Commodity derivatives contributing for rise or fall in risk

Golaka C Nath and T. Lingareddy[*]

Abstract

The government's decision to allow setting up of modern national commodity exchanges in 2002 helped revival of futures markets after nearly 40 years with more than 100 commodities covered under futures trading. The national exchanges equipped with modern technology helped taking futures market to many targeted participants which were possibly outside the domain in the earlier era. The functioning of futures markets came under scrutiny during 2006-07 and government has ordered for delisting of futures contracts in agricultural commodities like ***urad, tur, wheat and rice*** in early 2007 with a suspicion that futures trading in these commodities had been contributing for the rise in their domestic spot prices. The study attempts to explore the effect of introduction of futures trading on the spot prices of pulses. The study found that volatilities of urad, gram and wheat prices were higher during the period of futures trading than that in the period prior to introduction as well as after the ban of futures contracts.

[*] Dr Golaka C Nath is the Vice President and T. Lingareddy is the Deputy Manager, Research & Surveillance Department, The clearing Corporation of India Limited (CCIL), Mumbai.
The views expressed are authors' personal and the authors can be contacted at gcnath@yahoo.co.in and tulsi_lr@hotmail.com.

Commodity derivatives contributing for rise or fall in risk

A well-developed and effective commodity derivatives market facilitates price discovery and thereby reduces price risk associated with steep seasonal variations in demand and supply of commodities. Futures prices are generally referred as predictors of future spot prices (Samuelson, 1965) and tend to provide direction to spot prices thereby helping in price discovery as well as minimization of seasonal price variations. Hence, price determination in derivatives markets becomes crucial as it sends signals to spot markets of the underlying commodities. Thus, the efficiency of a futures exchange depends upon the ability of the exchange and the regulator to ensure that the prices of the contracts traded on the exchange reflect supply and demand (World Bank, 1985). If the futures' prices do not reflect the prevailing demand-supply situation due to information any reason then they may tend to disseminate wrong signals to the spot markets and destabilize them.

One such reason is believed to be the scarce and uncertain supply situation that may lead to spiraling of prices driven by excessive speculation. A similar opinion was also expressed by the Khusro Committee in its report

> "when everyone is expecting a price rise, both trend wise and seasonally, it may be thought that there are no dissenting opinions. All opinions would seem to converge over a price rise. It is thought that under these circumstances if speculators enter the futures market, they would also be buyers rather than sellers and their buying activity may further aggravate the price rise. The futures prices will then stand above the spot prices and would be rising over time" (GoI, 1980).

Further, the decision taken by the government of India in the early 2007 to ban futures contracts in urad, tur, wheat and rice appeared to have driven by a similar belief. In this context, an attempt is made to study whether the derivatives' trading in commodities has contributed for reduction of or increasing the risk in the Indian agricultural markets.

Backdrop

Futures markets in India had a long history of more than a Century since the inception of Bombay Cotton Trade Association Ltd in 1875 and they flourished in the early 1960s after the independence. But, the shortage in commodities cropped up in the mid 1960s due to the war in 1965 and natural calamities, has led to ban of futures trading in 1966 in most commodities except pepper and turmeric. Subsequently, based on the recommendation of the A. M. Khusro Committee (1980) futures trading in some commodities like gur, potatoes and castorseed was permitted in the early 1980s. Following this, the Kabra Committee (1993) recommended to permit futures in 17 commodities and unanimously opined against granting permission for futures in wheat, pulses, nonbasmati rice, tea, coffee, dry chillies, maize, vanaspati and sugar, on the basis of a case-by-case review of the suitability of each commodity in the light of its present and likely position in the coming years (Kabra, 2007).

Nevertheless, the government has allowed futures trading in more than 100 commodities and granted permission to set up modern national commodity exchanges in 2002. This step has led to the revival of futures markets after nearly 40 years and the national exchanges equipped with modern technology helped in taking futures markets to many targeted participants which were possibly outside the domain in the earlier era.

Table 1: Trends in volume trade on futures exchanges

	2002-03	**2003-04**	**2004-05**	**2005-06**	**2006-07**
Turnover (Rs. crore)	66,530	129363	571759	2134471	3327633
Growth (per cent)	92.8	94.4	342.0	273.3	55.9

Source: *Annual Reports*, Ministry of Food and Consumer Affairs, Delhi

Soon after the start of national exchanges, volumes picked momentum rather quickly (Table 1) in 2004-05 and extended further to 2005-06. Although the growth has persisted in the subsequent period, it has apparently decelerated to about 55 per cent in 2006-07. Besides this, the functioning of futures markets has also come under scrutiny during 2006-07. The government has ordered for delisting of futures contracts in ***urad, tur, wheat and rice*** during January and February 2007 with the suspicion that futures

trading in these commodities has been contributing for the rise prices of these essential items.

REVIEW OF RELEVANT LITERATURE

Review of recent literature on the impact of future trading on spot prices indicated that majority of them compared spot market volatility before and after the introduction of futures trading while some of them have investigated the impact of futures activity on spot volatilities.

Kamara (1982) compared cash market volatility before and after the introduction of futures trading and found that the introduction of commodity futures trading generally reduced or at least did not increase cash price volatility.

Further, Singh (2000) investigated the hessian cash (spot) price variability before and after the introduction of futures trading (1988-1997) in Indian markets using the multiplicative dummy variable model and concluded that futures trading has reduced the price volatility in the hessian cash market.

On the other hand, Yang *et al* (2005) examined the lead-lag relationship between futures trading activity and cash price volatility for major agricultural commodities. Granger causality tests and generalized forecast error variance decompositions showed that an unexpected and unidirectional increase in futures trading volume drove cash price volatility up. Further, a weak causal association between open interest and cash price volatility was also established.

However, Nitesh (2005) studied the implications of soy oil futures in Indian markets using simple volatility measures and concluded that the futures trading was effective in reducing seasonal price volatilities but did not brought down daily price volatilities significantly.

Sahi (2006) also studied the impact of introducing futures contracts on the volatility of the underlying commodities in India. Empirical results suggested that the nature of volatility did not change with the introduction of futures trading in wheat, turmeric, sugar, cotton, raw jute and soy oil. Nevertheless, a weak destabilizing effect of futures on spot prices was found in case of wheat and raw jute. Further, results of granger causality tests indicated that unexpected increase in futures activity in terms of rise in volumes and open interest has caused increase in cash price volatilities in all the

commodities listed. The study has confirmed the notion of destabilizing effect of futures trading on spot prices of commodity.

DATA AND METHODOLOGY

Spot price data for the analysis of trends in pre and post-futures trading were not available from any authenticated and reliable sources particularly for the period prior to futures trading. Hence, the Wholesale Price Index (WPI) series, compiled and published by the Central Statistical Organisation (CSO), were taken for the commodities under study covering a period from January 2001 to August 2007.

Apart from prices, commodity-wise futures volumes were collected from the websites of the respective exchanges and the forward Markets Commission (FMC). Data on indices of various financial markets along with commodity futures were collected from secondary sources like website of stock exchanges, etc. Data series on Comdex, a comprehensive index on all groups of commodities on MCX was collected from the website of MCX.

Data were analyzed using various methods including simple percentages, percentage variations, correlations, regression analysis and Granger causality test.

Linear Regression

The following linear regression was used to study factors influencing the spot prices.

$$urad_t = \alpha + \beta_1 * urad_{t-1} + \beta_2 * gram_t + \beta_3 * pulses_t + \beta_4 * allcommo_t + \beta_5 * foodgrains_t + \beta_6 * dummy \quad \text{---1}$$

$$gram_t = \alpha + \beta_1 * gram_{t-1} + \beta_2 * urad_t + \beta_3 * pulses_t + \beta_4 * allcommo_t + \beta_5 * foodgrains_t + \beta_6 * dummy \quad \text{---2}$$

$$wheat_t = \alpha + \beta_1 * wheat_{t-1} + \beta_2 * rice_t + \beta_3 * cereals_t + \beta_4 * allcommo_t + \beta_5 * foodgrains_t + \beta_6 * dummy \quad \text{---3}$$

The prices in their first differentials have been used for the study. We strongly believe that there is an economic rationality for establishing a relationship between the price of urad and the price of other pulses. The inclusion of prices of foodgrain as well as all commodities in the regression is to understand the effect from general price rise in foodgrains and other components of WPI. The price of commodity like urad is dependent on price of other substitute items like pulses and chana as well as its own previous prices. The price rise may be a general rise due to increase in price of other food items and other commodities. Since we have used weekly prices, we have taken the previous week's price of the commodity into the regression equation. The dummy variable is used to find out if the event of introducing futures contract had any impact on the price movements of the commodities. The dummy variable will take the value "0" or "1" corresponding to the period of presence or absence of futures trading respectively.

Granger causality test

Testing of causal relations between two stationary series X_t and Y_t (in bi-variate case) can be based on the following two equations

$$Y_t = \alpha_0 + \sum_{k=1}^{p} \alpha_k Y_{t-k} + \sum_{k=1}^{p} \beta_k X_{t-k} + u_t$$

$$X_t = \varphi_0 + \sum_{k=1}^{p} \varphi_k Y_{t-k} + \sum_{k=1}^{p} \phi_k X_{t-k} + \nu_t$$

Where p is a suitably chosen positive integer; α_k's and β_k's, k = 0, 1, …, p are constants; and u_t and v_t are usual disturbance terms with zero means and finite variances. The null hypothesis that X_t does not Granger-cause Y_t is not accepted if the β_k's, k>0 in equation (2) are jointly and significantly different from zero using a standard joint test (eg. an F test). Similarly, Y_t Granger-causes X_t if the φ_k's, k>0 coefficients in equation (3) are jointly different from zero (Nath, 2003).

This test will help to understand if there is a bi-directional impact flowing from one to other prices and vice versa. Apart from prices, the test is also used for understanding the relation between volumes and prices of urad, gram and wheat.

Results

Trends in agricultural futures trading

Indian commodity exchanges have the largest number of futures contracts in agricultural commodities compared to any other exchange in the world. Among a large number of agricultural commodities traded on futures exchanges, major volume has been contributed by only four to five commodities including guar, gram, urad and to some extent soya oil. Further, based on the data available from January 2005 it is evident that only volumes of guar seed, gram and to some extent soya oil were persistent throughout the period while that of other largely traded commodities including urad, mentha oil, pepper and jeera were shifting from one to other following the regulatory measures such as additional & special margins, positions limits, compulsory delivery etc.,

Table 2: Trends in turnover of agricultural commodities

(Rs crore)

	Jan-Dec 2005	share	Jan-Dec 2006	share	Jan-Mar 2007	share
Agri	879149.1	100.0	1285372.0	100.0	245426	100.0
Guarseed	337844.9	**38.4**	326344.4	**25.4**	35766	**14.6**
Gram	166587.5	**18.9**	341035.7	**26.5**	40145	**16.4**
Urad	106012.3	**12.1**	145333.9	**11.3**	3004	1.2
Mentha Oil	19354.3	2.2	63041.6	**4.9**	11241	**4.6**
Tur All	24055.8	2.7	25696.7	2.0	2529	1.0
Soy Oil	67204.2	**7.6**	85861.6	**6.7**	28331	**11.5**
Guargum	35301.8	**4.0**	15980.5	1.2	1458	0.6
Soyseed	14493.9	1.6	22145.4	1.7	8620	3.5
Pepper	9213.0	1.0	**60905.8**	**4.7**	31891	**13.0**
Jeera	10879.8	1.2	33124.5	2.6	38241	**15.6**
Wheat	9072.7	1.0	28828.8	**2.2**	1409	0.6
R Chillies	3431.3	0.4	35432.6	2.8	6805	2.8

Source: Market Review, FMC (www.fmc.gov.in)

On the other hand, wheat and tur gained only about 2-3 per cent of total volumes in agricultural category and that too for only a short period. Thus, urad and gram have contributed for a major portion of volumes among foodgrains.

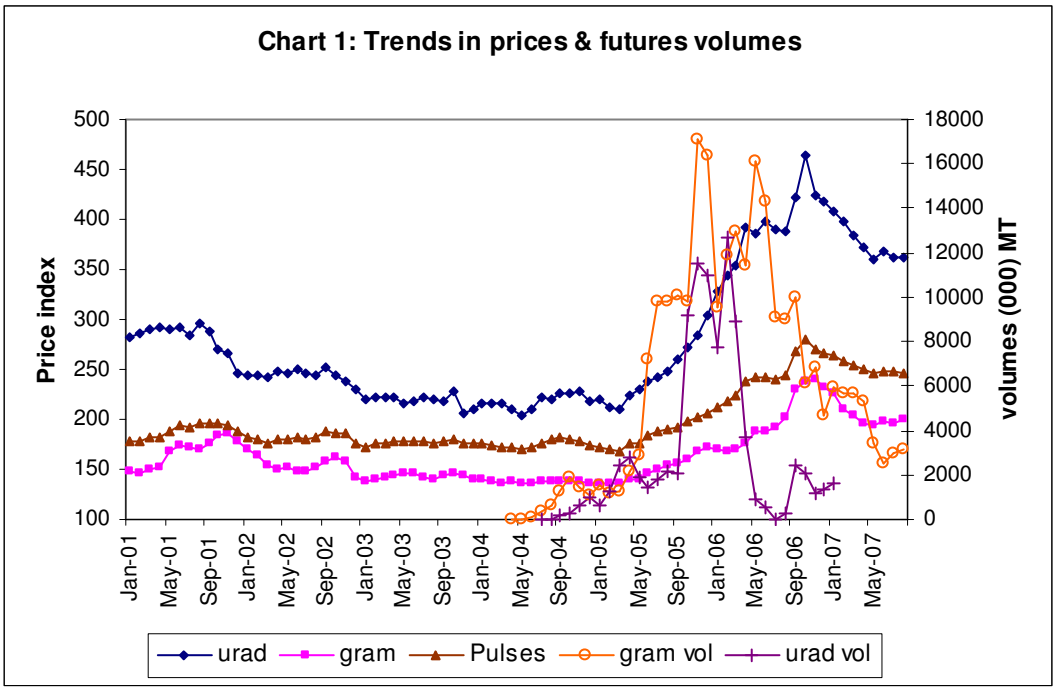
Trends in spot prices pre and post introduction of futures trading:

Trends in spot prices during pre- and post-futures trading periods were studied in order to find whether the futures trading has any influence on spot prices of urad and gram. Prices (WPI) of the selected commodities were juxtaposed with volumes traded on futures as depicted in Chart 1.

Urad: Though urad futures contract was introduced in July 2004 it started trading actively from January 2005 onwards. However, there was a spurt in futures trading volumes after September 2005. Coinciding this, there was a distinct rise in prices of urad and consequently that of pulses as a whole. But, no significant change in production of urad was noticed in the corresponding period.

Nevertheless, the volumes dipped sharply from April 2006 on account of the regulatory measures taken by to the exchanges under the directions of FMC's. The measure included the raise in margins to an extent of about 45 per cent in the form of additional, special and initial margins. Subsequently, the FMC has directed the exchanges in April 2006 to stop introducing fresh contracts of the existing urad futures that allow trade exclusively in imported (Burmese) variety of urad.

However, on the directions of the FMC, the exchanges have once again introduced the modified contracts of urad on July 14, 2006. The modified urad futures allowed the trade in both desi as well as imported varieties. Consequently, the volumes have once again moved moderately up in the subsequent months. However, before the volumes could pickup further momentum, rumors of ban turned the market participants apprehensive and cautious and lead to a moderate fall in volumes during November and December 2006. Nevertheless, the ban came into effect from January 23, 2007. Incidentally, urad prices have also posted a declining trend from November 2006 onwards.

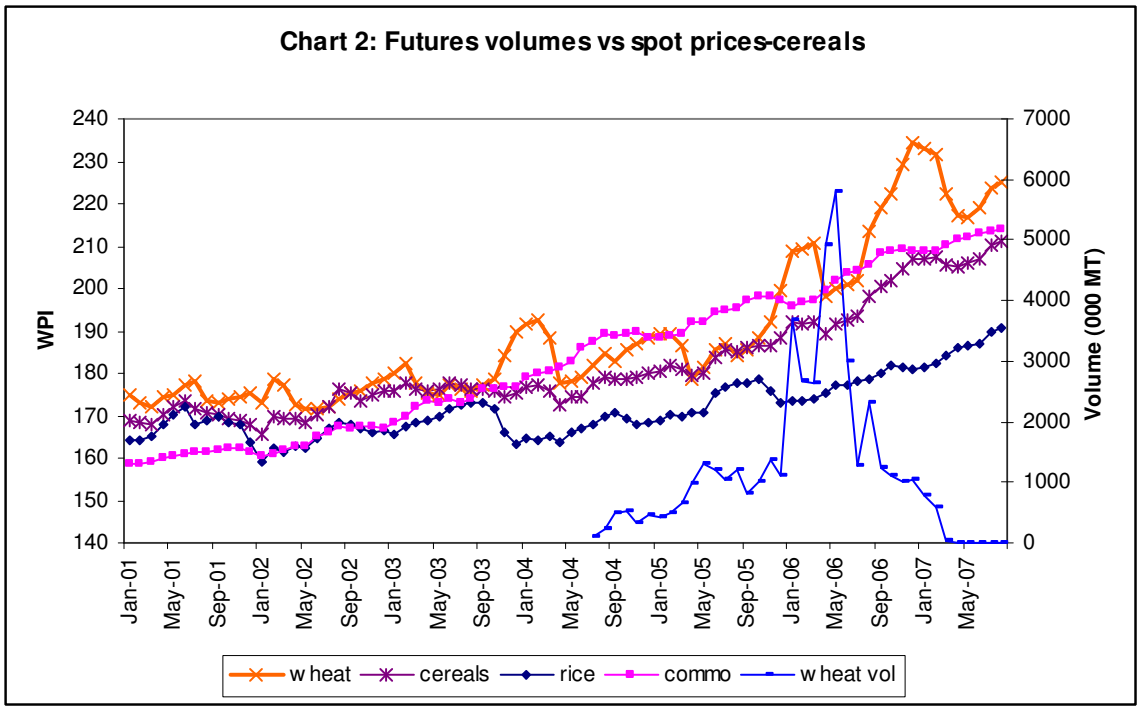


Gram: on the other hand, futures contracts of gram were introduced in April 2004 but gained considerable volumes only after September 2004. Similar to the case of urad, a spurt in volumes was noticed in the case of gram as well from June 2005 onwards with a corresponding but moderate rise in spot prices though there was no significant change in production. The WPI of gram has crossed 150 mark in July 2005 after a gap of nearly three years (November 2002) and continued to rise thereafter though at a slow pace. However, the volumes have shown wide fluctuations corresponding to the regulatory measures. The FMC has started directing the exchanges from the early 2006 to impose regulatory measures such imposition of position limits, margins (additional & special), reducing the daily price variation limits etc., in order to control extreme price fluctuations. However, spot prices of gram continued to rise steadily until November 2006 and started declining thereafter.

Wheat: in the case of wheat futures, co movement of futures volumes and spot price rise was noticed for a very brief period. Wheat contracts were started trading in July 2004 but the volumes remained at about one million MT a month until the later half of 2005. However, a spurt in volumes was seen in January 2006 (off-season) with a corresponding rise in prices. The volumes continued to grow until May 2006 and declined thereafter

while the prices preceded to recede in April itself with start of wheat marketing season. Nevertheless, the volumes have declined thereafter rather steeply and consistently despite a persistent rise in prices. Although the spurt in futures volumes was coincided with rise in prices for a brief period, the fall in wheat production consistently for two years (2004-05 and 2005-06 to about 68 million tones from 71 million tones) could have contributed for increase in wheat prices. However, empirical evidence to that extent was explored and presented in the subsequent sections.

No significant futures volumes were available in rice and hence not considered for the study.



Thus, it is evident from Chart-1 that there was a distinct rise in urad prices in the period of futures trading. Further, the steep rise in urad prices has also pushed prices of total pulses. Further, the spurt in spot prices was observed in post futures trading period even in the case of gram though less distinct compared to that in urad. Whereas no specific pattern of association between wheat prices and futures volumes was noticed from the trends plotted in Chart 2. In order to test the significance of the apparent trends,

further statistical tests such as correlation, regression and granger causality tests were carried out and the results are presented in the following sections.

Price variations

In order to find the impact of futures trading on price volatilities, the entire period was divided in to three viz., PI-covers prior to futures trading (Jan 2001 to Sept 2004), PII-covers active futures trading in all the three commodities (Oct 2004 to Jan 2007) and PIII- covers post-ban period (Feb 2007 to Oct 2007). Mean, standard deviation and coefficient of variation in the three periods for all the variables were calculated.

Table 3: Average changes and volatilities in prices

	Urad	Gram	Pulses	Wheat	Cereals	Food grains	Commodities
Average change in prices							
P-I	-0.168	-0.054	-0.012	0.023	0.027	0.023	0.093
P-II	**0.463**	**0.39**	**0.303**	**0.179**	**0.114**	**0.14**	**0.079**
P-III	-0.296	-0.45	-0.211	-0.019	0.083	0.026	0.073
Standard Deviation (volatility)							
P-I	1.716	1.226	0.827	0.641	0.404	0.389	0.202
P-II	**2.544**	**1.306**	**1.174**	**0.847**	**0.347**	**0.349**	**0.215**
P-III	1.756	1.284	0.784	0.775	0.300	0.336	0.157

The results as presented in Table 3 indicated that the average change in prices of urad, gram and pulses was negative prior to futures trading and became positive uniformly across the three variables in PII but once again turned negative in PIII. This apparently suggests that the prices of uard, gram and pulses have increased in the period of futures trading in urad and declined in the other two period of pre-futures trading and post-ban of futures trading in urad. Similar results were found in case of wheat also. The average change was distinctly higher during the period of futures trading (PII) than that in PI and PIII. The standard deviation of price changes have also gone up in PII and declined in PIII, across the three variables and more prominently in case of urad indicating the increase in volatilities.

Table 4: Results of two-sample t-tests

	P-I & PII	**P-II & P-III**	**P-I & P-III**

	F-stat	t-Statistic	F-stat	t-Statistic	F-stat	t-Statistic
Urad	0.457*	-2.434*	0.476**	-1.910**	0.961	0.371
	0.000	*0.008*	*0.013*	*0.031*	*0.416*	*0.356*
Gram	0.886	-3.061*	0.967	3.131*	0.916	1.606
	0.226	*0.001*	*0.480*	*0.001*	*0.353*	*0.055*
Pulses	0.499*	-2.601*	0.446*	-2.861*	0.893	0.663
	0.000	*0.005*	*0.008*	*0.003*	*0.376*	*0.254*
Wheat	0.572*	-1.773**	0.837	1.303	1.463**	0.320
	0.000	*0.039*	*0.267*	*0.097*	*0.052*	*0.375*
Cereals	1.352**	-2.058**	0.745	0.510	0.551**	0.988
	0.033	*0.020*	*0.148*	*0.305*	*0.016*	*0.163*

1. Two sample t-tests of unequal variances were conducted when the F turned statistically significant or else two sample t-tests of equal variance were conducted
2. * and ** indicates significant at 1% and 5% level.
3. Figures in italics indicate the 'ρ' values

Further, the results of sample variances (F) tests and two sample t-tests indicated that the observed increase in average price changes and volatilities in the second period (P-II) compared to the first (P-I) as well as the third period (P-III) were found to be statistically significant in case of urad, gram, wheat, pulses and to some extent cereals.

Thus, the average price levels as well as volatilities of urad, gram, wheat and consequently pulses and cereals were significantly higher in the period where futures trade in all the three commodities was allowed.

Detection of association

Linear regression analysis was carried out to test the statistical significance of the apparent impact of futures trading on spot prices of urad, wheat and gram. In view of the significant associations noticed in correlation analysis, regressions were tried with all the variables including their lags. A dummy was introduced to indicate the period of futures trading. Results of the best fit are presented below

Urad: Of all the regressions tried, the following equation turned out to be the best fit for urad. The results (Table 5) indicated that the coefficients included in the fitted regression equation explained about 68 per cent of the variation in the dependent variable, urad prices. The coefficients of urad with one lag, prices of gram and pulses were found to be

significant at one per cent level. However, the negative sign of the coefficient of urad with one lag needs further probe for a precise explanation. One possible reason could be the high volatilities in urad prices as the variables considered were changes and not the actual values.

Table 5: Results of regression for urad

Variables	Coefficient	Std. Error	t-Statistic	Prob.	Significance
Intercept	-0.145	0.085	-1.709	0.088	
Urad (-1)	-0.093	0.031	-3.006	0.003	*
Gram	-0.615	0.063	-9.793	0.000	*
Pulses	2.076	0.088	23.563	0.000	*
Food grains	0.218	0.193	1.130	0.259	
All-commodities	-0.556	0.318	-1.749	0.081	
D-urad	0.278	0.136	2.041	0.042	**
R-squared	0.688				
Adjusted R-squared	0.682				
Durbin-Watson statistic	2.187				
n	345				

* and ** indicates significant at 1% and 5% level

On the other hand, the dummy variable turned statistically significant at five per cent level suggesting that there was a moderate impact on spot prices of urad during the period of futures trading in urad. Thus, the null hypothesis is rejected and the alternate hypothesis saying that the trading in futures has a moderate influence on spot prices of urad is accepted.

Gram: Regression results of gram on the other hand indicated that only 52 per cent of variation in gram prices was explained by the fitted regression (Table 6). Further, only the coefficients of urad and pulses were found statistically significant at one per cent level. The dummy variable bifurcating the pre and post-futures trading turned out to be statistically not significant suggesting that there was no significant direct impact of futures trading on spot price changes of gram. The apparent rise in prices in the post futures trading period could be on account of other reasons like mismatch in demand and supply.

Table 6: Regression results for gram

	Coefficients	t Stat	P-value	Significance
Intercept	-0.081	-1.112	0.267	

D-gram	0.112	1.116	0.265	
Gram(-1)	0.028	0.501	0.617	
pulses	1.331	16.047	0.000	*
food	0.163	1.085	0.279	
All-commodities	-0.084	-0.340	0.734	
urad	-0.359	-9.671	0.000	*
R Square	0.526			
Adjusted R Square	0.512			
Observations	345			

* and ** indicates significant at 1% and 5% level

Wheat: although the fitted regression explained about 75 per cent of variation in wheat prices, the dummy variable representing the presence of futures trading was not found statistically significant. The estimates of wheat with one lag, rice and cereals were found statistically significant at 5%, 1% and 1% respectively.

Table 7: Results of regression for wheat

Variables	Coefficient	Std. Error	t-Statistic	Prob.	Significance
Intercept	-0.03	0.02	-1.10	0.27	
Wheat(-1)	0.05	0.03	1.86	0.06	
Rice	-1.08	0.06	-18.32	0.00	*
Cereals	2.16	0.15	14.35	0.00	*
Food grains	-0.04	0.15	-0.26	0.79	
All comm	0.03	0.10	0.25	0.80	
Dummy	0.03	0.05	0.67	0.50	
R-squared	0.753				
Adjusted R-squared	0.749				
Durbin-Watson statistic	2.01				
n	345				

* indicates significant at 1% level

Thus, the regression analysis gives some clear hints about the influence of futures on spot prices particularly of urad. However, the signs of the coefficients especially the lag-variables need further explanation as they have not turned out to be in the expected lines.

Results of Granger causality tests

Futures activity-Spot Prices: It is evident from the results of Granger causality tests that futures volumes had a significant causal impact on spot prices in case of wheat and urad.

However, in case of gram the causal relation from volumes to prices was not found significant while spot prices found to have a mild causal effect on volumes of gram.

Table 8: Results Granger causality tests between volumes and prices

Null Hypothesis:	F-Statistic	Prob.	significance
Volume of URAD does not Granger Cause spot price	3.427	0.002	*
Spot price of URAD does not Granger Cause Volume	0.927	0.475	
Volume of Gram does not Granger Cause spot price	0.714	0.638	
Spot price of Gram does not Granger Cause Volume	2.328	0.031	**
Spot price of wheat does not Granger Cause Volume	3.928	0.000	*
Volume of wheat does not Granger Cause spot price	1.789	0.027	**

* and ** indicates significant at 1% and 5% level

Further, to test the causality among gram, urad, pulses and foodgrains, pair-wise Granger causality tests were conducted on both price changes as well as volatilities.

Prices-Prices: The results showed that change in urad has a significant influence on total pulses prices and vice-versa while that of gram has significant causal influence on urad as well as on pulses. Thus, when there was a steep rise in urad prices during the post-futures trading period, prices of pulses also went up correspondingly though at a lower pace.

Table 9: Granger causality results for price changes

Null Hypothesis:	F-Statistic	Prob.	Significance
ΔPULSES does not Granger Cause ΔGRAM	0.660	0.6196	
ΔGRAM does not Granger Cause ΔPULSES	2.721	0.0296	**
ΔURAD does not Granger Cause ΔGRAM	1.367	0.2449	
ΔGRAM does not Granger Cause ΔURAD	4.073	0.0031	*
ΔURAD does not Granger Cause ΔPULSES	2.534	0.0401	**
ΔPULSES does not Granger Cause ΔURAD	5.424	0.0003	*
Δ wheat does not Granger Cause Δ cereals	0.455	0.841	
Δ cereals does not Granger Cause Δ wheat	0.774	0.590	

* and ** indicates significant at 1% and 5% level

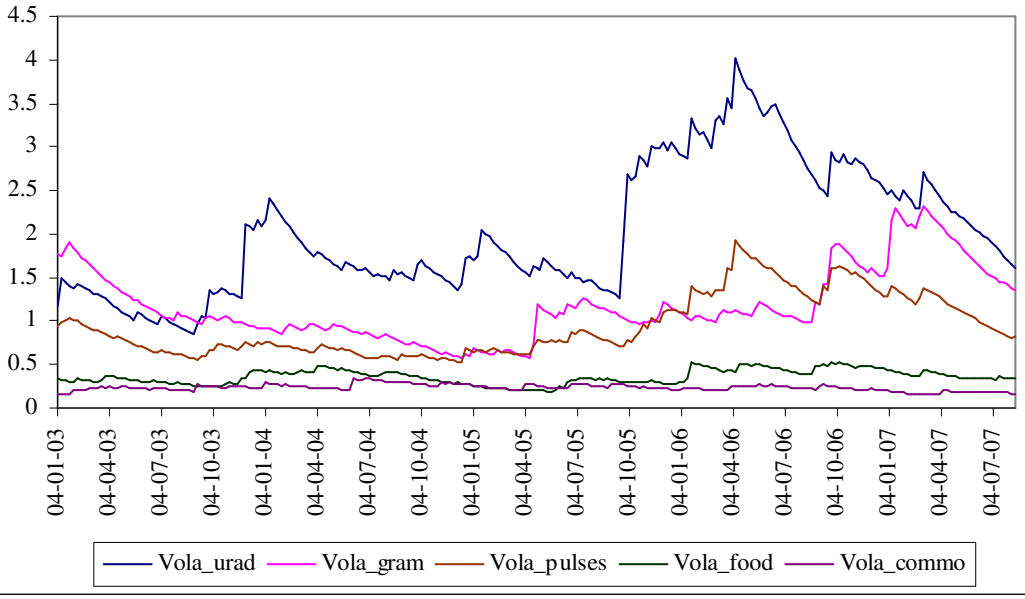
Thus, futures activity in terms of volumes has a positive and significant causal effect on volatilities in spot prices of urad and wheat while the same could not be established in case of gram. On the other hand, price changes in urad were caused by changes in both gram and pulses prices whereas urad prices did not have causal impact on gram prices.

Spillover of Volatilities in pulses

Correlations among price volatilities of urad, gram, pulses, foodgrains and all-commodities were studied to check the spillover of volatilities. The volatilities were estimated using an IGARCH method with the decay factor (Lambda) of 0.94 and plotted in Chart 3, the scale on X-axis indicates number of weeks starting from the first week of January 2001 to August 2007.

Urad prices have shown significant volatility followed by gram compared to other prices in our study. As apparent in Chart 3 below, the volatility was higher during the period of futures trading. The same came down after the futures were banned.

Chart 3: Pattern of Volatility in Prices



Correlation of volatilities indicated that there was a significant spillover of volatilities among pulses and foodgrains. Flow found to be strong and significant from urad to pulses, pulses to foodgrains, urad to foodgrains and from gram to pulses as presented in Table 10.

Table 10: Descriptive Statistics and Correlation Coefficients of Volatilities

	N	Mean	Std	Minimum	Maximum
Vola urad	345	1.99	0.70	0.85	4.01
Vola_gram	345	1.23	0.36	0.58	2.31
Vola_pulses	345	0.94	0.29	0.53	1.93

Vola_foodgrains	345	0.38	0.08	0.19	0.53
Vola_commo	345	0.21	0.05	0.13	0.34
	Vola_urad	Vola_gram	Vola_pulses	Vola_food	Vola_commo
Vola_urad	1				
Vola_gram	0.071	1			
Vola_pulses	0.803*	0.509*	1		
Vola_foodgrains	0.529*	0.292*	0.602*	1	
Vola_all-commo	-0.155*	-0.498*	-0.271*	-0.254*	1

* Indicates significant at one per cent level
Vola : indicates volatility

Volatilities-Volatilities: Results of granger causality tests of volatilities among the selected variable indicated that there was a spillover of volatilities. The causality tests were found statistically significant from volatilities of urad to foodgrains, gram to pulses and urad to pulses.

Table 11: Granger causality results for price volatilities

Null Hypothesis:	F-Statistic	Prob.	significance
VOLA_URAD does not Granger Cause VOLA_FOOD	2.407	0.0923	***
VOLA_FOOD does not Granger Cause VOLA_URAD	0.201	0.8179	
VOLA_PULSES does not Granger Cause VOLA_GRAM	1.565	0.2112	
VOLA_GRAM does not Granger Cause VOLA_PULSES	3.440	0.0337	**
VOLA_URAD does not Granger Cause VOLA_PULSES	3.191	0.0429	**
VOLA_PULSES does not Granger Cause VOLA_URAD	1.002	0.3684	

** and *** indicates significant at 5% and 10% level
Vola : indicates volatility

Thus, a significant causal relation from urad to pulses, pulses to gram and gram to urad existed during throughout, while the correlation of volatilities indicated a mild flow of volatility from urad to foodgrains and gram to pulses prices but a relatively strong spillover from urad to pulses and from pulses to foodgrains.

CONCLUSION

Futures trading in the selected commodities has apparently led to increase volatilities particularly in case of urad. Although gram prices too have posted a moderate rise in the post-futures trading period, the impact was not found statistically significant. Nevertheless, the average price changes as well as volatilities have gone up during the

period of futures trading in case of urad, gram and wheat. Futures activity has a significant and direct causal influence on urad volatilities whereas the same has not turned statistically significant in case of gram. Although a similar increase was observed in case of wheat, steep fall in supply coincided the same period thus brnging ambiguity in the inference. The mild spillover of volatilities spread from urad to foodgrains did not seem to extend to all-commodities.

Thus, the proposition of futures activity increasing price volatilities and thereby increasing risk turns out to be true in the case of urad though enough statistical evidence to that extent could not be found in case of gram and wheat. However, the suspicion of futures trading contributing for a rise in inflation (WPI) appears to have no merit in the present context considering the absence of direct causal relationship between prices of pulses (urad and and gram) and all-commodities.

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