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Preface

Price risk management is very critical to the success of agriculture, and yet there is a lack of tools used to manage risk as well as a lack of understanding of the tools themselves. 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, agricultural performance is highly dependent on many exogenous variables. Crop output and productivity are highly susceptible to uncontrollable factors such as climatic disruptions, natural hazards and pest attacks. Physical risks such as pilferage and deterioration can result in a considerable loss of value during storage and transportation. Trading risks of non-delivery and counterparty 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 themselves 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 (i.e. commodity prices rising less rapidly than those of manufactured prices) and price volatility (Page and Hewitt, 2001).

Commodity price risk management is not a new idea. The failure of international efforts such as stabilization funds and international commodity agreements in stemming commodity price fluctuations has been well known. Loss of safety nets due to 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 agricultural price risk. Market-based mechanisms essentially entail shifting risks to entities in a better position and more willing to bear them. Being market-based, these 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 not the subject of this paper, it must be mentioned that some of these instruments effectively serve as an alternate agri-marketing system, providing a market, price and 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 here have a long history and are actively traded in many markets. It is unfortunate that lack of awareness and know-how among developing countries has limited their widespread use and has resulted in lagged critical benefits to developing countries.

This paper is designed to acquaint the reader with these market-based instruments. The subject is relevant for any entity associated with or impacted by the integrated areas of agricultural marketing and financing. It is hoped that this paper will help readers better appreciate the advantages of managing risks through markets and give them a clear understanding of the underlying mechanisms as a basis for 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 incalculable. While case studies are provided to aid readers' understanding and appreciation of these instruments, this paper does not deal with the application of these instruments.

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Abstract

Market-based instruments for managing agricultural price risk are a practical and non-intervening alternative for managing commodity price volatility. This market-based approach differs significantly from the often failed national and international regimes of price controls. Unfortunately, they have been less embraced in developing countries where institutional strength and a mere lack of awareness of the use of the instruments have deprived these countries of their benefits.

This paper focuses on five of the most important instruments of price risk management. Section I covers an introduction and discusses commodity price risks and the change from a stabilization approach to a market-based one. Section II provides a comprehensive understanding of the concepts and mechanisms and examples of these instruments: forward contracts, which are bilateral contracts, provide a customized solution in locking in (although not perfectly) the future price of the agri-produce; futures and options contracts, which are traded on an exchange (like a stock), similarly help in locking in the future price, but with a varying flexibility structure as against a forward contract; swaps, which like forward contracts are bilateral agreements for managing price risk, change an undesired type of cash flow to the desired one; and agricultural insurance, most commonly available through comprehensive products of revenue management, provides a safeguard against both price and yield risk. Section III provides a summary of market-based price risk management instruments and recommendations for encouraging their use.

Some policy measures are touched on in the paper, such as the encouragement of the use of options, and application of these instruments in government price risk mitigation and in price support programmes. It also provides measures towards awareness-building, which would provide a thrust in both developing markets and in providing direct dividends to all stakeholders.

I. Introduction

1. Commodity price risks

Over the last two decades, commodity prices have been more volatile than those 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 because he does not know whether he will be able to pay back the loan for the investment (i.e. labour, fertilizer, equipment and repairs). The expected commodity price, prices of competing crops and government programmes play important roles in determining the area to be planted. Uncertain prices pressure a borrower's ability to repay and thus make agriculture financing a risky proposition for lenders. In the absence of appropriate risk management instruments, financiers are reluctant to finance traders given the cash-flow uncertainty. Often, they will raise interest rates to cover uncertain risks, or simply refuse to provide credit. As a result, it is not surprising that a lack of price risk management is one of the major reasons that poor farmers stay poor (World Business Council for Sustainable Development, 2004). Farmers' associations may also run similar risks: if they advance their members' credits to be reimbursed through future deliveries of crops, they run the risk that at the moment that the crop is sold, prices may have fallen to levels too low to enable loan reimbursement (UNCTAD, 2002).

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 and 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 (World Business Council for Sustainable Development, 2004).

IMF Research (Cashin, 2003) emphasizes fluctuations in world commodity prices and terms of trade as being the most important external shocks that would affect macroeconomic performance and external balances of developing countries. For commodity-dependent countries, 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 due to 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 and enabling producers to adjust their use of inputs (UNCTAD, 1999). Although it is impossible to completely eliminate the impact of these 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 possibly investors/speculators – who may have an opposing view on the future direction of the market.

Chapter I highlights the failure of historical efforts at stabilizing prices and introduces the market-based approach, which poses unchallengeable alternatives. Chapter II examines four important instruments of commodity price risk management: forwards, futures, options and swaps. A systematic description is provided for the essential concepts and the risk management mechanisms that underlie these instruments. The paper also briefly looks at some insurance-based products that can be used to manage price risk. A previous paper by the co-author (Kang, 2005) covered innovative agricultural insurance products and their alternatives as financial tools for yield risk management. The concluding Chapter III summarizes the instruments, provides some recommendations of caution to their users and offers some suggestions to policy-makers on encouraging their use.

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

A. Stabilization 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 among these mechanisms were compensatory mechanisms, stabilization mechanisms and international commodity agreements, which are briefly reviewed below.[1]

The International Monetary Fund (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 (Stabilisation des recettes d'exportation), for the purpose of stabilizing export earnings of the agricultural sector in the African, Caribbean and Pacific (ACP) states. By their very nature these schemes were designed to provide financial assistance to adjust to external commodity price or volume shocks, rather than provide a tool for *ex ante* price risk management (Varangis and Larson, 1996). Many of the schemes failed because they were based on administratively set benchmarks that 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 unhedged exposures to price risk, the stabilization programmes were difficult to

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

maintain when payments were required over consecutive years (the International Task Force on Commodity Risk Management, 1999).

In developing countries, domestic price stabilization was targeted through marketing boards that 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. 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 and Larson, 1996).

Major International Commodity Agreements – sugar (1954), coffee (1962), cocoa (1972), natural rubber (1980) – were initiated under the auspices of the UN Conference on Trade and Development (UNCTAD), aiming to influence world prices by employing instruments of buffer stocks and export quota.[2] The unsatisfactory performance of the commodity agreements concerned: 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, and because of disagreements and lack of discipline among members (Varangis and 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.[3] 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, the North Bukedi

2 See Varangis and Larson (1996) and the International Task Force on Commodity Risk Management (1999) on the decline of and the lessons from these international commodity agreements.

3 Concerning the theoretical and empirical studies that contributed to a change in thinking from price stabilization to risk management, see Larson, Varangis and Yabuki (1998) and Varangis, Larson and Anderson (2002).

Cotton Company and the Lango Cooperative Union, overcame their problems by taking a more proactive role in marketing. They started using these instruments and had brokers and commission agents communicating vital information on a daily basis. They first used their access to risk management markets in order to be able to guarantee minimum prices to their farmers (Ngategize, 1997).

The key advantages of market-based instruments over price stabilization schemes are elucidated below (adapted from Varangis and Larson, 1996):

- Unlike facilities such as the international commodity agreements and government buffer stock schemes, which tried to manage price volatility by influencing the price, market-based instruments provide certainty of future revenues (or expenditures), and thus ensure the user of concrete cash flows.

- Market-based instruments rely on market prices rather than administrative prices, thus shifting risks to viable financial markets that are better able and willing to assume risks. For developing countries with 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 programmes.

- Commodity-derivative instruments can improve the terms of commodity financing. They can be used to lock in future revenues and ensure the lender that these revenues will cover repayment of the loan. They can therefore increase the creditworthiness of the borrower. This is especially important for the recently liberalized commodity subsectors, 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 on 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 and delivery dates, etc.

It should be mentioned that these markets are not a panacea for farmers' problems – such markets 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-scale farmers unless they are well organized and trained. Nevertheless, enabling access to these markets could greatly help farmers in developing country 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 best, inefficient solutions that often lock them in a vicious cycle of poverty (UNCTAD, 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 that permits one to buy or sell the commodity (the *underlying*) at a future time, at a price 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: (i) the standardized instruments that are traded on commodity exchanges (here the key derivative instruments are *futures* and *options*); and (ii) over-the-counter (OTC)[4] 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)[5] 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 an 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 original and simplest form, the OTC market resembles the traditional forward trade in commodities – 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) (UNCTAD, 1998).

4 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 and Terry, 1997).

5 Also see Santana-Boado and Gross (2006) for a very comprehensive overview of the status of commodity exchanges.

1. FORWARD CONTRACTS[6]

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. The terms and conditions of the forward contract are therefore usually specific to each transaction.

There are three essential concepts in using forwards. First, given that no cash transfer occurs when the contract is signed, the seller of the commodity is obliged to deliver the commodity at maturity; however the buyer does not have to pay money up front (except for transaction fees). 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 (UNCTAD, 1998). 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 (CFTC, 2005).

B. Price risk management using forwards

The general mechanism is as follows: a producer or trader 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 may 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, he 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 (UNCTAD, 1998). 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:[7]

As forwards are negotiated contracts, various possibilities arise in structuring them. Some of the broad guiding elements in structuring a contract are: the basis for pricing; flexibility in timing the pricing; flexibility over timing the receivables; and the ability to participate in favourable price movements. The key forward contracts are mentioned below; in addition some international trading houses such as Cargill provide proprietary contracts for their customers (see box 1).

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6 This section was largely drawn from the website of the Risk Management Agency (RMA), the US Department of Agriculture (USDA) (www.rma.usda.gov/pubs/rme/fctsht.htmal), Harwood et al. (1999), Stasko (1997); an authoritative paper by UNCTAD, *Farmers and farmers' associations in developing countries and their use of modern financial instruments* (UNCTAD, 2002); and the risk management resources available at Cargill Aghorizons.

7 For detailed notes on the merits, demerits and mechanism of each of these forward contracts, see www.cargillaghorizons.com/cah/cahpublic.nsf/pages/basis?OpenDocument.

Box 1
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: (i) a selected futures floor price; or (ii) 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.

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

Fixed price contract: A fixed price (or *flat price*) contract is one of the most common types of forward contracts. 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 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.[8]

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 export contracts for commodities from Latin America. They are also very common in Asia, and although still common in Africa, are relatively less used. 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 deemed most opportune.

Deferred pricing contract: A 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 decision. 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 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-scale farmers, especially where there is an established level of confidence in the buyer.

8 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 fall. Such hedging mechanics in the futures market will be elaborated in the next section.

Deferred payment contract: A 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 take advantage of 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 (Varangis and Simmons, 2000) 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 automatically paid 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.

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

2. Futures[9]

A. Futures

Futures contracts were invented as a way to standardize forwards. In its simplest sense, a futures contract is a standardized forward contract that is exchange traded. It should therefore be emphasized from the start that a future is not a stock or a commodity, but can be thought to trade like a stock. The buyer (seller)[10] of a futures contract agrees, as 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. Futures contracts are usually closed by making an

9 For this and the next section on "options", refer to Kleinman (2004).

10 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 in which 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 in which 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).

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 according to market conditions.

Futures, unlike forwards, are standardized and traded on exchanges. For example, every soybean contract traded on the Chicago Board of Trade (CBOT) is for 5 000 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 because they provide liquidity and a performance guarantee due to being exchange traded. The standardization enhances liquidity by making it possible for large numbers of market participants to trade the same instrument. Trades among the members are settled through the exchange's clearinghouse that 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.[11]

B. Essential concepts

Margins: The striking and almost sole difference between futures and forwards is that futures are traded through organized exchanges, while forwards are traded privately. However, both buyers and sellers are required to make a good faith deposit (*margin*) with their brokerage firm to ensure their respective commitments. The margin is typically a small percentage of the value of the trade. Therefore, 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 mark*et: at the end of each day, a trader's margin account is adjusted in line with the closing price of the futures contract. Gains and losses on futures contracts are credited and deducted on a daily basis. For example, an 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 those new to derivatives, this concept may appear a bit strange. Can one sell futures without owning the commodity today? The 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 (offset), by taking physical delivery of the asset, or by cash settlement.

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11 It should be noted that sophisticated instruments, such as Exchange for Risk (EFR) transactions provided by an exchange, permit the holder of a forward (or another OTC product) to unwind his/her position on the exchange, effectively converting the forward into a future. Parties to an EFR transaction must be the same as those participating in the OTC transaction. See the CBOT for a primer on EFR transactions.

Box 2
Extract of a commodity futures quotes from *The Wall Street Journal* showing the previous day's futures trading

Tuesday, 4 Aug 1998								
Month	Open	High	Low	Settlement	Change	Lifetime high	Lifetime low	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 CBOT is shown above. The **contract size** is 5 000 bushels of corn, i.e. upon buying one futures contract of corn, one buys 5 000 bushels of corn.

Month reflects 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 attained in course of the day's trading.

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 previous 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 that are outstanding. Hence, it is the sum of all the long positions or of all the 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. Together with price data, OI 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 together 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).

Source: *Options, Futures & Other Derivatives* (Hull, 2006).

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. Participants who trade (any instrument) with the objective of managing price risk and not of speculation are called *hedgers*. There are also several

other reasons for which hedgers rarely take or make physical delivery against futures: the futures' delivery grade may not be the same as that which the hedger needs or produces; the futures delivery location may be inconvenient or unsuitable for the hedger; or the 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 may 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 than two percent 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 US$3/bushel, and in two months at the time of delivery the price of the contract rises to US$3.4/bushel, under cash settlement the futures buyer receives the difference of US$0.4 per/bushel.

Reading futures markets: An ability to read futures markets would surely help crystallize the concept of futures. An extract of a commodity futures quote is given in box 2. Additionally, it is recommended that the reader browse some key commodity websites such as www.cbot.com etc to further enhance his understanding. The standardized elements (see box 2) 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.

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 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 (i.e. a farmer hoping to sell three months later, sells futures today and buys back the futures three months later), the profits (losses) 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 that 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 US$2.50 per bushel. He decides to hedge the entire expected yield by selling three April corn futures contracts on CBOT at a price of

US$2.50 per bushel (the standard contract size of a CBOT corn futures contract is 5 000 bushel).

At harvest time, the October futures falls to US$2.00/bushel and local cash prices fall to US$1.88/bushel. The producer offsets his futures position by purchasing back three April corn futures contracts, making a profit of US$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 US$2.38 per bushel (US$1.88 plus US$0.50).

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

TABLE 1
A corn producer's hedging example

	When futures price rises	When futures price falls
Revenue	(+) US$7,500, profit from futures trading (sell 15,000@$2.50 and buy 15,000 @ US$2.00) (+) US$28,200, sale to the local elevator Total revenue: US$35,700	(–) US$15,000, loss from futures trading (sell 15,000@US$2.50 and buy 15,000 @ US$3.50) (+) US$50,700, sale to the local elevator Total revenue: US$35,700
Sale price	Futures gain US$0.50 Cash sales price US$1.88 Net sales price US$2.38	Futures loss – US$1.00 Cash sales price US$3.38 Net sales price US$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 to be purchased in August. To protect itself against prices being higher than the existing futures price of US$140 per tonne, it buys August futures at US$140 per tonne. In the case that August wheat futures rise to US$155 per tonne in August, the government would gain US$15 per tonne (US$155 less US$140 per tonne) on closing out the futures position. Given that futures and cash prices move in the same direction, let us assume that cash prices also rise to US$155. The government purchases wheat at US$155 per tonne in the spot market. The cash price of US$155 per tonne and the profit of US$15 on the futures position result in a net purchase price of US$140 per tonne. It should be pointed out that this results in the effective futures price that was trading in May.

Now consider the case where August wheat futures fall to US$130 per tonne in August. The government loses US$10 per tonne on the closing out of the futures position. Let us assume that the cash price of wheat falls to US$128 per tonne. The government purchases wheat at US$128 per tonne in the spot market. The cash price of US$128 per tonne plus the US$10 per tonne gain in futures results in a net purchase price of US$138 per tonne. This effectively results in a cost price that is less 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. The expected purchase or sales price in hedging with futures can therefore be 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 for 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 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 (UNCTAD, 1998).

The basis is important because 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, the hedger would improve his position while weakening of the basis would worsen his position. In case of a long hedge, 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 might be easier to understand these forward contracts that are based on futures.)*

Basis contract (also known as 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 1 July that a farmer sells a specified quantity for November delivery at US$0.20. (The 1 November cash price minus a set basis of 20 cents, or the 1 November futures price plus a set basis of 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 due to 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): A 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 the 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 (offset) this contract when it nears maturity, and buy another longer-term contract. This is called a *rollover*, which 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, in *contango,* or carrying a charge. For instance, when March cotton futures trade at 53 hundredweight/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, and loss due to loss of weight or deterioration in quantity. 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, i.e. 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, or due to a contract maturing in the peak season.

D. Indirect benefits of commodity futures[12]

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

12 This section was largely drawn from Apostolou and Apostolou (2000) and Alizadeh and Nomikos (2005).

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 that helps in estimating the profitability of different commodities. Essentially, when futures price levels cover both fixed and variable[13] 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).

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. By selling a future they could then 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-1990s among 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 with the exception of cotton, 79-87 percent 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 percent (see Harwood *et al*., 1999).

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, *inter alia*, 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: (i) hedgers who actually face price risk and hope to limit this by participating in the futures markets; (ii) fund managers who seek to diversify the risks of their portfolios by investing partially in a weakly correlated asset class such as commodities; and (iii) speculators who hope to profit from the fluctuations in commodity prices.

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13 Variable production costs are costs – such as for seed, fertilizer, custom work, and rent for land or storage space – that 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).

Hedgers can further be categorized into three user classes: producers, consumers and 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. For example, a popcorn manufacturer who thinks that the price of corn is going to rise, or a biscuit manufacturer looking to buy 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 this price risk.

Traders: Traders are important participants in the futures markets. Like exporters, they often buy goods from producers before they sell them, or they may sell the goods before buying them (i.e. essentially fixing the price at end and being open to market vagaries in the other end). 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 such as pension funds, mutual funds, insurance and investment companies tend to allocate at least 5 percent 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 (Ithurbide and Vincent Chaigneau, 2005) 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: A speculator is one who does not produce or use a commodity but risks his own capital trading futures in the hope of making a profit on price changes. While speculation is not considered one of the economic purposes of a futures market, speculators improve the functioning of markets by providing liquidity.[14]

14 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 and Goodman, 2003).

3. Options

A. Options

Options can provide the seller of a commodity with the assurance of receiving a minimum selling price and the buyer of paying a maximum purchase price – they are therefore like insurance. In addition to the above "insurance", options are attractive since they may permit the buyer of an option to participate in favourable price movements. Options can be therefore used to provide *downside protection* while retaining some degree of *upside potential*.

What, then, 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 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 OTC (like forwards). OTC options (more common in currency markets) have the obvious flexibility in providing a customized contract, but have the inherent disadvantages of illiquidity, counterparty risk and higher costs. While the core risk management principles are common for the two, this section elucidates mechanisms of exchange-traded options (i.e. standardized options), which are more commonly used in commodity markets.

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

Put options give the buyer of the put option (*long put*) the *right* to *sell* the underlying commodity at a specified price (*exercise price*). The seller of the put (*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 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 that is traded (see box 3).

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 such as the price of the underlying commodity, volatility of the underlying, strike price, time until expiration and risk-free interest rate.

Settlement of options: Options can be exited in three ways. The first way is to offset the trade by taking an opposite position. In doing so, the option buyer sells the option. This can be done

BOX 3
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 (06 May 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 US$2.6. (The fourth digit is to be read as 1/8 cent/bushel, thus 170'4 would be read as US$1.7 $^{1/2}$ [US$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,** the **highest option price**, the **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 because 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.

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, there are two styles of options: American options and European options. An American-style option may be exercised at any time 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 the CBOT should enhance the reading of option markets.

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 (for example, a contract farming arrangement) in the spot market that assures a minimum price, could also influence his strategy. When a seller or buyer has a contract farming type arrangement that guarantees a fixed price, options would not be used to get a minimum price assurance because this is already assured in

Box 4
Put options enhance terms of credit

Rabobank with the International Task Force (ITF) have conducted pilots for coffee in Nicaragua, Uganda and Tanzania. The period of coverage ranged from one to six months consistent with physical transactions. 250 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 percent 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 percent. Another major result of hedging was that local banks extended credit to counterparts whom they had refused before.

World Business Council for Sustainable Development, 2004

the physical contract. In this case, options would then be used to allow flexibility to profit from favourable price movements. In such a case, therefore, the seller of a commodity would buy a call option that would yield profits in the eventuality that prices rise. Options have also been used by governments (see box 5) and supply chain partners (see Box 6) to help farmers reduce price risk. The following examples, illustrate the use of options from both the buyer's and seller's perspective, under two circumstances, one when there is a fixed contract and two when there is no fixed contract.

Seller risk management when there is no existing physical contract guaranteeing a minimum price[15]

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 three months, having a strike price of US$800 at a premium of US$10. This gives him the right to sell a standard batch of cocoa at an agreed price of US$800. Three months later at harvest time, cocoa prices fall to US$770 per tonne and the put option is trading at US$25. The farmer has two alternatives. He could exercise the option, delivering cocoa at US$800 per tonne at the stipulated warehouse and realize a net price (less premium costs) of US$790 per tonne. Alternatively, if he does not wish to deliver the cocoa, he could sell the put option (close/offset his position) at a profit of US$15 (US$25-US$10), effectively getting a selling price of US$785 (US$770+US$15) per tonne. If cocoa prices rise to US$825 per tonne, 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 US$800 per tonne. Three months later, cocoa prices in the market increase to US$840, which results in an opportunity loss of US$40 per tonne for the grower. If the farmer had bought a call option, it could have helped the farmer participate in the

15 This example was taken from Pass *et al*. (2005).