

# Commodity Futures Market in India

## A Study of Trends in the Notional Multi-Commodity Indices

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### Abstract

The main purpose of the present study would be to look into some characteristics of the Indian commodity futures market in order to judge whether prices indicate efficient functioning of the market or otherwise, particularly as this market is less developed compared to the financial derivatives markets, being constrained by its chequered history with many policy reversals. Using the available notional price indices for the commodity market we find that multi-commodity indices, which have higher exposure to metals and energy products, with clear and efficient price dissemination in national and international markets, behave like the equity indices in terms of efficiency and flow of information. Both the contemporaneous futures and spot prices contribute to price discovery and the futures market can provide information for current spot prices and thus help to reduce volatility in the spot prices of the relevant commodities and provide for effective hedging of price risk. Agricultural indices on the other hand do not exhibit such features very clearly. Our results also help to build a case for opening up of parts of the Indian agricultural futures market.

### 1. Introduction

The study of Indian derivatives markets in *Money & Finance* would be incomplete without an account of the commodity derivatives market in the country. In this paper we attempt to bring forth the nature of information flows between futures and spot prices in the market for commodity derivatives in India, taking into consideration the history of commodity derivatives globally, and the importance of and problems associated with commodity markets particularly in less mature economies. In our previous studies on the Indian stock and futures markets we have seen that the characteristics exhibited by the price index/returns in these markets are more or less in agreement with or at least lean towards what should be expected in a mature or efficient market. Here we make an attempt to see whether price movements in the Indian commodity derivatives market exhibit similar trends or not, particularly as this market is less developed compared to the financial derivatives markets, being constrained by its chequered history with many policy reversals.

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product commodity  
futures are quite  
different from  
financial derivatives.  
They do not raise  
resources for firms  
to invest; rather,  
commodity futures  
allow producers  
(both agricultural  
and industrial) to  
obtain insurance  
for the future value  
of their outputs  
(or inputs).

The two major economic functions of a commodity futures market are price risk management and price discovery. Forward contracting in commodities is an important activity for any economy to meet food and raw material requirements, to facilitate storage as a profitable economic activity and also to manage supply and demand risk. Forward contracts, however, give rise to price risk; so there arises the need of price risk management. Price risk in forward contracts can be managed through futures contracts. A commodity futures contract is an agreement to buy (or sell) a specified quantity of a commodity at a future date, at a price agreed upon—the futures price—when entering into the contract. In determining the futures price, market participants compare the current futures price to the spot price that can be expected to prevail at the maturity of the futures contract.<sup>1</sup> Inventory decisions link current and future scarcity of the commodity and consequently provide a connection between the current spot price and the expected future spot price.

As an investment product commodity futures are quite different from financial derivatives. They do not raise resources for firms to invest; rather, commodity futures allow producers (both agricultural and industrial) to obtain insurance for the future value of their outputs (or inputs). Commodity futures do not necessarily represent direct exposures to actual commodities. Investors in commodity futures receive compensation for bearing the risk of short-term commodity price fluctuations. Standardised, organised and centralised futures exchanges guarantee that risks are borne by a vast number of investors (including speculators) in return for a premium. The diversity of requirements and opinions of the market participants leads to efficient price discovery in the market. The inherent difficulty with commodities, and hence commodity futures, is that within the asset class they display many differences. Some commodities are storable and some are perishable; some are input goods and some are intermediate goods, and within the same commodity group there may be vast differences in quality. These features make the development of commodity markets that much more difficult and command more resources for infrastructure as compared to financial markets.

It is well known that though India is considered a pioneer in some forms of derivatives in commodities, the history of formal commodity derivatives trading is rather chequered. In recent times there has been an enormous amount of interest generated in commodities trading

<sup>1</sup> In other words, futures markets are forward looking and the futures price embeds expectations about the future spot price. If spot prices are expected to be much higher at the maturity of the futures contract than they are today, the current futures price will be set at a high level relative to the current spot price. Lower expected spot prices in the future will be reflected in a low current futures price (Black, 1976).

in India along with the massive growth in stock market trading volumes. This is indeed a welcome sign as it is historically proven that inclusion of commodity exposures can reduce the overall volatility (risk) of a portfolio of investments, while significantly improving the return potential of the portfolio. Thus simultaneous growth of financial and physical derivatives trading could help to widen and deepen both markets as investors have more choice and they may benefit from a portfolio strategy involving both underlyings.

In India government policy regarding the agricultural commodity futures market keeps fluctuating according to the needs of public (food) policy and the observed inflation trends at any point of time.<sup>2</sup> This is understandably not unique to India but is true of global commodity markets particularly in developing countries. However, despite temporary reversals, the policy thrust in India now is on using the commodity derivatives market to integrate the vast numbers of poor agriculturists into the mainstream financial markets. The debate on how soon and how well the developments in the market for commodity futures in India would actually serve the cause of poor and marginal farmers/producers remains wide open.<sup>3</sup> But there is no doubt that efficient commodity derivatives markets have immense potential for contributing to price stability and economic development.

The main purpose of the present study would be to look into some characteristics of the Indian commodity futures market in order to judge whether prices indicate efficient functioning of the market or otherwise. Two of India's national level electronics exchanges, the Multi Commodity Exchange of India Ltd. (MCX) and the National Commodity and Derivatives Exchange Ltd. (NCDEX), have been tracking multi-commodity indices for spot and futures prices, constituting prices of a basket of commodities from various sectors. We make use of these index values to comment on the efficiency in price formation in the electronically traded commodity derivatives market. We try to empirically answer some questions related to the Indian market:

1. What is the nature of information flows between the spot and futures market for commodities? Is price formation in one market aided by the other or are prices formed in isolation in the two markets?
2. How far are the Indian Spot and Futures indices (/prices) integrated in the commodity market? Do they exhibit same features of cointegration and fairly efficient information flows

<sup>2</sup> A recent example being the ban on wheat futures due to rising prices of domestic wheat. Whether or not futures trading should be censured for the volatile (wheat) prices in India is being extensively studied by the committee headed by Abhijit Sen.

<sup>3</sup> The impact of improved access to commodity price insurance on poverty depends on how the benefits of this access can be transmitted to small holders (World Bank, 1999).

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as found in the relatively liberalised and better-developed stock market? Is there any difference between the multi-commodity and the agricultural indices in this respect?

3. How far are the Indian Spot and Futures indices (/prices) integrated with world indices?
4. What is the relationship between the Indian equity futures index and the multi-commodity index? More specifically, do the two show low/negative correlation such that there are benefits of portfolio diversification available to investors in both asset classes?

The rest of this paper is structured as follows: Section II discusses the case for commodity derivatives as an instrument to bring about price stability in commodity markets as made out by international developmental agencies like the World Bank and UNCTAD. Section III briefly touches upon the evolution of the market in India and the existent regulations. The section also presents some charts to depict the growth of the market. Section IV first discusses how price trends in the market can indicate the presence of inefficiencies in the market. The second part of this section presents our sample data followed by an outline of the methodology followed. The major findings from our analysis of price trends are listed in the last part of this section. Section V concludes this study with a discussion on policy indications from this as well as a few other studies on developing commodity derivative markets.

## II. The Case for Commodity Derivatives

### *The Backdrop*

Price volatility is perhaps the most pressing issue facing producers of primary commodities. The low prices for basic commodities limit the income farmers(/small producers) can receive for their products and the high volatility of these prices makes it very difficult for them to optimise the use of their income (Morgan, 2000).<sup>4</sup> While these producers are not exclusively located in LDCs, the impact of volatility on producers there is much greater than it is for those in developed market economies.<sup>5</sup> Policies designed to counter the effects of the inherent instability of commodity markets have taken various forms since the 1930s but in general it is possible to say that they all shared a

<sup>4</sup> In order to mitigate these risks at the farm level, many producers adopt low-risk and low-yield crop and production patterns to ensure a minimum income. These production patterns come at the expense of high-risk, high-return production that could create income growth and the build-up of capital.

<sup>5</sup> There are a number of countries that rely very heavily on one or two commodities for their export earnings, such as Uganda (coffee), Ghana (cocoa) and Bolivia (copper). This contrasts with only three OECD countries that rely on commodity exports for more than 50% of their merchandise exports (Norway, New Zealand and Australia).

common feature of being based on intervention. In essence, buffer stock schemes were heavily promoted especially through the establishment of the International Commodity Agreements (ICAs) (for a more detailed review of the earlier history of these and other policies, see Gordon-Ashworth, 1984). However, two main problems arose within this system. First, the difficulty in setting the price range and updating it over time in response to changes in either costs or consumer tastes. Second, finding sufficient funds to keep prices within the specified range, a problem that was especially acute if there was a run of years of high production with low prices and stocks needed to be held over a long period.

Concerns about commodity price fluctuations also led to pervasive commodity policy interventions by national governments. The goal has been either to replace the price discovery by markets with a planned and regulated system of prices or to insulate producers and consumers from market price fluctuations through price controls or subsidies. Many countries have unilaterally pursued price stabilisation, particularly in agriculture. These have typically taken the form of institutional arrangements for price stabilisation programmes, including physical buffer stock schemes, stabilisation funds, variable tariff schemes, and marketing boards. Commodity futures markets thus have a limited presence in developing countries where commodity markets fall short of the ideal. Historically, governments in many of these countries have discouraged futures markets; if they were not banned, their operations were constricted by regulation. The main concern being that speculative activity in futures markets could reinforce price instability and volatility in essential commodities and lead to further problems of food security.

Government interventions to artificially stabilise prices, on the other hand, pre-empted the development of a market-based price risk management system. In the recent past, however, countries have begun to liberalise commodity markets and in a reversal of earlier trends, the development of commodity futures markets is being pursued actively with support from governments. The World Bank initiative to devise market-based approaches for dealing with commodity price risk has provided a fresh impetus for research in the area of commodity futures markets as a policy option.<sup>6</sup> The World Bank (1999) notes: "...market-based management instruments, despite several limitations, offer a promising alternative to traditional stabilisation schemes...". The argument is that the use of price risk management instruments allows

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<sup>6</sup> The policy environment has an impact on the incentives for producers to manage price risks and this makes it pivotal to investigate and analyse the policy and regulatory environment under which price risk management instruments are used. The environment that is most conducive to the use of hedging instruments exists in countries having liberalised markets, no direct government intervention in pricing, and well functioning private marketing institutions.

Coinciding with  
policy developments  
favouring  
commodity  
derivatives trading,  
a revolution in  
information  
technology spurred  
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management  
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market  
fragmentation  
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pricing.

governments to disengage from costly, distortionary, and counterproductive policies. At the national level, many countries have unilaterally abandoned marketing boards that were once common for coffee, cocoa, and other import crops—as well as long-standing food marketing agencies.<sup>7</sup> Others have done so under budget pressure or as part of reforms supported by the World Bank and other institutions.<sup>8</sup>

Coinciding with policy developments favouring commodity derivatives trading, a revolution in information technology spurred the growth of risk management centres, especially in areas where market fragmentation impeded efficient pricing. UNCTAD (2002) notes that well-organised commodity exchanges form natural reference points for physical trade, and help the price discovery process. If a commodity exchange manages to link different warehouses in the country, this allows trade to take place more efficiently. Historically, most commodity exchanges developed as physical transaction hubs where producers delivered and sold their crops to buyers with storage facilities. Because producers had little choice but to accept the spot offer price, most exchanges were buyers markets. Market fragmentation—i.e., poor price correlation among the regional exchanges—also characterised the exchange network. Electronic transaction models and instant price dissemination systems have transformed these traditional market arrangements. The new electronic exchanges broadcast multiple prices from various spot and forward markets giving producers a range of seasonal and geographic options for storing or marketing their crops. By disseminating a spectrum of instantly observable or transparent prices, these exchanges have conferred pricing power to the producer and aided institutional development, e.g., grading and warehouse receipt systems, supply chain integration and farm credit facilitation (FAO, 2007).<sup>9</sup>

<sup>7</sup> While some countries, such as Argentina, Brazil, New Zealand and South Africa, opted for the elimination of price supports and other interventionist measures, many introduced safety net programmes as a means to ensure minimal levels of income for producers when prices decline below certain threshold levels.

<sup>8</sup> There are limits to the capacity of many countries to borrow. This is especially true for highly indebted poor countries, practically all of whom are commodity dependent. Even for governments who can afford to take on additional debt, compensatory financing and other borrowing opportunities can provide some balance-of-payment support. Several countries still rely on variable import tariffs to smoothen prices for producers, but such policies can disrupt domestic markets and run counter to WTO-sponsored efforts to rationalise import tariffs (World Bank, 1999).

<sup>9</sup> In newly formed futures and derivatives markets, electronic platforms have also been pivotal in establishing market integrity. By incorporating instant audit trails and safeguards against fraud, market manipulation and execution errors, they require less regulatory supervision than the traditional open outcry systems. In addition, the trend towards restructuring the governance of the exchanges from mutually held, often exclusive, membership associations to transparent shareholder organisations has instilled participant confidence in exchange integrity. [See UNCTAD (2007) for a description of the evolution of commodity exchanges globally and their possible impact on development.]

### *The Potential Benefits*

The case for developing the commodity futures markets globally has been made out based on its potential contribution to price stability, poverty reduction and economic development in a market-based economy, through various channels, some of which we summarise here. [See Box 1 for some general information on commodity markets.]

#### **BOX 1: Some General Information on Commodity Futures Trading**

A commodity futures contract is a tradable standardised contract, the terms of which are set in advance by the commodity exchange. A futures market facilitates offsetting trades without exchanging physical goods until the expiry of a contract. As a result, the futures market attracts hedgers for risk management, and encourages participation of traders (speculators and arbitrageurs) who possess market information and price judgement. While hedgers have long-term perspective of the market, the traders or arbitrageurs prefer an immediate view of the market and these diverging views lead to price discovery for the commodity concerned.

Insurance offers coverage of the risks of physical commodity losses due to fire, pilferage, transport mishaps, etc.; it does not cover similarly the risks of value losses resulting from adverse price variations, which occur with a much higher probability.

*Hedging* is the practice of offsetting the price risk inherent in any cash market position by taking an equal but opposite position in the futures market. This technique is very useful in the case of any long-term requirements for which the prices have to be firmed so as to quote a sale/purchase price, but the hedger wants to avoid buying the physical commodity immediately to prevent blocking of funds and incurring large holding costs.

*A Simple Hypothetical Illustration:* A wheat miller enters into a contract to sell flour to a bread manufacturer four months from now. The price is agreed upon today though the flour would only be delivered after four months. A rise in the price of wheat during the course of the next four months would result in losses on the contract to the miller. To safeguard against the risk of increasing prices of wheat, the miller buys wheat futures contracts that call for the delivery of wheat in four months time. After the expiry of four months, as feared by the miller, the price of wheat may have risen. The miller then purchases the wheat in the spot market at a higher price. However, since he has hedged in the futures market, he can now sell his contract in the futures market at a gain since there is an increase in the futures price as well. Hedging thus offsets losses from purchase of wheat at a higher cost through sale of the futures contract thereby protecting the profit on the sale of the flour.

The tendency of the difference between spot and futures prices to decline continuously, so as to become zero on maturity, is referred to as *Convergence*. Convergence occurs at the expiration of the futures contract because any difference between the cash and futures prices would then quickly be negated by arbitrageurs.

There are two types of futures contracts, those that provide for *physical delivery* of a

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grading and  
warehouse receipt  
systems, supply  
chain integration  
and farm credit  
facilitation.

Futures markets also play a role in inventory management. The basis or price spread, which is the price difference between futures contracts of different maturities, signals the availability of stocks to the market.

particular commodity or item and those which call for a *cash settlement*. Delivery on futures contracts is the exception rather than the rule; however, a delivery provision offers buyers and sellers the opportunity to take or make delivery of the physical commodity if they so choose. More importantly, however, the fact that buyers and sellers can take or make delivery helps to assure that futures prices will accurately reflect the cash market value of the commodity at the time the contract expires.

*Futures prices* evolve from the interaction of bids and offers emanating from all over the country. The bid and offer prices are based on the expectations of prices on the maturity date. Two methods generally used for predicting futures prices are fundamental analysis and technical analysis. The fundamental analysis is concerned with basic supply and demand information, such as, production and consumption, import and export patterns, weather conditions, and relevant policies of the government like taxation. Technical analysis includes analysis of movement of prices in the past. Many participants use fundamental analysis to determine the direction of the market, and technical analysis to time their entry and exist.

*Settlement price* is the price at which all the trades outstanding are settled, i.e., profits or losses, if any, are paid. The method of fixing settlement price is prescribed in the bye-laws of the exchanges; normally it is a weighted average of the prices of transactions both in the spot and futures market during the period specified.

An important part of understanding futures and cash price dynamics is being able to explain and anticipate cash/futures basis movement. *Basis* is normally calculated as cash price minus the futures price. A positive basis indicates a futures discount (*Backwardation*) and a negative number, a futures premium (*Contango*). When the prices of spot, or contracts maturing earlier, are higher than a particular futures contract, it is said to be trading at Backwardation. It is usual for a contract maturing in the peak season to be in backwardation during the lean period. Contango means a situation where futures contract prices are higher than the spot price and the futures contracts maturing earlier. It arises normally when the contract matures during the same crop season. In a well-integrated market, Contango is equal to the cost of carry, viz. interest rate on investment, loss on account of loss of weight or deterioration in quality, etc. As basis volatility (risk) increases the effectiveness of the hedge decreases.

The primary benefit of futures markets is to allow for anticipatory hedging in a free-market price regime. Hedging is the practice of offsetting the price risk inherent in any cash market position by taking an equal but opposite position in the futures market. Hedging involves buying or selling of a standardised futures contract against the corresponding sale or purchase respectively of the equivalent physical commodity. By taking a position in the futures markets that is opposite to that held in the spot market, the producer can potentially offset losses in the latter with gains in the former. Futures markets thus offer a mechanism for dealing with price risk. Secondly, because futures markets offer a range of contracts for each commodity, there is a great deal of flexibility in pricing for the individual trader, as compared with a fixed policy rate regime.



Futures markets also play a role in inventory management. The basis or price spread, which is the price difference between futures contracts of different maturities, signals the availability of stocks to the market. In essence, the basis is a measure of storage and interest costs that must be borne by a spot market trader in holding stocks now, for sale at some point in the future. Clearly, as the basis gets larger, the incentive to store increases; as a result, the level of inventories held in the spot market will be determined by the basis. This ensures an efficient process of private storage and in turn leads to a smoother pattern of prices in the spot market and hence can, potentially, reduce price volatility. Futures markets can also provide price support for credit needs to small producers. In fact, better access to credit has been driving demand for commodity price hedging in the developed market economies. The collateral value of inventory is substantially enhanced if it is hedged, enabling firms (/farmers) to borrow a larger proportion of inventory value on more attractive terms.

There are other wider benefits to the economy of a more efficient allocation of resources that could arise from establishing or using futures markets. Entities in commodity-dependent countries have little or no access to price risk management instruments, particularly for agricultural products, mostly due to policy barriers. Even though many of these countries are major producers of primary products, and some are also major consumers, their participation in commodity futures markets is minor. Uncertainty, especially long-term, has a negative impact on productivity and therefore reduces growth. When a commodity is produced and then sold on a spot market, there is considerable risk that in the time between a production decision being taken and the output being sold, prices could have moved against the trader. This spot price risk creates problems for producers who do not know what their income levels will be and this hinders their planning process. An efficient futures market provides reasonably accurate indications of the future spot price and thus helps in production planning.<sup>10</sup>

In the financial markets commodity futures can be seen as an additional risk management tool since, as an asset class, commodity futures have been seen to exhibit negative correlation with stock futures and bonds and positive correlation with inflation (Gorton and Rouwenhorst, 2005). Hence it provides a degree of stability under volatile market conditions. This in turn generates a wide investor base for commodity

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<sup>10</sup> Governments too can benefit from commodity price insurance through futures markets. Where governments are exposed to commodity price risks and can hedge this exposure, perceived country risk should be lower, and better budgetary control would improve debt management—these effects, if large, would show up in higher growth rates. For oil or metals, based on hedging, anticipated tax revenues could make government budgets more predictable, enabling more consistent policy making and greater accountability. Finally, better access to commodity price insurance also can improve food security for countries dependent on imports of staple food from world markets.

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futures as an asset, as it extends the investor base beyond only those who have exposures in the physical commodity market.

There are obvious limitations to the benefits from commodity futures. Futures provide protection against price risk, and price risk instruments address only a portion of the underlying problem of income protection. For example, in the case of metals or energy commodities, where shocks typically originate on the demand side through the industrial business cycle, production can be planned and from the producer's point of view volatile prices explain most revenue volatility. However, agricultural commodities, especially field crops, are also subject to variable weather and pest conditions and the actual income protection gained from hedging may vary largely. Nevertheless, price insurance would, in most cases, contribute significantly to income stability as hedging delivers a substantial reduction in uncertainty over the time horizon it covers.

### **III. The Indian Market** *Evolution and Regulation*

In India local markets for futures on agricultural commodities have been recorded to be around from the 1800s. After Independence, the Forward Contracts (Regulation) Act, 1952 (FCRA, 1952) was passed to regulate this market with Forward Markets Commission (FMC) being set up in 1953 in Mumbai as the regulator. Commodity derivatives were banned in the late '60s, but were revived again in the '80s. After the successful equity market reforms of the '90s, the Government of India tried to replicate similar reforms for the commodity derivatives markets and in 1999 suggested that the Minimum Support Price (MSP) as a price-hedging instrument could be replaced with derivatives markets. National-level multi-commodity exchanges were permitted to be set up on conditions of being backed by internationally prevailing best practices of trading, clearing and settlement. The national commodity exchanges follow electronic, transparent trading and clearing with novation, similar to the equity market [See Box 2]. At present, 103 commodities have been approved for trading out of which 92 commodities are actively traded.

The development of the commodity derivatives market in India like many other countries has been hindered by policy reversals on concerns regarding its effect on prices and supplies of essential commodities. This apart, integration of spot and futures market is cited as a critical factor for further growth of commodity futures in India. According to Nair (2004), the major stumbling block for the development of commodity futures markets in India is the fragmented physical/spot market with government laws and various taxes that hinder the free movement of commodities. Thomas (2003) in a similar critique draws attention to the prevalence of bilateral deals in local exchanges, the lack of price transparency both in the (fragmented) futures and spot markets for many commodities and the absence of certified warehouses.

## BOX 2: Commodity Exchanges in India and their Functioning

At present 22 Exchanges are recognised/registered for forward/futures trading in commodities. Most of the commodity exchanges in India are single commodity platforms and cater mainly to the regional requirements. However, four national-level multi-commodity exchanges have been set up in the country to overcome the problem of fragmentation. These exchanges are:

1. National Multi Commodity Exchange of India (NMCE)
2. National Board of Trade (NBOT)
3. Multi Commodity Exchange of India (MCX)
4. National Commodity & Derivatives Exchange of India (NCDEX)

NMCE, the first state-of-the-art demutualised multi-commodity exchange, commenced futures trading in 24 commodities on November 26, 2002 on a national scale and the basket of commodities has grown substantially since then to include cash crops, food grains, plantations, spices, oil seeds, and metals & bullion, among others.

National Board of Trade (NBOT) was incorporated on July 30, 1999 to offer a transparent and efficient trading platform to various market intermediaries in the commodity futures trade. Futures trading primarily in soy and some other edible oils is carried out here.

MCX is India's largest independent and demutualised multi-commodity exchange. It was inaugurated on November 10, 2003 and has permanent recognition from the Government of India for facilitating online trading, clearing and settlement operations for commodities futures markets across the country. By 2006, MCX featured amongst the world's top three bullion exchanges and top four energy exchanges. MCX is now the world's 8<sup>th</sup> largest commodity exchange, and accounts for 75 per cent of the market share in India. It has strong partnerships with banks, financial institutions, warehousing companies and other stakeholders of the marketplace. MCX has various strategic Memoranda of Understanding/Licensing Agreements with global exchanges like The Tokyo Commodity Exchange (TOCOM), New York Mercantile Exchange (NYMEX), London Metal Exchange (LME), Dubai Multi Commodities Centre (DMCC), and New York Board of Trade (NYBOT). With NYSE Euro Next, the parent body of NYSE picking up 5 per cent stake in the exchange the total foreign holding in MCX would be about 32 per cent. Commodity categories traded here cover: Agri Commodities, Bullion, Metals—Ferrous & Non-ferrous, Pulses, Oils & Oilseeds, Energy, Plantations, and Spices and other soft commodities. MCX maintains an insured Settlement Guarantee Fund of about Rs. 100 crore.

NCDEX is a nation-level, technology driven demutualised online commodity exchange with an independent Board of Directors and professional management. It commenced operations on December 15, 2003. The four institutional promoters of NCDEX are prominent players in their respective fields and contribute significantly to its technological and risk management skills. NCDEX has tied up with NCCL for clearing all trades on the exchange. NCDEX also maintains and manages a settlement guarantee fund in order to deal with defaults.

NCDEX prescribes the accreditation norms, comprising financial and technical parameters, which would have to be met by the warehouses. NCDEX takes an assayer's

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Harmony in the policies of different states is advocated for developing nationwide commodity markets.

Absence of standards and grading systems is a more difficult issue; however, it is unlikely to be an enduring obstacle especially for widely traded commodities such as cotton, sugar, wheat or oils.

certificate for confirming compliance with technical norms by the warehouses. The exchange specifies, in its contract description, the particular grade/variety of a commodity that is being offered for trade. A range is specified for all the properties and only those grades/varieties that fall within the range is accepted for delivery. In case the commodities fall within the range, but differ from the benchmark specifications, the exchange also specifies a premium/rebate.

The exchanges follow best international risk management practices and provide a financially secure environment by putting in place a suitable risk management mechanism (system of upfront margining based on the Value at Risk margining system, daily mark to market and special intra-day clearing and settlement in the event of high volatility in prices). The performance of the contracts registered by the exchange are guaranteed either by the exchange or its clearing house. Clearing Houses put in place a sound risk-management system to be able to discharge their role as a counter-party to all participants. Clearing Houses interpose between buyers and sellers as a legal counter-party, i.e., the clearing house becomes the buyer to every seller and *vice versa* (novation). Novation thus obviates the need for ascertaining the credit-worthiness of each counter-party and the only credit risk that the participants face is the risk of clearing house committing a default. The exchanges also maintain their own Trade/Settlement Guarantee Fund, which can be used in case of any default. Some exchanges have also prescribed certain minimum capital adequacy norms.

The spot market in commodities is controlled to a large extent by the State Governments. There are restrictions on holding of stocks, turnover, and movement of goods and there are variations in the duties levied by the different State Governments. This fragments the commodity spot markets and impedes the commodity futures markets from reaching the market players outside the boundaries of the states, or zones in which the exchanges are located. Harmony in the policies of different states is advocated for developing nationwide commodity markets. Absence of standards and grading systems is a more difficult issue; however, it is unlikely to be an enduring obstacle especially for widely traded commodities such as cotton, sugar, wheat or oils.

There are three tiers of regulators governing forward trading, viz. the Central Government, Forward Markets Commission (FMC) and the recognised Commodity Exchanges/Associations.<sup>11</sup> The Central Government broadly determines the policy as to commodities in which futures/forward trading is to be permitted and the Exchange/Association

<sup>11</sup> Most of the agricultural markets in India are regulated. Agricultural commodities in the country are traded through a network of 28,090 wholesale and primary rural markets and 7,557 regulated markets scattered across the country. The functioning of agricultural spot markets in India is governed by two important legislations—the Essential Commodities Act, 1955 and the Agricultural Produce Marketing Committee (APMC) Act, 1966. Existing APMC laws restrict trading in notified agricultural produce through a mechanism of multiple licensing. This makes licence approval and maintenance a tedious and expensive process. [See Bose, 2006 for a brief overview of the commodity derivatives market development in India and its problems.]

through whom such trading is to be permitted. The Forward Markets Commission performs the role of approving the rules and regulations of the exchanges subject to which the trading is to be conducted, accords permission for commencement of trading in different contracts, monitors market conditions continuously and takes remedial measures whenever the trading tends to go outside the permissible limits. The recognised exchanges/associations provide the framework of rules and regulations for conduct of trading as well as the platform for trading, reporting and recording of contracts, execution and settlement of contracts and a forum for exchange of documents and payments, etc.

Certain proposed amendments to the FCRA, 1952 (FMC, 2006) are expected to strengthen the regulatory aspects and ensure orderly conditions in the commodity futures market. So far, FMC was attached to office of the Ministry of Consumer Affairs, Food and Public Distribution, and it did not have adequate financial and operational autonomy. An Ordinance has been issued in January 2008, converting FMC into an independent regulatory body. This would help to restructure and strengthen FMC on the lines of the Securities and Exchange Board of India (SEBI), the securities market regulator, and confer upon the FMC all the required powers for effective regulation of the commodity derivatives market. The Bill provides for statutory provision relating to registration of members and other intermediaries to ensure their effective monitoring by the FMC. The Bill also provides for inserting new provisions relating to corporatisation and demutualisation of the existing commodity exchanges and for setting up of a Clearing Corporation. The penal provisions in the present Act are inadequate for regulating the markets effectively; hence, the proposed amendment seeks to enhance penal provisions. The proposed amendment also seeks to introduce options in goods and commodity derivatives. This will provide farmers and other stakeholders with a more flexible risk management tool.

### ***Recent Market Trends***

Even as reforms initiatives are slowly taking shape, turnover in the Indian commodity derivatives market has increased many times over. In 2003-04 the value of commodity futures traded was 1.29 lakh crore, in 2004-05 it was up by 342% and in 2005-06 the turnover showed another increase of 277% to 21.34 lakh crore. Trading volumes (presented in *Charts 1.A&B*) depict this growth, globally and for the Indian market. Such growth in volumes imparts much needed liquidity to the market and thus helps in efficient price formation.<sup>12</sup>

<sup>12</sup> In commodity (and stock) markets there has been a long lasting debate on whether futures trading stabilises or destabilises spot prices. A key theoretical question was about the role of speculators. Some have recognised that while speculators could act as a moderator to stabilise prices, they could also destabilise prices by speculating on other players' behaviour rather than acting on the basis of market fundamentals. Others have pointed out that hedging and speculation in the

An Ordinance has been issued in January 2008, converting FMC into an independent regulatory body. This would help to restructure and strengthen FMC on the lines of the SEBI, and confer upon the FMC all the required powers for effective regulation of the commodity derivatives market.

CHART 1A  
BIS-Global Commodity Volume Turnover (USD Mln.)

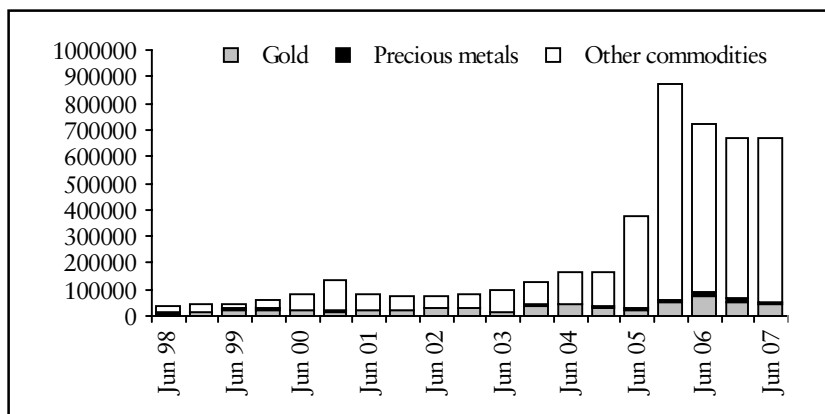
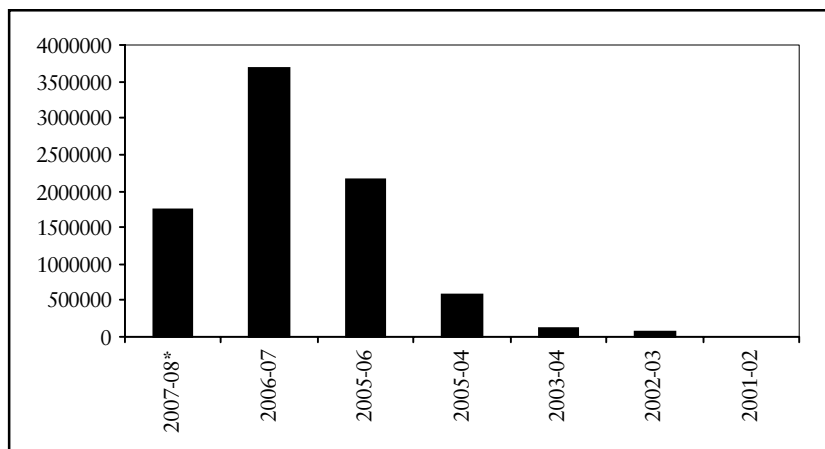


CHART 1.B  
Combined Value of Trade at all Indian Exchanges (Rs. crore)

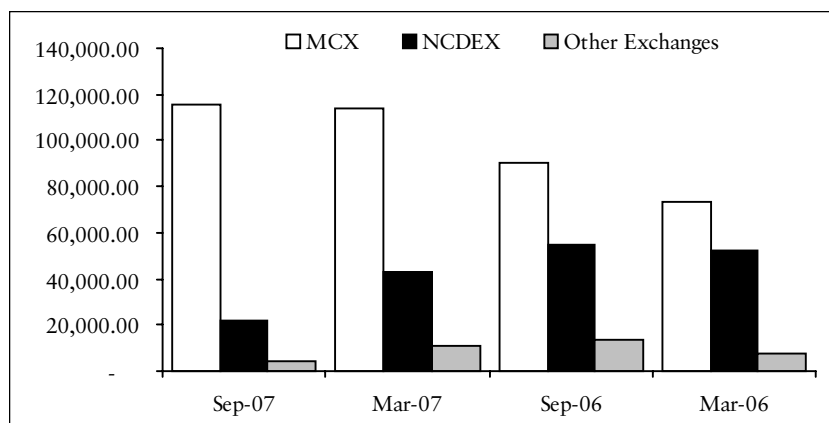


\* Up to September 2007.

futures market provided more information on expected prices and thus reduced the volatility of the cash market. In India, there has arisen a certain degree of apprehension regarding the role of speculators and other players manipulating commodity prices through the futures market. There have been demands for re-imposition of bans on futures for certain essential commodities. It has also been argued that futures markets are dominated by speculative interests, and that the price rise can be partially attributed to such trading. Some of the counter arguments provided by industry participants and regulators run as follows: It is difficult to accept that commodity prices can be manipulated indefinitely as all these commodities are under OGL. In case any participant tries to corner stocks of a commodity to manipulate price, importers will eventually import the commodity nullifying the attempt at such price manipulation through hoarding. Based on empirical research Kaul (2007) shows that inflation rates have been much higher in several commodities which are not at all traded on the exchange. Further, price volatility in several commodities has in fact come down post-introduction of futures in those commodities. Thus there is no one to one correspondence between futures trading and commodity price inflation in India as yet. It is also shown that hedgers make up a significant part of trades in the market to refute fears related to excessive speculative activity.

Recent evidence suggests that local exchanges are steadily losing to the national, multi-commodity exchanges (*Chart 1C*), suggesting the need for redesigning these fragmented exchanges to bring their infrastructure in line with the nation-wide exchanges.

CHART 1.C  
Value of Trade at Different Indian Exchanges (Rs. crore)



#### IV. Empirical Evidence on Price Trends, Information Flows and Efficiency

##### *What the Price Trends Tell Us*

Before we present the details of our empirical analysis we try to explain here the motivation behind looking at trends in the commodity and futures indices. As we have mentioned, the most important role of commodity futures markets is to provide price stability through hedging. The benefits of hedging flow from the relationship between the prices of commodities and those of futures contracts. So long as these two sets of prices move in close unison and display a parallel (or closely parallel) relationship, losses in the physical market are offset, either fully or substantially, by the gains in the futures market.<sup>13</sup> Hedging thus performs the economic function of helping to reduce significantly, if not eliminate altogether, the losses emanating from the price risks in commodities.

Derivatives contracts can be good hedging instruments only when they are efficiently priced. An efficient market is one in which prices always fully reflect available information and where no traders in the market can make a profit with monopolistically controlled information. For efficiency of the futures market, it is essential that the current futures prices contain all available information to predict the future spot price. In general there are three forms of testing market efficiency: *strong-form* tests in which the current information set

Derivatives contracts can be good hedging instruments only when they are efficiently priced. An efficient market is one in which prices always fully reflect available information and where no traders in the market can make a profit with monopolistically controlled information.

<sup>13</sup> Telser, 1981 shows that complete price insurance is only possible if spot and futures prices move exactly together.

The price discovery function of the futures market hinges on whether new information in the market is reflected first in the changes in futures prices or changes in spot prices. For the futures price to be an unbiased predictor of subsequent spot price the futures price should lead the spot price and not *vice versa*.

includes everything relevant; *semi-strong-form* tests in which the obviously publicly-available information is considered; and *weak-form* tests in which the current information set contains the historical price series only.<sup>14</sup>

The development of cointegration theory by Engle and Granger (1987) provided a new technique for testing market efficiency. The theory of cointegration relates to the study of the efficiency of a futures market in the following way: Let,  $S_t$  be the spot price at time  $t$  and  $F_{t-i}$  be futures price taken at  $i$  periods before the contract matures at time  $t$ , where  $i$  is the number of periods of interest. If the futures price can provide a predictive signal for the spot price  $i$  periods ahead, then some linear combination of  $S_t$  and  $F_{t-i}$  is expected to be stationary. If  $S_t$  and  $F_{t-i}$  are not cointegrated, they will drift apart without bound, so that the futures price provides little information about the movement of the spot price. Since cointegration is a necessary condition for market efficiency, inefficiency can be concluded if the futures price and the spot price are not cointegrated.<sup>15</sup>

However, cointegration *per se* does not indicate where the new information is processed and which market adjusts to the other. The price discovery function of the futures market hinges on whether new information in the market is reflected first in the changes in futures prices or changes in spot prices. If the futures price is an information efficient indicator of the future spot price there should be a degree of information flow between the spot and futures markets, exhibited through lead-lag relationships between the two sets of prices. For the futures price to be an unbiased predictor of subsequent spot price the futures price should lead the spot price and not *vice versa*.

The empirical literature,<sup>16</sup> which tests whether commodity futures prices lead spot prices, began with Garbade and Silber (1983) who tested whether a change in the *basis* of the previous time period was correlated with a change in the spot or futures prices of the current time period. If basis innovations forecast futures returns, then the spot market can be said to lead the futures market. On the contrary, if basis innovations exactly forecast spot returns then this would imply that the spot market is a pure satellite of the futures market. If each set of prices is seen to predict the other it is taken as evidence of bi-directional causality, i.e., a clear case of information flowing from each market to the other and prices being adjusted accordingly. With improvements in econometric techniques these tests have been extended in several directions. These extensions include considering a longer lag structure

<sup>14</sup> Most of the studies so far have been focused on the weak-form tests since both the strong and semi-strong tests are difficult to conduct empirically.

<sup>15</sup> The current cash price and the current futures price are linked through the carrying charge; if the carrying charge is non-stationary, then the tests for bivariate cointegration between the spot and futures prices are unlikely to indicate cointegration (Zapata and Fortenbery, 1996).

<sup>16</sup> See the Appendix for a survey of the literature.



of dependence between the futures and the spot returns by using a Granger causality framework.<sup>17</sup>

### *The Sample Data*

Given the extensive volumes in commodity futures trading and their inclusion in portfolios of a variety of investors, here we consider commodity futures as a financial instrument equivalent to the equity futures. Hence we analyse the trends depicted by the *multi-commodity indices* estimated by the two nation-wide multi-commodity exchanges. Futures contracts are electronically traded on these exchanges giving rise to timely and efficient dissemination of information on prices. It should be noted that Indian commodity/futures indices are notional indices; they are provided to the market participants only for information and unlike the equity/futures indices are not (yet) exchange tradable. However, since they are constructed from real time prices of exchange traded commodities/futures, each index is indicative of the price movements in the spot/futures market as a whole (or the relevant sub-sector).

Our sample data consists of the multi-commodity spot and futures indices from the MCX and the agricultural commodities' spot and futures indices maintained by the NCDEX and global indices maintained by Dow Jones and Reuters. All indices are based on the prices of the near month futures contract. The sample period spans from June 2005 to September 2007.

The data sets are:

- (i) Index values of the multi-commodity spot (MCXSCOMDEX referred to here as MCXS) and futures (MCXCOMDEX/MCXF) price indices maintained by the MCX (daily closing values);
- (ii) Index values of the agricultural-commodity spot (MCXSAGRI/MCXSA) and futures (MCXAGRI/MCXFA) price indices maintained by the MCX (daily closing values);
- (iii) Index values of the agricultural-commodity spot (NCDEXAGRI) and futures (FUTEXAGRI) price indices maintained by the NCDEX (daily closing values);
- (iv) Index values of the multi-commodity spot (DJAIGSP) and futures (DJAIGCI) indices maintained by the Dow Jones (daily closing values);
- (iv) Index values of the multi-commodity spot (CRB-Spot) and futures (CCI) indices maintained by the Reuters-Commodity Research Bureau (CRB) (month end values);
- (v) Daily closing values of the 50 share NSE S&P CNX Nifty Index (Nifty) traded on the National Stock Exchange of India.

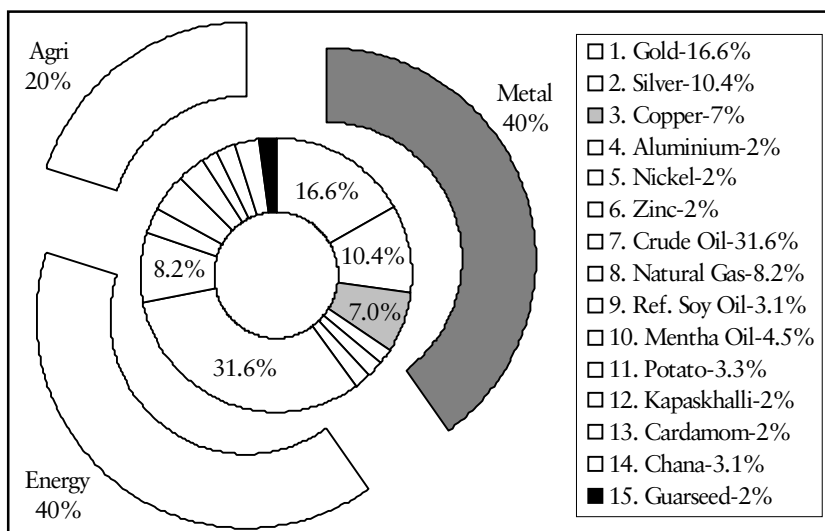
<sup>17</sup> Or analysing the long-term and the short-term dependence between the two markets using the error correction models. Another class of improvements involves adjusting the estimation to become robust to heteroscedasticity of the returns data.

It should be noted that Indian commodity/futures indices are notional indices. However, since they are constructed from real time prices of exchange traded commodities/futures, each index is indicative of the price movements in the spot/futures market as a whole (or the relevant sub-sector).

MCX-COMDEX thus captures diverse sectors encompassing futures contracts drawn on metals, energy and agricultural commodities that are traded on MCX.

MCX-COMDEX is composed of futures contracts on 15 physical commodities with three sub-indices, representing the major commodity sectors within the index: Metals, Energy and Agri (*Chart 2*). The index thus captures diverse sectors encompassing futures contracts drawn on metals, energy and agricultural commodities that are traded on MCX.<sup>18</sup> The NCDEX agri futures index has the same basket of 20 commodities that is present in the NCDEX Agri spot index and like the NCDEX Agri spot index each individual commodity has equal weightage in the index. The commodity groups include cereals, pulses, plantation crops, fibre crops, oil seeds, spices, sugar and *gur* and *guar* seed (cluster-beans). The DJ-AIGCI is composed of futures contracts on 19 physical commodities. The Continuous Commodity Index (CCI) maintained by Reuters and CRB consists of 17 commodities. It is widely viewed as a broad measure of overall commodity price trends because of the diverse nature of the commodities of which it is composed.<sup>19</sup>

CHART 2A  
Composition of Commodities and their Weights in MCX-COMDEX  
(Futures Price Index)



<sup>18</sup> The index was initially designed and developed by the Research and Development Department of MCX in association with Indian Statistical Institute (ISI), Kolkata, and launched in June 2005.

<sup>19</sup> Liquidity (measured by the number of contracts of each commodity traded on MCX in a specified period) is taken as the eligibility criterion for a commodity to be included in the index. Group weights of sub-indices in the composite index are 40 per cent each in the case of MCX Metal Index and MCX Energy Index and 20 per cent in the case of MCX Agri Index. For the purpose of index computation, only the near month active contract prices are used. The Index base period has been kept as average price of 2001. The DJ-AIGCI is composed of commodities traded on US exchanges, with the exception of aluminium, nickel and zinc, which trade on the London Metal Exchange (LME). There are nine sub-indices, representing the major commodity sectors within the index: *Energy* (including petroleum and natural gas), *Petroleum* (including crude oil, heating oil and unleaded gasoline), *Precious Metals*, *Industrial Metals*, *Grains*, *Livestock*, *Softs*, *Agriculture*

CHART 2B  
Commodity Composition of CCI

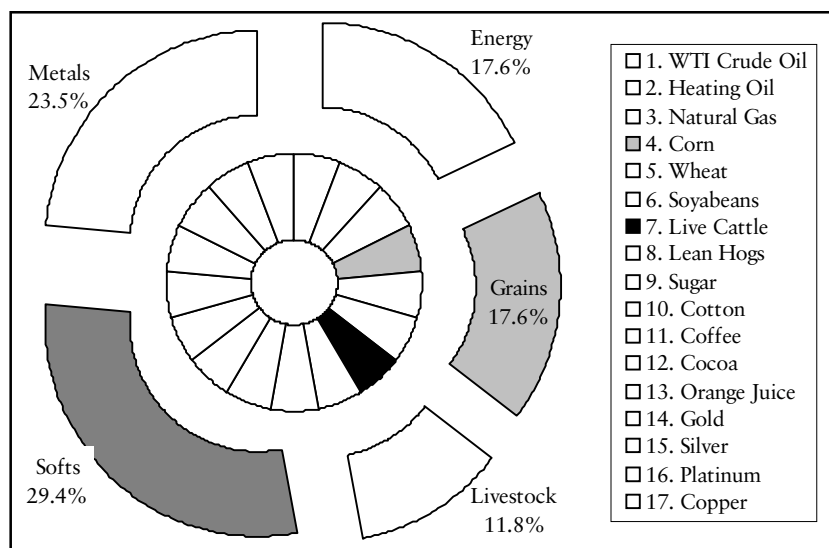
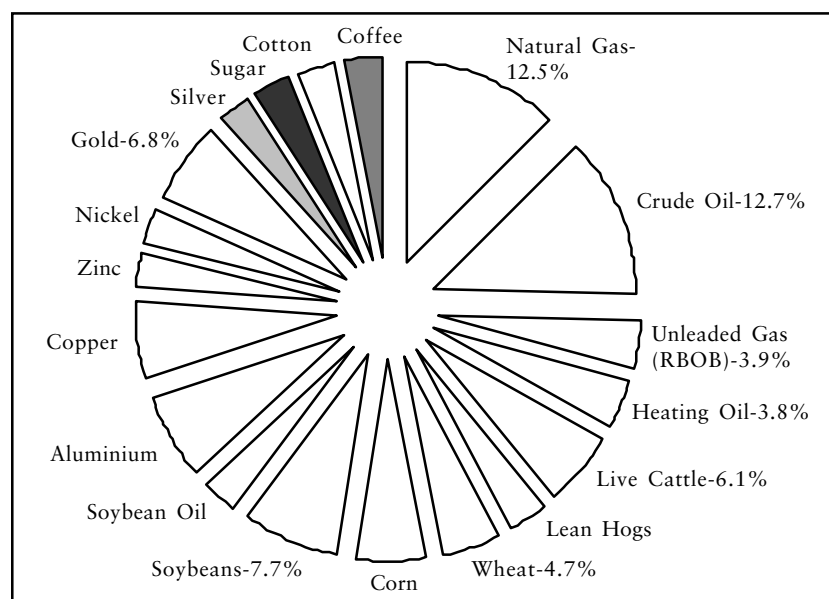


CHART 2C  
Commodity Composition of the DJAIGCI



and the Ex-Energy indices. Employing both liquidity and dollar-adjusted production data to determine its individual component weightings, the DJ-AIGCI index differs from other commodities indices as it allows for varying component weightings but maintains restrictions such as maximum and minimum component weightings to ensure adequate diversification. The CCI Index, in addition to averaging prices across 17 commodities, also incorporates an average of prices across time, within each commodity. Equal weighting is used for both arithmetic averaging of individual commodities over months and for geometric averaging of these 17 commodity averages.

Recent empirical research in futures markets suggests that for a *hedge* to result in overall price risk reduction there must be a stable and predictable relationship between cash and futures price movements.

We check for correlation between the sets of futures prices and the spot prices both contemporaneous and at different lags (of say, a week, a fortnight and a month) for the spot price.

### *Outline of Empirical Analysis*

Before we present the results we may recapitulate the theoretical underpinnings of the tests conducted. Recent empirical research in futures markets suggests that for a *hedge* to result in overall price risk reduction there must be a stable and predictable relationship between cash and futures price movements. Testing for the existence of this relationship provides evidence on the extent to which one price can be used to predict the other. Again, if the futures/cash price relationship is found to be stable and predictable (cointegrated), then cash market participants can effectively use futures positions to minimise cash price risk. If the two prices are found to be cointegrated then there is causality running from at least from one to the other. The existence of a price discovery function in futures markets hinges on whether price changes in futures markets lead price changes in cash markets more often than the reverse.

Our empirical analyses thus involve the following steps:

*Correlation analysis:* Charting of the data for our sample period shows that the futures and spot prices do indeed show similar movements over time. Correlation coefficients are estimated to formally measure the extent of short-term association between the spot and futures price indices. We check for correlation between the sets of futures prices and the spot prices both contemporaneous and at different lags (of say, a week, a fortnight and a month) for the spot price. The need to check for lagged correlation arises from the fact that the spot prices particularly of agricultural products are assimilated from different sources; thus there may be time lag before spot prices actually align with the futures prices. This would lead to a strong correlation between lagged spot prices and the current futures price. We also check for correlation between the two agricultural commodities futures indices estimated from futures prices on two different national exchanges. Taking into consideration the relation with international prices, we check for correlation between DJ-AIGCI and MCXF at different lags. In order to see the relation of prices in the equity and commodity derivatives market, we check for contemporaneous correlation between equity and commodity futures indices.

*Cointegration Analysis:* The possible existence of a long-term stable relation between different pairs of spot and futures indices is considered next. We carry out tests for (stationarity and) cointegration to see whether price formation is efficient. Formal statistical tests are conducted through Johansen's cointegration approach using the different spot and futures price indices with different forecasting horizons ranging from one day to one month.

*Causality Analysis:* To complete the analysis the causality between pairs of markets is studied in order to find out which market exerts a stronger influence on the other. We test for causal relationships between the spot and futures indices in each case to see if price movements in the futures market lead or lag price formation in the spot market.

### Findings

The movement of the various commodity futures and spot indices are presented below (*Charts 3.A-I*). The spot and futures series of commodity prices seem to reflect each other's movements over time; deviations are however, particularly noticeable in the case of the NCDEX Agri index, where there have been some wide fluctuations in the futures prices. The Indian and global futures indices also show similar trends in time, though the spot indices seem to diverge considerably.

Correlation analysis reveals a very high correlation between the cash and futures prices. This implies there is a strong relationship between the two price series, and provides preliminary evidence that both series respond similarly to changes in market fundamentals

CHART 3.A  
Time Trend of Spot and Futures Prices for the Multi-commodity Index  
Tracked by MCX

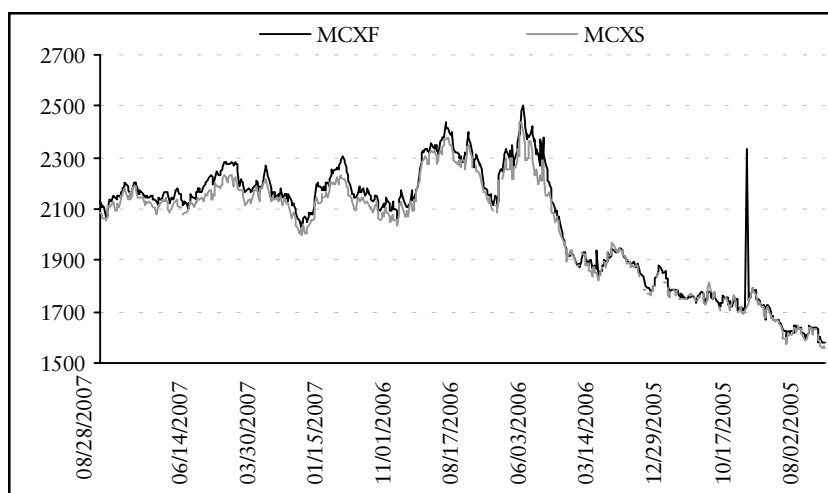
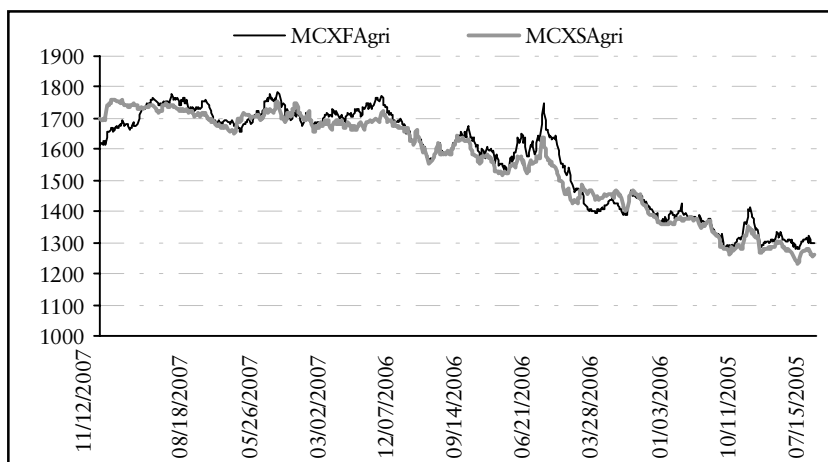


CHART 3.B  
Time Trend of Spot and Futures Prices for the Agri Index Tracked by MCX



Correlation analysis reveals a very high correlation between the cash and futures prices. This implies there is a strong relationship between the two price series, and provides preliminary evidence that both series respond similarly to changes in market fundamentals.

CHART 3.C  
Time Trend of Spot and Futures Prices for the Agricultural Spot and Futures Indices Tracked by NCDEX

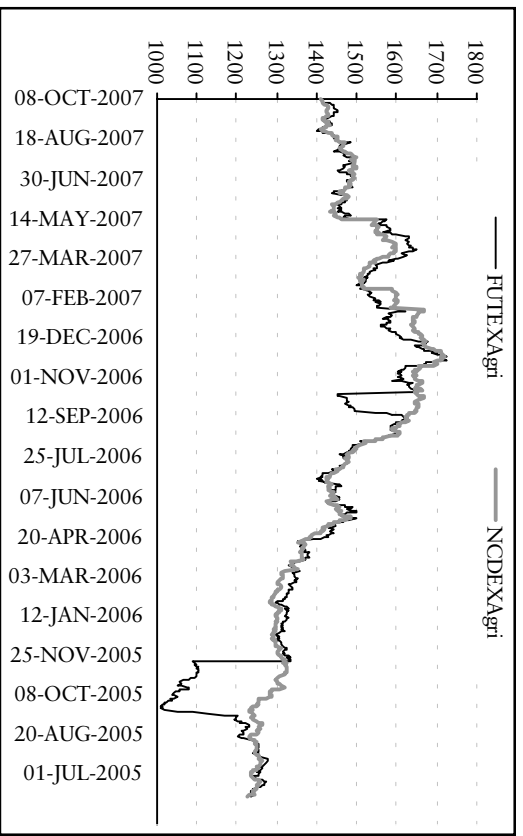


Chart 3.D-E  
Time Trend of Global (DJ-AIG) and Indian Multi-commodity Spot and Futures Indices

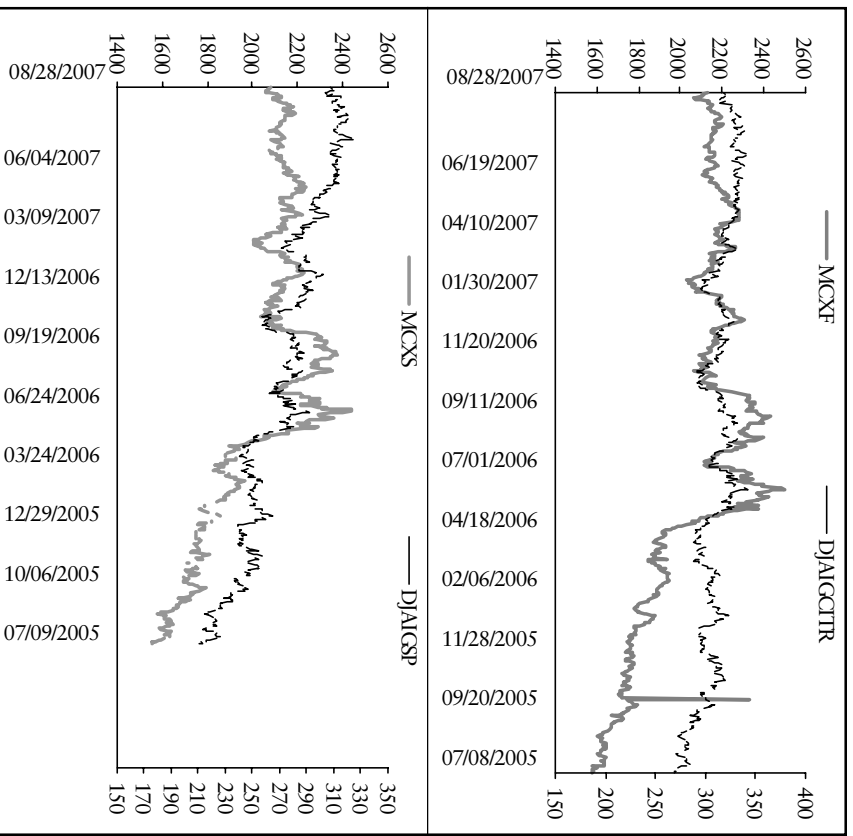
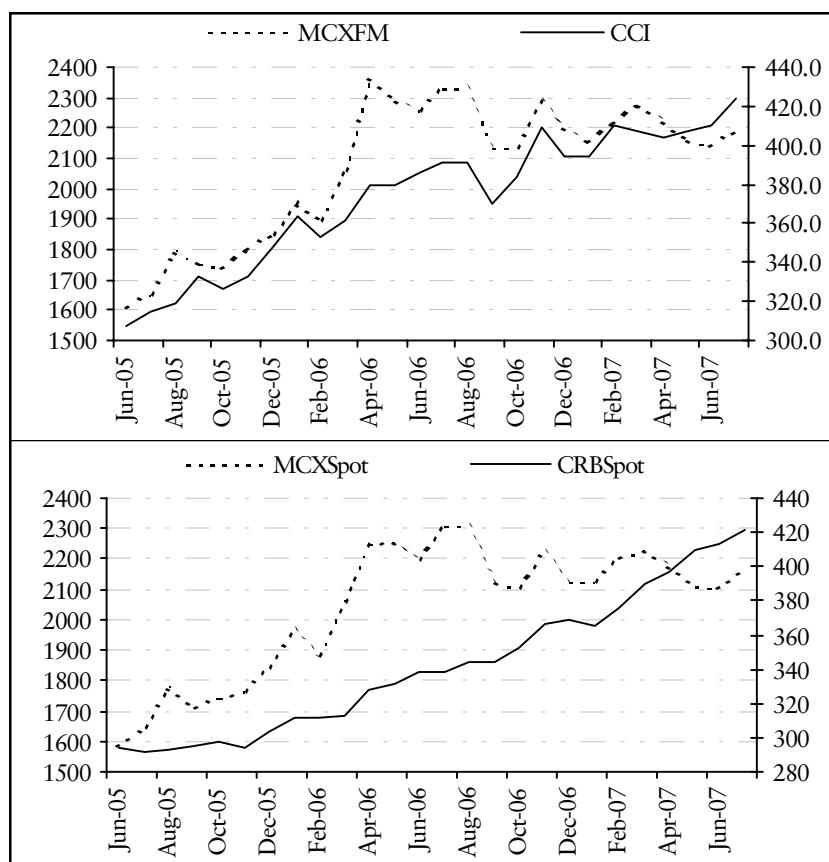


CHART 3.F-G  
Time Trend of Global (Reuters CCI Index) and Indian Multi-commodity  
Spot and Futures Indices



Monthly Closing Values

(Table 1). Contemporaneous correlation between the spot and futures is much higher for the multi-commodity indices at around 98 per cent and about 97 per cent for its component agri index, the MCXAgri. Contemporaneous correlation is lower at about 90 per cent in the case of the agri indices NCDEXAgri and FUTEXAgri.

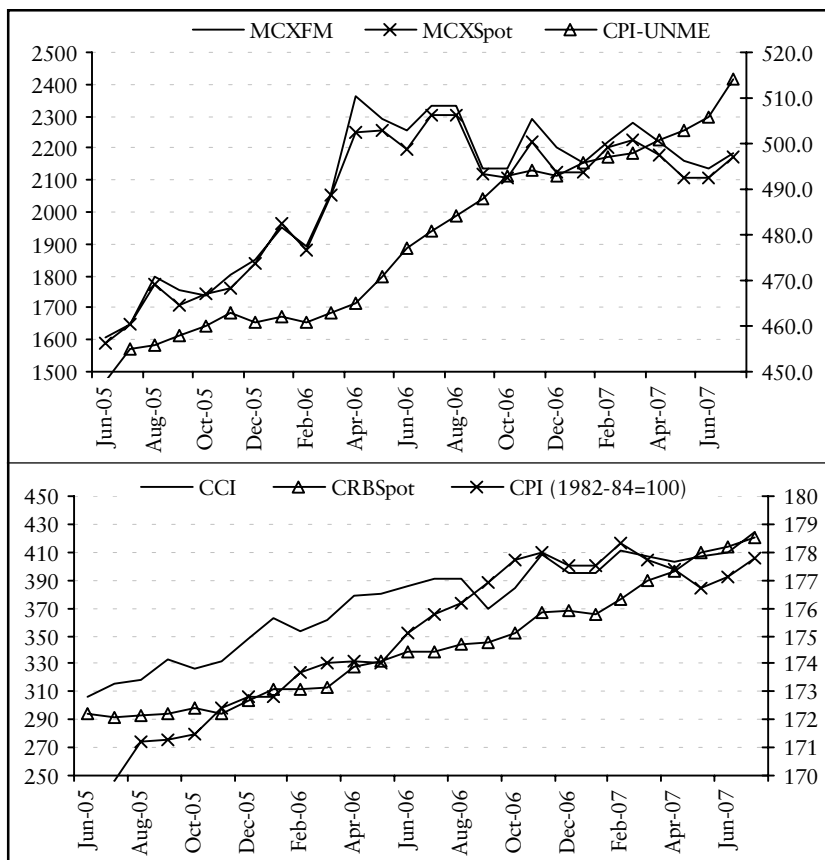
We also check whether each futures index is correlated with the spot prices a week ahead, two weeks ahead and a month ahead. Correlation weakens as we increase the time lag from contemporaneous to a week's lag and then to a month's lag, as expected. However, the correlation of the lagged futures and spot prices is quite high and thus, the futures prices a week, a fortnight and a month ahead seem to be good predictors of the future spot prices, particularly so for the agricultural indices.

Taking into account global commodity markets we find quite a high degree of correlation between the Indian and global indices: near about 78 per cent for the daily values of the MCX and previous day's Dow Jones spot index and 76 per cent for the futures. Even for the

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and 76% for the  
futures.

We find that the daily multi-commodity indices are cointegrated and hence satisfy the necessary condition for efficient price formation, as they move together in time and hence form a long run equilibrium relationship.

CHART 3.H-I  
Movement of Global and Indian Commodity Indices and the CPI



month-end values of the CCI index we find correlation with the MCX to the order of nearly 70 per cent for the spot index and a strong 89 per cent correlation for the futures prices.

As for correlation with the Indian stock market index we find that the degree of correlation is positive and fairly high around 70 per cent, but this could well be due to the strong growth trend present in both indices during the period of study.

The data reveals mean index levels of 2051 and 2032 points for futures and spot MCX respectively, with associated coefficients of variation of 11.04 and 10.4 per cent. Mean index levels for the MCX agri indices are 1572 and 1557 points for futures and spot respectively, with associated coefficients of variation of 10.01 and 10.3 per cent. For the NCDEX agri indices the mean levels are 1420 and 1443 points for futures and spot respectively, with associated coefficients of variation of 11.25 and 9.76 per cent.<sup>20</sup>

<sup>20</sup> The presence of unit-roots in prices is tested using the augmented Dickey-Fuller tests; and confirms that all series are integrated of order 1. And hence we can proceed to test for cointegration between the series.



Next we look for cointegration among the variables. To recapitulate, if  $S_t$  is the spot price at time  $t$  and  $F_{t-i}$  the futures price taken at  $i$  periods before the contract matures at time  $t$ , and if the futures price can provide a predictive signal for the spot price  $i$  periods ahead, then some linear combination of  $S_t$  and  $F_{t-i}$  is expected to be stationary. If  $S_t$  and  $F_{t-i}$  are not cointegrated, they will drift apart

TABLE 1A  
Descriptive Statistics for the Indices

	MCXS	MCXF	MCXSAGRI	MCXFAGRI	NCDEXAGRI	FUTEXAGRI
Mean	2031.96	2050.98	1556.99	1571.52	1442.77	1420.48
Median	2110.15	2136.33	1589.82	1625.63	1443.72	1449.99
Maximum	2434.03	2502.07	1762.40	1784.47	1720.73	1726.56
Minimum	1555.19	1577.29	1229.24	1277.85	1227.84	1009.81
Range	878.84	924.78	533.16	506.62	492.89	716.75
Std. Dev.	210.95	226.38	159.72	157.39	140.87	159.82

TABLE 1B  
Correlation Analysis

	MCXS		MCXAGRIS		NCDEXAGRI
MCXS	1	MCXAGRIS	1	NCDEXAGRI	1
MCXF	0.987	MCXAGRIF	0.972	FUTEXAGRI	0.895
MCXFLW	0.964	MCXAGRIFLW	0.969	FUTEXAGRILW	0.884
MCXLF	0.915	MCXAGRIFLF	0.959	FUTEXAGRILF	0.863
MCXFLM	0.827	MCXAGRIFLM	0.947	FUTEXAGRILM	0.832
	CRBSPOT		CRBSPOT		CCI
CRBSPOT	1	CRBSPOT	1	CCI	1
CCI	0.957	MCXSPOT	0.689	MCXFM	0.888
	DJAIGCITR		DJAIGSPI		DJAIGCITRI
DJAIGCITR	1	DJAIGSPI	1	DJAIGCITRI	1
DJAIGSP	0.947	MCXS	0.786	MCXF	0.762

without bound, so that the futures price provides little information about the movement of the spot price. We find that the daily multi-commodity indices (i.e., taking  $i=0$ ) are cointegrated and hence satisfy the necessary condition for efficient price formation, as they move together in time and hence form a long run equilibrium relationship.

The daily agri spot and futures indices of both NCDEX and MCX are not cointegrated; this is again understandable because of the problems with the accuracy and timeliness of dissemination of agricultural spot prices. However, futures prices  $F_{t-i}$  (with  $i=6, 12$  and  $30$ ) are cointegrated with the current spot prices for the multi-commodity as well as the MCX agri indices; thus one may say that these futures

prices do provide information on the movement of the future spot prices and a week, a fortnight and even a month ahead. However, this is not true for the NCDEX agri index if we look at futures prices a month ahead ( $i=30$ ) though futures prices a week and a fortnight ahead are cointegrated with the spot prices.

After finding significant evidence on cointegration of the spot and futures price series, we proceeded to test for causality between our different sets of futures and spot prices. We find that for the daily multi-commodity indices there is a clear bi-directional lead-lag relationship, showing that both markets assimilate new information and contribute to price discovery. For the agri indices futures prices lead the spot prices when higher lags (about seven to 12 days) of futures prices are included as explanatory variables in the causality test. However, the reverse is not true; thus there is some evidence of a price discovery role of the futures market in the agricultural commodities group. We may say that not only contemporaneous prices, but price history also plays a very important role in the relationship between agricultural commodity spot and futures markets. [All our above results are summarised in *Table 2*.]

**TABLE 2**  
**A Summary of Results**

	<i>Correlations</i>	<i>Cointegration</i>	<i>Causality</i>
<i>COMEX</i>			
Contemporaneous (MCXS-MCXF)	98.7%	Effective hedging possible	Clear evidence of 'Bi-directional causality'
Week ahead (MCXS & MCXFLW)	96.4%	Effective hedging possible	
Fortnight Ahead (MCXS & MCXFLF)	91.5%	Effective hedging possible	
Month ahead(MCXS & MCXFLM)	82.7%	Effective hedging possible	
<i>MCX_AGRI</i>			
Contemporaneous (MCXSAgri-MCXFAgri)	97.2%	Hedging not effective	Futures prices seem to lead Spot prices
Week ahead (MCXSAgri & MCXFAgriLW)	96.9%	Effective hedging possible	
Fortnight Ahead (MCXSAgri & MCXFAgriLF)	95.9%	Effective hedging possible	
Month ahead(MCXSAgri & MCXFAgriLM)	94.7%	Effective hedging possible	
<i>NCDEX_AGRI</i>			
Contemporaneous (NCDEXAgri-FUTEXAgri)	89.5%	Hedging not effective	Futures prices seem to lead Spot prices
Week ahead (NCDEXAgri-FUTEXAgriLW)	88.4%	Effective hedging possible	
Fortnight Ahead (NCDEXAgri-FUTEXAgriLF)	86.3%	Effective hedging possible	
Month ahead (NCDEXAgri-FUTEXAgriLM)	83.2%	Hedging not effective	

## V. Some Observations and Policy Issues

We have taken a slightly different approach to analysing the commodity futures market; rather than analysing the individual commodities and the efficiency of the futures market for each, here we have used the notional price indices for the commodity market to see the trends in these indices treating them at par with stock market indices. Our results provide an outlook of the commodity futures market in India and provide helpful information to domestic investors, producers

and policy makers. The results are also of interest to the international community which closely watches the Indian economy and is involved in commodity trading with India. The results also help to build a case for opening up of parts of the Indian agricultural futures market.

Our findings based on the movements of the existing commodity spot and futures indices, indicate an important informational role of the futures market. Price formation in the spot and futures market does not take place in isolation but is closely related, though to a lesser degree in the case of agricultural commodities. The futures indices provide more or less accurate indications of the future spot price at least a month ahead. Only for the agricultural commodities group, the futures price index seems to indicate the future spot price best when looked at about a week to a fortnight prior to the date for which the spot price is of interest. It is well known that spot prices of agricultural commodities are vastly different across the nation and it takes time to assimilate information on these prices. This is reflected in the lower correlation of the agri indices as compared to the multi-commodity indices that include mostly metals and energy items or the agri sub-index with mostly commercial crops, whose spot prices are much more evident and open for international comparison.

The indices considered here are significant barometers of the performance of the Indian commodities market. Once launched for futures trading with regulatory approvals, by holding and rolling positions in the MCX COMDEX futures, investors would be able to replicate the returns on the spot MCX COMDEX Index basket itself. The MCX COMDEX futures would give users the ability to efficiently hedge commodity price risks and inflation exposure. Thus, this study also gives an idea of how well the indices would serve as benchmark in case index trading is allowed in future as part of the liberalisation policy. Though there is positive correlation with the stock market index, the extent of correlation is not too high and commodity futures could still offer some portfolio diversification benefits to investors in both asset classes.

There is also evidence that Indian spot and futures indices do not deviate too much from global trends. In recent times of high inflation, price control measures within the Indian economy seem to be evident from the crossover between the global and Indian price indices, with the Indian indices falling below the global trend. While comparing global and Indian indices, it must be noted that the divergences in movements of Indian and global indices could arise not only due to differences in price expectations but also due to significant differences in commodity compositions. As actively traded commodities are included in the commodity indices, the differences in commodity composition of global and Indian commodity indices and the departure in trends also reflect the nature of trading interests globally and in the Indian markets.

We find that the multi-commodity indices, which have higher exposure to metals and energy products, with clear and efficient price dissemination in national and international markets, behave like the

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equity indices in terms of efficiency and flow of information. Both the contemporaneous futures and spot prices contribute to price discovery and the indices are cointegrated and the futures market can thus provide information for current spot prices and thus help to reduce volatility in the spot prices of the relevant commodities. The NCDEX agri index on the other hand does not show such features. However, we find that the futures index a fortnight and a week ago, are cointegrated with the spot price; thus they do provide valuable information for the future spot prices.

The difficulties of hedging agricultural price risk become more evident from this analysis. If we look at the agri index covering a wide variety of agricultural crops, the results become diffused and we can in no way say that possibilities of significant price risk reduction through efficient hedging exist as yet in this group of commodities. Similar results have been cited by Wang and Ke (2005) who tested the efficiency of the futures markets for agricultural commodities in China and found differences in the relative performance of the wheat and soybeans futures market. The futures market for wheat is found to be inefficient primarily due to excessive speculation and government intervention.<sup>21</sup> On the other hand, the futures market for soybeans performs its role of price discovery and hedging efficiently.<sup>22</sup>

We clearly see that indices with less weightage on agricultural products (the multi-commodity index) as well as the agri index with more of commercial products (like soya and mentha oil, cotton, cardamom and guar seed) show cointegration with spot prices more often than not providing possibilities for efficient hedging of price risk for these commodities. This result is supported by findings of studies on individual commercial crops. For example, Ramaswami and Singh (2006) note that despite the lack of key market institutions such as certified warehouses and centralised spot prices, the soya oil contract at the National Board of Trade (NBOT) has been liquid, as imports have ensured a full marketing season for soya oil and import driven hedging has drawn traders from consuming regions across the country. Karande (2006) finds that the castorseed futures market at Mumbai (which is the export base for this commodity) performs the function of price discovery, as opposed to another futures market (situated in the production hub) for the same commodity.

Let us now briefly take a look at the policy implications for further development and liberalisation of commodity futures markets emerging from this and some other studies. The case for the commodity futures market in India builds up from the premises that the Indian

<sup>21</sup> As the most important food grain, wheat is one of the commodities mostly related to national food security and a high priority concern of the government in making policy. For this reason, wheat imports and exports are tightly controlled by the government.

<sup>22</sup> Soybeans are used as feed and oilseeds and the market is less regulated. Soybean imports are no longer controlled and imports of the product have increased significantly in recent years.

(agricultural or even primary) commodities markets are not at all well developed. There remains a possibility of improving these markets (and the socio-economic conditions of the small producers) by developing trading interests in futures (as a financial instrument). Today, a poor farmer who harvests his crop has to sell it in the spot market at the prevailing price as he needs immediate cash and cannot sell forward even though he knows that the prices would improve in future which is the typical post-harvest tendency. Banks are also not willing to lend against commodities held in warehouses (except warehouses in the state sector) as they are not certain of the quantity, quality, grades and longevity of the crop stored due to the credibility factor. Such problems could be overcome by initiatives from profitable exchanges that become interested in the issues of warehousing, collateral management as well as insitutional financing (for the producers).<sup>23</sup> NCDEX already prescribes the accreditation norms, consisting of financial and technical parameters, which would have to be met by the warehouses that deal in delivery of futures contracts. MCX on the other hand has entered into a strategic alliance with India Post for its Gramin Suvidha Kendra (GSK) model, to cater to the needs of the Indian farming community.<sup>24</sup> Similarly, the success of the NBOT soya futures has reinforced significant research and training initiative in soybean productivity at the National Research Centre for Soybeans. It is also expected that with the development of futures trading and consequent transparency in pricing, the advent of contract or cooperative farming (and organised retail in agricultural commodities) would allow poor farmers to mitigate some of their risk.

However, all such initiatives are dependent on sustainable liquidity and profitability of the exchanges (or others involved in the trade) and hence the need for diversifying and expanding the investor base in commodity futures markets. Ramaswami and Singh (2006) point out that the liquid and efficient futures market in soybeans did not organically evolve from commodity trade in physicals; rather the futures exchange has encouraged improved marketing practices in physicals. A study by Williams *et al* (1998) examines mungbeans futures trading on the China Zhengzhou Commodity Exchange (CZCE). Their exposition of the mungbean contract's development contradicts conventional expectations about how a futures market develops. The development of the futures market for mungbeans aided the develop-

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<sup>23</sup> For example, the NCDEX is setting up a company that would function as a one-stop solution provider and facilitate all related activities associated with physical commodity delivery (*The Future of Commodity Derivatives*, NCDEX).

<sup>24</sup> From June 2006, it has started seed procurement in the harvest season and distribution at lower prices during the sowing season. Currently, GSK provides farmers with facilities such as expert advice on farming problems, better warehousing, quality testing, finance against warehouse receipts and MCX spot and futures prices for their produce. To create infrastructure MCX supplies computer terminals with Internet access, and a price ticker. In order to display the market information in villages, MCX also supplies blackboards to the village level post offices where updated prices are displayed.

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ment of the cash market and the mungbean physicals market adopted higher quality and uniformity requirements in recognition of the futures contract standards, improving its marketability. Similar insight is provided by Thomas and Karnde (2001), who find the futures market for the export-oriented produce to be price efficient. It is therefore conceivable that the development of futures exchanges could precede that of spot markets in developing countries. Our study on the Indian indices reinforces this view as it reveals that apart from the very fragmented agricultural market, futures market in the rest of the commodities including a variety of commercial crops, is already showing a lot of potential for effective hedging and price discovery. Thus, this efficient futures market has the ability to aid the development of the commodity market as a whole, and supports the case for further expansion of this market.

The road ahead seems to be bifurcated between policy makers who prefer to treat commodity derivatives as pure financial instruments and those who link it directly with the physical market. According to the first group, liquidity ensures pricing efficiency and this in turn ensures superior allocation of resources for productive purposes. Thus this group would advocate inclusion of institutional players like banks and FIIs in order to reap the benefits of their vast resources both financial as well as risk management expertise. The second group of policy makers however, would prefer to keep the market tightly linked to the physical market such that there is no scope of undue speculation and the futures market is used only by those having exposure to the physical commodity.<sup>25</sup> In extreme cases they advocate imposition of curbs on derivatives trading when prices show a rising trend.<sup>26</sup> It needs to be emphasised that even in the absence of futures markets, spot market prices will reflect the market participants' view about future demand and supply. Futures markets only seek to link the present scenario and the future prospects in a transparent and efficient manner in the presence of a large number of participants. It is thus necessary to

<sup>25</sup> The 17<sup>th</sup> Report on the FCRA Bill, 2006 notes that there is an enabling provision in the Bill, which provides for inclusion of foreign institutional investors and foreign intermediaries in the commodity market. Taking into consideration the interest of farmers and small investors, the Committee feels that hedge funds, banks and provident funds should not be allowed to participate in these markets. At the same time, the Committee also recommends that all the players, direct and those operating through others like brokers, must disclose their interest in actual, physical merchandising.

<sup>26</sup> Along with the type of participants, there is also divergence of opinion on the settlement system. Pure cash settlement (as in index trading) may lead to a spiral in speculative activities, while the threat of delivery would ensure that prices remain close to the fundamentals. However, so far as hoarding is concerned this could very well take place even without futures trading as large players create artificial shortage to bid up prices. Cash settlement of futures does not encourage additional hoarding in any way. Physical delivery on the other hand requires a huge investment in storage, grading and transportation, which may not be forthcoming if the volumes of turnover and associated profits in the market are not large enough.

strike a delicate balance between treating commodity futures like any other financial asset and allowing diverse participants in order to enhance liquidity and efficiency, and curbing undue speculation and involving only direct players in commodity markets (and thereby curbing liquidity and efficiency of the futures market). While it may be pertinent for the government to increase productivity and price stability of essential foodgrains through more direct intervention like intensive research and proper disbursement of bank credit, it may be worthwhile to use the route of futures market in the case of certain crops. Our results as those of some other studies do indicate that given limited resources it could very well be a viable option to open up futures markets for agricultural commodities like cotton, soya, and guar seed, which have commercial value in national and global markets.

## Appendix

### *A Review of Existing Literature*

There are numerous studies, both theoretical and empirical, that analyse the efficiency of futures markets in developed countries like the US and the UK. Garbade and Silber (1983) tested the relationship between spot and futures prices for seven commodities. Their goal was to test for efficiency in both functions of futures markets: risk management and price discovery. They developed a partial equilibrium model to explain characteristics of price movements in cash and futures markets for storable commodities. Garbade and Silber argue that the elasticity of supply for arbitrage services is constrained by both storage and transaction costs. Thus, futures contracts will not, in general, provide perfect risk transfer facilities over short-run horizons, though over the long run, cash and futures prices should be integrated. While they found all markets to be integrated over a month or two, there was considerable slippage between cash and futures markets over shorter time intervals, especially for grains (corn, wheat and oats). Gold and silver on the contrary were highly integrated even over one day. They suggest that the degree of market price integration over short horizons is a function of the elasticity of supply of arbitrage services and greater elasticity fosters more highly correlated price changes. McKenzie and Holt (1998) tested the efficiencies of the US futures markets for cattle, corn and soybean meal. Their results indicate that futures markets for all these commodities are both efficient and unbiased in the long run. Kellard, et al. (1999) examined the efficiency of several widely traded commodities in different markets, including soybeans on the CBOT and live cattle on the Chicago Mercantile Exchange. The results show that the long-run equilibrium condition holds, but again there was evidence of short-run inefficiency for most of the markets studied. Aulton, Ennew, and Rayner (1997) re-investigated the efficiency of UK agricultural commodity futures markets using the cointegration methodology. They found that contrary to earlier results (based on other techniques) the market is efficient for wheat (but not efficient for some other

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commodities like potatoes). Zapata *et al* (2005) who examine the relationship between sugar futures prices traded in New York and the world cash prices for exported sugar, conclude that the finding of cointegration between futures and cash prices suggests that the sugar futures contract is a useful vehicle for reducing overall market price risk faced by cash market participants selling at the world price (i.e., not enjoying favourable trade incentives).

The relationship between spot and futures markets in price discovery has been an important area of research, which broadly finds that in equity markets price innovations appear first in the futures market and are then transmitted down into the spot market (Stoll and Whaley, 1990; Chan *et al.*, 1991). This is consistent with the argument that positions on the index futures market enjoy greater leverage, which appeals to speculators, and this in turn adds liquidity as well as divergent trading interests to the market. In the case of commodity futures in the empirical literature there is a weak consensus, especially in agricultural commodity futures. Garbade and Silber (1983) showed with their sample of seven storable commodities that while the futures market dominates the spot market in price discovery, there are reverse information flows too. Their evidence suggests that the cash (spot) markets in wheat, corn, and orange juice are satellites for their respective futures markets, with about 75 per cent of new information incorporated first in futures prices and then flowing to cash prices. This seems to also be the case for gold, although data limitations prevented a conclusive statement. Price discovery for silver, oats, and copper, however, was more divided between the cash and futures. However, the degree of integration varied over the time lag taken into consideration. Zapata *et al* (2005) find uni-directional Granger causality from futures prices for world sugar on the New York Exchange and world cash prices for sugar. The futures market for sugar leads the cash market in price discovery and a shock in the futures price innovation generates a quick (one month) and positive response in futures and cash prices; but not *vice versa*. Silvapulle and Moosa (1999) examined the relationship between the spot and futures prices of WTI crude oil using a sample of daily data. Linear causality testing revealed that futures prices lead spot prices, but nonlinear causality testing revealed a bi-directional effect. This result suggests that both spot and futures markets react simultaneously to new information (though the degree and speed of reaction may vary). Asche and Guttormsen (2002) use data from the International Petroleum Exchange (IPE) on the gas oil (termed heating oil in Europe or the US) contract, which was launched as the IPE's first futures contract in 1981. Their results indicate that futures prices lead spot prices, and that futures contracts with longer time to expiration lead contracts with shorter time to expiration.

The literature on emerging commodity futures markets in developing countries is sparse due to lack of meaningful data. Wang and Ke (2005) test the efficiency of the futures markets for agricultural



commodities in China and their results suggest a long-term equilibrium relationship between the futures price and cash price for soybeans, and a weak short-term efficiency of the soybean futures market. Based on a comparison of the wheat and soy futures market, Wang and Ke (2005) conclude that participation in the world market helps to improve the price prediction role of the futures market. Thomas and Karande (2001) examined efficiency of the castor-seed futures markets in India. The examination included identifying the flow of information between futures and spot prices across two different markets, one export-oriented and another production-oriented. They find that futures dominate spot prices, and that the export-oriented market prices dominate the production-oriented market except in the harvest season when the relation was reversed. Ramaswami and Singh (2006) examined the success of the soya oil futures at the National Board of Trade (NBOT) for hedging purposes, using the principle of no-arbitrage conditions being satisfied for efficient hedging. They find that there are very low arbitrage opportunities in this market. Looking into the price discovery role of futures, Iyer and Mehta (2007) found the cash market for two commodities (chana and copper) to be a pure satellite of the futures market in the pre-(contract) expiration weeks, and for four commodities (chana, copper, gold and rubber) in the expiration weeks. Nickel was the only exception where the cash market played a dominant role. Gold and silver, as expected, showed the highest degree of integration between the spot and futures while nickel, rubber and chana showed very poor integration between the markets.

Thus, while most studies find evidence of information flows between the spot and futures markets, the degree of information flows and their direction vary significantly. The variation is mostly based on the type of commodity studied, the market infrastructure (such as provision of efficient price dissemination) and the operation of arbitrageurs in the futures market.

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