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RESEARCH ARTICLE

HEDGING EFFICIENCY OF FUTURES MARKET ON CASH CROPS (JUTE) - AN INDIAN EXPERIENCE.

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Abstract

Commodities have played a major role in shaping the international economy by affecting the lives and livelihoods of people. Particularly, in India Shortage of critical commodities sparked huge public outcry and social unrest. Price volatility which arises from bad weather irregular production and harvests as well as from swings in demand and supply is one of the key problems associated with commodity. Volatility evokes not only yield risk but also price risk for both producers and consumers of the commodity. To manage these price volatility derivative products i.e. commodity futures are being used by farmers, consumers, firms, exporters, importers etc. to reduce the price risk.

Commodity derivative market particularly, commodity futures is recognized as one of the important instrument that has been devised to achieve price risk management. In this context, an attempt has been made in the paper to evaluate the hedging effectiveness of commodity derivative market in the management of price risk with reference to the raw jute derivative market in India. The study utilized daily futures price and spot price data of Raw Jute provided by National Multi Commodity Exchange (NMCE) during the period 2010-14. Trend of spot and future prices in raw jute was analyzed by using descriptive statistical measures. To analyses the hedging effectiveness of the raw jute futures contract minimum variance hedge ratio has been used. Empirical evidence suggests variation in spot and futures prices of raw jute are higher however, an equal trend is found between the variations of spot and futures prices. The results of this study are useful for various stakeholders' of agricultural commodity markets such as producers, traders, commission agents, commodity exchange participants, regulators and policy makers.

Introduction:-

Since 19th century trading in Commodity Futures has been in existence in India with organized trading in cotton, through the establishment of Bombay Cotton Association Ltd. in 1875. Over a period of time, various other commodities were allowed to be traded in futures Exchanges. Though, India is a commodity based economy where

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two-third of the total population depend on agricultural commodities, surprisingly has an under developed commodity market. Since commodity "futures" trading was permitted by government in 2003 by lifting prohibition against futures trading and granting recognition to electronic exchanges namely National Multi Commodity Exchange of India (NMCE), Multi Commodity Exchange of India (MCX), National Commodity and Derivatives Exchange (NCDEX) as national multi commodity exchanges, the commodity derivative market in India has witnessed exceptional growth. In addition to the above exchanges the other major commodity exchanges operating now in India are Indian Commodity Exchange Limited (ICEX), Ace derivative and commodity exchange Limited (ACE) and Universal Commodity Exchange (UCE).

The primary economic function of futures markets is the hedging or risk sharing function and the secondary functions include price discovery function, financing function, liquidity function and price stabilization function (Somanathan, 1998). The argument of risk minimization through hedging primarily conditioned upon the movement of spot and futures markets together, so that losses in one market can be compensated by gains in other market. In fact, the existence of higher price volatility in the spot market provides a room for the operation of commodity derivative market to hedge against the price risk. Thus, an element of the price risk management in the commodity derivative market is expected to stabilize spot prices of the essential commodities. In order to manage price risk efficiently, it is enviable to control both price risk and basis risk[1]. An un-hedged producer or investor faces price risk in the spot market while a hedged investor or producer faces basis risk. When the basis risk is low, hedging can be used as an efficient instrument, but while basis risk is as large as price risk then hedging cannot be used as an effective instrument for mitigating business risk. In this case it is not profitable for producer or investor to enter into the derivative market. If the basis is close to zero in the maturity month then futures price converges to the spot price and there is no such business risk (Naik and Jain, 2002; Lokare, 2007; Commission for Agricultural Cost and Prices, 2008).

Jute is a natural fiber with golden and silky shine and hence called the golden fiber. It is the cheapest vegetable fiber procured from the skin of the plant's stem and the second most important vegetable fiber after cotton, in terms of usage, global consumption, production and availability. It has high tensile strength, low extensibility and ensures better breath ability of fabrics. The British East India Company was the first jute trader in India. After the fall of British Empire in India during 1947, most of the Jute Barons started evacuate India, leaving behind the industrial setup of the Industry. Then most of the jute mills were taken over by the Marwari businessmen. India is the largest producer with a share of 66% of the world' total production and West Bengal is the largest producing state in the country accounting for 71% of the national production. Therefore, it can be undoubtedly summarize that jute sector plays an important role in the economy of the country. However, the sector has been beset with several problems, including small and marginal growers with low bargaining power, inadequate institutional credit facility, imperfection in marketing structure, low productivity, competition from the synthetics, high labour costs, repeated industrial unrest, obsolete machinery, stagnating exports, all of which have led to prevalent sickness in the jute industry. Furthermore, with variation in the behaviour of weather, jute crop is potentially influenced by such weather vagaries. Instability in raw jute production dovetailed with little holding capacity of farmers generally gives rise to erratic price movement in raw jute both during intra-season and inter-seasons. Moreover, the Indian jute market is often guided by the existence of different price system i.e. spot, futures and government administered minimum support prices. So, the millions of families who are dependent on cultivation of jute especially in Eastern India often face price volatility in raw jute market.

Not many studies have been conducted in India after introduction of futures specifically on agricultural commodities. It is also safe to assume that the agricultural commodities spot market still continues to fragmented and inefficient. The futures market provides a unified price at national level acts as a bench mark for regional market. Jute being a cash crop cultivated and produced mostly in eastern India. Acreage for cultivation gets reduced year by year as the farmer do not realize the best of prices, as reported and adds to the distress sale.

In light of the above facts this study wants to examine the raw jute market and jute prices from 2010 to 2014. This also brings the fact that a few studies have been conducted on the jute with special reference to its futures and it provides a better scope to study the future market of jute.
The outline of the paper is as follows. The next section briefly reviews the related literatures and discusses the contribution of this study. Section III explains about the meaning, nature, production, and spot market prices of raw

[1] The difference between future price and spot prices are called Basis.

jute in Indian context and also the various regulatory bodies associated with the Indian jute industry. Section IV describes about jute futures market in Indian context and how the futures market can be used for hedging the spot exposure. Section V covers the sources and properties of the data, hypothesis along with the research methodology and its limitations. While the sixth section shows the empirical results of the applied tools. In the final section, it summarizes the main findings of the study in form of conclusion.

Review of Literature:-

Since the introduction of futures in Indian commodity market there are numerous studies have been conducted in the ascertainment of whether the price information is reflected in the spot market or in its underlying futures market under various interval of time. There have been both supporting and contrary views on impact of derivatives trading. The following are brief reviews of some of the research papers that have been done nationally and internationally to study the price risk management efficiency of commodity futures market.

Chan (1992), Garbade and Silber (1983), Oellermann et al. (1989) , Feeder cattle and Schroeder and Goodwin (1991) , Zhong et al. (2004), Zapta and Fortenberry (1997) tested the relationship between spot and futures prices and concluded that in the beginning the futures market captures the new information and then transfer happens to the spot market. They also explained that the futures market is the main source of market and futures market helps in price discovery. By supporting the explanation, Tan and Lim (2001), Tse (1999) propounded that futures market influences the cash market and vice versa.

Brockman and Tse (1995), Zapata et al (2005) ,Roy (2008) used econometrics technique such as Co-integration, Vector Error Correction Model (VECM) etc. and concluded that the physical market of the commodities follows the commodity futures market hence, futures market drives the price discovery.

Thomas and karande (2001) studied the price discovery process of castor seed futures traded on the regional exchanges of the Ahmadabad and Mumbai and concluded that there is no lag and lead relationship between the spot and futures prices of castor seed traded at Ahmadabad market and spot market dominates the Mumbai futures market.

Gopal and Sudhir (2002) in their study propounded that Indian agriculture commodity futures market is not fully competent for risk management and price discovery in the same time blamed poor management, infrastructure and logistics for the inefficiency of the market

Lingareddy, Tulsi (2008), in his paper named 'Expert committee on commodity Futures: Agreements and Disagreements' explained that futures trade in India has increased the price volatility of largely traded commodities like urad, chana and wheat during periods of excess liquidity and in contrast, other commodities like soya oil futures trading has led to a reduction in volatilities and better price discovery. They concluded that futures trading in agricultural commodities are beneficial for only those commodities that fulfill the basic selection criteria for futures trading.

Kumar Sunil (2004) in their study they have taken five Indian agricultural commodities and to examine the price discovery phenomenon applied Johansen Co-integration technique. It concluded that the Indian agriculture commodity futures is inefficient and it unable to absorb the spot market information.

Jose, k Sharon (2005), in his article titled "Forecasting Future basis levels in Commodity Futures" and **Mahalik et al. (2009) Shihabudheen and Padhi (2010), Ranajit and Asima, 2010, Srinivasan (2012), Gurbandini and Roy (2008)**, explained commodity futures contracts helps to hedge the commodity price risk which in turn helps in avoiding uncertainty of future cash flows so commodity futures can be used as an efficient price discovery vehicle.

Jose, k Sharon (2005),Kaul, Sanjay, (2007) their empirical evidences explains that introduction of derivatives does not destabilize the underlying market, but the literature strongly suggests that the introduction of derivatives tends to improve liquidity and information of the market.

A study by **Indian Institute of Management, Bangalore, (2006)** with regard to gram, sugar, guar-seed, wheat, urad, and tur states that these commodities witnessed higher price increase in the Post Exchange period as compared

with the pre-exchange period. It concludes that changes in the fundamentals were important in causing the higher post-futures price rise, with government policies also contributing. Therefore, the role of futures remains unclear.

The study by Sahi,G.S, (2006), R. Salvadi and P. Ramasundaram, 2008 the study suggests that excessive speculative activity in futures market which is not driven by those who manage price risks in physical trade. Their results showed the inefficiency of agricultural commodity futures market in terms of price discovery due to the non integration of futures and the spot market.

By examining efficiency of Indian commodity futures market **Samal, G.P and Swain, Anil (2015)** concluded that there was a long-term relationship existed between futures and spot prices for cotton, turmeric and castor seed during the calendar year 2013. Further, causality test proved that futures markets have stronger ability to predict subsequent spot prices for cotton, turmeric and castor seed during the same period.

From the literature review, it is observed that there is enormous amount of literature on the concerned subject considering the world-wide commodity market. However, it is comparatively less in case of price risk management in agricultural commodities, especially in raw jute. In the same time it is found out that there is enormous amount of literature on efficiency in information flow between the two markets i.e. Spot and the Futures, Co-integration between both the markets. The study relating to Jute has not made. Hence, the study is taken up. In such circumstances, this study carries a significant importance to re-look on the price risk management efficiency of agricultural commodity market in India.

Spot Market of Jute- In Indian Context:-

Jute is the cheapest and the strongest of all natural fibers also considered as the fiber of the future. According to world's production of textile fibers Jute is the second largest after cotton. Particularly India, Bangladesh, China, Thailand, south Asian countries and Brazil are the leading producers of raw Jute and also the main producers of White jute and dark jute. Jute is extensively used in the manufacture of different types of packaging fabrics, carpet backing, mats, bags, decorative fabrics, chic-saris, soft luggage's, footwear, greeting cards, molded door panels, tarpaulins, ropes and twines etc. and also other types of consumer products.

India is the largest producer of jute goods in the world, while Bangladesh is the largest cultivator of raw jute. Eastern Indian states v.i.z. West Bengal, Bihar, Assam, Tripura, Meghalaya, Odisha and Uttar Pradesh are the major cultivator of Jute. In India West Bengal alone produces approximately fifty percent of total raw jute. In India 4000,000 families are involved in the cultivation of raw jute. There are 76 jute mills and provides employment opportunity nearly to 1, 37,679 people. Several thousand other people are engaged in several jute related diversified goods also. The state seed corporation of Andhra Pradesh and Maharashtra produces more than 90 percent of jute seeds so, India is self-sufficient in the jute seed production.

Jute, being a natural fibre, is biodegradable and eco-friendly and it has many advantages over synthetics. It also enjoys the advantages like low extensibility, high tensile strength, lusture, moderate heat and fire resistance and long staple lengths. Recently Indian Jute Industries Research Association (IJIRA) has developed Hydrocarbon free jute bags and food grade jute bags of international standard. Now these bags have great demand throughout the world for packing food stuffs. There are many verities of jute but according to general utility purposes some of the important verities are the following:

- Hessian Or Burlap - these are plain woven fabric of 5 to 12 ozs./ yard, and used for making cloths and bags.
- Sacking – these qualities are made from lower grades of fiber and weighing from 12-20 ozs./yard popularly known as 'heavy goods'. In all types of bags these qualities are used.
- Canvas - it is the finest jute product and woven of the best grades of fiber used as a protection from the weather.
- Jute Yarn And Twine – it has varying weights and thickness these are consumed by the jute mills themselves in fabrics. It has variety of applications such as sewing, tying, packing pipe joints, cable binding etc.

There are many regulatory and development organizations associated with the jute industry for its sustainable development. The International Jute Study Group (IJSG) which is an intergovernmental body set up by the UNCTAD to promote the international trade by developing new markets, developing sustainable and qualitative new jute products and providing a platform for active participation among private sectors globally. In India under the National Jute Board Act, 2008 a statutory body was set up called National Jute Board (NJB) that functions under the

Ministry of Textiles, Govt. of India and has started its operation with effect from the 1 April 2010. The two organizations i.e. Jute Manufactures Development Council (JMDC) and National Centre for Jute Diversification (NCJD) are merged with the NJB. It functions with the objective of promoting standardization of raw jute and jute goods, developing entrepreneurship in jute sector by organising entrepreneurial development programmes, modernizing jute industry etc. Other organizations like Indian Jute Industries Research Association (IJIRA), Central Research Institute for Jute & Allied Fibers (CRIJAF), Jute Manufactures Development Council (JMDC), Indian Jute Mills Association (IJMA), Gunny Trades Association (GTA), Institute of Jute Technology (IJT), Office of Jute Commission (Ministry of Textile) and many more were established to strengthen the sector. Further in the year 2005 the govt. of India framed the national jute policy with the objective of improving the quality of jute, increasing its export, producing and exporting the jute goods which confirms the international standard, utilizing the advanced technology in production, improving the working environment of the jute industry and providing fair emoluments to the workers which are conducive for their reasonable quality of life etc.

So far as the pricing of the raw jute is concerned the Government of India every year determines the Minimum Support Price of various grades of raw jute with the consolation of Commission for Agricultural Cost and Prices (CACP). This year Government has increased the Minimum Support Price (MSP) of raw jute of TD-5 grade from Rs. 2300 per quintal (100 Kilograms) to Rs. 2400 per quintal for the 2014-2015 seasons i.e. an increase of 4.34 percent over last year's.
Government also fixes the MSP for grades of raw jute. Jute Corporation of India (JCI) acts as a nodal agency of the govt. for undertaking price support operations.

Minimum Support Prices of Jute of TD-5 (a tossa variety grown in Assam) Grade in India.

Crop Year	MSP Per 100 Kgs	Price Increase	% of Price Increase	Crop Year	MSP Per 100 Kgs	Price Increase	% of Price Increase
2014-15	2400	100	4.34%	2002-03	850	40	04.94%
2013-14	2300	100	4.54%	2001-02	810	25	03.18%
2012-13	2,200	525	31.34%	2000-01	785	35	04.67%
2011-12	1,675	100	06.35%	1999-2000	750	100	15.38%
2010-11	1,575	200	14.55%	1998-99	650	80	14.03%
2009-10	1,375	125	10.00%	1997-98	570	60	11.76%
2008-09	1,250	195	18.48%	1996-97	510	20	04.08%
2007-08	1,055	55	05.50%	1995-96	490	20	04.26%
2006-07	1,000	90	09.89%	1994-95	470	20	04.44%
2005-06	910	20	02.25%	1993-94	450	50	12.50%
2004-05	890	30	03.49%	1992-93	400	00	00.00%
2003-04	860	10	01.18%				

Source: Jute Corporation of India Limited.

Jute Futures Market and Hedging Effectiveness - In Indian Context:-

As mentioned earlier price volatility is one of the key problems associated with commodities. To manage these price volatility derivative products like Commodity futures can be used. Commodity Futures contracts are standardized forward contracts that are transacted through a recognized commodity exchange. In futures contracts underlying's are standardized in quality, quantity and location but leaving price as the only variable factor. Modern futures agreements began in Chicago in the 1840s. The following are some of the salient features of commodity futures:

- Commodity Futures contracts always traded on an organized exchange such as NCDX, MCX, NMCE etc. in India and NYMEX, LME, COMEX etc. internationally. These exchange provides a ready, liquid market in which futures can be bought and sold at any time
- Quality, quantity, and delivery date, of the underlying are predetermined by the exchanges and different exchanges have their own standard.
- The minimum price variation which is standardized for every contract called tick size and it also may vary from exchanges to exchange.
- Commodity Futures exchanges use clearing house which acts as a guarantor for both the parties against counter party risk by keeping margin money. It gives the guarantee for execution and delivery of the contracts held till

maturity.

- In order to avoid counter party risk, both the parties' deposits some amount of money with the clearing house called margin money. Generally there are two types of margin money v.i.z. initial margin and maintenance margin.
- On daily basis profit and loss on each transaction is determined which is called mark to market or making to market. On daily basis the profit is credited and the loss is debited in the margin money account of the trader for which it is called daily reconnected forwards.
- Its Proper regulation ensures fair practices in these markets. Previously commodity futures market was regulated by the forward market commission (FMC) but after the merger of FMC with SEBI now it is coming under the purview of SEBI.

Futures market provides many advantages directly and indirectly as the primary objectives of any commodity futures exchange are price discovery and an efficient price risk management. Based on inputs regarding demand and supply equilibrium, weather forecasts, expert views and comments, inflation rates, Government policies, market dynamics, hopes and fears, hedgers' trades at commodity futures exchanges facilitates determining the fair value of a commodity. Secondly the futures market provides the platform to the hedgers for price risk management. By taking an equal but opposite position in the futures market, participants like farmers, processors, merchandisers, manufacturers, exporters, importers etc are used it to hedge their spot exposure. Thirdly the importers and exporters can hedge their price risk and improve their competitiveness by making use of futures market. Fourthly, futures contracts will enable predictability in domestic prices which helps the manufacturers to smooth out the influence of changes in their input prices. Otherwise the manufacturers are required to keep sufficient financial reserve to met the adverse price changes which could have been utilized for making other profitable investments. Fifthly, the quality certificates that are issued by the exchange-certified warehouses where farmers kept their standardized produce, have the potential to become the norm for physical trade. Last but not the least commodity futures market needs modern warehousing, quality and grading testing centers that leads to development of infrastructures which paves the way of economic development of a country.

Despite of the above benefits there are also some loop holes of the futures market. First the low margin requirement may encourage to the speculative activity among the participants which leads to unnecessary risk taking as a result the potential for losses is also increases. Participation of large number of farmers is also imperative for an efficient commodity futures market but bringing the farmers into the mechanism by creating awareness among them is also challenging. Some also argued that the delivery based settlement is the most critical part of the commodity futures for which the speculators those trade in a exchange without having the underlyings squares up their position before the contract period approaches. Others have the view that trading in futures are just for experts for general people it's a risky business. But enormous studies suggest that futures can be used as an important instrument for price risk management.

So far as the participants of the future market are concerned, they can be broadly divided into three types v.i.z. hedgers, speculators and arbitrageurs. Hedgers are the commercial producer enters into futures market for hedging their spot exposure whereas speculators predicts the direction of prices and makes profit by using the futures market. When price differential prevails between the two market arbitragers makes money by simultaneously buying and selling the same commodities in different markets. Hedgers transfers the risk of adverse price movement by foregoing the profit potential where as speculators accepts that risk with objective of making money by predicting the future price movement for All the above participant makes the futures market efficient and speculators brings equilibrium between the two market which makes price discovery process more efficient in the futures market.

Risk arises due to unanticipated and unfavorable movement of the price. Risk can't be completely eliminated but can be reduced by using different strategies and techniques. Commodity futures is one of the most important technique among the available alternatives. Unfavorable price changes in the commodity cash market can be hedged by using commodity futures. In the context of future trading hedging is the process of taking a position in futures market to protect the value of spot positions. There are different concepts of hedging such as Perfect Hedge, Carrying charge Hedging, Discretionary Hedging, Anticipatory Hedging, Long Hedge, Short Hedge, Cross Hedging etc.

Research Methodology:-

The study utilized secondary data source viz. daily historical closing spot and futures price of raw jute transacted in National Multi Commodity Exchange (NMCE) during 2010-14. Thus, the data collected is for a period of five years from 2010 to 2014. The data are collected from the home page of National Multi Commodity Exchange of India i.e. www.nmce.com

Trend of spot and futures prices in raw jute was analyzed in the study by using descriptive statistical measures like mean, standard deviation and coefficient of variation. For empirical analysis of raw jute futures market in India the following methodology has been applied are as follows:

To identify the minimum variance hedge ratio, we first rewrite the cash flows in terms of prices changes i.e. $=S^T - S$ and $\Delta F = F^T - F$ denote the change in spot and futures prices respectively over the hedging horizon. Now it is required to add and subtract quantity QS to obtain;

$$QS^T - QS + QS - H(F^T - F) = Q(S^T - S) - H(F^T - F) + QS$$

$$Q\Delta S - H\Delta F + QS \quad \text{---------- Eq.- 1.1}$$

Now let *h* =H/Q denote the hedge ratio. The cash flow (1.1) can be expressed in terms of hedge ratio as

$$Q[\Delta S - h\Delta F] + QS \quad \text{---------- Eq. 1.2}$$

We want to pick *h* to minimize the variance of this quantity. It should be noted that the last term QS is a known quantity at the time hedge is put on, so it contributes nothing to the variance. From (Eq-1.2) the variance of the hedged cash flow comes from the three sources[2]:

- The variance of spot price changes ΔS. Denote this quantity by $\sigma^2(\Delta S)$.
- The variance of futures price changes ΔF. Denote this quantity by $\sigma 2(\Delta F)$.
- The co variance between these quantities, denoted cov. (ΔS,ΔF).

Using this notation the variance of hedged cash flow (1.2) is

$$\text{Var}[Q(\Delta S - h\Delta F)] = Q^2 \text{Var}(\Delta S - h\Delta F)$$

$$= Q^2[\sigma 2(\Delta S) + h^2 \sigma 2(\Delta F) - 2h\,\text{Cov.}(\Delta S, \Delta F) \quad \text{---------- Eq. - 1.3}$$

The presence of the h^2 term ensures that the last term is U- shaped as a function of h. to identify the point of minimum variance, we have to take the derivative of Eq.-1.3 with respect to h and set it equal to zero. This yields-

$$2h\sigma^2(\Delta F) - 2\,\text{Cov.}(\Delta S, \Delta F) = 0 \quad \text{---------- Eq.1.4}$$

Or $h\sigma 2(\Delta F) = \text{Cov.}(\Delta S, \Delta F)$. Thus the variance minimizing value of h is :

$$h = \text{cov.}(\Delta S, \Delta F) / \sigma 2\,F \quad \text{---------- Eq. - 1.5}$$

To express *h* in terms of the correlation *P* between ΔS and ΔF, note that by definition

$$\rho = \text{Cov.}(\Delta S, \Delta F) / \sigma(\Delta S)\,\sigma(\Delta F) \quad \text{---------- Eq.1.6}$$

Thus Cov. (ΔS, ΔF) = $\rho\,\sigma(\Delta S)\,\sigma(\Delta F)$, SO *h*can also be written as

$$h = \rho(\sigma\Delta S)/(\sigma\Delta F) \quad \text{---------- Eq.-1.7}$$

Where, h = Minimum Variance Hedge Ratio

ΔS = Change in spot price during a period of time equal to the life of the hedge

ΔF = Change in futures price during a period of time equal to the life of the hedge

σΔS = Standard deviation of change in spot price.

σΔF = Standard deviation of change in futures price.

ρ = co-efficient of correlation between ΔS and ΔF.

If ρ =1, and σ ΔF= σ ΔS then, *h* = 1. In this case, the futures price mirrors the spot price perfectly. If ρ =1 and σ ΔF= 2 σ ΔS, then the hedge ratio *h* will be 0.5. In this case, the futures price always changes by twice as much as the spot price. So, the proportion of variance which is eliminated by hedging is called hedge effectiveness.

As stated earlier minimum variance hedge ratio or risk minimizing hedge ratio *h* is the multiplication of 'ρ' with the scaling factor. 'ρ' denotes the correlation between ΔS and σ ΔF and the 'scaling factor' denotes the ratio of σ ΔS to σ ΔF. when hedging a given quantity of an asset we have to multiply h by the number of units of the spot good per the

[2]Das,Sundaram. (2013), "*Derivative: Principles and Practice*' 'Tata McGraw-Hill Publishing Company Limited, New Delhi, p- 107.

number of unites covered by a futures contract[3]. Number of futures contracts to trade to have a risk minimizing hedge will be

$$= h \frac{\text{quantity of the cash assets to be hedged}}{\text{quantity of the asset underlying one futures contracts}}. \text{ ---------- Eq.-1.8}$$

For instance - if h =0.7 and one futures contract covers 100 unites, then for hedging 800 unites, the risk minimizing number of futures contracts required to sell is 5.6(i.e. 07*800/100).

Hypothesis of the Study:-
Ho: Indian Raw Jute Futures market manages price risk efficiently
H1: Indian Raw Jute Futures market does not manage the price risk efficiently.

Limitations of the study:-
The important limitations of the study are as follows:

- The research work is completely based on secondary data which is collected from the websites of National Multi commodity Exchange.
- The secondary data of raw jute futures and spot prices are collected only from one commodity derivative exchange. i.e. NMCE.
- The third limitation of the project is regarding period of data i.e. only five years (2010-2014) data are taken for the purpose of study.

Empirical Finding and Discussion :-

Trends of Spot and Futures Prices of Raw Jute:

Before analyzing the trend of futures price and spot price, it is necessary to understand the concept of types of market. As the delivery date of a futures contract is approached, the futures price converges to the spot price of the underlying asset. In other word when the delivery period is reached, the futures price equals or is very close to the spot price. In such a case the market is known as a perfect market. But if the futures price is more than the spot price at the time to maturity then, it is known as a normal market and if the futures price is less than the spot price at the time to maturity, it is known as an inverted market. The hedger is advised to enter into the derivative market in case of a perfect market.

The spot and future prices of raw jute by using daily data over a period of last five years (2010-14) is presented in table 1 and its diagrammatic illustration is given in figure 1 . The spot price of raw jute, which was quoted at Rs. 3109.85 per quintal in 2010, decreased to Rs.2441.58 in 2012 and then rose to Rs. 3034.01 in 2014, registering an up and down trend over the period. The coefficient of variation around the annual mean price of raw jute has at first gone up from 9.02 in 2010 to 20.60 in 2012. Thereafter, the variation exhibited a decreasing trend and reached at 4.47 in 2014. Interestingly, the downward trends in prices are also associated with smaller standard deviations, resulting in lesser coefficient of variations during 2013-14. Over the whole five year period (2010-14), there is a lower variation in the spot prices of raw jute and the coefficient of variation is found to be around 12.23 percent. In case of futures price, coefficient of variation is recorded at 12.33 percent over the last five years. Thus, the futures price shows a more or less same extent of variation in comparison to spot price of raw jute. A year-wise analysis suggests that in most of the years, coefficient of variation lies below 10 per cent in spot and futures prices of raw jute. The only exception is found in the years 2011 and 2012.

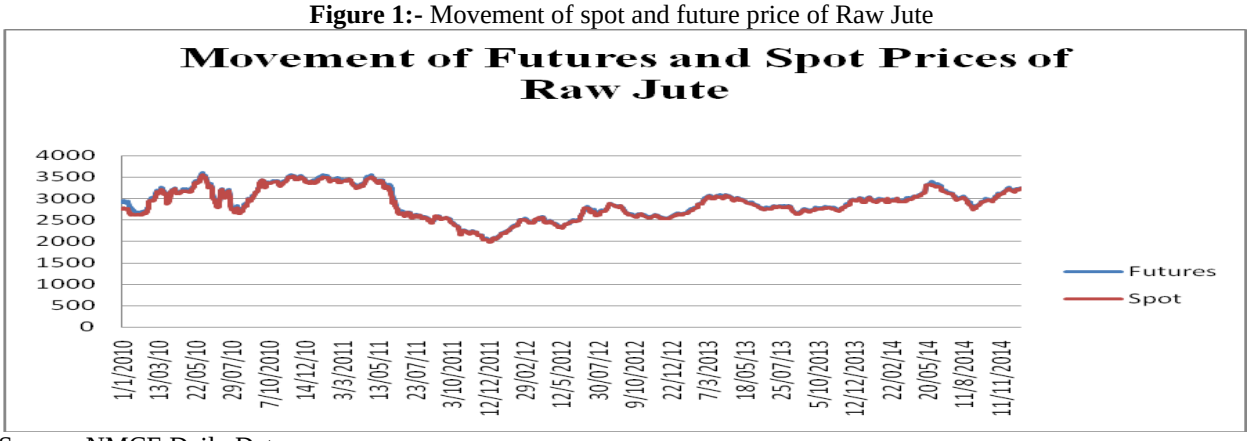
Table 1:- Trend of Spot and Future Prices of Raw Jute in India (2010-14)

Descriptive Statistics	2010	2011	2012	2013	2014	Whole Period (2010-2014)
Spot Price (Raw Jute)						
Count	297	288	277	291	248	1401
Mean	3109.85	2822.55	2441.58	2826.39	3034.01	2865.11
Standard Deviation	280.55	516.12	503.06	123.69	135.64	350.40
coefficient of variation (CV)	9.02	18.29	20.60	4.38	4.47	12.23
Future Price (Raw Jute)						

[3]Dubofsky, David A and Miller Jr., Thomas. (2003), "*Derivatives: Valuation and Risk Management*'', Oxford University Press, New York, p-172.

Count	297	288	277	291	248	1401
Mean	3149.07	2847.77	2452.26	2842.77	3055.64	2888.06
Standard Deviation	264.82	527.13	505.69	124.87	140.73	356.23
coefficient of variation (CV)	8.41	18.51	20.62	4.39	4.61	12.33
Source: NMCE Daily Data						

Figure 1:- Movement of spot and future price of Raw Jute



Source: NMCE Daily Data

Correlation between Change in Spot and Futures Price of Raw Jute:-

The Table-2 clearly depicts throughout the year 2010 the co-relation between change in spot and futures of raw jute remains above 80% except for the month Dec., March and August touching 90% which are the lean seasons, so in these period prices normally farmed up. The harvest season starts from Sept. to Nov. end and the price falls during this period because most of the jute small farmers cultivating jute bring the jute in the market as they don't have the space to store off and further these marginal farmers needs money badly. Even at times it leads to distress sell.

In Oct. and Nov. of each year the co-relation is very high because of supply factor. The correlation was more than 60 times in between 0.75 to1.0 in harvesting period, and Oct. of every year there is a strong correlation found between the prices i.e. nearer to 90 percentages. The traders enter the spot and also probably to protect the price rise, enter the futures simultaneously. Hence, bringing a strong correlation between both the returns. Supply continues till Jan. and from March onwards the supply gets reduced normally. From April to Aug. which is the sowing season normally the farmers don't hold the stock and it is the traders who are found mostly in spot and futures. In harvesting season though there is a positive co-relation between spot and futures the returns are very less in both the prices. In the beginning of the harvesting month (Sept.) the returns are higher because the traders take position in both the spot and futures simultaneously. Hence market remains volatile due to the expectation of new a arrivals. In true sense from Jul. to Aug. is the lean season, here also returns are higher. July is equally far from sowing and harvesting, so this is the month which gives better returns to trader and big farmers who holds stock. In the month of May returns are not good in the same time the correlation between the returns were very poor i.e. 80 times the correlation was below0.75. This trend is found in every year.

So the futures and spot market takes cues from the production cycle. The market seems to the spot reflects to the futures and in other way futures do reflects the spot. Though the market is not hundred percent efficient it moves increasingly towards efficiency.

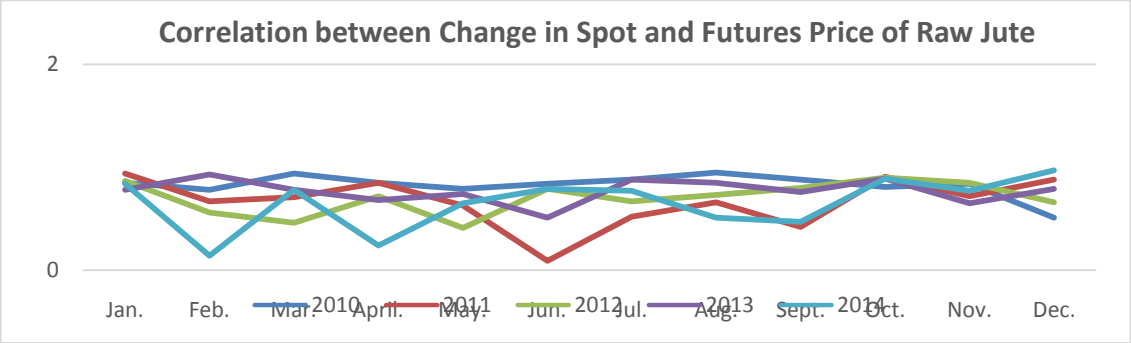
Table 2:- Correlation between Change in Spot and Futures Price of Raw Jute.

Month/ Year	**2010**	**2011**	**2012**	**2013**	**2014**	**% times the correlation was**	
						<0.75	**0.75-1.0**
Jan.	0.85	0.94	0.87	0.78	0.84		100
Feb.	0.78	0.67	0.56	0.93	0.14	60	40
Mar.	0.94	0.71	0.46	0.78	0.78	40	60
April.	0.85	0.85	0.72	0.68	0.24	60	40
May.	0.79	0.63	0.41	0.74	0.65	80	20
Jun.	0.84	0.09	0.79	0.51	0.79	40	60

Jul.	0.88	0.52	0.67	0.88	0.77	40	60
Aug.	0.95	0.66	0.73	0.85	0.51	60	40
Sept.	0.88	0.42	0.8	0.76	0.47	40	60
Oct.	0.81	0.91	0.9	0.89	0.89	-	100
Nov.	0.84	0.72	0.85	0.65	0.77	40	60
Dec.	0.51	0.88	0.66	0.79	0.97	40	60
<0.75	8	67	59	25	42		
0.75-1.0	92	33	41	75	58		

Source: Calculation based on NMCE data(calculated by taking the daily price changes of the respective month)

Figure 2:-



Source: NMCE Daily Data

Volatility of Spot and Futures Market:-

Standard deviation measures the variation in spot and futures prices. From Jan. to Apr. the variation in spot return is more than the variation of futures return indicates that the supply is more in the spot and the farmers bring the stock to the market. From May on wards till sept the supply from the farmer's side get reduced and bringing volatility in the spot market and these are the lean seasons. From Oct. to Jan. which is the harvesting season the futures remains more volatile than the spot and the price is normally discovered by the futures market during this period.

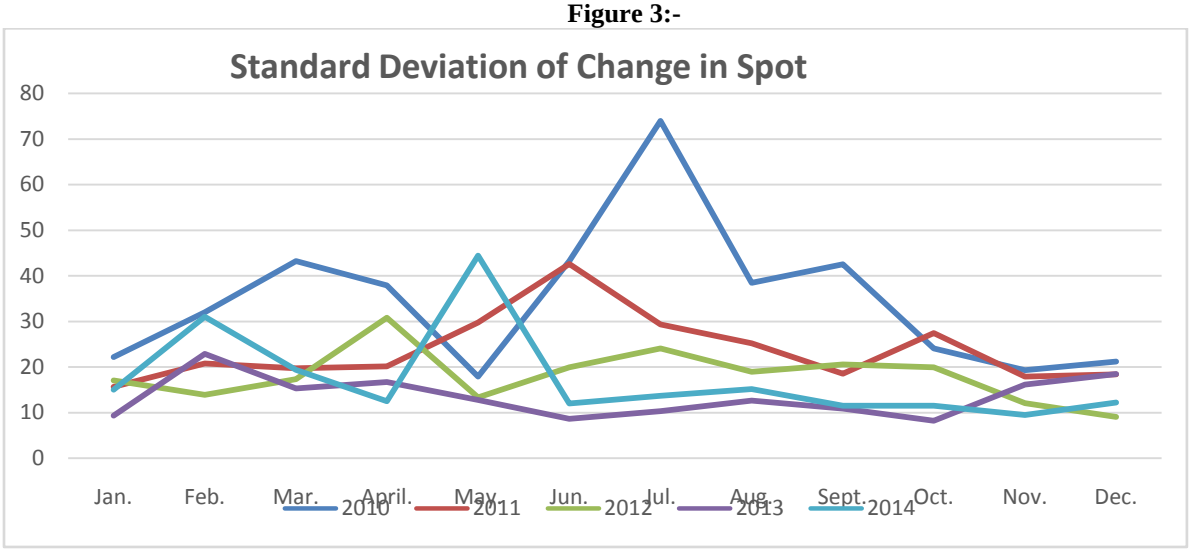
In majority cases the trend in volatility of futures and spot indicates that the price is discovered during the harvesting season with futures higher volatility than the spot and in lean season the trend get reversed.

Table 3:- Standard Deviation of Change in Spot

Month/Year	**2010**	**2011**	**2012**	**2013**	**2014**
Jan.	22.2	15.66	17.04	9.292	14.96
Feb.	31.98	20.82	13.85	22.83	30.96
Mar.	43.23	19.76	17.29	15.26	19.31
April.	37.93	20.16	30.83	16.69	12.47
May.	17.9	29.75	13.32	12.72	44.4
Jun.	43.26	42.62	19.93	8.59	11.93
Jul.	73.98	29.33	24.09	10.31	13.67
Aug.	38.43	25.23	18.96	12.57	15.09
Sept.	42.57	18.52	20.56	10.86	11.43
Oct.	24.11	27.42	19.95	8.191	11.46
Nov.	19.29	17.92	12	16.09	9.423
Dec.	21.23	18.42	9.004	18.4	12.14

Source: Calculation based on NMCE data, (calculated by taking the daily price changes of the respective month)

Figure 3:-



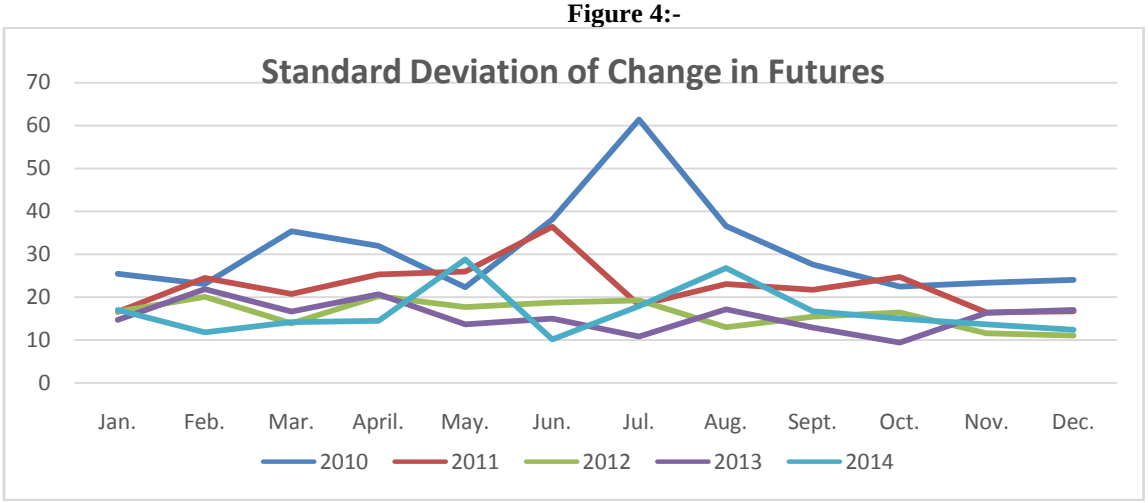
Source: NMCE Daily Data

Table 4:- Standard Deviation of Change in Futures

Month/Year	2010	2011	2012	2013	2014
Jan.	25.42	16.5	16.64	14.7	16.98
Feb.	23.02	24.39	20.05	21.8	11.76
Mar.	35.34	20.69	13.88	16.6	14.15
April.	31.89	25.26	20.19	20.6	14.47
May.	22.25	25.88	17.68	13.6	28.8
Jun.	38.11	36.35	18.69	15	10.11
Jul.	61.38	18.12	19.22	10.8	17.87
Aug.	36.53	22.99	12.98	17.1	26.81
Sept.	27.54	21.69	15.41	12.9	16.68
Oct.	22.41	24.64	16.43	9.4	14.94
Nov.	23.29	16.37	11.55	16.3	13.62
Dec.	23.97	16.64	11.04	17	12.36

Source: Calculation based on NMCE data, (calculated by taking the daily price changes of the respective month)

Figure 4:-



Source: NMCE Daily Data

Ratio of Standard Deviation of Change in Spot to Change in Futures:-

The ratio indicates the variation between spot and futures prices. From Oct. on wards when the harvesting seasons starts not only the co-relation between the change in spot and change in futures remains high but also spot prices varies more than the variation in the futures prices resulting a higher ratio of standard deviation of change in spot to standard deviation of futures. It simply depicts the volatility in spot is more than the volatility in futures prices basically due to supply factor. Particularly in this harvesting month of every year the ratio remains 100 times in between 0.75 and 1.25. This trend sustains till Jan. end of every year. Feb, Aug and Sept. are the periods coming between sowing and harvesting season shows a very low ratio. This kind of trend is found in all the years.

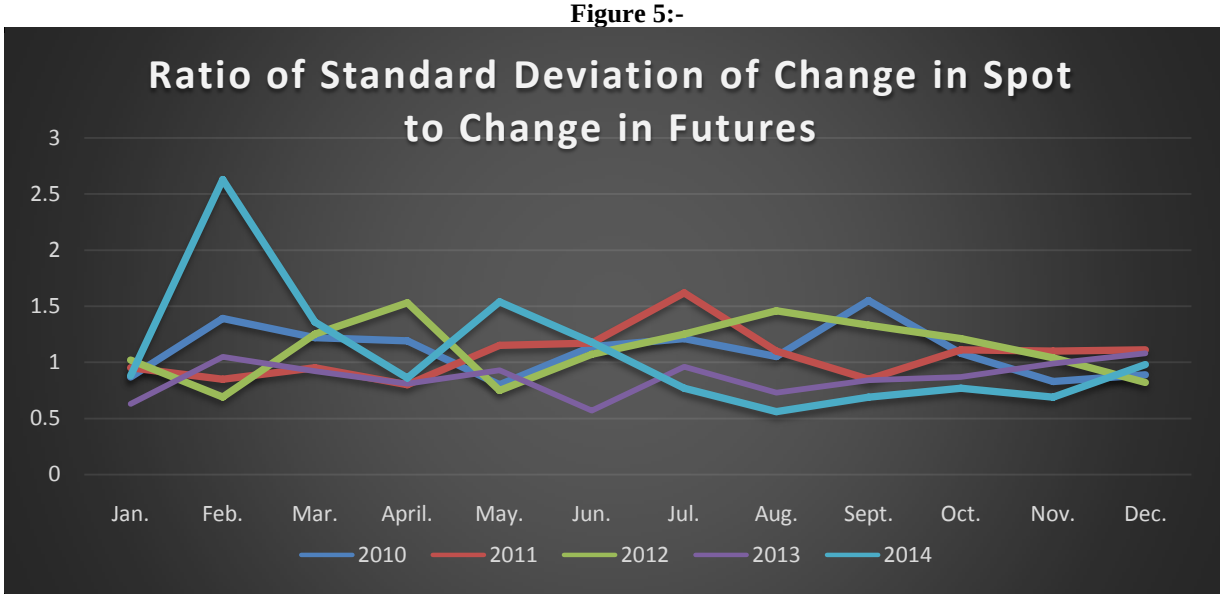
In the year 2011, 92 times the ratio was between 0.75 to 1.2. The year 2014 shows lowest ratio i.e. only 50 times the ratio was between 0.75 to 1.25.

Table 5:- Ratio of Standard Deviation of Change in Spot to Change in Futures.

Month/Year	2010	2011	2012	2013	2014	Per cent of times the ratio was		
						<0.75	0.75-1.25	>1.25
Jan.	0.87	0.95	1.02	0.63	0.88	20	80	-
Feb.	1.39	0.85	0.69	1.05	2.63	20	40	40
Mar.	1.22	0.95	1.25	0.92	1.36	-	80	20
April.	1.19	0.8	1.53	0.81	0.86	-	80	20
May.	0.8	1.15	0.75	0.93	1.54	-	80	20
Jun.	1.14	1.17	1.07	0.57	1.18	20	80	-
Jul.	1.21	1.62	1.25	0.96	0.77	-	80	20
Aug.	1.05	1.1	1.46	0.73	0.56	40	40	20
Sept.	1.55	0.85	1.33	0.84	0.69	20	40	40
Oct.	1.08	1.11	1.21	0.87	0.77	-	100	-
Nov.	0.83	1.1	1.04	0.99	0.69	-	100	-
Dec.	0.89	1.11	0.82	1.08	0.98	-	100	-
<0.75	-	-	8	25	25			
0.75-1.25	83	92	67	75	50			
>1.25	17	8	25	-	25			

Source: Calculation based on NMCE data, (calculated by taking the daily price changes of the respective month)

Figure 5:-



Source: NMCE Daily Data

Analysis of minimum variance hedge ratio:-

The most important function of the futures market is enabling investors to hedge exposures i.e. to reduce the riskiness of cash flow associated with spot market commitments. A hedge is said to be perfect when the basis is riskless at the time of terminating hedge, this only ensures a certainty cash flow from the hedge. But perfect hedge is a theoretical phenomenon due to various factors perfect hedge is not practically possible. The first factor which doesn't let the perfect hedge model practically possible is the commodity mismatch. Standardization is the most important characteristic of futures contract. Standard grade underlying of the futures contract may not be the same as the grade of the assets being hedged. As a result the futures price F^T may not coincide with S^T, the time T spot price of the assets being hedged. So the basis $F^T - S^T$ is in nonzero. This is what the basis risk caused by commodity mismatch or grade mismatch.

The second factor is delivery date mismatch. Though futures contract have standardized delivery period, so the available futures contract may not coincide with the investors' date of market commitment. Even if there is no commodity mismatch, but due to delivery period mismatch of the commodity the basis will be nonzero. So the presence of basis risk implies that cash flow can't be made completely riskless by hedging. Risk can be reduced by hedging. First, it is need to measure the risk. As usual the risk of cash flow can be measured by its variance. Variance is a good first approximation of risk. So here we will identify the hedge that will lead to the least cash flow variance among all possible hedges. This is called minimum variance hedge.

It is already earlier mentioned that hedging is nothing but an offsetting of risk. In hedging we offset the exposure of spot with futures. In other word we are trying to offset the effect of spot price movement with price movement so that the resulting cash flow has minimum risk. For offsetting the exposure of spot with futures it is inevitable to take into consideration the movement of both spot and futures prices to cancel the effect of one by other. This is called correlation between spot and futures prices. The higher the degree of correlation greater the co-movement and the easier to offset the risk. So when there is perfect co- relation between the movement of spot and futures prices, then offsetting the exposure of spot with futures is also perfect. So we obtain a riskless hedge.

For this purposes hedge ratio is taken by the investors or hedgers. The hedger ratio simply measures the number of futures position taken per unit of spot exposure. It is earlier mentioned that optimal hedge ratio is the hedge ratio of unity i.e. one for one. It means for offsetting one spot exposure you should go for equal futures position. But in practice in the presence of basis risk, it is not generally optimal to hedge exposure one to one but variance minimizing hedge ratio which we called minimum variance hedge ratio.

Minimum variance hedge ratio has two important aspect one is co- relation between the change in spot and futures prices and the other one is ratio of standard deviation between the change in spot and futures prices. Thus minimum variance hedge ratio is the co-relation '*P'* multiplied by the scaling factor i.e. $(\sigma \Delta S)/ (\sigma \Delta F)$.

To understand the minimum variance hedge ratio we have to go to the deep. It is earlier mentioned that minimum variance hedge ratio has two aspect i.e. *'P'* and 'scaling factor'. Let's take the first factor *'ρ'* which signifies the Co-relation between the change in spot and futures prices. If co-relation is zero, then there is no offsetting of risk at all from hedging using futures. In this case any hedging activity will increase the overall cash flow risk by creating cash flow uncertainty from the second source i.e. the futures position. Thus the optimal hedge ratio will becomes zero. As co-relation increases, however greater offsetting of risk is facilitated, so we want to use a higher hedge ratio to take advantages.

Now let's take the second important factor i.e. 'scaling factor'. The first question arises here is: why scale the co-relation by the ratio of standard deviation? As we know the objective of hedging is nothing but offsetting the exposure of spot by using futures. Suppose the typical move in futures prices is twice the size of typical move in spot prices. Then other things remaining equal the size of the futures position used for hedging should be only half of the size of the spot exposure. This typical price movement of both spot and futures are measured by their respective standard deviations. When $\sigma \Delta F$ is more than the $\sigma \Delta S$, then less number of futures contracts are required to hedge the higher number of spot contracts, keeping all other things same. In other word keeping other factors constant, if $\sigma \Delta S$ is less than the $\sigma \Delta F$ then with less number of futures contract positions can be able to hedge the higher number of spot contracts exposures and vice-versa. When $\sigma \Delta S$ is equal to the $\sigma \Delta F$ then keeping the effect of 'P' value constant hedging ratio will be one. Minimum variance hedge ratio increases as the co-relation increases or in other word variance of cash flow under the minimum variance hedge ratio will be lower when co-relation is

higher, higher correlation implies a superior ability to offset cash flow risk by hedging[4]. In the limit, when co-relation is perfect, the minimized cash flow variance will become zero.

Minimized variance will not be zero except in the trial case where 'P'= +/- 1 i.e. when the ΔS and the ΔF are perfectly co-related either negatively or positively. But futures and spots are perfectly co-related only when there is no basis risk, so if basis risk is present there is always some residual uncertainty even after hedging. By concluding the above discussion we can say that higher the 'ρ' value more is the hedge ratio and vice- versa, when all other factors remain constant. And higher the σ ΔF than the σ ΔS then lesser number of futures contracts can be able to hedge a larger number of spot contracts position. The detail analysis of minimum variance hedge ratio of raw jute is given below:

Table No-6 depicts the hedge ratio of different years on month wise which is calculated by taking the daily change in prices of spot and futures. It is very clear from the table that when harvesting season starts i.e. from Oct. onwards till Jan. end the hedge ratio remains high. In this period more than 60 times the hedge ratio remains between 0.75 to1.25. In the month of Oct. it remains high with the expectation of new arrivals and when actually supply comes to the market it also becomes high. The reverse is found in sowing seasons. In harvesting season the co-relation between the change in spot and futures increase and the variation in change in spot becomes more than the variation in change in futures resulting a high minimum variance hedge ratio. Particularly this kind of trend is found in every year.

Table 6:- Analysis of 'ρ', 'Scaling factor' and Minimum Variance Hedge Ratio

Year	'ρ'	σ ΔS	σ ΔF	σΔS/σΔF	Hedge Ratio
2010					
Jan.	**0.85**	**22.2**	**25.42**	**0.87**	**0.75**
Feb.	**0.78**	**31.98**	**23.02**	**1.39**	**1.09**
Mar.	**0.94**	**43.23**	**35.34**	**1.22**	**1.15**
April.	**0.85**	**37.93**	**31.89**	**1.19**	**1.01**
May.	**0.79**	**17.9**	**22.25**	**0.8**	**0.63**
Jun.	**0.84**	**43.26**	**38.11**	**1.14**	**0.95**
Jul.	**0.88**	**73.98**	**61.38**	**1.21**	**1.06**
Aug.	**0.95**	**38.43**	**36.53**	**1.05**	**1**
Sept.	**0.88**	**42.57**	**27.54**	**1.55**	**1.36**
Oct.	**0.81**	**24.11**	**22.41**	**1.08**	**0.88**
Nov.	**0.84**	**19.29**	**23.29**	**0.83**	**0.7**
Dec.	**0.51**	**21.23**	**23.97**	**0.89**	**0.45**
2011					
Jan.	**0.94**	**15.66**	**16.5**	**0.95**	**0.9**
Feb.	**0.67**	**20.82**	**24.39**	**0.85**	**0.57**
Mar.	**0.71**	**19.76**	**20.69**	**0.96**	**0.67**
April.	**0.85**	**20.16**	**25.26**	**0.8**	**0.68**
May.	**0.63**	**29.75**	**25.88**	**1.15**	**0.72**
Jun.	**0.09**	**42.62**	**36.35**	**1.17**	**0.11**
Jul.	**0.52**	**29.33**	**18.12**	**1.62**	**0.85**
Aug.	**0.66**	**25.23**	**22.99**	**1.1**	**0.72**
Sept.	**0.42**	**18.52**	**21.69**	**0.85**	**0.36**
Oct.	**0.91**	**27.42**	**24.64**	**1.11**	**1.02**
Nov.	**0.72**	**17.92**	**16.37**	**1.1**	**0.78**
Dec.	**0.88**	**18.42**	**16.64**	**1.11**	**0.98**
2012					
Jan.	**0.87**	**17.04**	**16.64**	**1.02**	**0.89**
Feb.	**0.56**	**13.85**	**20.05**	**0.69**	**0.38**
Mar.	**0.46**	**17.29**	**13.88**	**1.25**	**0.57**
April.	**0.72**	**30.83**	**20.19**	**1.53**	**1.1**
May.	**0.41**	**13.32**	**17.68**	**0.75**	**0.31**

[4].Das,Sundaram. (2013), "*Derivative: Principles and Practice*'',Tata McGraw-Hill Publishing Company Limited, New Delhi, p- 107

Jun.	**0.79**	**19.93**	**18.69**	**1.07**	**0.85**
Jul.	**0.67**	**24.09**	**19.22**	**1.25**	**0.84**
Aug.	**0.73**	**18.96**	**12.98**	**1.46**	**1.07**
Sept.	**0.8**	**20.56**	**15.41**	**1.33**	**1.07**
Oct.	**0.9**	**19.95**	**16.43**	**1.21**	**1.09**
Nov.	**0.85**	**12**	**11.55**	**1.04**	**0.89**
Dec.	**0.66**	**9.004**	**11.04**	**0.82**	**0.54**
2013					
Jan.	**0.78**	**9.292**	**14.69**	**0.63**	**0.49**
Feb.	**0.93**	**22.83**	**21.76**	**1.05**	**0.97**
Mar.	**0.78**	**15.26**	**16.55**	**0.92**	**0.72**
April.	**0.68**	**16.69**	**20.57**	**0.81**	**0.55**
May.	**0.74**	**12.72**	**13.61**	**0.93**	**0.69**
Jun.	**0.51**	**8.59**	**15**	**0.57**	**0.29**
Jul.	**0.88**	**10.31**	**10.77**	**0.96**	**0.84**
Aug.	**0.85**	**12.57**	**17.15**	**0.73**	**0.62**
Sept.	**0.76**	**10.86**	**12.94**	**0.84**	**0.64**
Oct.	**0.89**	**8.191**	**9.403**	**0.87**	**0.78**
Nov.	**0.65**	**16.09**	**16.31**	**0.99**	**0.64**
Dec.	**0.79**	**18.4**	**17.02**	**1.08**	**0.85**
2014					
Jan.	**0.84**	**14.96**	**16.98**	**0.88**	**0.74**
Feb.	**0.14**	**30.96**	**11.76**	**2.63**	**0.37**
Mar.	**0.78**	**19.31**	**14.15**	**1.36**	**1.06**
April.	**0.24**	**12.47**	**14.47**	**0.86**	**0.21**
May.	**0.65**	**44.4**	**28.8**	**1.54**	**1.01**
Jun.	**0.79**	**11.93**	**10.11**	**1.18**	**0.94**
Jul.	**0.77**	**13.67**	**17.87**	**0.77**	**0.59**
Aug.	**0.51**	**15.09**	**26.81**	**0.56**	**0.28**
Sept.	**0.47**	**11.43**	**16.68**	**0.69**	**0.32**
Oct.	**0.89**	**11.46**	**14.94**	**0.77**	**0.68**
Nov.	**0.77**	**9.423**	**13.62**	**0.69**	**0.53**
Dec.	**0.97**	**12.14**	**12.36**	**0.98**	**0.96**

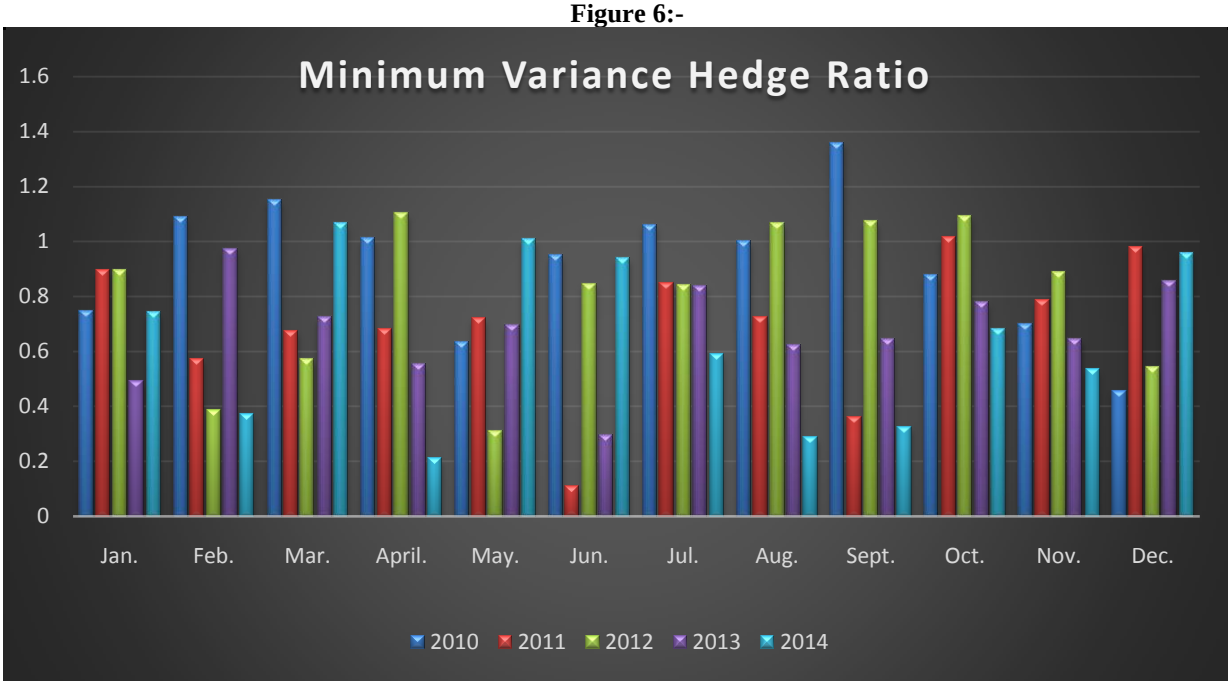
Source: Calculation based on NMCE data, (calculated by taking the daily price changes of the respective month)

Table 7:- Minimum Variance Hedge Ratio (*h)*

Month/Year	**2010**	**2011**	**2012**	**2013**	**2014**	**Per cent of times the ratio was**		
						<0.75	**0.75-1.25**	**>1.25**
Jan.	0.75	0.9	0.89	0.49	0.74	40	60	-
Feb.	1.09	0.57	0.38	0.97	0.37	60	40	-
Mar.	1.15	0.67	0.57	0.72	1.06	60	40	-
April.	1.01	0.68	1.1	0.55	0.21	40	60	-
May.	0.63	0.72	0.31	0.69	1.01	80	20	-
Jun.	0.95	0.11	0.85	0.29	0.94	40	60	-
Jul.	1.06	0.85	0.84	0.84	0.59	20	80	-
Aug.	1	0.72	1.07	0.62	0.28	60	40	-
Sept.	1.36	0.36	1.07	0.64	0.32	60	40	-
Oct.	0.88	1.02	1.09	0.78	0.68	20	80	-
Nov.	0.7	0.78	0.89	0.64	0.53	60	40	-
Dec.	0.45	0.98	0.54	0.85	0.96	40	60	
<0.75	25	42	33	67	67			
0.75-1.25	75	58	67	33	33			
>1.25								

Source: Calculation based on NMCE data, (calculated by taking the daily price changes of the respective month)

Figure 6:-



Source: NMCE Daily Data

Number of Futures Contracts Required to Trade to have a Risk Minimizing Hedge.

As stated earlier minimum variance hedge ratio or risk minimizing hedge ratio *'h'* is the multiplication of *'p'* and the 'scaling factor' of change in spot and futures prices. When hedging a given quantity of an asset, multiply *'h'* by the number of unites of the spot good per the number of unites covered by a futures contract[5]. For example- 8oo unites are to be hedged, one futures contract covers 100 unites and hedge ratio is .7, then the risk minimizing number of futures contracts to take position is 5.6 (i.e. .7*800/100). The Table-8 shows that the number of futures contract position required to take at NMCE for raw jute (GRADE-TD4, West Bengal) to have a risk minimizing hedge, if you have 1000MT of spot exposure. The standardized raw jute futures quantity traded at NMCE is 10MT, for three month expiry. The following calculation is made by assuming we have 100MT of raw jute (GRADE-TD4, West Bengal) spot exposure.

The number of contracts required to trade in futures to offset the spot exposure remains more than 60 times between 70 to 120 in harvesting periods which is nearer to one. And again from jun. to Aug. it also follows the same pattern. This trend is found in every year. But the periods which arises in between harvesting and sowing seasons i.e. March, Aug, and Sept. the market was not efficient i.e. far away from optimal hedging number. So it can be concluded that the market is not efficient but moving increasingly towards efficiency.

Table 8:- Number of Futures Contracts Required to Trade to have a Risk Minimizing Hedge

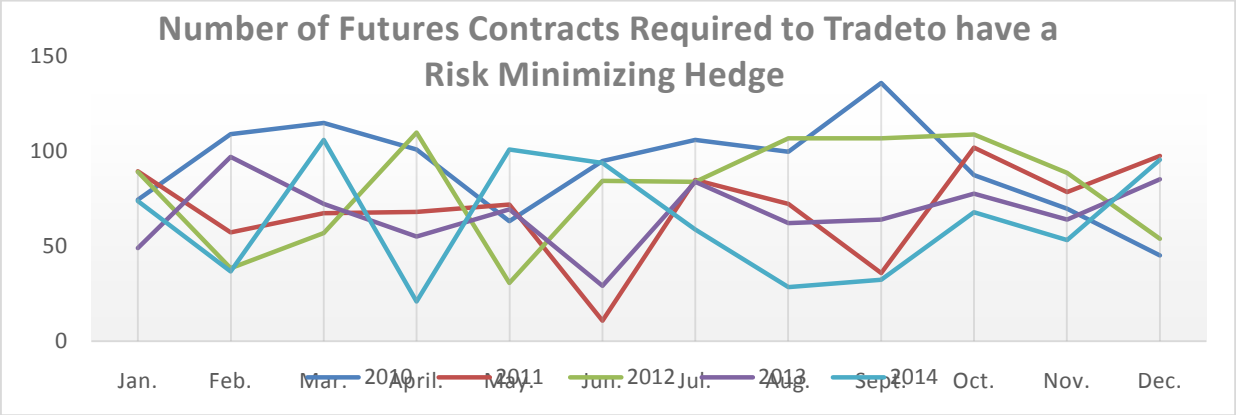
Month/Year	**2010**	**2011**	**2012**	**2013**	**2014**	**% of times the number of contract was**		
						<70%	**70%-120%**	**>120%**
Jan.	74.5	89.5	89.2	49.1	73.9	20	80	-
Feb.	109	57.4	38.4	97.1	36.9	60	40	-
Mar.	115	67.5	57	72.3	106	40	60	-
April.	101	68.1	110	55.2	21	60	40	-
May.	63.3	72	30.7	69.5	101	60	40	-
Jun.	94.9	10.8	84.6	29.3	93.8	40	60	-
Jul.	106	85	84.1	83.9	58.9	20	80	-

[5]Dubofsky, David A and Miller Jr., Thomas. (2003), "*Derivatives: Valuation and Risk Management*'', Oxford University Press, New York, p- 172.

Aug.	99.9	72.3	107	62.2	28.5	40	60	-
Sept.	136	36	107	64.1	32.4	60	20	20
Oct.	87.5	102	109	77.7	68	20	80	-
Nov.	69.8	78.5	88.7	64.2	53.4	40	60	-
Dec.	45.3	97.6	54	85.4	95.5	40	60	-
<70%	25	42	33	58	58			
70%-120%	67	58	67	42	42			
>120%	8	-	-	-	-			

Source: Calculation based on NMCE data, (calculated by taking the daily price changes of the respective month)

Figure 7:-



Source: NMCE Daily Data

Concluding Remarks:-

Empirical evidence suggests a wide variation in spot and futures prices of raw jute over a period of five years (2010-2014). However no such variation is established in between the movement of spot and futures prices of raw jute. In fact the extent of fluctuation in both spot and futures market are found to be the same. The result is further supported by the monthly minimum variance hedge ratio indicating that the market is increasingly moving towards efficiency. In such an efficient market structure futures can be used as an instrument of hedging to offset the spot market exposure. A lower basis risk in comparison to spot price risk, as established in the study would provide an additional advantages for the hedger to enter the derivative market.

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