

# **Price Discovery in Commodity Futures Markets in India**

A report submitted for  
Ph. D. Enhancement

By  
Upananda Pani  
Roll No. 09HS9405

Under the supervision of  
Dr. Kishor Goswami



**Department of Humanities and Social Sciences  
Indian Institute of Technology Kharagpur  
July 2011**

## 1. Introduction

Commodities such as agricultural, metal, and energy are important to producers, processors, consumers, lenders, and brokers. Raw products of such categories are widely traded on both spot and derivative markets. Commodity derivative markets include trading of forward and futures contracts, which derive values from the underlying commodities. An efficient commodity futures market as a welfare raising mechanism plays an important role in managing price risk uncertainty contextual to the primary commodities price (Morgan, 2000). In an open economy commodity futures markets hold pervasive importance to discover a reference price for the producers and trade functionaries by reducing price volatility in the wake of seasonal oscillations of the commodities prices and uncertain production decisions (Lokare, 2007). Eventually, price in the spot market of a commodity is affected by fundamental factors like demand and supply, market structure and government policies, whereas future prices is usually affected by hedgers, speculators, traders and other market participants. In principle, the study of price behavior in commodities futures markets provides a better analytical prospective towards high and low price elasticities of future contract and the shifts in such elasticities over time.

Over the past several years, interest in the commodities market has grown significantly as commodities markets have not only presented an attractive investment alternative to the securities markets but also an increasingly popular vehicle to hedge investments. The existing literature support the economic significance of an efficient functioning commodity futures market irrespective of the nature of the commodity markets. The economic role and function of the commodity futures markets in developed economies have been studied from the perspective of different market participants like hedgers, speculators and other market participants<sup>1</sup>. Among the most notable empirical literature the issues, which have drawn considerable attention from the researchers include; intertemporal price behaviour, hedging effectiveness and basis relationship (Garcia and Leuthold, 2004)

Moreover, it has been argued that amid the general characteristics of market structure and nature of traded commodity the sound business objectives and opportunities in some commodities markets are inappropriate for others. Pertinent to the economic liberalisation and globalisation in the developing economies, role of commodity futures market has been reemphasised in the context of shifting attention from intervention approach to market based approach (Kang and Mahajana, 2006). In this regard, given the dynamic economic and institutional factors pertinent to emerging economy it is evident to expect significant difference in the dynamics of commodity pricing behavior in these markets compared to the developed economy counterparts. In the context of India, following the commodity market reform since 2003, the commodity futures trading for agricultural, metal, and bullion commodities has grown significantly across major commodity exchanges (Kabra, 2007). Assuming the positive role of the commodity futures market development towards minimisation of price risk uncertainty and economic efficiency from an emerging economy prospective, it is evident to study different issues, which explain the dynamics of pricing behavior of Indian commodities futures markets.

---

<sup>1</sup>A hedger is usually considered to have a position in both anticipated or current in the cash (spot)market and uses futures to offset the price risk inherent in the cash market. Whereas, a speculator in futures markets is generally viewed as one who takes a position in without any position in the cash market. Other market participants include arbitragers who usually exploit the price differential of two markets and they expect instant profit from the market operation

## 2. Relevance of the study

The broad objectives of Government of India for establishing futures market for various commodities include shifting the price fluctuation risk through hedging and performing the function of price discovery and price reference for the spot market (Kabra, 1994). Futures markets serve two important functions i.e., risk transference and price discovery to the organization of economic activity in an economy (Figuerola-Ferretti and Gonzalo, 2010; Malliaris, 1999; Working, 1962). Risk transference function is realized when speculators buy futures contract from hedgers. Price discovery function implies the use of future price on the pricing of cash (or spot) market transactions (Working, 1948). These are the main attributes of a futures market, which also justify for their existence and continued functioning in society. However, the above features of a futures market are only theoretical in nature. It is necessary to empirically validate these features for every new futures market before a case can be made for its continued existence. If a newly introduced futures market for any commodity fails to perform any of the above functions satisfactorily, then there is no justification for its continued existence. Alternatively, if futures markets are indeed performing the above mentioned functions satisfactorily, then there is a strong case for introducing new futures markets for other commodities. Thus, there is a need for extensive review of the performance of the future markets on the basis of their economic role and the need for their existence for the welfare of the society.

Commodity futures trading came into existence in India since 1875. However, the commodity futures markets have been in the state of hibernation for the past few decades owing to a lot of government restrictions. Significant developments took place in 2003-04 in terms of commodity futures market. The government issued a notification on April 1, 2003 withdrawing all previous notifications, which prohibited futures trading in a large number of commodities in the country. This was followed by a notification in May 2003 revoking prohibition on non-transferable specific delivery forward contracts. The futures market was opened in anticipation of sound market institutions and market design. In order to set up proper markets, the Government of India (GOI) on recommendation of Forward Market Commission (FMC) granted recognition to National Multi Commodity Exchange, Ahmadabad (NMCE); Multi Commodity Exchange, Mumbai (MCX) and 21 regional commodity exchanges. This resulted manyfold increase in futures trading. The total turnover of future trading has grown from Rs 5.72 to 60.80 lakh crores during the year 2003-04 and 2009-10<sup>2</sup>. Whereas, total turnover as a percentage of gross domestic product has increased from 4.6% in 2003-04 to 142.15% in 2009-10<sup>3</sup>. This shows the exponential growth of the commodity future segment in the Indian economy.

In recent years, commodity futures market has drawn attention from the researchers regarding its functions and contribution to the Indian economy. As futures market play an important role in managing price risk, and also serve the price discovery role for the spot market in the economy, there is a need to look at the dynamics of the price behaviour of future market. In this context question arises how does the future price behave? How to interpret information it conveys to the market? Whether future contracts are effective in reducing the price risk or not? These issues are more pertinent for the assessing the performance of commodity future market in India.

---

<sup>2</sup>Forward Market Commission Report, 2010

<sup>3</sup>Economic Survey, Government of India, 2003-2009

### 3. Literature Review

Price discovery is one of the roles of futures market, which plays crucial role in price formation in future markets (Figuerola-Ferretti and Gonzalo, 2010; Garbade and Silber, 1983). It is the revealing of information about future spot market price through the futures market and refers to the use of futures price for pricing spot market transactions. The essence of price discovery is to establish a competitive reference (futures) price from which the spot price can be derived and hinges on whether information is reflected first in changed futures price or in changed spot price (Gardner, 1976). The futures price serves as the expectation of the market of subsequent spot price (Houthakker, 1992).

The significance of price discovery depends upon a close relationship between futures and spot price. The extent to which futures market performs this function can be measured from the temporal relation between futures and spot price. If information is reflected first in futures price and subsequently in spot price, futures price should lead spot price, indicating that the futures market performs the price discovery function. In an efficient market where all available information is fully and instantaneously utilized to determine market price, futures price should move concurrently with its corresponding spot price without any lead or lag in price movement from one market to another. In the absence of market friction, price in the futures market and its corresponding spot market should move contemporaneously in response to arrival of information. Since futures and spot market represent the same commodity, their price should exhibit a mutual (similar) response to a given information event, a process facilitated by arbitrage (Antonioni and Foster, 1992).

If one market processes information faster than the other, a lead lag relation may exist between the markets. There are many reasons why one market may react more rapidly to the arrival of new information. Possible explanatory factors include ease of short sale, lower transaction cost, institutional arrangement, market microstructure effect, etc. The lead lag characteristics of futures and spot market illustrate how rapidly one market incorporates information relative to the other (Foster, 1996). These characteristics also indicate the efficiency of their functioning as well as the degree of integration between the two markets (Silvapulle and Moosa, 1999). Traders act faster and at lower cost in the futures market as compared to spot market resulting in a lead lag relation between futures and spot price (Grossman and Miller, 1988).

Futures trading facilitates the allocation of production and consumption over time by providing market guidance in the holding of inventories (Houthakker, 1992). If the futures price for distant delivery is above that for early delivery, postponement of consumption becomes attractive. Thus, a change in futures price results in subsequent change in spot price. Speculators prefer to hold a futures contract because they are not interested in the physical commodity per se and a futures position can be offset easily. Further, hedgers who are interested in the physical commodity and have storage constraint may hedge themselves by buying a futures contract. Therefore, both hedgers and speculators may react to information by transacting in futures rather than spot market. Consequently, futures price tends to lead spot price.

Chan (1992) contends that the adverse selection cost faced by discretionary liquidity traders who can choose the timing of their transactions strategically (such as large institutional traders) may be minimized by trading in futures rather than spot market. Again, this implies that the transmission of information is from futures to spot market. It has been suggested by Grünbichler, Longstaff and Schwartz (1994) that difference in liquidity between the two markets also creates a lead lag

relationship. They pointed out that if the average time between trades in spot market is longer than in futures market, information will be incorporated more rapidly in futures rather than spot price.

In practice, futures market is commonly observed to update price more frequently than spot market (Stoll and Whaley, 1990). Investors with strong beliefs about the direction of market, trade in futures rather than spot market because transaction cost is lower and the degree of leverage attainable is higher. Such trading moves future price first and then pulls spot price by means of arbitrage creating a lead lag relation. Considering the relation between futures and spot prices, Kawaller, Koch and Koch (1987) put forward the general principle that spot price is affected by past spot price, current and past futures price and other market information. Similarly, futures price is affected by past futures price, current and past spot price and other market information. Thus, causality is likely to be bi-directional. They further argued that the lead lag pattern between futures and spot price changes as new information arrives. Each may lead the other as market participants shift information for clues that are relevant to their spot or futures position.

Price discovery function of a commodity futures contract also signals for competing contracts traded in the market. Substitutability of a commodity also affects the price discovery function for other similar contracts in the market. Cross hedging and cross speculation can be inferred from the linkages between contracts (Malliaris and Urrutia, 1996). Price discovery process may be affected by the nature of commodity. If a group of commodities are related with each other because of substitutability or complementarity, then price discovery function of a commodity futures contract signals valuable information to other related commodity future contracts. If the cross elasticity of demand of two unrelated commodities is zero, then we should assume that future prices of each commodities are independent of each other. However, if prices of unrelated commodities move together, then the herd behaviour explains that the market participants are randomly behaving with bearish or bullish phenomenon ignoring the fundamentals.

Kumar (2004) investigated the price discovery in six Indian commodity exchanges for five commodities. He has used the daily futures and comparable ready price and engaged the ratio of standard deviations of spot and future rates for empirical testing of ability of futures markets to incorporate information efficiently. Besides, the study has empirically analyzed the efficiency of spot and future markets by employing the Johnson co-integration technique. They found that inability of futures markets to fully incorporate information and confirmed inefficiency of future market. However, the authors concluded that the Indian agricultural commodities future markets are not yet mature and efficient.

Karande (2006) analyzed the price discovery in the castorseed market of India, considering Ahmedabad and Bombay commodity exchanges by using daily closing data on future and spot prices that spans from May 1985 to December 1999. Although, he has employed Garbade and Silber (GS) model and seemingly unrelated regression approach, the interpreted relationship between spot and future markets remained the same in both the estimation approaches. Besides, estimating GS return equation separately for the respective months like March, June, September, and December, the study ultimately estimated pooled data in merging four contracts. They found that out of four, three seasonal contracts in Bombay future prices lead the Ahmedabad future prices while the March contract in Ahmedabad future prices lead the former one. Despite having smaller volume, the Bombay dominates the future prices over the Ahmedabad prices for all the contracts except the contracts maturing at the

time of harvest. The reason is due to the fact that prices of castor seeds are largely driven by the export demand. Since the traders or exporters expose to the port in Bombay, the markets have a lead in getting information that drives prices in the June, September, and December contracts. This study shows that markets that trade exactly the same asset, in the same time zone, do react differently to information and also small market may lead the large market.

Pavabutr and Chaihetphon (2010) explained the rate of convergence of information from future market to spot market between expiration and non-expiration weeks and found that it plays significant role in the price discovery process. For copper, gold and silver, the rate of convergence is almost instantaneous during the expiration week of the futures contract affirming the utility of futures contracts as an effective hedging tool. However, in case of chickpeas, nickel and rubber the convergence worsens during the expiration week indicating the non-usability of futures contract for hedging.

The conclusion that can be derived from the above discussion is that there is some rationale for the hypothesis that futures price leads spot price and also for the hypothesis that spot price leads futures price. However, the case for the first hypothesis is stronger and more compelling. Thus, we see that the utility of commodity derivative markets in price risk management is based primarily on their ability to perform price discovery. There is a need to empirically test the price discovery role of future markets in the above dimensions.

#### **4. Theoretical Framework**

#### **5. Methodology**

#### **6. Sample Selection Criteria**

#### **7. Model Estimation and Result Interpretation**

#### **8. Conclusion**

#### **9. Chapterisation plan**

## References

- Antoniou, A. and Foster, A. J., 1992, The effect of futures trading on spot price volatility: Evidence from Brent crude oil using Garch, *Journal of Business Finance & Accounting*, vol. 19, pp. 473–484.
- Chan, K., 1992, A further analysis of the lead-lag relationship between the cash market and stock index futures market, *Review of Financial Studies*, vol. 5, pp. 123–152.
- Figuerola-Ferretti, I. and Gonzalo, J., 2010, Modelling and measuring price discovery in commodity markets, *Journal of Econometrics*, vol. 158, pp. 95–107.
- Foster, A. J., 1996, Price discovery in oil markets: a time varying analysis of the 1990-1991 Gulf conflict, *Energy Economics*, vol. 18, pp. 231–246.
- Garbade, K. D. and Silber, W. L., 1983, Price Movements and Price Discovery in Futures and Cash Markets, *The Review of Economics and Statistics*, vol. 65, pp. 289–97.
- Garcia, P. and Leuthold, R. M., 2004, A selected review of agricultural commodity futures and options markets, *European Review of Agricultural Economics*, vol. 31, pp. 235–272.
- Gardner, B. L., 1976, Futures Prices in Supply Analysis, *American Journal of Agricultural Economics*, vol. 58, pp. 81–84.
- Grünbichler, A., Longstaff, F. A. and Schwartz, E. S., 1994, Electronic Screen Trading and the Transmission of Information: An Empirical Examination, *Journal of Financial Intermediation*, vol. 3, pp. 166 – 187.
- Grossman, S. J. and Miller, M. H., 1988, Liquidity and Market Structure, *The Journal of Finance*, vol. 43, pp. 617–633.
- Houthakker, H. S., 1992, Futures trading, in P. Newman, M. M. and Eatwell, J. (Eds.), *The New Palgrave Dictionary of Money and Finance*, Macmillan, vol. 2, pp. 211–13.
- Kabra, K. N., 1994, Report of the committee on forward markets, Tech. rep., Ministry of consumer affairs, Government of India.
- Kabra, K. N., 2007, Commodity Futures in India, *Economic and Political Weekly*, vol. XLII, pp. 1163–1170.
- Kang, M. G. and Mahajana, N., 2006, An introduction to market-based instruments for agricultural price risk management, Tech. rep., Food and agricultural organisation of the United Nations.
- Karande, K. D., 2006, A Study of Castorseed Futures Market in India, Ph.D. thesis, Indira Gandhi Institute of Development Research, Mumbai.
- Kawaller, I. G., Koch, P. D. and Koch, T. W., 1987, The Temporal Price Relationship between S&P 500 Futures and the S and P 500 Index, *Journal of Finance*, vol. 42, pp. 1309–29.
- Kumar, S., 2004, Price Discovery and Market Efficiency: Evidence From Agricultural Commodities Futures Markets, *South Asian Journal of Management*, vol. 11.
- Lokare, S., 2007, Commodity Derivatives and Price Risk Management: An Empirical Anecdote from India, *Reserve Bank of India Occasional Papers*, vol. 28, pp. 27–78.
- Malliaris, A. (Ed.), 1999, *Foundations of Futures Markets*, vol. I, United States: Edward Elgar Publishing Limited.
- Malliaris, A. G. and Urrutia, J. L., 1996, Linkages between agricultural commodity futures contracts, *Journal of Futures Markets Markets*, vol. 16, pp. 595–609.
- Morgan, C., 2000, Commodity Futures Markets in LDCs: A Review and Prospects, Research paper, Centre for Research in Economic Development and International Trade, University of Nottingham.

- Pavabutr, P. and Chaihetphon, P., 2010, Price discovery in the Indian gold futures market, *Journal of Economics and Finance*, vol. 34, pp. 455–467.
- Silvapulle, P. and Moosa, I. A., 1999, The relationship between spot and futures prices: Evidence from the crude oil market, *Journal of Futures Markets*, vol. 19, pp. 175–193.
- Stoll, H. R. and Whaley, R. E., 1990, The Dynamics of Stock Index and Stock Index Futures Returns, *The Journal of Financial and Quantitative Analysis*, vol. 25, pp. 441–468.
- Working, H., 1948, Theory of the Inverse Carrying Charge in Futures Markets, *Journal of Farm Economics*, vol. 30, pp. 1–28.
- Working, H., 1962, New Concepts Concerning Futures Markets and Prices, *American Economic Review*, vol. 52, pp. 431–459.

## Appendix

Table 1: Exchange-wise Turnover (In crores of rupees)

Exchange Name	2006	2007	2008	2009	2010
BCEXL	0.28 (0.01)	0.57 (0.01)	0.20 (0.00)	0.55 (0.01)	0.55 (0.01)
BCEXM	0.03 (0.00)	0.02 (0.00)	0.07 (0.00)	0.06 (0.00)	0.55 (0.01)
BOAOEX	0 (0.00)	166.6 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
CICEXG	0.26 (0.01)	0.27 (0.01)	0.00 (0.00)	0.04 (0.00)	0.03 (0.00)
COCH	9.17 (0.28)	17.39 (0.44)	8.83 (0.17)	8.83 (0.12)	6.69 (0.06)
ESIM	0.01 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
FCEXIL	0.48 (0.01)	0.19 (0.00)	0.19 (0.00)	0.07 (0.00)	0.12 (0.00)
HCLHI	0.39 (0.01)	1.55 (0.04)	0.55 (0.01)	0.41 (0.01)	0.13 (0.00)
IPSTAK	0.05 (0.00)	0.28 (0.01)	0.52 (0.01)	0.25 (0.00)	0.42 (0.00)
MCX	2093.65 (63.53)	3086.17 (78.05)	4512.44 (88.29)	6339.10 (84.82)	9255.07 (86.64)
NBOTI	72.03 (2.19)	95.31 (2.41)	34.33 (0.67)	60.45 (0.81)	47.30 (0.44)
NCDEX	1002.18 (30.41)	706.13 (17.86)	494.15 (9.67)	875.70 (11.72)	1226.18 (11.48)
NMCEIL	100.60 (3.05)	22.58 (0.57)	43.45 (0.85)	171.85 (2.30)	134.52 (1.26)
ROAOED	0.88 (0.03)	1.32 (0.03)	0.68 (0.01)	0.51 (0.01)	0.42 (0.00)
RSOBMA	3.46 (0.10)	6.24 (0.16)	6.66 (0.13)	5.73 (0.08)	5.45 (0.05)
SCOAOL	3.35 (0.10)	3.71 (0.09)	2.31 (0.05)	4.18 (0.06)	4.28 (0.04)
TACEXL	6.60 (0.20)	10.60 (0.27)	5.98 (0.12)	5.98 (0.08)	0.00 (0.00)
TEIJAHEL	0.07 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
TMACEL	0.25 (0.01)	0.14 (0.00)	0.20 (0.00)	0.12 (0.00)	56.8 (0.00)
TSOELS	0.11 (0.00)	0.13 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
VBCL	1.92 (0.06)	1.13 (0.03)	0.21 (0.00)	0.01 (0.00)	0.00 (0.00)

<sup>1</sup> Note: Figures in Parenthesis shows the percentage of total trade.

<sup>2</sup> Source: Forward Market Commission, Government of India.