Market Efficiency of Hessian Cloth and Sacking Bags' Transferable Specific Delivery Contract transactions in a Regional Commodity Exchange in West Bengal, India

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Abstract

The price stabilization function of the commodity futures market is conditioned upon the efficiency of the market. An attempt has been made in this paper to test the efficiency of the hessian cloth and sacking bags' contracts transactions in the East India Jute and Hessian Commodity Exchange - the oldest commodity-specific regional exchange in India - so as to gauge its contribution in the economically significant roles of price stabilization and price discovery in the underlying commodity spot market. Empirical results, based on the Johansen cointegration test, suggested that most of the hessian and sacking bags' contracts were inefficient in the long run. In the short run, the sacking bags' forward market exhibited short-run inefficiencies and pricing biases. However, large positive deviations from the co-integrating relation between the forward and spot prices of hessian cloth contracts were significantly corrected in the following period in the forward market. Therefore, the paper concludes, hessian forward contracts are relatively more efficient as compared to sacking bags' contracts.

Keywords: Market efficiency, East India Jute and Hessian Commodity Exchange, Hessian, Sacking, Cointegration test, Vector Error Correction.

JEL classification: C58, G13, G14, P22.

INTRODUCTION

In recent times, fluctuations in spot prices of essential agricultural commodities has sparked a lot of attention in the commodity derivatives market as investors seek to hedge the price risk in the spot market. Hedging is the practice of off-setting the price risk inherent in any cash market position by taking an equal but opposite position in the futures market (Easwaran & Ramasundaram, 2008). Hedging in futures market generally exercises a stabilizing influence on spot prices by reducing the amplitude of short term fluctuations. Available empirical evidence suggests that the introduction of futures transactions in seasonally produced and storable commodities has a favorable impact on stabilization of production; thereby

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smoothing out the oscillations in seasonal spot prices (Gilbert, 1989; Singh, 2007). However, the success of these markets in performing the stabilizing function critically depends on whether they are "efficient" (Fama, 1970). If the markets are efficient there exists a co-movement between the spot and futures (or forward) prices, and thus the extent of fluctuations in both spot and derivatives markets remains roughly the same, for storable commodities and indeed, for any underlying assets. (Lokare, 2007).

India is the largest producer of jute accounting for about 60 per cent of the world's output. Though the cultivation of jute is confined to the eastern region, West Bengal and Bihar states are the largest producers. They have consistently accounted for over 50 percent of total jute output in the nation – a venture which provides a means of livelihood to over 4 million families. Jute products like hessian cloth and sacking bags[3] are classified as continuous storage goods. Stocks of such products can be held throughout the year, even though production of raw jute may be discontinuous (i.e., seasonal). In reality, the jute market is often characterized by a "dual price system" – a system under which different prices for the same commodities exist. Often the market is guided by virtue of the existence of different price systems: spot prices, forward prices, futures prices and government administered minimum support prices. However, cultivators face price volatility in the raw jute market. In this scenario, it is expected that only trading of derivative instruments can protect farmers by providing useful price signals through the price discovery mechanism. The Commission for Agricultural Cost and Prices (CACP) has suggested that the minimum support price should provide the floor price, and futures trading should be utilized to hedge the risk of price volatility for prices above the minimum support price. On the other hand, during times of raw jute scarcity, it is expected that prices would be moderated to protect mill owners. Thus, it is envisaged that trading of futures contracts plays a pivotal role in bridging the gap between farmers and industry and thereby meeting needs at both ends.

In an emerging economy like India, the growth of commodity futures market would ordinarily depend on the efficiency of the market. However, besides some favorable impacts, several stakeholders have given different views that the market is not serving the proper purpose. Rather, they say, it has witnessed increased speculation and unbridled trading in futures, causing a cascading impact on the uptrend of jute prices (CACP, 2011). However, existing empirical evidence suggests that the derivatives market has indeed reduced the price volatility for storable commodities, like hessian (Singh, 2007). The futures market enables the production of hessian by facilitating an inventory of the primary, but seasonal, input in the manufacture of hessian and sacking products - jute. The stock holding of jute helps in stabilizing the spot price of hessian products. However, this can be possible only if the hessian futures market is efficient. This paper yielded some empirical evidence which indicated the presence of cointegration between the spot and futures prices of hessian at the East India Jute and Hessian Commodity Exchange (referred to as the EIJHE henceforth). It therefore suggests a significant degree of efficiency of the hessian futures market and

[3] Hessian and sacking bags are jute products. Hessian is a woven fabric usually made from skin of the jute, while a sacking bag, also known as a "gunny sack," is an inexpensive bag made of hessian usually formed from jute or other natural fibers. The demand for hessian is somewhat elastic because of foreign competition and availability of substitute goods. It is facing tough competition from cheaper polypropylene products (Singh, 2007).

contrasts Naik & Jain (2002) who concluded that the hessian futures market at the EIJHE had substantial evidence of inefficiency.

In this context, one question that largely remains unsettled in academic and policy discussions is: are the transactions of hessian and sacking products at the EIJHE efficient? To provide an empirical answer to the research question, an attempt has been made in this paper to test the weak form of efficiency of the hessian and sacking transactions in the EIJHE. The remaining part of the paper is organized as follows: The next section reviews existing literature on the efficiency of the commodity derivatives market. This is followed by the section on data and methodology, which provides an analysis of the data sources and the methodology of the study. The section on results and discussion presents empirical results pertaining efficiency at the EIJHE, and finally; concluding remarks and policy implications are outlined in the last section.

REVIEW OF LITERATURE

In existing theoretical literature, an efficient market is characterized as one in which the spot market "fully reflects" the available information and no one can consistently make abnormal profits. In such a market also, the spot prices at delivery cannot be known beforehand, eliminating the possibility of guaranteed profits (Sahi & Raizada, 2006). Fama (1991) classified market efficiency into three variant forms - weak, semi-strong and strong. In a weakly efficient market, the current prices of securities already fully reflect all the information that is contained in the historical sequence of prices. The semi-strong form of the efficient market hypothesis holds that current prices of securities not only reflect all informational content of historical prices but also reflect all publicly available knowledge. The strong form of the efficient market hypothesis maintains that not only is publicly available information useless, but all information is useless to the investor in that it cannot help him make abnormal gains in the market (Fisher & Jordan, 2008). The weak form of market efficiency relies on the historical sequence of prices and is the form of efficiency which is most commonly tested in the literature (Chowdhury, 1991).

Empirical research pertaining testing for efficiency of the securities market has been carried out in several countries, including India (Sharma & Robert, 1977; Barua, 1981; Barman & Madhusoodhan, 1991; Poshakwale, 1996; Ahmad et. al., 2006), However, not much research has been done on the efficiency of commodity markets globally and particularly in India. Some past studies which have tested the efficiency of futures markets include Aulton et al, (1997) on the UK agricultural commodities, McKenzie & Holt, (2002) on the Chicago Board of Trade and Chicago Mercantile Exchange, Viljoen, (2003) on the JSE Securities Exchange, and Wang & Ke, (2005) & Xin et al, (2006) on the Chinese Commodity Futures Market. In the context of India, some attempts have been made to test market efficiency by considering agricultural commodities transacted in well known national commodity exchanges[4]. They include: Sahadevan, (2002); Lokare, (2007); Easwaran &

[4] Presently, there is a two-tier structure for commodity exchanges in India: regional and country-wise national commodity exchanges. Six country-wide national exchanges (MCX, NCDEX, NMCE, ICX, ACE, and UCX) are organized as multi-commodity electronic exchanges with a demutualised ownership pattern. In addition, presently 13 commodity specific regional exchanges are permitted to have only a limited number of contracts, which are approved by the FMC. East India Jute and Hessian Commodity Exchange (EIJHE) can be considered as the oldest commodity exchange ever operating in India.

Ramasundaram, (2008); Sahoo & Kumar, (2009); Kaur & Rao, (2010); Viswanathan & Pillai, (2010); and Inoue & Hamori, (2012).

In some of the India-specific studies, empirical results reveal that many of the commodity futures exchanges fail to provide an efficient hedge against the risk emerging from price volatility of many farm products (Sahadevan, 2002; Easwaran & Ramasundaram, 2008; Kaur & Rao, 2010). Some of the factors attributed by these studies to the inefficient functioning of futures markets are identified as: infrequent trading, lack of effective participation of trading members, non-awareness of futures markets by farmers, poor development of spot markets, poor physical delivery in many commodity markets, absence of well-developed grading and standardization systems, and market imperfections (Easwaran & Ramasundaram, 2008). On the other hand, some studies have empirical support to validate the notion of market efficiency in the operation of nationalized commodity exchanges in India. (Lokare, 2007; Sahoo & Kumar, 2009; Inoue & Hamori, 2012). Lokare (2007) argued that futures markets are marching in the desired direction of achieving improved operational efficiency, albeit, at a slower pace. Sahoo & Kumar (2009) suggested that the transactions of five selected commodities (gold, copper, petroleum crude, soya oil and chana) in the nationalized commodity futures markets are efficient. Ballabh et al (2010) reiterated that to ensure efficiency of futures market, there must exist an efficient spot market because both markets play an equally important role from a policy perspective.

So far, only a few attempts have been made in testing the efficiency of the operation of commodity-specific regional exchanges in India. In an important contribution to the literature, Naik & Jain (2002) examined the performance of futures markets of pepper traded in Kochi, castor seed traded in Ahmedabad and Mumbai, gur traded in Hapur and Muzaffarnagar, potato traded in Hapur, turmeric traded in Sangli and hessian traded in Kolkata. On the EIJHE, located at Kolkata, empirical evidence in the paper suggested that there is no cointegration between the spot and futures prices in the maturity month for hessian futures contracts. Results of efficiency and lack of bias provided substantial evidence of inefficiency in hessian futures market. Singh (2007) examined the role of the hessian futures market in stabilization of spot prices and thereby in the reduction of volatility in cash prices. Using data on cash price volatility before and after the introduction of futures trading of hessian (over the 1988-1992 and the 1993-1997 periods), empirical results based on volatility measures suggested that the cash price volatility was less pronounced after 1992, when futures trading commenced. Econometric results based on the Ordinary Least Squares methodology provided more empirical support to the conclusion that volatility in the second period (1993-97) was lesser than in the first period (1988-92). Evidence presented in the paper pointed to the presence of cointegration between the spot and futures prices, which is consistent with market efficiency. The study, thus, advocated for reintroduction of futures trading in hessian to reduce uncertainty in agricultural markets. From the foregoing review of literature, it is clear that a deep understanding of a commodity exchange is required to assess implications of commodity trading in the exchange on risk hedging, price discovery, efficiency and price volatility. However, only two studies (Naik & Jain, 2002; Singh, 2007) have been undertaken so far to test the efficiency of the hessian futures market at the EIJHE, while testing of efficiency in sacking futures market had, prior to the current study, remained

unexplored. The up-to-date status of the present study is further underscored by the fact that data used in both prior studies is from the last two decades of the twentieth century.

A serious threat to the existence of the EIJHE occurred in 2004. Some members of the exchange complained to the Forward Market Commission (FMC), the regulatory authority of the futures market in India, about an alleged takeover bid in the November 2003 delivery. Consequently, FMC suspended hessian trading on the exchange after the February 2004 delivery. It also cleared the jute futures trading proposals of two rival exchanges: the Multi Commodity Exchange of India Ltd (MCX) and the National Commodity and Derivatives Exchange Ltd (NCDEX). In the 2004, MCX and the NCDEX started trading in raw jute, which led to an exodus of traders from the EIJHE. FMC granted formal authorization to EIJHE to conduct futures trading in raw jute on April 7, 2006. Accordingly, the EIJHE made necessary changes in its raw jute trading by-laws to get the permission. Further, the FMC made physical delivery mandatory. This development provided an incentive to ring members who had left to come back to the exchange (Mondal, 2006, May 25). However, the 51st annual general meeting of the EIJHE in 2008 ended on a sad note as efforts to revive the age-old institution appeared to have failed (BS Reporter, 2008, October 3).

The recognition of the EIJHE came to a halt in 2012 and no transferable specific delivery (TSD) contracts or hedging contracts were transacted after January 2012. This development has greatly undermined the salient economic role that the exchange has been playing as far as the underlying jute spot market is concerned. This paper therefore focuses on testing whether the transactions of hessian and sacking products in the years 2008 - 2012 were efficient and the causes of inefficiency if the aforementioned derivatives transactions were actually not efficient.

DATA SOURCE AND METHODOLOGY OF THE STUDY

This study mainly relied on secondary data obtained from the Annual Reports of the EIJHE. It covered the 2008-09 and 2011-12 time periods[5]. The reports provided information on the daily closing quotations for transferable specific delivery (TSD) contracts[6] in hessian and sacking products. 41 forward contracts, each for hessian and sacking products, were considered in the study. Among the wide range of hessian cloths and sacking products traded in the EIJHE[7], the benchmark indicators of hessian cloth (101.5 cm x 213 gm / m2 per 100 meters) and of sacking bags (L twills 112 cm x 67.5 cm x 1135 gm per 100 bags), as

[5] The recognition of the EIJHE was come to a halt in the year 2012. No transferable specific delivery (TSD) or hedging contract was taken place after January 2012. In the annual report of 2012-13 of the exchange it was documented that: "The exchange did not receive the order from the Ministry of Consumer Affairs, Government of India, to be considered as a recognized commodity exchange under F.C [R] Act. Hence, forward trading through T.S.D contracts or futures trading through hedge contracts became prohibited and could not be conducted and monitored by the exchange under the aegis and permission of the Forward Markets Commission for the year 2012-13".

[6] TDS contracts, though freely transferable from one party to another, are concerned with a specific and pre-determined consignment or variety of the commodity. Delivery, of the agreed variety, is mandatory (Somanathan, 1999, pp.12).

[7] EIJHE usually published the daily closing quotations of the different specifications of hessian cloth (101.5 cm x 183 gm / m2 per tone, 101.5 cm x 213 gm / m2 per 100 meters, 101.5 cm x 248 gm / m2 per tone, 101.5 cm x 270 gm / m2 per tone, 101.5 cm x 305 gm / m2 per 100 meters) and sacking bags (B twills 94 cm x 57 cm x 665 gm per 100 bags, B twills 112 cm x 67.5 cm x 907 gm per 100 bags, B twills 112 cm x 67.5 cm x 1020 gm per 100 bags, L twills 112 cm x 67.5 cm x 1135 gm per 100 bags, A twills 112 cm x 67.5 cm x 1200 gm per 100 bags, Sugar Bag: Type A 87.5 cm x 58 cm x 630 gm per 100 bags, Sugar Bag: Type B 91.5 cm x 56 cm x 475 gm per 100 bags).

specified by the exchange, were selected and their spot and forward prices were extracted. Forward contracts were not homogeneous since the contract cycle varied from one to six months (Table 1). Due to the heterogeneous nature of the contracts, it was not possible to construct a pooled forward price series using the roll over process. As such, contract wise data did not overlap, and intuitively, the methodological problems associated with overlapping of data were avoided[8]. Presentation of results also followed a contract-wise format[9].

TABLE 1
List of Hessian and Sacking TSD Contracts

Contract Month	Expiry Month	Starting date	Expiry date	Obs.	Forward
May 2008	July 2008	17.05.08	31.07.08	63	2 months
	August 2008	17.05.08	30.08.08	86	3 months
	September 2008	17.05.08	30.09.08	112	4 months
August 2008	October 2008	27.08.08	31.10.08	50	2 months
	November 2008	27.08.08	29.11.08	74	3 months
	December 2008	27.08.08	31.12.08	85	4 months
October 2008	January 2009	21.10.08	30.01.09	67	3 months
	February 2009	21.10.08	28.02.09	91	4 months
	March 2009	21.10.08	31.03.09	115	5 months
January 2009	April 2009	27.01.09	30.04.09	74	3 months
	May 2009	27.01.09	30.05.09	98	4 months
	June 2009	27.01.09	30.06.09	124	5 months
June 2009	July 2009	19.06.09	31.07.09	36	1 month
	August 2009	19.06.09	31.08.09	59	2 months
	September 2009	19.06.09	30.09.08	80	3 months
July 2009	October 2009	22.07.09	31.10.09	77	3 months
	November 2009	22.07.09	30.11.09	100	4 months
	December 2009	22.07.09	12.12.09	111	4 months
October 2009	January 2009	23.10.09	12.12.09	42	1 month
	February 2010	23.10.09	26.02.10	53	4 months
	March 2010	23.10.09	31.03.10	80	5 months
February 2010	April 2010	15.02.10	30.04.10	60	2 months
	May 2010	15.02.10	31.05.10	85	3 months
	June 2010	15.02.10	30.06.10	111	4 months
May 2010	July 2010	11.05.10	31.07.10	70	2 months
	August 2010	11.05.10	31.08.10	96	3 months
	September 2010	11.05.10	30.09.10	119	4 months
August 2010	October 2010	07.08.10	30.10.10	64	2 months
	November 2010	07.08.10	30.11.10	87	3 months
	December 2010	07.08.10	31.12.10	112	4 months
October 2010	January 2011	09.10.10	31.01.11	88	3 months
	February 2011	09.10.10	28.02.11	110	4 months
	March 2011	09.10.10	31.03.11	136	5 months
December 2010	April 2011	10.12.10	30.04.11	112	4 months

[8] A word of caution was sounded by Lai & Lai (1991) that data of different contracts should not overlap as the time series analysis will suffer from autocorrelation problems because of informational overlap and the results will be questionable.

[9] A similar contract-wise representation of the results is followed in Naik & Jain (2002), Lokare (2007), Sendhil et al (2013).

	May 2011	10.12.10	31.05.11	138	5 months
	June 2011	10.12.10	30.06.11	164	6 months
May 2011	July 2011	06.05.11	30.07.11	74	2 months
	August 2011	06.05.11	30.08.11	97	3 months
	September 2011	06.05.11	30.09.11	122	4 months
October 2011	November 2011	12.10.11	30.11.11	40	1 month
	December 2011	12.10.11	31.12.11	66	2 months

The conventional ordinary least square method of testing the efficiency of the futures market is inadequate if data are non-stationary and integrated of order say, one, i.e. AR (1) (Chowdhury, 1991). Therefore, the study employed the non-parametric runs test to check the randomness of the successive price changes of hessian and sacking products. In the runs test, the number of runs is actually the number of consecutive sequences which bear the same sign. The actual number of runs observed is then compared with the expected number of runs - computed from a series of randomly generated price changes. When the expected number of runs is significantly different from the observed number of runs, the test rejects, at a given level of significance, the null hypothesis of randomness of the price series (Fisher & Jordan, 2008).

Co-integration is a relatively new statistical concept in market efficiency testing; it was pioneered by Engle & Granger (1987). Evidence of cointegration between non-stationary spot and futures prices indicates that there is a stable long run relationship between them. It establishes that information is transmitted between futures prices and spot prices adequately and this leads to efficient price discovery. Therefore, cointegration between two non-stationary time series is a necessary condition for market efficiency (Aulton et al, 1991; Chowdhury, 1991). In the study, a two-step procedure of testing for efficiency was applied. First, we tested for the presence of co-integration in the long run and then we tested whether the futures price at contract purchase was an unbiased predictor of the spot price at contract termination (Viljoen, 2003).

Co-integration between spot and forward prices requires that both price series are non-stationary in same level form. In other words, the test procedure is dependent on whether the underlying price series are stationary or not. The Augmented Dickey Fuller (ADF) test is used to test the stationary of the price series. The ADF test is applied to the following model:

$$\Delta P_t = \alpha_0 + \gamma P_{t-1} + \sum_{i=1}^{n} \beta_i \Delta P_{t-i} + \varepsilon_t \quad \text{----------(1)}$$

where ΔP_t = change in the value of P (i.e., $P_t - P_{t-1}$) and ε_t = white noise error term. In the model formulation, the unit root test is carried out under the null hypothesis that γ =1 against the alternative hypothesis of γ <1. In the test procedure, at first, the value of test statistic $\tau = (\hat{\gamma} - 1) / SE(\hat{\gamma})$. is computed, and then the calculated value is compared to the relevant critical value for the Dickey-Fuller test. If the test statistic is more than the critical value then the null hypothesis of γ =1 is rejected and the series is deemed stationary.

Often, it has been seen that the original price series is non-stationary in level form. Differencing the data makes the price series stationary. However, differencing the data has the attendant disadvantage of perpetuating the losing of information about underlying long run relationships between prices (Lokare, 2007). Thus, its spot and forward prices in level

form which are considered in testing for the possibility of the existence of long run relationships between the prices. The Johansen co-integration test is performed to evaluate the presence of a long term relationship between the spot and forward prices. When two price variables are co-integrated, they tend to move together in a close fashion over time and they never drift too far apart in the long run. The existence of a linear combination of non-stationary price series is considered as supportive evidence of market efficiency and thereby, it actually reflects improved transmission of information in both the physical and derivative markets. In the presence of such information transmission mechanism, the market would ensure operational efficiency since forward prices could be derived from the spot prices and current forward prices could provide forecasts of the future spot price.

The study implemented a Vector Auto Regression (VAR) based co-integration test by using the methodology developed by Johansen (1988, 1995). Johansen's method is used to test the restrictions imposed by co-integration on the unrestricted VAR involving the series. The estimation procedure used in the Johansen cointegration test is based on the error-correction representation of the VAR model with Gaussian errors. However, the co-integration test is sensitive to the choice of the length of lag in the system. The length of lag at which the estimated values of information criterion (Akaike Information criteria, Schwarz Bayesian criterion and Hannan-Quinn criterion) are smallest is chosen for carrying out the co-integration test.

Testing of unbiasedness is an integral part in testing for market efficiency. It essentially involves testing whether the forward price at contract purchase is an unbiased predictor of the spot price at contract termination. To test this proposition, the spot price at maturity ($P_{s,t}$) is regressed on the forward price at some time prior to maturity ($P_{F,t-1}$):

$$P_{s,t} = a + bP_{F,t-1} + u_t \quad \text{----------(2)}$$

The conditions of market efficiency and unbiasedness are implied by the restrictions, a=0 and b=1. Rejection of the restrictions imposed to the parameters 'a' and 'b' means that either the market is inefficient or a non-zero risk premium ($a \neq 0$) exists in the forward market.

When spot and futures prices for a commodity are non-stationary, the existence of a cointegrating relationship between the two is a necessary but not a sufficient condition for short-run market efficiency and unbiasedness (McKenzie & Holt, 2002). If the relationship between spot and futures prices exists in the long run, then it can be said that there is an error correction representation which indicates short run responsiveness of all the underlying factors (Engle & Granger, 1987). In the Vector Error Correction (VEC) specification, the error correction term is incorporated to show how the deviation from long run equilibrium is corrected gradually through a series of partial short-run adjustments. In such specification, the error correction term provides an estimate of the speed of adjustment. Here, the residuals of the multivariate co-integrating regressions are included as explanatory variables.

The empirical specification of the error correction mechanism can be written as:

$$\Delta P_{s,t} = -\rho u_{t-1} + \beta \Delta P_{F,t-1} + \sum_{i=1}^{m} \beta_i \Delta P_{F,t-1} + \sum_{j=1}^{k} \psi_j \Delta P_{s,t-j} + v_t \quad \text{----------(3)}$$

Where: Δ is a first difference operator, u_{t-1} is the error correction term and v_t is a stationary white-noise residual term. Co-integration implies $\rho > 0$ because spot price changes respond to deviations from long-run equilibrium (McKenzie & Holt, 2002).

EMPIRICAL RESULTS AND DISCUSSION

Test of Stationary

It is usually held that the spot and forward prices of hessian cloth and sacking bags are non-stationary in level form. To test this proposition, the Augmented Dickey Fuller (A.D.F) test was employed in the study. The results of this test are presented in Appendix A. The empirical results of the A.D.F test suggested that none of the price series were stationary in level form. The series became stationary after the first differencing i.e. price returns were found to be stationary. To arrive at this conclusion, the A.D.F test statistic was compared with Mac Kinnon critical values. Though Mc Kinnon critical values are given at 1 percent, 5 percent and 10 percent level of significance, for simplicity purposes, we used the Mac Kinnon critical value at 10 percent level of significance in our comparison.

Runs Test

Empirical results of the Runs Test are presented in Table 2. In the test procedure, the median was used as the test statistic. From the table, it is evident that the values of the Z test statistic were negative and statistically significant at 1 percent level. The significant negative Z value for spot and forward prices indicated that the actual number of runs fell short of the expected number of runs. Thus the results rejected the null hypothesis that the contract prices follow a random walk at 1 percent level of significance. The negative Z values for prices also indicated positive autocorrelation. This suggests that the individual series of spot and forward prices were non-random and thereby implying that the spot and forward markets in hessian cloth and sacking bags were inefficient in the weak sense. They further suggest that in the futures exchange, past prices' information was not effectively absorbed in subsequent days' prices.

TABLE 2
Results of the Runs Test for Hessian and Sacking

Contract	F/S	Runs	Z [a]	Contract	Runs	Z [a]	Contract	Runs	Z [a]
Hessian									
July 2008	F	4	-7.19	Sep 2009	3	-8.55	Nov 2010	4	-8.73
	S	2	-7.74		3	-8.55		4	-8.73
Aug 2008	F	4	-8.68	Oct 2009	2	-8.6	Dec 2010	5	-9.83
	S	4	-8.68		2	-8.6		5	-9.83
Sep 2008	F	6	-9.68	Nov 2009	4	-9.45	Jan 2011	5	-8.58
	S	4	-10.06		4	-9.45		5	-8.58
Oct 2008	F	5	-5.88	Dec 2009	4	-10.01	Feb 2011	4	-9.71
	S	7	-5.42		4	-10.01		4	-9.71
Nov 2008	F	3	-8.19	Jan 2010	2	-6.05	Mar 2011	4	-11.15
	S	8	-6.67		2	-6.05		4	-11.15
Dec 2008	F	4	-8.62	Feb 2010	2	-7.07	Apr 2011	5	-9.77
	S	8	-7.25		2	-7.07		5	-9.77
Jan	F	3	-7.75	Mar	2	-8.75	May	6	-10.92

2009	S	3	-7.75	2010	2	-8.77	2011	6	-10.92
Feb 2009	F	8	-8.11	Apr 2010	9	-5.73	June 2011	6	-12.06
	S	8	-8.11		5	-6.73		6	-12.06
Mar 2009	F	6	-9.81	May 2010	11	-6.98	July 2011	2	-8.43
	S	8	-9.38		5	-8.4		2	-8.43
Apr 2009	F	4	-7.95	June 2010	7	-9.43	Aug 2011	3	-9.49
	S	4	-7.95		7	-9.44		2	-9.7
May 2009	F	4	-9.33	July 2010	2	-8.19	Sep 2011	3	-10.71
	S	4	-9.33		2	-8.19		3	-10.7
June 2009	F	4	-10.64	Aug 2010	3	-9.44	Nov 2011	3	-5.39
	S	4	-10.64		3	-9.44		3	-5.39
July 2009	F	2	-5.58	Sep 2010	3	-10.59	Dec 2011	5	-7.19
	S	2	-5.58		5	-10.22		5	-7.19
Aug 2009	F	2	-7.48	Oct 2010	2	-7.81			
	S	2	-7.48		2	-7.81			
Sacking									
July 2008	F	6	-6.72	Sep 2009	3	-8.47	Nov 2010	2	-9.16
	S	5	-6.96		3	-8.47		2	-9.16
Aug 2008	F	10	-7.32	Oct 2009	4	-8.14	Dec 2010	6	-9.64
	S	7	-8.01		4	-8.14		4	-10.04
Sep 2008	F	6	-9.68	Nov 2009	2	-9.84	Jan 2011	4	-8.78
	S	7	-9.4		2	-9.84		4	-8.78
Oct 2008	F	7	-5.42	Dec 2009	4	-10.01	Feb 2011	6	-9.56
	S	2	-6.83		4	-10.01		6	-9.57
Nov 2008	F	8	-6.99	Jan 2010	2	-5.99	Mar 2011	7	-10.66
	S	6	-7.47		2	-5.99		7	-10.67
Dec 2008	F	6	-7.95	Feb 2010	2	-7.07	Apr 2011	4	-10.05
	S	4	-8.62		2	-7.07		4	-10.05
Jan 2009	F	4	-7.51	Mar 2010	3	-8.55	May 2011	2	-11.61
	S	2	-7.99		5	-8.10		2	-11.61
Feb 2009	F	5	-8.74	Apr 2010	2	-7.54	June 2011	4	-12.37
	S	4	-8.95		2	-7.55		4	-12.37
Mar 2009	F	6	-9.82	May 2010	5	-8.39	July 2011	2	-8.42
	S	4	-10.20		3	-8.83		2	-8.42
Apr 2009	F	5	-7.77	June 2010	6	-9.60	Aug 2011	3	-9.46
	S	5	-7.77		4	-10.00		3	-9.46
May 2009	F	6	-8.97	July 2010	3	-7.94	Sep 2011	3	-10.66
	S	6	-8.97		3	-7.94		3	-10.66
June 2009	F	4	-10.67	Aug 2010	4	-9.23	Nov 2011	1[c]	-----
	S	4	-10.67		4	-9.23		1[c]	-----
July 2009	F	5	-4.54	Sep 2010	4	-10.38	Dec 2011	5	-7.18
	S	5	-4.54		4	-10.38		5	-7.19
Aug 2009	F	4	-6.95	Oct 2010	2	-7.81			
	S	4	-6.95		2	-7.81			

Source: Authors' calculation based on Annual reports of EIJHE (Various years)

Note: (1) a. Median

(2) b. All values are greater than or less than the cutoff. Runs Test cannot be performed.

(3) c. Only one run occurs. Runs Test cannot be performed.

Johansen Co-integration Test

The co-integration test was used to examine the presence of a long run relationship between the spot and forward prices of hessian and sacking products transacted in the EIJHE. The test

procedure was crucially dependent on the number of lag terms included. For the purpose of the choice of length of lag, the trial and error method was used[10]. The model which had minimum estimated values of information criterion like the Akaike information criteria, the Schwarz Bayesian criteria and the Hannan - Quinn criteria was selected. We carried out Vector Auto Regression (VAR) analysis repeatedly starting with 1-1 up to 1-5; where 1-i (i =1, 2…5) specifies a model involving a regression of the first difference on lag i of the first difference. After a suitable lag selection, the results of the Johansen method of co-integration in hessian cloth and sacking bags were presented in tables 3 and 4.

TABLE 3
Co-integration Results for Hessian Cloth

Contract	Trace Statistics	Prob.**	Hypothesized No. of CE(s)	Contract	Trace Statistics	Prob.**	Hypothesized No. of CE(s)
July 2008	21.72714	0.0050	None *	April 2010	11.66467	0.1737	None
	0.907632	0.3407	At most 1		3.169490	0.0750	At most 1
August 2008	36.34583	0.0000	None *	May 2010	13.89607	0.0858	None
	0.796610	0.3721	At most 1		2.335159	0.1265	At most 1
September 2008	41.34766	0.0000	None *	June 2010	20.55392	0.0079	None *
	1.255930	0.2624	At most 1		4.461055	0.0347	At most 1*
October 2008	7.443042	0.5267	None	July 2010	19.33774	0.0125	None *
	1.792755	0.1806	At most 1		0.705891	0.4008	At most 1
November 2008	8.944218	0.3706	None	August 2010	24.38742	0.0018	None *
	1.153815	0.2828	At most 1		1.270841	0.2596	At most 1
December 2008	6.333403	0.6561	None	September 2010	23.29621	0.0027	None *
	0.706291	0.4007	At most 1		0.117862	0.7314	At most 1
January 2009	11.50363	0.1823	None	October 2010	------	------	------
	3.136787	0.0765	At most 1		------	------	------
February 2009	15.80957	0.0448	None *	November 2010	------	------	------
	4.385290	0.0362	At most 1 *		------	------	------
March 2009	14.97146	0.0598	None	December 2010	15.73507	0.0460	None *
	2.227279	0.1356	At most 1		4.407924	0.0358	At most 1 *
April 2009	14.49362	0.0703	None	January 2011	10.67286	0.2324	None
	0.250239	0.6169	At most 1		2.054742	0.1517	At most 1
May 2009	18.97024	0.0143	None *	February 2011	12.78010	0.1231	None
	0.576876	0.4475	At most 1		1.883580	0.1699	At most 1
June 2009	21.95034	0.0046	None *	March 2011	9.684676	0.3058	None
	1.936129	0.1641	At most 1		0.135474	0.7128	At most 1
July 2009	------	------	------	April 2011	20.27065	0.0088	None *
	------	------	------		2.858196	0.0909	At most 1
August 2009	25.96238	0.0009	None *	May 2011	24.63464	0.0016	None *
	1.118792	0.2902	At most 1		3.487047	0.0618	At most 1
September 2009	10.41299	0.2503	None	June 2011	17.38000	0.0257	None *
	1.629619	0.2018	At most 1		2.248764	0.1337	At most 1
October 2009	14.78985	0.0637	None	July 2011	10.22647	0.2637	None
	0.160673	0.6885	At most 1		0.328012	0.5668	At most 1
November 2009	9.831524	0.2939	None	August 2011	13.40546	0.1008	None
	1.395658	0.2375	At most 1		3.735586	0.0533	At most 1
December 2009	8.551213	0.4085	None	September 2011	15.39070	0.0518	None
	0.045566	0.8309	At most 1		4.975944	0.0257	At most 1 *
January	4.809158	0.8288	None	November	22.96092	0.0031	None *

[10] Table relating to the systematic procedure of lag selection is presented in Appendix B.

2009	1.399370	0.2368	At most 1	2011	0.545465	0.4602	At most 1
February 2010	5.192406	0.7881	None	December 2011	37.42221	0.0000	None *
	0.639433	0.4239	At most 1		2.498790	0.1139	At most 1
March 2010	9.804255	0.2961	None				
	3.006892	0.0829	At most 1				

Data Source: Annual reports of EIJHE (Various years)
Note:* denotes rejection of the hypothesis at 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

Summarizing the result over the period of analysis, the study identified the efficient and inefficient transactions of hessian cloth on the basis of the number of the co-integrating equation(s). In hessian cloth contracts, efficiency (i.e., where there was at least one co-integrating equation) was generally achieved in the months of June, July and August, whereas the contracts in January, February and March were found to be inefficient (i.e., there were no-cointegrating equations). The pattern of co-integration suggested that the market becomes efficient after the planting season of raw jute, which generally runs from March to May.

The non-availability of raw jute, used as the input of hessian cloth and sacking bags, during times of its scarcity in planting season resulted in greater participation of stakeholders in the commodity exchange, and thereby enhanced the efficiency of the market. Conversely, availability of raw jute at the exchange during a time of glut, i.e. after September, when jute is normally harvested, yielded inefficiency in the operation of the forward market.

TABLE 4
Co-integration Results for Sacking L-twill Bag

Contract	Trace Statistics	Prob.**	Hypothesized No. of CE(s)	Contract	Trace Statistics	Prob.**	Hypothesized No. of CE(s)
July 2008	34.52417	0.0000	None*	April 2010	4.540866	0.8555	None
	5.204728	0.0225	At most 1*		1.029352	0.3103	At most 1
August 2008	52.48225	0.0000	None *	May 2010	7.934244	0.4725	None
	0.342214	0.5586	At most 1		2.475895	0.1156	At most 1
September 2008	51.10485	0.0000	None *	June 2010	10.19444	0.2661	None
	0.003204	0.9531	At most 1		2.441406	0.1182	At most 1
October 2008	6.659628	0.6175	None	July 2010	------	------	------
	1.794601	0.1804	At most 1		------	------	------
November 2008	6.620344	0.6222	None	August 2010	------	------	------
	0.876834	0.3491	At most 1		------	------	------
December 2008	6.340041	0.6553	None	September 2010	25.63083	0.0011	None *
	0.742663	0.3888	At most 1		0.172092	0.6783	At most 1
January 2009	12.10768	0.1518	None	October 2010	19.08614	0.0137	None *
	1.024969	0.3113	At most 1		7.644111	0.0057	At most 1 *
February 2009	9.837411	0.2934	None	November 2010	9.455722	0.3249	None
	2.113929	0.1460	At most 1		1.476755	0.2243	At most 1
March 2009	11.66674	0.1736	None	December 2010	11.98369	0.1577	None
	2.232335	0.1351	At most 1		3.798922	0.0513	At most 1
April 2009	------	------	------	January 2011	9.315952	0.3370	None
	------	------	------		1.851447	0.1736	At most 1
May 2009	------	------	------	February 2011	9.254125	0.3424	None
	------	------	------		2.622501	0.1054	At most 1
June 2009	------	------	------	March 2011	11.61110	0.1766	None
	------	------	------		3.276564	0.0703	At most 1
July 2009	20.15441	0.0092	None *	April 2011	18.09712	0.0198	None *
	3.822035	0.0506	At most 1		0.634114	0.4258	At most 1
August 2009	3.418348	0.9447	None	May 2011	22.59335	0.0036	None *
	0.214896	0.6430	At most 1		0.787882	0.3747	At most 1
September	8.897773	0.3749	None	June 2011	14.71152	0.0654	None

2009	1.159882	0.2815	At most 1		0.021643	0.8830	At most 1
October 2009	53.78952	0.0000	None*	July 2011	6.477942	0.6390	None
	0.244047	0.6213	At most 1		0.014993	0.9024	At most 1
November 2009	24.85123	0.0015	None *	August 2011	8.622665	0.4014	None
	0.031057	0.8601	At most 1		0.769305	0.3804	At most 1
December 2009	24.87306	0.0015	None *	September 2011	10.74436	0.2277	None
	0.000453	0.9847	At most 1		1.055777	0.3042	At most 1
January 2010	14.37601	0.0732	None	November 2011	23.45430	0.0026	None *
	1.866466	0.1719	At most 1		0.193711	0.6598	At most 1
February 2010	13.24548	0.1061	None	December 2011	------	------	------
	0.091868	0.7618	At most 1		------	------	------
March 2010	13.21225	0.1073	None				
	3.292601	0.0696	At most 1				

Data Source: Annual reports of EIJHE (Various years)
Note:* denotes rejection of the hypothesis at 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

Like in the hessian cloth contracts price series, a systematic pattern of co-integration was also observed for sacking L-twill bags' contracts price series (Table 4). The sacking contracts in January, February and March were generally observed to be inefficient, while efficiency in the transactions of sacking products was experienced in the months of September, October and July. The presence of a large number of inefficient contracts could possibly have created up a possibility of arbitrage in hessian and sacking bag contracts in the long run. In the absence of transmission of information in both spot and forward markets, it would be difficult for a sugar factory, for instance,[11] to predict the future spot price of sugar bags.

While co-integration is a necessary condition for market efficiency, it is not sufficient without testing whether the futures price is an unbiased predictor of the future spot price (Viljoen, 2003). Thus, in the second stage, Johansen likelihood ratio tests of the long run unbiasedness hypothesis on the implied (0,1) restrictions of a and b were carried out only for the 17 hessian contracts (41.46 percent of total hessian contracts) and the 12 sacking contracts (29.27 percent of total sacking bag contracts) which had at least one co-integrating equation. Empirical results suggested that three sacking contracts and six hessian contracts were biased in predicting forward prices in future.

For the remaining contracts (11 hessian contracts and 9 sacking contracts), the null hypothesis (a=0 and b=1) could not be rejected, and therefore, in the absence of time-varying risk premiums, we inferred that the forward prices for hessian and sacking provided unbiased forecasts of future spot prices in the long run (Table 5).

TABLE 5
Johansen tests of Restrictions on the Co-integration Regressions

Contract	CE	LR test statistic	Probability	Remark
Hessian				
Jul-08	1	1.495324	0.221392	Efficient
Aug-08	1	0.35241	0.552752	Efficient
Sep-08	1	0.064423	0.799636	Efficient
Feb-09	2	2.469986	0.116039	Efficient
May-09	1	1.419526	0.233481	Efficient

[11] Sacking L-twill bag is generally used in sugar industry for the purpose of packaging the product.

Jun-09	1	0.310112	0.577611	Efficient
Aug-09	1	0.025981	0.871947	Efficient
Jun-10	2	2.360449	0.124446	Efficient
Jul-10	1	16.05522	0.000062	Inefficient
Aug-10	1	15.5825	0.000079	Inefficient
Sep-10	1	15.12308	0.000101	Inefficient
Dec-10	2	6.773661	0.009251	Inefficient
Apr-11	1	0.480611	0.488145	Efficient
May-11	1	0.427997	0.512973	Efficient
Jun-11	1	1.900677	0.168003	Efficient
Nov-11	1	7.642373	0.005701	Inefficient
Dec-11	1	6.333846	0.011846	Inefficient
Sacking				
Jul-08	2	3.662146	0.055662	Inefficient
Aug-08	1	3.365017	0.066595	Inefficient
Sep-08	1	0.888113	0.345989	Efficient
Jul-09	1	4.95E-05	0.994386	Efficient
Oct-09	1	0.348294	0.55508	Efficient
Nov-09	1	0.277122	0.598594	Efficient
Dec-09	1	0.395884	0.529222	Efficient
Sep-10	1	5.81555	0.015885	Inefficient
Oct-10	2	0.175746	0.675055	Efficient
Apr-11	1	0.09553	0.757262	Efficient
May-11	1	0.093298	0.760025	Efficient
Nov-11	1	0.006185	0.937317	Efficient

Data Source: Annual reports of EIJHE (Various years)

Vector Error Correction (VEC)

In the VEC specification, it is assumed that deviations from the equilibrium relationship between forward and spot prices are corrected at the speed of the coefficient of the error correction term. In hessian, the t-test on these coefficients suggested that the speed of adjustment was significant in the forward price equation but not in the spot price equation[12]. That is, large positive deviations from the co-integrating relation between the forward and spot prices for hessian contracts were significantly corrected in the following period in the forward market and no such corrections were observed in the physical market (Table 6). However, no such empirical evidence of correction in the short run was found in sacking bags' contracts, (Table 7) and thus, we can deduce that sacking bags' contracts exhibited short-run inefficiencies and pricing biases.

TABLE 6
Results of VECM (Hessian Cloth)

	July 2008		August 208		September 2008	
	D(S)	D(F)	D(S)	D(F)	D(S)	D(F)
ECT	0.149913	0.493796	0.070463	0.537998	0.021472	0.419825

[12] Out of 11 hessian contracts, short run error corrections were experienced in 9 contracts.

	(0.12364)	(0.13062)	(0.12039)	(0.11284)	(0.08503)	(0.07817)
	[1.21246]	**[3.78027]**	[0.58528]	**[4.76776]**	[0.25252]	**[5.37051]**
D(S(-1))	0.030199	-0.163460	-0.133792	-0.198480	-0.041958	-0.086683
	(0.21613)	(0.22833)	(0.16192)	(0.15177)	(0.12733)	(0.11705)
	[0.13973]	[-0.71589]	[-0.82628]	[-1.30781]	[-0.32953]	[-0.74055]
D(F(-1))	0.018856	0.205332	0.103011	0.184927	-0.016786	0.135618
	(0.19006)	(0.20079)	(0.15631)	(0.14651)	(0.12098)	(0.11122)
	[0.09921]	[1.02262]	[0.65900]	[1.26221]	[-0.13874]	[1.21935]
C	0.388186	0.457812	0.484716	0.531161	0.433885	0.428362
	(0.60851)	(0.64287)	(0.51583)	(0.48348)	(0.41673)	(0.38310)
	[0.63793]	[0.71214]	[0.93968]	[1.09863]	[1.04116]	[1.11813]
	February 2009		May 2009		June 2009	
	D(S)	D(F)	D(S)	D(F)	D(S)	D(F)
ECT	0.326135	0.413480	-0.420995	-0.074808	-0.251539	0.081923
	(0.16616)	(0.16494)	(0.35437)	(0.34653)	(0.43786)	(0.44025)
	[1.96283]	[2.50681]	[-1.18801]	[-0.21588]	[-0.57447]	[0.18609]
D(S(-1))	0.259975	0.250870	-0.289503	-0.462596	-0.292026	-0.362214
	(0.50326)	(0.49959)	(0.46132)	(0.45112)	(0.55387)	(0.55689)
	[0.51658]	[0.50215]	[-0.62755]	[-1.02545]	[-0.52724]	[-0.65043]
D(F(-1))	-0.258936	-0.251780	0.238406	0.427094	0.262579	0.326725
	(0.49929)	(0.49565)	(0.47335)	(0.46288)	(0.55331)	(0.55632)
	[-0.51861]	[-0.50798]	[0.50365]	[0.92269]	[0.47456]	[0.58730]
C	0.559147	0.337241	1.094892	1.078648	2.067332	2.079466
	(0.83276)	(0.82668)	(0.62457)	(0.61075)	(0.74818)	(0.75225)
	[0.67144]	[0.40794]	[1.75302]	[1.76609]	[2.76316]	[2.76433]
	August 2009		June 2010		April 2011	
	D(S)	D(F)	D(S)	D(F)	D(S)	D(F)
ECT	-0.039039	0.546310	0.143470	0.414267	0.046626	0.371963
	(0.24654)	(0.23052)	(0.08094)	(0.11115)	(0.06294)	(0.10320)
	[-0.15835]	[2.36993]	[1.77246]	**[3.72699]**	[0.74077]	**[3.60419]**
D(S(-1))	0.043390	-0.237381	0.057344	0.306666	0.017173	-0.304364
	(0.27732)	(0.25930)	(0.15786)	(0.21677)	(0.13262)	(0.21746)
	[0.15646]	[-0.91548]	[0.36326]	[1.41469]	[0.12949]	[-1.39965]
D(F(-1))	-0.117828	0.168891	-0.003199	-0.145691	0.017725	0.083088
	(0.28610)	(0.26750)	(0.10701)	(0.14695)	(0.07831)	(0.12841)
	[-0.41185]	[0.63136]	[-0.02989]	[-0.99144]	[0.22633]	[0.64708]
C	-2.839445	-2.696046	-1.483947	-0.917670	-0.479328	-0.777349
	(1.54490)	(1.44449)	(1.11689)	(1.53372)	(0.98866)	(1.62104)
	[-1.83795]	[-1.86644]	[-1.32865]	[-0.59833]	[-0.48483]	[-0.47954]
	May 2011		June 2011			
	D(S)	D(F)	D(S)	D(F)		
ECT	0.040870	0.364910	0.109688	0.395245		
	(0.05825)	(0.09393)	(0.07633)	(0.11624)		
	[0.70164]	**[3.88479]**	[1.43702]	**[3.40036]**		
D(S(-1))	0.016012	-0.287135	-0.066130	-0.405487		
	(0.12004)	(0.19358)	(0.13959)	(0.21256)		
	[0.13338]	[-1.48325]	[-0.47376]	[-1.90762]		
D(S(-2))			-0.040324	-0.176510		
			(0.12015)	(0.18296)		
			[-0.33562]	[-0.96475]		
D(S(-3))			0.012215	-0.099626		
			(0.12099)	(0.18424)		
			[0.10097]	[-0.54075]		
D(S(-4))			-0.187222	0.183860		
			(0.12044)	(0.18340)		

			[-1.55452]	[1.00250]		
D(S(-5))			0.045814	-0.015256		
			(0.12476)	(0.18998)		
			[0.36723]	[-0.08030]		
D(F(-1))	0.015125	0.077530	0.065812	0.180552		
	(0.07224)	(0.11649)	(0.09377)	(0.14279)		
	[0.20938]	[0.66556]	[0.70186]	[1.26445]		
D(F(-2))			0.013053	0.130931		
			(0.07737)	(0.11781)		
			[0.16872]	[1.11136]		
D(F(-3))			0.058113	0.129662		
			(0.07661)	(0.11666)		
			[0.75858]	[1.11146]		
D(F(-4))			0.182250	-0.178541		
			(0.07595)	(0.11566)		
			[2.39964]	[-1.54373]		
D(F(-5))			0.045355	0.157973		
			(0.08278)	(0.12605)		
			[0.54792]	[1.25322]		
C	-0.638935	-0.936131	-0.938448	-1.305870		
	(0.82230)	(1.32606)	(0.78154)	(1.19013)		
	[-0.77701]	[-0.70595]	[-1.20076]	[-1.09725]		

Data Source: Annual reports of EIJHE (Various years)
Note: Standard errors in ( ) & t-statistics in [ ]

TABLE 7
Results of VECM (Sacking Bag)

	September 2008		July 2009		October 2009	
	D(S)	D(F)	D(S)	D(F)	D(S)	D(F)
ECT	0.098769	0.353542	-0.000540	1.473553	-0.174582	0.476614
	(0.10655)	(0.11906)	(0.07340)	(0.49761)	(0.30321)	(0.33739)
	[0.92700]	[2.96955]	[-0.00736]	[2.96125]	[-0.57578]	[1.41265]
D(S(-1))	-0.250775	-0.103869	0.124688	-0.170377	0.041176	-0.060552
	(0.30744)	(0.34353)	(0.24442)	(1.65696)	(0.36959)	(0.41126)
	[-0.81569]	[-0.30236]	[0.51015]	[-0.10283]	[0.11141]	[-0.14724]
D(F(-1))	-0.145585	-0.287674	-0.006120	0.028718	-0.056703	0.064048
	(0.26068)	(0.29129)	(0.03130)	(0.21221)	(0.33082)	(0.36811)
	[-0.55847]	[-0.98760]	[-0.19549]	[0.13533]	[-0.17140]	[0.17399]
C	7.464591	8.737239	-1.121856	-1.887233	4.137714	5.233950
	(6.28414)	(7.02188)	(5.20784)	(35.3053)	(4.54904)	(5.06187)
	[1.18785]	[1.24429]	[-0.21542]	[-0.05345]	[0.90958]	[1.03399]
	November 2009		December 2009		October 2010	
	D(S)	D(F)	D(S)	D(F)	D(S)	D(F)
ECT	-0.088502	0.253532	-0.093687	0.229974	-0.118630	0.274765
	(0.17144)	(0.20256)	(0.15157)	(0.17497)	(0.17315)	(0.17510)
	[-0.51622]	[1.25164]	[-0.61811]	[1.31433]	[-0.68513]	[1.56923]
D(S(-1))	0.007539	-0.089163	0.015421	-0.088853	0.121670	0.286659
	(0.27710)	(0.32739)	(0.24404)	(0.28172)	(0.20101)	(0.20327)
	[0.02721]	[-0.27234]	[0.06319]	[-0.31539]	[0.60529]	[1.41025]
D(F(-1))	-0.038159	0.075532	-0.045282	0.073416	0.128081	0.011698
	(0.23668)	(0.27964)	(0.21356)	(0.24653)	(0.20023)	(0.20248)
	[-0.16122]	[0.27010]	[-0.21204]	[0.29779]	[0.63968]	[0.05777]
C	6.348855	7.149237	6.182921	6.905434	5.344248	5.050262
	(3.96342)	(4.68278)	(3.70486)	(4.27691)	(3.80486)	(3.84760)
	[1.60186]	[1.52671]	[1.66887]	[1.61458]	[1.40459]	[1.31258]

	April 2011		May 2011		November 2011	
	D(S)	D(F)	D(S)	D(F)	D(S)	D(F)
ECT	-0.024433	0.132625	-0.022998	0.133603	0.105983	0.602166
	(0.07914)	(0.08738)	(0.07512)	(0.08201)	(1.58982)	(1.61325)
	[-0.30871]	[1.51786]	[-0.30613]	[1.62917]	[0.06666]	[0.37326]
D(S(-1))	-0.054598	-0.132881	-0.047786	-0.125839	0.877550	0.864086
	(0.17151)	(0.18934)	(0.16022)	(0.17489)	(1.81150)	(1.83820)
	[-0.31834]	[-0.70179]	[-0.29826]	[-0.71952]	[0.48443]	[0.47007]
D(S(-2))					-0.024278	-0.025114
					(1.81849)	(1.84529)
					[-0.01335]	[-0.01361]
D(S(-3))					-0.763740	-0.575261
					(1.24724)	(1.26562)
					[-0.61234]	[-0.45453]
D(S(-4))					-0.935908	-1.129242
					(1.27061)	(1.28933)
					[-0.73658]	[-0.87584]
D(F(-1))	-0.012107	0.065720	-0.011425	0.066368	-0.916636	-0.903665
	(0.14113)	(0.15581)	(0.13509)	(0.14747)	(1.75407)	(1.77992)
	[-0.08578]	[0.42179]	[-0.08457]	[0.45005]	[-0.52258]	[-0.50770]
D(F(-2))					-0.019717	-0.023496
					(1.76402)	(1.79002)
					[-0.01118]	[-0.01313]
D(F(-3))					0.768934	0.592437
					(1.17700)	(1.19435)
					[0.65330]	[0.49603]
D(F(-4))					0.867200	1.047620
					(1.20125)	(1.21895)
					[0.72191]	[0.85944]
C	-2.878876	-4.243547	-2.725910	-3.829519	5.689299	5.007982
	(2.75123)	(3.03738)	(2.37229)	(2.58962)	(6.78806)	(6.88809)
	[-1.04640]	[-1.39711]	[-1.14906]	[-1.47879]	[0.83813]	[0.72705]

Data Source: Annual reports of EIJHE (Various years)
Note: Standard errors in ( ) & t-statistics in [ ]

CONCLUSIONS AND POLICY IMPLICATIONS

The price stabilization function of the commodity derivative market is conditioned upon the efficiency of the market. An attempt was made in this paper to critically examine the efficiency of the hessian and sacking bags' contracts in one of the regional commodity exchange in India, the EIJHE. Empirical analysis indicates that, out of 41 contracts each for hessian cloth and sacking bags, the necessary condition for market efficiency held for only 17 hessian cloths' contracts and 11 sacking bags' contracts. Majority of the hessian and sacking contracts, i.e. those contracts which had long run linear relationships between the spot and forward prices, demonstrated evidence of unbiasedness. Thus we can infer that it is possible to forecast spot prices of hessian cloth and sacking bags' contracts in the future for this limited number of contracts (11 hessian contracts and 9 sacking contracts).

However, the Vector Error Correction methodology's results suggested that the sacking bag contracts' forward market exhibited short-run inefficiencies and pricing biases. In hessian cloth contracts, large positive deviations from the co-integrating relation between the forward and spot prices were significantly corrected in the following period in the forward market. Overall, the empirical results suggest that even though most of the contracts

were inefficient, hessian cloths' forward contracts were relatively more efficient in comparison to sacking bags' contracts.

Nevertheless, this indication of inefficiency is rather to be expected given the fact that thin trading volumes and infrequent trading of hessian cloth and sacking bags' contracts are two major challenges which the EIJHE was facing over the study period, and, which ultimately resulted in declining liquidity at the market[13].

To regain the glory of the oldest derivatives exchange in India, the EIJHE needs to implement several innovative steps so as to keep in pace with other sophisticated nationalized exchanges. A competitive advantage for the EIJHE is that it is situated in an area where the spot market of jute is very advanced, unlike some of its competitors. However, the locational advantage of EIJHE in trading raw jute and jute products was neutralized, to some degree, after the opening of the nationalized exchanges - MCX and NCDEX - in 2002.

Even though some steps have been taken to modernize the exchange and solve its liquidity problem, they are insufficient in relation to the requirements at hand. Distribution of handout quotations during trading hours as the medium of information dissemination of the prices of hessian and sacking contracts does not attract the influential jute mill owners, shippers, and dealers to the trading platform of the exchange. Further, no attempt to establish linkage with other nationalized exchanges, like MCX and NCDEX, had been made until very recently. The licensing by FMC to trade in transferable specific delivery contracts without any resort to hedging contracts made the market a haven of speculators. Still, it can be argued that inefficiency in the forward market at the EIJHE could have been due to the underdeveloped nature of the jute spot market.

[13] A trend of declining liquidity, as measured by the total volume of trading as a proportion of total production, in the EIJHE is presented in a table of appendix C. The volume of hessian transaction in the exchange is nearly three times its production in the country during 2008-09 and declined to less than one times in 2011-12. A similar trend of deceleration also noticeable in sacking: from nearly one and seven times in 2008-09 to a negligible less than one time in 2011-12 (Appendix C). Thus liquidity is considered as one of the serious problem in this exchange in recent times.

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APPENDICES

APPENDIX A
Results of Augmented Dickey Fuller Test of Spot and Forward Prices

Contract month	Price	Level /First Difference	ADF test Statistic (Hessian)	ADF test Statistic (Sacking)	Mac Kinnon CV 10 per cent
July 2008	Forward	Level	-1.206685	-2.029735	-2.5923
		First Difference	-4.266866	-5.169200	-2.5928
	Spot	Level	-1.160879	-2.322951	-2.5923
		First Difference	-3.392895	-3.702168	-2.5928
August 2008	Forward	Level	-1.166915	-0.904097	-2.5851
		First Difference	-5.319217	-7.702398	-2.5853
	Spot	Level	-1.107388	0.173791	-2.5851
		First Difference	-4.653555	-7.632449	-2.5853
September 2008	Forward	Level	-1.474889	-0.338799	-2.5809
		First Difference	-4.114326	-6.171527	-2.5811
	Spot	Level	-1.462084	0.715840	-2.5809
		First Difference	-3.905897	-5.084561	-2.5811
October 2008	Forward	Level	-2.086200	-1.901460	-2.5990
		First Difference	-4.418375	-4.477261	-2.5997
	Spot	Level	-2.210628	-2.001870	-2.5990
		First Difference	-4.498889	-4.797925	-2.5997
November 2008	Forward	Level	-1.832063	-2.015795	-2.5882
		First Difference	-4.098513	-4.302103	-2.5886
	Spot	Level	-2.942241	-0.916904	-2.5882
		First Difference	-4.166926	-4.809171	-2.5886
December 2008	Forward	Level	-2.260160	-1.840080	-2.5853
		First Difference	-6.544067	-6.205802	-2.5855
	Spot	Level	-2.383597	-0.865919	-2.5853
		First Difference	-6.665883	-6.260883	-2.5855
January 2009	Forward	Level	-1.264494	-1.296929	-2.5907
		First Difference	-5.612090	-6.005701	-2.5911
	Spot	Level	-1.133631	-1.118529	-2.5907
		First Difference	-5.656348	-5.347837	-2.5911
February 2009	Forward	Level	-1.326606	-1.729794	-2.5840
		First Difference	-6.467786	-5.728069	-2.5842
	Spot	Level	-1.280477	-1.595314	-2.5840
		First Difference	-6.501745	-5.222946	-2.5842
March 2009	Forward	Level	-0.739699	-1.742628	-2.5805
		First Difference	-5.048657	-4.318515	-2.5807
	Spot	Level	-0.792448	-1.663489	-2.5805
		First Difference	-5.127095	-4.147136	-2.5807
April 2009	Forward	Level	-0.777892	-0.462129	-2.5882
		First Difference	-4.429103	-4.042862	-2.5886
	Spot	Level	-0.753050	-0.462129	-2.5882
		First Difference	-4.716531	-4.042862	-2.5886
May 2009	Forward	Level	-0.857398	-0.027971	-2.5827
		First Difference	-4.951332	-5.035704	-2.5829
	Spot	Level	-0.865862	-0.027971	-2.5827
		First Difference	-5.246522	-5.035704	-2.5829

June 2009	Forward	Level	1.137676	0.170123	-2.5795
		First Difference	-4.611163	-4.695327	-2.5796
	Spot	Level	1.256835	0.170123	-2.5795
		First Difference	-4.620648	-4.695327	-2.5796
July 2009	Forward	Level	0.388136	-3.522712	-2.6133
		First Difference	-5.512358	-6.861803	-2.6148
	Spot	Level	0.388136	-1.877883	-2.6133
		First Difference	-5.512358	-4.840252	-2.6148
August 2009	Forward	Level	-1.219854	-0.186370	-2.5937
		First Difference	-5.974724	-5.852108	-2.5942
	Spot	Level	-1.001632	-0.278698	-2.5937
		First Difference	-5.740743	-6.030048	-2.5942
September 2009	Forward	Level	-1.286425	-1.096477	-2.5865
		First Difference	-4.338105	-4.721354	-2.5868
	Spot	Level	-2.024764	-1.284080	-2.5865
		First Difference	-3.588373	-4.613853	-2.5868
October 2009	Forward	Level	0.072904	-0.725113	-2.5874
		First Difference	-4.141921	-4.107324	-2.5876
	Spot	Level	0.180437	-0.550196	-2.5874
		First Difference	-3.772077	-4.147166	-2.5876
November 2009	Forward	Level	1.101412	-0.227389	-2.5824
		First Difference	-4.968994	-4.820355	-2.5826
	Spot	Level	1.261897	0.138891	-2.5824
		First Difference	-4.839588	-4.930901	-2.5826
December 2009	Forward	Level	0.679965	-0.266878	-2.5811
		First Difference	-3.815011	-4.043655	-2.5812
	Spot	Level	1.048066	-0.068610	-2.5811
		First Difference	-3.922013	-3.903112	-2.5812
January 2009	Forward	Level	-1.640128	-1.280126	-2.6059
		First Difference	-4.677872	-4.673783	-2.6069
	Spot	Level	-1.109619	-1.329189	-2.6059
		First Difference	-5.042711	-4.624052	-2.6069
February 2010	Forward	Level	-0.853109	-0.206130	-2.5970
		First Difference	-5.592022	-5.340394	-2.5977
	Spot	Level	-1.208220	-0.415577	-2.5970
		First Difference	-5.453336	-5.626175	-2.5977
March 2010	Forward	Level	-2.456669	-1.995375	-2.5865
		First Difference	-4.561710	-4.255110	-2.5868
	Spot	Level	-2.665928	-1.823867	-2.5865
		First Difference	-4.366667	-4.285804	-2.5868
April 2010	Forward	Level	-2.799818	-0.944598	-2.5932
		First Difference	-5.696500	-4.974036	-2.5937
	Spot	Level	-2.585914	-1.112156	-2.5932
		First Difference	-4.725226	-4.419111	-2.5937
May 2010	Forward	Level	-2.927608	-1.639480	-2.5853
		First Difference	-4.746080	-4.408262	-2.5855
	Spot	Level	-2.234575	-1.688635	-2.5853
		First Difference	-4.313514	-4.124196	-2.5855
June 2010	Forward	Level	-0.238400	-2.141448	-2.5811
		First Difference	-3.940030	-4.091727	-2.5812
	Spot	Level	0.215348	-1.799017	-2.5811
		First Difference	-3.204999	-4.231386	-2.5812

July 2010	Forward	Level	-0.586295	-1.147898	-2.5896
		First Difference	-2.866556	-4.319388	-2.5899
	Spot	Level	-0.584205	-1.147898	-2.5896
		First Difference	-2.749208	-4.319388	-2.5899
August 2010	Forward	Level	-0.974906	-0.350756	-2.5831
		First Difference	-3.929801	-5.395912	-2.5833
	Spot	Level	-0.996352	-0.350756	-2.5831
		First Difference	-3.538441	-5.395912	-2.5833
September 2010	Forward	Level	-0.250759	0.124218	-2.5801
		First Difference	-3.541859	-4.257924	-2.5802
	Spot	Level	-0.317284	0.247278	-2.5801
		First Difference	-3.355048	-4.471981	-2.5802
October 2010	Forward	Level	-2.217870	-2.877977	-2.5919
		First Difference	-4.612687	-4.695623	-2.5923
	Spot	Level	-2.217870	-2.611077	-2.5919
		First Difference	-4.612687	-4.522567	-2.5923
November 2010	Forward	Level	-2.597173	-1.954202	-2.5849
		First Difference	-5.317643	-4.646205	-2.5851
	Spot	Level	-2.597173	-1.667321	-2.5849
		First Difference	-5.317643	-4.619134	-2.5851
December 2010	Forward	Level	-3.465166	-1.771693	-2.5809
		First Difference	-4.312780	-4.325420	-2.5811
	Spot	Level	-3.583361	-1.569251	-2.5809
		First Difference	-4.354993	-4.610317	-2.5811
January 2011	Forward	Level	-1.580560	-1.919437	-2.5846
		First Difference	-4.620626	-3.873359	-2.5849
	Spot	Level	-1.598161	-1.803031	-2.5846
		First Difference	-4.692713	-3.674231	-2.5849
February 2011	Forward	Level	-1.899887	-2.130752	-2.5812
		First Difference	-3.924672	-4.519538	-2.5813
	Spot	Level	-1.983464	-1.974869	-2.5812
		First Difference	-3.774426	-3.971559	-2.5813
March 2011	Forward	Level	-0.061774	-2.317204	-2.5783
		First Difference	-4.437276	-4.949102	-2.5784
	Spot	Level	0.091605	-2.205927	-2.5783
		First Difference	-4.323393	-4.428237	-2.5784
April 2011	Forward	Level	-1.850373	-1.411216	-2.5809
		First Difference	-4.627632	-4.661365	-2.5811
	Spot	Level	-1.864245	-0.687586	-2.5809
		First Difference	-3.764203	-4.399075	-2.5811
May 2011	Forward	Level	-2.051558	-1.506934	-2.5782
		First Difference	-5.217508	-5.093520	-2.5783
	Spot	Level	-2.079849	-0.843430	-2.5782
		First Difference	-4.305267	-4.829161	-2.5783
June 2011	Forward	Level	-1.464275	-0.737784	-2.5763
		First Difference	-5.666336	-5.101304	-2.5764
	Spot	Level	-1.263036	0.133773	-2.5763
		First Difference	-4.658528	-4.489961	-2.5764
July 2011	Forward	Level	1.243096	-0.181059	-2.5882
		First Difference	-6.757651	-4.857132	-2.5886
	Spot	Level	0.955438	0.023012	-2.5882
		First Difference	-6.188108	-4.997584	-2.5886

August 2011	Forward	Level	-1.704249	-0.869381	-2.5829
		First Difference	-5.652108	-5.487469	-2.5831
	Spot	Level	-1.328069	-0.905238	-2.5829
		First Difference	-5.550411	-5.513686	-2.5831
September 2011	Forward	Level	-2.169153	-1.008661	-2.5797
		First Difference	-3.811563	-3.621449	-2.5798
	Spot	Level	-1.659200	-1.063247	-2.5797
		First Difference	-3.432881	-3.010749	-2.5798
November 2011	Forward	Level	-2.323800	-1.956669	-2.6080
		First Difference	-4.264884	-3.547636	-2.6092
	Spot	Level	-1.418291	-0.959287	-2.6080
		First Difference	-4.239575	-3.946029	-2.6092
December 2011	Forward	Level	-1.652605	-1.748130	-2.5911
		First Difference	-3.918005	-3.888379	-2.5915
	Spot	Level	-1.458114	-1.338833	-2.5911
		First Difference	-4.010921	-4.158848	-2.5915

Data Source: Annul reports of EIJHE (various years).

APPENDIX B
Selection of Lag from VAR Specification

Contract month		Hessian				Sacking		
	lags	AIC	BIC	HQC	lags	AIC	BIC	HQC
July 2008	***1***	8.949282*	9.162431*	9.032308*	***1***	16.381746*	16.594895*	16.464772*
	2	9.012068	9.367317	9.150445	2	16.49989	16.85513	16.63826
	3	9.025159	9.522508	9.218887	3	16.50117	16.99852	16.6949
	4	9.07561	9.715058	9.324688	4	16.56242	17.20187	16.8115
	5	9.177168	9.958715	9.481597	5	16.65589	17.43744	16.96032
August 2008	***1***	10.395285*	10.572651*	10.466446*	***1***	20.32805	20.505417*	20.399212*
	2	10.43229	10.727901	10.550893	2	20.280872*	20.57648	20.39948
	3	10.476568	10.890424	10.642613	3	20.32839	20.74224	20.49443
	4	10.534491	11.06659	10.747976	4	20.38988	20.92197	20.60336
	5	10.599312	11.249657	10.860239	5	20.45051	21.10085	20.71144
September 2008	***1***	10.616486*	10.766364*	10.677245*	***1***	20.05834	20.208213*	20.11909
	2	10.670044	10.919842	10.771309	2	19.96397	20.21377	20.065239*
	3	10.682549	11.032265	10.824319	3	19.925998*	20.27571	20.06777
	4	10.707425	11.15706	10.889701	4	19.96029	20.40993	20.14257
	5	10.757382	11.306936	10.980164	5	20.00189	20.55144	20.22467
October 2008	***1***	9.211641*	9.452529*	9.301441*	***1***	17.500856*	17.741744*	17.590656*
	2	9.376296	9.777777	9.525964	2	17.66654	18.06802	17.81621
	3	9.495463	10.057535	9.704998	3	17.81127	18.37334	18.0208
	4	9.607943	10.330608	9.877346	4	17.93723	18.6599	18.20664
	5	9.524981	10.408239	9.854251	5	18.05755	18.94081	18.38682
November 2008	***1***	9.972576*	10.166846*	10.049650*	***1***	17.765546*	17.959816*	17.842620*
	2	10.052558	10.376342	10.181014	2	17.87329	18.19707	18.00174
	3	10.112641	10.565938	10.292479	3	17.96444	18.41774	18.14428
	4	10.199429	10.782239	10.430649	4	18.03289	18.6157	18.26411
	5	10.202065	10.914389	10.484667	5	18.08376	18.79608	18.36636
December 2008	***1***	11.394581*	11.573233*	11.466208*	***1***	18.645754*	18.824406*	18.717381*
	2	11.485941	11.783694	11.605319	2	18.74083	19.03858	18.86021
	3	11.569735	11.986589	11.736864	3	18.81964	19.23649	18.98677
	4	11.607218	12.143174	11.822098	4	18.86839	19.40435	19.08327

	5	11.66223	12.317287	11.924861	5	18.95659	19.61165	19.21922
	1	11.255678*	11.461529*	11.336500*	***1***	19.557680*	19.763532*	19.638503*
	2	11.380147	11.723233	11.514851	2	19.66894	20.01203	19.80364
	3	11.501035	11.981355	11.689621	3	19.78271	20.26303	19.97129
January	4	11.540696	12.158251	11.783164	4	19.84408	20.46164	20.08655
2009	5	11.666267	12.421056	11.962616	5	19.90749	20.66228	20.20384
	1	10.729900*	10.901133*	10.798813*	***1***	19.649204*	19.820438*	19.718118*
	2	10.820516	11.105905	10.935372	2	19.71154	19.99693	19.8264
	3	10.906386	11.305931	11.067185	3	19.78219	20.18173	19.94298
February	4	10.930972	11.444673	11.137713	4	19.85851	20.37221	20.06525
2009	5	11.018768	11.646624	11.271451	5	19.9167	20.54455	20.16938
	1	11.131406*	11.278705*	11.191151*	***1***	19.303418*	19.450717*	19.363163*
	2	11.200628	11.446126	11.300203	2	19.3468	19.5923	19.44638
	3	11.263194	11.606891	11.4026	3	19.39783	19.74153	19.53724
March	4	11.286637	11.728534	11.465873	4	19.45216	19.89405	19.63139
2009	5	11.304989	11.845085	11.524054	5	19.49801	20.03811	19.71708
	1	10.275876*	10.470146*	10.352949*	***1***	------	------	------
	2	10.332903	10.656686	10.461358	2	------	------	------
	3	10.361202	10.814499	10.54104	3	------	------	------
April	4	10.386791	10.969602	10.618012	4	------	------	------
2009	5	10.37548	11.087804	10.658083	5	------	------	------
	1	9.837142	10.000536*	9.903116*	***1***	------	------	------
	2	9.870985	10.143308	9.980941	2	------	------	------
	3	9.877164	10.258416	10.031103	3	------	------	------
May	4	9.876176	10.366357	10.074097	4	------	------	------
2009	5	9.829836*	10.428945	10.071739	5	------	------	------
	1	10.439475*	10.579599*	10.496375*	***1***	------	------	------
	2	10.493689	10.727229	10.588522	2	------	------	------
	3	10.502479	10.829435	10.635245	3	------	------	------
June	4	10.50414	10.924512	10.67484	4	------	------	------
2009	5	10.47539	10.989177	10.684023	5	------	------	------
	1	------	------	------	***1***	22.603210*	22.880756*	22.693683*
	2	------	------	------	2	22.81244	23.27501	22.96323
	3	------	------	------	3	22.83833	23.48593	23.04943
July	4	------	------	------	4	22.98191	23.81455	23.25333
2009	5	------	------	------	5	22.97075	23.98842	23.30249
	1	13.073205	13.294204*	13.158436*	***1***	16.742865*	16.963863*	16.828095*
	2	13.138569	13.5069	13.28062	2	16.85321	17.22154	16.99526
	3	13.165862	13.681525	13.364733	3	16.93202	17.44768	17.13089
August	4	13.043806*	13.7068	13.299497	4	17.0656	17.72859	17.32129
2009	5	13.102995	13.913321	13.415506	5	17.0273	17.83763	17.33981
	1	13.573632*	13.759031*	13.647659*	***1***	17.923543*	18.108942*	17.997571*
	2	13.663927	13.972925	13.787306	2	17.92869	18.23769	18.05207
	3	13.736146	14.168743	13.908877	3	18.02919	18.46179	18.20192
September	4	13.693916	14.250113	13.916	4	18.11569	18.67189	18.33777
2009	5	13.719055	14.398852	13.99049	5	18.12571	18.80551	18.39714
	1	12.237000*	12.426723*	12.312529*	***1***	17.140326*	17.330048*	17.215855*
	2	12.309264	12.625468	12.435146	2	17.23208	17.54828	17.35796
	3	12.316708	12.759394	12.492943	3	17.23309	17.67578	17.40932
October	4	12.419347	12.988513	12.645933	4	17.32249	17.89166	17.54908
2009	5	12.433365	13.129013	12.710304	5	17.41934	18.11499	17.69628
November	***1***	12.723165*	12.884463*	12.788342*	***1***	18.249050*	18.410348*	18.314226*
2009	2	12.793053	13.061882	12.90168	2	18.31842	18.58725	18.42705

	3	12.821644	13.198005	12.973722	3	18.31298	18.68934	18.46505
	4	12.900448	13.384341	13.095977	4	18.37728	18.86117	18.57281
	5	12.909513	13.500937	13.148493	5	18.44448	19.0359	18.68346
	1	13.785074*	13.935835*	13.846178*	***1***	18.380900*	18.531661*	18.442004*
	2	13.850471	14.101738	13.952311	2	18.44188	18.69314	18.54372
	3	13.904397	14.256172	14.046974	3	18.45035	18.80213	18.59293
December	4	13.957304	14.409586	14.140617	4	18.50217	18.95445	18.68548
2009	5	14.010916	14.563705	14.234965	5	18.56073	19.11352	18.78478
	1	16.230620*	16.491850*	16.322716*	***1***	18.965470*	19.226700*	19.057566*
	2	16.422463	16.857846	16.575956	2	19.08368	19.51907	19.23718
	3	16.621138	17.230675	16.836029	3	19.12615	19.73569	19.34104
January	4	16.762082	17.545771	17.038369	4	19.14916	19.93285	19.42545
2009	5	16.937372	17.895215	17.275056	5	19.31315	20.27099	19.65084
	1	16.628832*	16.862732*	16.717223*	***1***	20.104472*	20.338372*	20.192864*
	2	16.778389	17.168223	16.925708	2	20.16964	20.55947	20.31696
	3	16.918868	17.464635	17.125114	3	20.18671	20.73248	20.39295
February	4	17.034857	17.736557	17.30003	4	20.24765	20.94935	20.51282
2010	5	17.065616	17.92325	17.389717	5	20.27645	21.13408	20.60055
	1	15.800816*	15.986215*	15.874844*	***1***	20.331913*	20.517312*	20.405941*
	2	15.894283	16.203282	16.017663	2	20.40143	20.71042	20.5248
	3	15.992808	16.425406	16.165539	3	20.50717	20.93977	20.6799
March	4	16.036713	16.59291	16.258796	4	20.56963	21.12583	20.79172
2010	5	16.111875	16.791672	16.38331	5	20.58532	21.26511	20.85675
	1	14.781415	15.000396*	14.866097	***1***	19.50911	19.728096*	19.593796*
	2	14.642146	15.007115	14.783282*	2	19.63021	19.99518	19.77134
	3	14.673968	15.184926	14.87156	3	19.61809	20.12905	19.81569
April	4	14.535002	15.191947	14.789048	4	19.53421	20.19116	19.78826
2010	5	14.480908*	15.283841	14.791409	5	19.422271*	20.2252	19.73277
	1	14.684953	14.863605*	14.756579*	***1***	19.371620*	19.550272*	19.443247*
	2	14.640132	14.937885	14.75951	2	19.4582	19.75595	19.57758
	3	14.652224	15.069079	14.819353	3	19.46211	19.87896	19.62924
May	4	14.606682	15.142638	14.821562	4	19.50207	20.03803	19.71695
2010	5	14.538187*	15.193245	14.800818	5	19.48271	20.13777	19.74534
	1	15.260376*	15.411136*	15.321480*	***1***	19.151695*	19.302455*	19.212799*
	2	15.305674	15.556942	15.407514	2	19.19989	19.45116	19.30173
	3	15.340776	15.692551	15.483352	3	19.22836	19.58014	19.37094
June	4	15.300767	15.753049	15.48408	4	19.26014	19.71242	19.44345
2010	5	15.276929	15.829719	15.500978	5	19.22293	19.77572	19.44698
	1	12.325418*	12.526131*	12.404612*	***1***	------	------	------
	2	12.361319	12.69584	12.493309	2	------	------	------
	3	12.439657	12.907987	12.624443	3	------	------	------
July	4	12.375111	12.977249	12.612693	4	------	------	------
2010	5	12.472774	13.208721	12.763152	5	------	------	------
	1	13.314199*	13.479751*	13.380989*	***1***	------	------	------
	2	13.379594	13.655513	13.49091	2	------	------	------
	3	13.425693	13.811979	13.581535	3	------	------	------
August	4	13.404738	13.901391	13.605106	4	------	------	------
2010	5	13.44798	14.055001	13.692876	5	------	------	------
	1	13.451393*	13.595404*	13.509839*	***1***	17.730470*	17.874480*	17.788915*
	2	13.506835	13.746853	13.604245	2	17.73496	17.97498	17.83237
	3	13.53615	13.872175	13.672524	3	17.79848	18.1345	17.93485
September	4	13.544715	13.976747	13.720053	4	17.74981	18.18184	17.92515
2010	5	13.568957	14.096995	13.783258	5	17.76597	18.29401	17.98027

	1	------	------	------	***1***	18.334060*	18.545335*	18.416534*
	2	------	------	------	2	18.38872	18.74085	18.52618
	3	------	------	------	3	18.47747	18.97045	18.66991
October	4	------	------	------	4	18.55807	19.19189	18.80549
2010	5	------	------	------	5	18.60499	19.37966	18.90739
	1	------	------	------	***1***	18.742084*	18.918185*	18.812786*
	2	------	------	------	2	18.81147	19.10497	18.92931
	3	------	------	------	3	18.76844	19.17935	18.93341
November	4	------	------	------	4	18.81393	19.34223	19.02603
2010	5	------	------	------	5	18.88064	19.52635	19.13988
	1	11.269586*	11.419465*	11.330345*	***1***	18.69037	18.840246*	18.751127*
	2	11.336898	11.586695	11.438162	2	18.75082	19.00062	18.85209
	3	11.377323	11.727039	11.519093	3	18.65332	19.00304	18.79509
December	4	11.440206	11.889841	11.622482	4	18.65316	19.10279	18.83543
2010	5	11.498401	12.047955	11.721183	5	18.644286*	19.19384	18.86707
	1	11.917094*	12.091950*	11.987341*	1	17.6053	17.780152*	17.67554
	2	12.002882	12.294308	12.11996	2	17.69515	17.98658	17.81223
	3	12.06466	12.472658	12.228571	***3***	17.508728*	17.91673	17.672639*
January	4	12.141742	12.66631	12.352484	4	17.59739	18.12196	17.80813
2011	5	12.200186	12.841325	12.45776	5	17.67178	18.31292	17.92935
	1	11.595621*	11.747276*	11.657075*	***1***	17.989995*	18.141650*	18.051449*
	2	11.662251	11.915009	11.764674	2	18.06163	18.31438	18.16405
	3	11.70823	12.062091	11.851621	3	18.00896	18.36282	18.15235
February	4	11.761804	12.216769	11.946165	4	18.08025	18.53521	18.26461
2011	5	11.805499	12.361567	12.030829	5	18.14837	18.70443	18.3737
	1	11.569029*	11.700717*	11.622540*	***1***	17.951215*	18.082904*	18.004726*
	2	11.624193	11.843674	11.713378	2	18.00824	18.22772	18.09743
	3	11.667585	11.974858	11.792444	3	17.98798	18.29525	18.11284
March	4	11.721905	12.11697	11.882437	4	18.04328	18.43834	18.20381
2011	5	11.773531	12.256388	11.969737	5	18.09727	18.58013	18.29348
	1	15.524902	15.674780*	15.585660*	***1***	17.554773*	17.704651*	17.615532*
	2	15.550007	15.799804	15.651272	2	17.62615	17.87595	17.72741
	3	15.600442	15.950158	15.742212	3	17.69683	18.04654	17.8386
April	4	15.625278	16.074912	15.807554	4	17.76915	18.21879	17.95143
2011	5	15.457873*	16.007427	15.680655	5	17.79442	18.34397	18.0172
	1	15.128526	15.258918*	15.181512*	***1***	17.230109*	17.360501*	17.283095*
	2	15.142655	15.359975	15.230966	2	17.28737	17.50469	17.37568
	3	15.179017	15.483265	15.302652	3	17.34415	17.64839	17.46778
May	4	15.192527	15.583702	15.351485	4	17.39619	17.78736	17.55515
2011	5	15.014880*	15.492983	15.209163	5	17.40686	17.88496	17.60114
	1	14.930203	15.046011*	14.977231	***1***	18.455351*	18.571159*	18.502379*
	2	14.940685	15.133698	15.019065	2	18.49792	18.69093	18.5763
	3	14.96809	15.238308	15.077822	3	18.53898	18.8092	18.64871
June	4	14.977831	15.325254	15.118916	4	18.58312	18.93055	18.72421
2011	***5***	14.802467*	15.227096	14.974904*	**5**	18.62027	19.04489	18.7927
	1	10.700317	10.894587*	10.777391*	***1***	18.959489*	19.153759*	19.036562*
	2	10.707	11.030783	10.835455	2	19.06612	19.3899	19.19458
	3	10.714063	11.16736	10.893901	3	19.17086	19.62415	19.35069
July	4	10.644188*	11.226998	10.875408	4	19.27304	19.85585	19.50426
2011	5	10.661417	11.373741	10.94402	5	19.3494	20.06172	19.632
	1	11.844181*	12.008645*	11.910560*	***1***	18.556095*	18.720559*	18.622474*
August	2	11.917594	12.191702	12.028226	2	18.63689	18.911	18.74753
2011	3	11.985293	12.369044	12.140178	3	18.71667	19.10043	18.87156

	4	12.059311	12.552704	12.258449	4	18.79516	19.28855	18.9943
	5	12.110592	12.713629	12.353983	5	18.85489	19.45792	19.09828
	1	12.424862*	12.566512*	12.482370*	***1***	18.050114*	18.191763*	18.107622*
	2	12.48341	12.719493	12.579257	2	18.11268	18.34876	18.20852
	3	12.539297	12.869813	12.673482	3	18.1743	18.50482	18.30849
September	4	12.600015	13.024965	12.77254	4	18.23475	18.6597	18.40727
2011	5	12.659472	13.178855	12.870335	5	18.27543	18.79481	18.48629
	1	9.507039*	9.773670*	9.599080*	1	14.67286	14.93949	14.7649
	2	9.717199	10.161584	9.870601	2	14.4713	14.915681*	14.6247
	3	9.932616	10.554755	10.147378	3	14.42157	15.04371	14.63633
November	4	9.785574	10.585467	10.061697	***4***	14.313559*	15.11345	14.589682*
2011	5	9.826365	10.804012	10.163848	5	14.36237	15.34002	14.69985
	1	8.949702*	9.157329*	9.031073*	1	13.77114	13.97877	13.85251
	2	9.071303	9.417348	9.206921	2	13.48118	13.82723	13.6168
	3	9.193597	9.67806	9.383463	3	13.32831	13.81277	13.51817
December	4	9.061055	9.683936	9.305168	4	13.16934	13.792224*	13.41346
2011	5	9.03292	9.794219	9.331281	***5***	13.104019*	13.86532	13.402379*

Data Source: Annual reports of EIJHE (Various years)

Note: (1) Lag shown in bold and italics is selected for Co-integration

(2) The asterisks below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion, BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

(3) ---- implies that VAR is not possible due to insufficient number of observations.

APPENDIX C

Volume of Trading as a Proportion of Total Hessian (or Sacking) Production

	2008-09		2009-10		2010-11		2011-12	
Month	Hessian	Sacking	Hessian	Sacking	Hessian	Sacking	Hessian	Sacking
April	1.924	6.364	3.033	0.101	0.487	0.651	0.361	3.842
May	5.924	0.163	2.569	0.025	2.930	0.154	1.054	1.392
June	7.570	1.038	1.827	0.340	3.379	0.536	0.294	0.460
July	4.397	3.088	2.222	0.042	1.071	0.000	3.013	0.477
August	1.703	3.500	3.169	0.527	2.344	0.467	0.225	0.899
September	1.537	2.714	0.921	0.801	0.466	0.072	0.045	0.825
October	1.840	0.758	1.256	0.773	0.396	0.478	0.159	0.940
November	1.596	0.032	0.376	1.150	0.148	0.897	0.176	1.069
December	3.088	0.140	0.104	0.043	0.520	0.867	0.077	0.578
January	1.206	0.647	0.000	0.000	0.194	0.000	---	---
February	1.816	1.568	0.000	0.490	0.125	0.344	---	---
March	1.800	0.400	0.938	0.501	1.341	1.468	---	---
Total	2.812	1.709	1.611	0.461	1.157	0.489	0.434	0.788

Source: Annual reports of EIJHEL (various years)