INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION AND MANAGEMENT

CONTENTS

CHIEF PATRON

PROF. K. K. AGGARWAL
Chancellor, Lingaya's University, Delhi
Founder Vice-Chancellor, Guru Gobind Singh Indraprastha University, Delhi
Ex. Pro Vice-Chancellor, Guru Jambheshwar University, Hisar

PATRON

SH. RAM BHAJAN AGGARWAL
Ex. State Minister for Home & Tourism, Government of Haryana
Vice-President, Dadri Education Society, Charkhi Dadri
President, Chinar Syntex Ltd. (Textile Mills), Bhiwani

CO-ORDINATOR

DR. BHAVET
Lecturer, M. M. Institute of Management, Maharishi Markandeshwar University, Mullana

ADVISORS

PROF. M. S. SENAM RAJU
Director A. C. D., School of Management Studies, I.G.N.O.U., New Delhi
PROF. M. N. SHARMA
Chairman, M.B.A., Haryana College of Technology & Management, Kaithal
PROF. S. L. MAHANDRU
Principal (Retd.), Maharaja Agrasen College, Jagadhri

EDITOR

PROF. R. K. SHARMA
Dean (Academics), Tecnia Institute of Advanced Studies, Delhi

CO-EDITOR

DR. SAMBHAV GARG
Faculty, M. M. Institute of Management, Maharishi Markandeshwar University, Mullana, Ambala, Haryana

EDITORIAL ADVISORY BOARD

DR. AMBIKA ZUTSHI
Faculty, School of Management & Marketing, Deakin University, Australia
DR. VIVEK NATRAJAN
Faculty, Lomar University, U.S.A.
PROF. PARVEEN KUMAR
Director, M.C.A., Meerut Institute of Engineering & Technology, Meerut, U. P.
PROF. H. R. SHARMA
Director, Chhatarpati Shivaji Institute of Technology, Durg, C.G.
PROF. MANOHAR LAL
Director & Chairman, School of Information & Computer Sciences, I.G.N.O.U., New Delhi
PROF. ANIL K. SAINI
Chairperson (CRC), Guru Gobind Singh I. P. University, Delhi
PROF. SANJIV MITTAL
University School of Management Studies, Guru Gobind Singh I. P. University, Delhi
PROF. SATISH KUMAR
Director, Vidya School of Business, Meerut, U.P.
PROF. ROSHAN LAL
Head & Convener Ph. D. Programme, M. M. Institute of Management, M. M. University, Mullana
DR. ASHWANI KUSH
Head, Computer Science, University College, Kurukshetra University, Kurukshetra
DR. BHARAT BHUSHAN
Head, Department of Computer Science & Applications, Guru Nanak Khalsa College, Yamunanagar
DR. VIJAYPAL SINGH DHAKA
Head, Department of Computer Applications, Institute of Management Studies, Noida, U.P.
DR. KULBHUSHAN CHANDEL
Reader, Himachal Pradesh University, Shimla, Himachal Pradesh
DR. ASHOK KUMAR CHAUHAN
Reader, Department of Economics, Kurukshetra University, Kurukshetra

DR. SAMBHAVNA
Faculty, I.I.T.M., Delhi
DR. MOHINDER CHAND
Associate Professor, Kurukshetra University, Kurukshetra
DR. MOHENDER KUMAR GUPTA
Associate Professor, P. J. L. N. Government College, Faridabad
DR. VIVEK CHAWLA
Associate Professor, Kurukshetra University, Kurukshetra
DR. VIKAS CHOUDHARY
Asst. Professor, N.I.T. (University), Kurukshetra

ASSOCIATE EDITORS

PROF. NAWAB ALI KHAN
Department of Commerce, Aligarh Muslim University, Aligarh, U.P.
PROF. ABHAY BANSAL
Head, Department of Information Technology, Amity School of Engineering & Technology, Amity University, Noida
DR. ASHOK KUMAR
Head, Department of Electronics, D. A. V. College (Lahore), Ambala City
DR. ASHISH JOLLY
Head, Computer Department, S. A. Jain Institute of Management & Technology, Ambala City
DR. PARDEEP AHLAWAT
Reader, Institute of Management Studies & Research, Maharshi Dayanand University, Rohtak
DR. SHIVAKUMAR DEENE
Asst. Professor, Government F. G. College Chitguppa, Bidar, Karnataka
SUNIL KUMAR KARWASRA
Vice-Principal, Defence College of Education, Tohana, Fatehabad
PARVEEN KHURANA
Associate Professor, Mukand Lal National College, Yamuna Nagar
SHASHI KHURANA
Associate Professor, S. M. S. Khalsa Lubana Girls College, Barara, Ambala
ASHISH CHOPRA
Sr. Lecturer, Doon Valley Institute of Engineering & Technology, Karnal
MOHITA
Lecturer, Yamuna Institute of Engineering & Technology, Village Gadholi, P. O. Gadhola, Yamunanagar
SAKET BHARDWAJ
Lecturer, Haryana Engineering College, Jagadhri

TECHNICAL ADVISORS

AMITA
Lecturer, E.C.C., Safidon, Jind
MONIKA KHURANA
Associate Professor, Hindu Girls College, Jagadhri
SURUCHI KALRA CHOUDHARY
Head, Department of English, Hindu Girls College, Jagadhri
NARENDERA SINGH KAMRA
Faculty, J.N.V., Pabra, Hisar

FINANCIAL ADVISORS

DICKIN GOYAL
Advocate & Tax Adviser, Panchkula
NEENA
Investment Consultant, Chambaghat, Solan, Himachal Pradesh

LEGAL ADVISORS

JITENDER S. CHAHAL
Advocate, Punjab & Haryana High Court, Chandigarh U.T.
CHANDER BHUSHAN SHARMA
Advocate & Consultant, District Courts, Yamunanagar at Jagadhri

CALL FOR MANUSCRIPTS

We invite unpublished novel, original, empirical and high quality research work pertaining to recent developments & practices in the area of Computer, Business, Finance, Marketing, Human Resource Management, General Management, Banking, Insurance, Corporate Governance and emerging paradigms in allied subjects. The above mentioned tracks are only indicative, and not exhaustive.

Anybody can submit the soft copy of his/her manuscript **anytime** in M.S. Word format after preparing the same as per our submission guidelines duly available on our website under the heading guidelines for submission, at the email addresses, **info@ijrcm.org.in** or **infoijrcm@gmail.com**.

GUIDELINES FOR SUBMISSION OF MANUSCRIPT

1. **COVERING LETTER FOR SUBMISSION:**

Dated: ________________________

The Editor

IJRCM

Subject: **Submission of Manuscript in the Area of (Computer/Finance/Marketing/HRM/General Management/other, please specify)**.

Dear Sir/Madam,

Please find my submission of manuscript titled '____' for possible publication in your journal.

I hereby affirm that the contents of this manuscript are original. Furthermore It has neither been published elsewhere in any language fully or partly, nor is it under review for publication anywhere.

I affirm that all author (s) have seen and agreed to the submitted version of the manuscript and their inclusion of name(s) as co-author(s).

Also, if our/my manuscript is accepted, I/We agree to comply with the formalities as given on the website of journal & you are free to publish our contribution to any of your journals.

Name of Corresponding Author:

Designation:

Affiliation:

Mailing address:

Mobile & Landline Number (s):

E-mail Address (s):

2. **INTRODUCTION**: Manuscript must be in English prepared on a standard A4 size paper setting. It must be prepared on a single space and single column with 1" margin set for top, bottom, left and right. It should be typed in 12 point Calibri Font with page numbers at the bottom and centre of the every page.

3. **MANUSCRIPT TITLE**: The title of the paper should be in a 12 point Calibri Font. It should be bold typed, centered and fully capitalised.

4. **AUTHOR NAME(S) & AFFILIATIONS**: The author (s) full name, designation, affiliation (s), address, mobile/landline numbers, and email/alternate email address should be in 12-point Calibri Font. It must be centered underneath the title.

5. **ABSTRACT**: Abstract should be in fully italicized text, not exceeding 250 words. The abstract must be informative and explain background, aims, methods, results and conclusion.

6. **KEYWORDS**: Abstract must be followed by list of keywords, subject to the maximum of five. These should be arranged in alphabetic order separated by commas and full stops at the end.

7. **HEADINGS**: All the headings should be in a 10 point Calibri Font. These must be bold-faced, aligned left and fully capitalised. Leave a blank line before each heading.
8. **SUB-HEADINGS**: All the sub-headings should be in a 8 point Calibri Font. These must be bold-faced, aligned left and fully capitalised.
9. **MAIN TEXT**: The main text should be in a 8 point Calibri Font, single spaced and justified.
10. **FIGURES &TABLES**: These should be simple, centered, separately numbered & self explained, and titles must be above the tables/figures. Sources of data should be mentioned below the table/figure. It should be ensured that the tables/figures are referred to from the main text.
11. **EQUATIONS**: These should be consecutively numbered in parentheses, horizontally centered with equation number placed at the right.
12. **REFERENCES**: The list of all references should be alphabetically arranged. It must be single spaced, and at the end of the manuscript. The author (s) should mention only the actually utilised references in the preparation of manuscript and they are supposed to follow **Harvard Style of Referencing**. The author (s) are supposed to follow the references as per following:

- All works cited in the text (including sources for tables and figures) should be listed alphabetically.
- Use (**ed.**) for one editor, and (**ed.s)** for multiple editors.
- When listing two or more works by one author, use --- (20xx), such as after Kohl (1997), use --- (2001), etc, in chronologically ascending order.
- Indicate (opening and closing) page numbers for articles in journals and for chapters in books.
- The title of books and journals should be in italics. Double quotation marks are used for titles of journal articles, book chapters, dissertations, reports, working papers, unpublished material, etc.
- For titles in a language other than English, provide an English translation in parentheses.
- Use endnotes rather than footnotes.
- The location of endnotes within the text should be indicated by superscript numbers.

PLEASE USE THE FOLLOWING FOR STYLE AND PUNCTUATION IN REFERENCES:

Books
- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio," Ohio State University.

Contributions to books
- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

Journal and other articles
- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

Conference papers
- Chandel K.S. (2009): "Ethics in Commerce Education." Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

Unpublished dissertations and theses
- Kumar S. (2006): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

Online resources
- Always indicate the date that the source was accessed, as online resources are frequently updated or removed.

Website
- Kelkar V. (2009): Towards a New Natural Gas Policy, Economic and Political Weekly, Viewed on February 17, 2011 http://epw.in/epw/user/viewabstract.jsp

PRICE DISCOVERY IN THE COMMODITY MARKETS: THE CASE OF FEEDER CATTLE AND LIVE CATTLE MARKETS

S. JACKLINE
PH. D. RESEARCH SCHOLAR
DEPARTMENT OF COMMERCE
PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014

DR. MALABIKA DEO
PROFESSOR AND HEAD
DEPARTMENT OF COMMERCE
PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014

ABSTRACT

This paper examines the relationship between the futures market and spot market for the feeder cattle and live cattle markets during the sample period January 2001 through May 2010 and quantifies the price discovery function of commodity futures prices in relation to spot prices of the sample markets. The cointegration tests and Vector Error Correction Models (VECM) employed in the study proved that both the selected futures markets share and provide certain long-run price information to cash markets and they have cointegrated. Both these markets were found to respond favourably to the price discovery mechanism and acted in a similar way.

KEYWORDS

Cointegration, Feeder Cattle and Live Cattle, Price Discovery.

INTRODUCTION

Futures markets generally perform two important roles, hedging of risks (in other words called as risk transfer) and price discovery. The efficacy of the hedging function is dependent on the price discovery process or how well new information is reflected in price. Price discovery, or transmission of information into prices, is a crucial function of any markets. Price discovery takes place when order flow from different types of traders is aggregated in a single market, which can be a physical exchange floor or an electronic trading system. This aggregation of trading interests allows for trade prices to correctly represent supply and demand, although market frictions, noise trading, and investor psychology ensure that observed prices are imperfect proxies for the underlying asset values. As markets evolve, it is imperative that the new market structures and trading protocols continue to provide reliable price discovery. In general, futures markets are found to respond faster to new information than spot markets since the transaction cost is lower and the degree of leverage attainable is higher. Whether the spot or the futures market is the center of price discovery in commodity markets has for a long time been discussed in the literature. Stein (1961) showed that futures and spot prices for a given commodity are determined simultaneously. Garbade and Silver (1983) (GS thereafter) developed a model of simultaneous price dynamics in which they established that price discovery takes place in the market with highest number of participants. Their empirical application concludes that “about 75 percent of new information is incorporated first in the future prices.” More recently, the price discovery research has focused on microstructure models and on methods to measure it.

SIGNIFICANCE OF THE STUDY AND OBJECTIVES

Price discovery is a concept used frequently, but seldom defined. Thomsen and Foote defined price discovery in 1952 as the process of buyers and sellers arriving at a transaction price for a specific quantity and quality of a commodity or product at a specific time and place. Their definition allows focusing on many interrelated components of the pricing process, and numerous topics may be categorized as price discovery research. Examples include studies of transaction prices and relationships with underlying supply and demand determinants; price relationships and dynamics between and among vertical stages in the marketing channel; spot versus forecasted or futures market prices; price impacts associated with market information, especially public reports; price and product characteristic relationships; spatial and temporal price patterns and dynamics; and price impacts associated with market structure and behaviour changes.

Price discovery research in commodity market has become an increasingly important, because of structural and behavioural changes in storable and non storable commodities, both horizontal and vertical, and the resulting potential price and market information impacts. Structural and behavioural changes in meatpacking and related stages in the livestock-meat subsector have raised questions about price discovery for various species and classes of livestock (Purcell and Rowsell, 1987). Hence, this study attempts to provide empirical evidence on the price discovery mechanisms, taking into consideration the feeder cattle and live cattle.

The objectives so framed for the study were as follows:

1. To examine the relationship between the futures market and spot market for the sample commodities;
2. To quantify the price discovery function of commodity futures prices in relation to spot prices of feeder cattle and live cattle; and,
3. To analyze whether the price information reflects first in futures market or in the spot market.

METHODOLOGY

JOHANSEN'S VECTOR ERROR CORRECTION MODEL (VECM)

Johansen's (1988) Vector Error Correction Model (VECM) was employed to investigate the causal relationship between spot and futures prices. The following steps were followed to estimate Johansen's Vector Error Correction Model (VECM).

Step 1: The stationarity of the data series was evaluated by Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) tests.

Step 2: Once the series were found integrated in an identical order, then Johansen Multivariate Maximum likelihood cointegration test was employed to investigate the long-run relationship between spot and futures prices and it is presented below.

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i X_{t-i} + \prod X_{t-1} + \varepsilon_t;\ \varepsilon_t = \begin{pmatrix} \varepsilon_{s,t} \\ \varepsilon_{F,t} \end{pmatrix} \approx N(0,\Sigma) \quad (1)$$

Where X_t= (S_t F_t)' is the vector of spot and futures prices, Δ denotes the first difference operator; Γ_i and Π are 2×2 coefficient matrices measuring the short-and long-run adjustment of the system to change in X_{ti} and ε_t is 2×1 vector of white noise error terms.

Step 3: The test results were quite sensitive to the lag length. Hence, the lag length P was selected on the basis of multivariate generalizations of Akaike's information criteria (AIC).

Step 4: The two likelihood ratio tests were employed to identify the co-integration between the two series. The first statistic λ_{trace} tests whether the number of cointegrating vectors is zero or one, and the other λ_{max} tests whether a single cointegrating equation was sufficient or if two were required.

In general, if r cointegrating vector is correct. The following test statistics can be constructed as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} ln\left(1 - \hat{\lambda}_i\right) \quad (2)$$

$$\lambda_{Max}(r, r+1) = -T\ ln\left(1 - \hat{\lambda}_{r+1}\right) \quad (3)$$

Where, n is the number of separate series to be examined, T is the number of usable observations and ($\hat{\lambda}_i$) are the estimated Eigen values (also called characteristic roots) obtained from the (i+1) × (i+1) 'cointegrating matrix.'

The first test statistic (λ_{trace}) tests whether the number of distinct cointegrating vectors was less than or equal to r. The second test statistic (λ_{max}) tests the null that the number of cointegrating vectors is r against an r+1. MacKinnon-Haug-Michelis (1999) provide the critical values of these statistics. The rank of Π may be tested using the λ_{max} and λ_{trace}. If rank (Π) =1, then there was single cointegrating vector and Π can be factored as Π=αβ', where α and β' are 2×1 vectors. Using this factorization β'represents the vector of cointegrating parameters and α is the vector of error correction coefficients measuring the speed of convergence to the long-run steady state.

Step 5: If spot and futures prices were cointegrated, then causality must exist at least in one direction (Granger, 1986). To test the causality, the following vector error correction model (VECM) is estimated by using ordinary least square (OLS) in each equation.

$$\Delta S_t = a_{s,0} + \sum_{i=1}^{p-1} a_{s,i}\Delta S_{t-i} + \sum_{i=1}^{p-1} b_{s,i}\Delta F_{t-i} + \alpha_s Z_{t-1} + \varepsilon_{s,t} \quad (4)$$

$$\Delta F_t = a_{F,0} + \sum_{i=1}^{p-1} a_{F,i}\Delta S_{t-i} + \sum_{i=1}^{p-1} b_{F,i}\Delta F_{t-i} + \alpha_F Z_{t-1} + \varepsilon_{F,t} \quad (5)$$

where $a_{S,0}$, $a_{F,0}$ are intercept terms; $a_{S,i}$, $b_{S,i}$, $a_{F,i}$, $b_{F,i}$ are the short-run coefficients and Z_{t-1}= β' X_{t-1} is the error correction term from equation 1.

In terms of the vector error correction model (VECM) of equation 4 & 5, F_t Granger Causes S_t if some of the $b_{S,i}$, coefficients, i =1,2,…., p-1 are not zero and α_S, the error correction coefficient in the equation for spot prices, is significant at conventional levels. Similarly, S_t Granger causes Ft if some of the $a_{F,t}$ coefficients, i =1,2,…., p-1 are not zero and α_F is significant at the conventional levels. These hypotheses can be tested by using either t-tests or F-tests on the joint significance of the lagged estimated coefficients. If both S_t and F_t Granger cause each other, then there is a feedback relationship between the two markets. Therefore, the error correction coefficients, α_S and α_F serve two purposes.

They are (i) to identify the direction of causality between spot and futures prices and (ii) to measure the speed with which deviations from the long-run relationship are corrected by changes in the spot and futures prices.

The vector error correction model (VECM) equation 4 & 5 provides a framework for valid inference in the presence of I (1) variable. Moreover, the Johansen (1988) procedure provides more efficient estimates of the cointegrating relationship than the Engel and Granger (1987) estimator (Gonzalo, 1994). Also, Johansen (1988) tests are shown to be fairly robust to presence of non normality and heteroscedasticity disturbances (Lee and Tse, 1996).

Since the futures prices series and the spot prices series of both feeder and live cattle appeared to be non stationary, causality test had been ignored.

REVIEW OF RELATED LITERATURE

Many previous papers are focused on the price discovery of cross-listed stocks and assets with the same value base. 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. **Leuthold (1974)** investigated the price performance of Live Beef Cattle on the futures market. From the results it was found that Cash cattle prices were found to be more accurate indicators of subsequent cash cattle price conditions than are the futures prices for distant contracts. In other words, evaluation of live beef cattle price relationships revealed that for distant futures, the cash price is a more accurate indicator of future cash price conditions than is the futures price. Also, the futures price becomes less and less efficient both absolutely and relative to the cash price estimates. In other words, the cash price is more stable than the futures price for distant contracts. **Oellermann and Farris (1985)** investigated lead lag relation between change in futures and spot price for live beef cattle between 1966 and 1982. The futures price led spot price during nearly every sub period analysed. Based on Granger causality test for various sub samples of their data, they conclude that change in live cattle futures price led change in live cattle spot price. They also found that the spot market responded to change in futures price within one trading day. The authors conclude that futures market was the centre of price discovery for live cattle. They suggest that a likely explanation for the results is that the futures market serves as a focal point for information assimilation. They conclude that the cattle futures market contributes towards a more efficient price discovery process in the underlying spot market for live beef cattle.

A slightly different approach was adopted by **Koontz et al. (1990)** to study price discovery in the livestock market. Using weekly U.S. cash and futures prices from 1973 through 1984, they investigated the spatial nature of the price discovery process. They adopted the procedure proposed by Geweke (1982) to generate causality tests and measures of interaction between major cash markets, and between cash and futures markets. In general, their findings suggested that there was a high degree of interaction between cash and futures prices. They also identified that the pricing relationships changed over time, reflecting changes in the industry which suggests that the price discovery process is dynamic and is influenced by the structure of the underlying markets. **Bessler and Covey (1991)** studied the futures/cash price relationships for slaughter cattle, a non-storable commodity. They used daily settlement prices for the nearby live cattle futures contract from August 21, 1985 through August 20, 1986, and daily average cash prices (per cwt.) for direct sale of choice 900-1300lbs. slaughter cattle steers in the Texas-Oklahoma market. Their cash series reflected a direct rather than auction sales market for slaughter cattle. Thus, their cash series included sales throughout the entire five-day business week. For a sample of 261 observations on daily live cattle prices, they obtained mixed results. Within sample fits (conducted on the first 130 data points) indicated that both cash and futures prices were generated by processes not statistically distinguishable from a random walk. Tests for cointegration based on residuals from a static regression (using the same 130 data points) showed marginal support for the cointegration hypothesis between cash and nearby futures prices. No cointegration was discovered between cash prices and more distant contracts. The results are consistent with the suggestion that the greater the temporal spread between futures and cash prices, the greater the degree of independence. **Schroeder and Goodwin (1991)** studied the price discovery mechanism for livestock in the periods 1979-1986 and 1975- 1989, respectively. Both studies tested the extent of short-run price discovery, and found that information tends to be discovered first in futures markets and then transferred to cash markets. Both studies also adopted other procedures to verify their results in the long run. They used cointegration procedures to verify that daily cash and futures prices for live hogs didn't share a long-run relationship. They found a short-run relationship between cash and futures prices based on Garbade-Silber model, but failed to find a long-run relationship using either Granger-causality or cointegration procedures. Thus as the process of adding to the existing literature, the present study uses the cointegration tests and VECM tests to study the price discovery mechanisms in the feeder cattle and live cattle markets through the years 2001 to 2010.

EMPIRICAL RESULTS

DATA AND SAMPLE PERIODS

The study period of this research was made during 2nd January 2001 to 31st May 2010. The spot and futures prices of feeder cattle and live cattle were obtained from Multi Commodity Exchange of India (MCX).

UNIT ROOT TEST

A necessary condition to carry out a cointegration test in a time series data is that the data have to be non-stationary at the level, but stationary in the differences. Each series of feeder cattle and line cattle prices were first tested for the existence of a unit root by using Augmented Dickey and Fuller (ADF, 1981). The ADF test uses the existence of a unit root as the null hypothesis, that is:

H_0: $\alpha = 0$

H_1: $\alpha \neq 0$

TABLE 1: UNIT ROOT TEST RESULTS: AUGMENTED DICKEY AND FULLER (ADF) TEST

Commodities	Null Hypothesis	t-statistic	p-value*	Existence of Unit Root
Feeder Cattle	Futures prices series has a Unit Root	-1.934793	0.3164	Yes
	Spot prices series has a Unit Root	-1.888035	0.3382	Yes
Live Cattle	Futures prices series has a Unit Root	-2.700976	0.0740	Yes
	Spot prices series has a Unit Root	-1.609250	0.4777	Yes

Confidence level α = 0.05

The results from Augmented Dickey and Fuller (ADF) tests were reported in Table 1. The optimal number of augmenting lags was determined by using Akaike Information Criterion (AIC). The results show that both spot and futures prices of feeder cattle and live cattle were non-stationary (have unit roots).

TABLE 2: UNIT ROOT TEST RESULTS: PHILLIPS-PERRON (PP) TEST

Commodities	Null Hypothesis	t-statistic	p-value*	Existence of Unit Root
Feeder Cattle	Futures prices series has a Unit Root	-1.933917	0.3168	Yes
	Spot prices series has a Unit Root	-1.774476	0.3936	Yes
Live Cattle	Futures prices series has a Unit Root	-2.606832	0.0917	Yes
	Spot prices series has a Unit Root	-1.558817	0.5036	Yes

Confidence level α = 0.05

In order to double check the robustness of the results, the Phillips-Perron (PP) test was employed and the results were given in Table 2. As showed in Table 2, the ADF test fails to reject the null hypothesis of the presence of a unit root for the original-prices series.

COINTEGRATION TEST

Given that the spot and futures prices of feeder cattle and live cattle were integrated at the same order, cointegration techniques was used to determine if a long-run relationship exists between the spot and futures prices. Cointegration is an econometric property of time series variables. If two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are said to be co-integrated. In practice, cointegration is a means for correctly testing those hypotheses concerning the relationship between two variables having unit roots. The Engle–Granger two step methods (Engle & Granger, 1987) and the Johansen trace test

(Johansen, 1988; 1991) are the two main approaches for testing cointegration. Since the spot-futures prices of feeder cattle and live cattle were non-stationary, in this study, the Johansen trace test was adapted to test the presence of the long-run equilibrium relationship in the hourly prices and trading volume series in pairs. As stated by Johansen (1988), the likelihood ratio-test statistic for the hypothesis of the at most r co-integrated relationship and the at least m = n - r common trend is given by:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln\left(1 - \hat{\lambda}_i\right)$$

Where T is the sample size, and $\hat{\lambda}$ represents Eigen values of the squared canonical correlation between the two residual vectors from the level regressions. The results of the Johansen trace test were reported in Table 3.

TABLE 3: JOHANSEN COINTEGRATION TEST RESULTS

Commodities	Hypothesized No. of CE (s)	Eigenvalue	Trace Statistic	0.05 critical value	Max-Eigen Statistic	0.05 critical value	p-value*
Feeder Cattle	No cointegration*	0.061591	146.4872	15.49471	142.9048	14.26460	0.0001
	Atmost one Cointegration	0.001592	3.582444	3.841466	3.582444	3.841466	0.0584
Live Cattle	No cointegration*	0.010283	25.50765	15.49471	23.11238	14.26460	0.0011
	Atmost one Cointegration	0.001071	2.395265	3.841466	2.395265	3.841466	0.1217

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

As seen in Table 3, the rejection of the ‘‘null hypothesis of no cointegration” indicates that the spot and futures price series of the feeder cattle and live cattle have a long-run equilibrium relationship.

VECTOR ERROR CORRECTION MODEL

A vector error correction model (VECM; Engle & Granger, 1987) can lead to a better understanding of the nature of any non-stationarity among the different component series and can also improve the longer-term forecasting over an unconstrained model. Because the spot-futures prices of feeder cattle and live cattle were co-integrated, the VECM was used to investigate the lead-lag relationship of spot and futures prices. Assuming that S_t is the spot prices series, and F_t denotes the futures prices series, and then the VECM in this study can be illustrated as follows:

$$\Delta S_t = a_{s,0} + \sum_{i=1}^{p-1} a_{s,i} \Delta S_{t-i} + \sum_{i=1}^{p-1} b_{s,i} \Delta F_{t-i} + \alpha_s Z_{t-1} + \varepsilon_{s,t}$$

$$\Delta F_t = a_{F,0} + \sum_{i=1}^{p-1} a_{F,i} \Delta S_{t-i} + \sum_{i=1}^{p-1} b_{F,i} \Delta F_{t-i} + \alpha_F Z_{t-1} + \varepsilon_{F,t}$$

where Δ is the differencing operator, p, q, m, and n are the orders of lag which were determined by Akaike’s information criterion evidence, and $\varepsilon_{s,t}$ and $\varepsilon_{F,t}$ were white noises.

TABLE 4: VECTOR ERROR CORRECTION ESTIMATES RESULTS

Feeder Cattle			**Live Cattle**		
Cointegrating Eq:	**CointEq1**		**Cointegrating Eq:**	**CointEq1**	
FCFUTURES(-1)	1.000000		LCFUTURES(-1)	1.000000	
FCSPOT(-1)	-0.852299		LCSPOT(-1)	-0.578245	
	(0.02389)			(0.08764)	
	[-35.6824]			[-6.59774]	
C	2.820009		C	-18.81324	
Error Correction:	**D(FCFUTURE)**	**D(FCSPOT)**	**Error Correction:**	**D(LCFUTURES)**	**D(LCSPOT)**
CointEq1	-0.059775	-0.000866	CointEq1	-0.014528	0.005952
	(0.00533)	(0.00564)		(0.00344)	(0.00298)
	[-11.2225]	[-0.15360]		[-4.21917]	[2.00026]
D(FCFUTURES(-1))	0.032798	-0.041151	D(LCFUTURES(-1))	0.051287	-0.020475
	(0.02061)	(0.02180)		(0.02114)	(0.01827)
	[1.59174]	[-1.88759]		[2.42609]	[-1.12086]
D(FCFUTURES(-2))	0.022158	-0.002644	D(LCFUTURES(-2))	0.053896	0.017166
	(0.02063)	(0.02183)		(0.02115)	(0.01828)
	[1.07390]	[-0.12111]		[2.54771]	[0.93906]
D(FCSPOT(-1))	-0.058020	0.074044	D(LCSPOT(-1))	-0.028108	0.045975
	(0.02045)	(0.02164)		(0.02448)	(0.02116)
	[-2.83671]	[3.42158]		[-1.14810]	[2.17316]
D(FCSPOT(-2))	-0.049161	-0.011974	D(LCSPOT(-2))	-0.003819	0.028366
	(0.02054)	(0.02173)		(0.02450)	(0.02117)
	[-2.39389]	[-0.55111]		[-0.15591]	[1.34000]
C	0.001506	0.004093	C	0.003902	0.005906
	(0.02030)	(0.02148)		(0.02042)	(0.01765)
	[0.07421]	[0.19059]		[0.19108]	[0.33466]
R-squared	**0.054089**	**0.006771**	**R-squared**	**0.012595**	**0.005470**
Adj. R-squared	**0.051982**	**0.004558**	**Adj. R-squared**	**0.010383**	**0.003242**

As stated by Engle and Granger (1987), the error correction term S_{t-i} means a deviation from the long-run co-integrated equilibrium in the last period. This model interprets that the change in the spot-prices series (S_t) and the futures-prices series (F_t) was due to short-run effects from past ΔS_t and ΔF_t, and to the adjustment of the long-run equilibrium. The final results of the vector-error correction estimates were listed in Table 4. As seen in Table 4, the rejection of the null hypothesis of no VECM indicates that the spot and futures prices series of feeder cattle and live cattle have a cointegrated relationship.

CONCLUSIONS AND IMPLICATIONS

In this paper, an attempt was made to investigate the price discovery mechanisms in the feeder cattle and live cattle markets. Both these markets were found to respond favourably to the mechanism and act in a similar way. The futures and spot prices appeared to be non stationary for these commodities. The evidence obtained supports the fact that the forward pricing role may serve price discovery on commodity markets (Black, 1976; Peck, 1985). Consistent with this finding, in this study also the selected futures markets share and provide certain long-run price information to cash markets for both non storable commodities during the sample periods. The findings disagree somewhat with the prevalent suspicion that a price discovery function would not work at all for non storable commodities because of the lack of storage. However, it also cautions against the naive use of futures prices as expected cash prices for most livestock commodities. In sum it can be concluded that both of these markets share long run equilibrium and they have cointegrated relationships.

The study can be useful to the investors, producers and academicians who are very keen in observing the trend of these markets. Since the interests of the investors on the non storable markets are comparatively low when compared to the agricultural products, research contribution to the price discovery mechanisms on these markets can help in extending its market boundaries. At the same time, it is suggested that in future, the study can still be extended as the comparison between some of the storable assets and the non storable assets so that a clear understanding on whether asset storability impacts price discovery can be empirically proven.

REFERENCES

1. Bessler, D.A., & Covey, T. (1991), “Cointegration. Some Results on U.S. Cattle Prices,” *Journal of Futures Markets*, Vol. 11, pp. 461-474.
2. Black, F. (1976), “The Pricing of Commodity Contracts,” *Journal of Financial Economics*, Vol. 3, pp. 167-179.
3. Engle, R.F., & Granger, C.W.J. (1987), “Cointegration, and Error Correction. Representation, Estimation and Testing,” *Econometrica,* Vol. 55, pp. 251-76.
4. Garbade, K.D., & Silber, W.L. (1983), “Price Movements and Price Discovery in Futures and Cash Markets,” *Review of Economics and Statistics*, Vol. 65, pp. 289-297.
5. Geweke, J., 1982, “Measurement of Linear Dependence and Feedback between Multiple Time Series,” *Journal of American Statistical Association*, Vol. 76, pp. 363-73.
6. Gonzalo, J. (1994), “Five Alternative Methods of Estimating Long-Run Equilibrium Relationships,” *Journal of Econometrics*, Vol. 60, pp. 203-233.
7. Granger, C. (1986), “Developments in the Study of cointegrated Variables,” Oxford *Bulletin of Economics and Statistics*, Vol. 48, pp. 213-227.
8. Johansen, S. (1988), “Statistical analysis of cointegration vectors,” *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231–254.
9. Johansen, S. (1991), “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models,” *Econometrica,* Vol. 59, pp. 1551-80.
10. Koontz, S.R., J.N. Trapp, and S.E. Meyer. "An Inverse Demand Model of Weekly Boxed Beef Prices." Proceedings of the NCR-134 Conference on *Applied Commodity Price Analysis, Forecasting, and Market Risk Management*, ed. B.W. Brorsen, p. 144-54. Stillwater, OK: Oklahoma State University, April 1990.
11. Lee, T., & Tse, Y. (1996), “Cointegration Tests with Conditional Heteroscedasticity,” *Journal Econometrics*, Vol. 73, pp. 401-410.
12. Leuthold, R. (1974), “The Price Performance on the Futures Market of a Non-storable Commodity,” *American Journal of Agricultural Economics*, Vol. 56, pp. 271-136.
13. Oellermann, C.M., B. W. Brorsen., and P. L. Farris (1989), “Price discovery for feeder cattle,” *The Journal of Futures Markets*, Vol. 9, pp. 113-121.
14. Peck, A.E. (1985), “The Economic Role of Traditional Commodity Futures Markets,”. In *Futures Markets: Their Economic Roles*, A.E. Peck, ed., American Enterprise Institute for Public Policy Research, Washington.
15. Purcell, W.D., & Hudson, M.A. (1985), “The Economic Roles and Implications of Trade in Livestock Futures,”. In *Futures Markets: Regulatory Issues*, A.E. Peck, ed., American Enterprise Institute for Public Policy Research, Washington.
16. Schroeder, T.C., & Goodwin, B.K. (1991), “Price Discovery and Cointegration for Live Hogs,” *Journal of Futures Markets*, Vol. 11, pp. 685-696.
17. Stein, J.L. (1961), “The simultaneous determination of spot and future prices,” *The American Economic Review*, Vol. 51, pp. 1012-1025.
18. Thomsen, F.L. and R.J. Foote. (1952), “*Agricultural Prices*”, 2nd ed. McGraw-Hill, New York, NY.

REQUEST FOR FEEDBACK

Esteemed & Most Respected Reader,

At the very outset, International Journal of Research in Commerce and Management (IJRCM) appreciates your efforts in showing interest in our present issue under your kind perusal.

I would like to take this opportunity to request to your good self to supply your critical comments & suggestions about the material published in this issue as well as on the journal as a whole, on our E-mails i.e. **info@ijrcm.org.in** or **infoijrcm@gmail.com** for further improvements in the interest of research.

If your good-self have any queries please feel free to contact us on our E-mail **infoijrcm@gmail.com**.

Hoping an appropriate consideration.

With sincere regards

Thanking you profoundly

Academically yours

Sd/-

Co-ordinator