical times. However, formal trading of commodity options on exchanges has been confined to the last 30 years, when the standardized, exchange-listed, and government-regulated options were introduced first on the Chicago Board of Trade in 1973**.**

[1] The London International Financial Futures Exchange (LIFFE) merged with London Commodity Exchange (LCE) in 1996. Later in 2001, Euronext acquired LIFFE and was renamed to Euronext.liffe.

This section is based on: World Bank (1996); Larson et al (1998); and Alizadeh, Nomikos (2005).