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VOLATILITY AND LIQUIDITY SPILLOVERS IN AGRICULTURAL COMMODITY MARKETS: EMPIRICAL EVIDENCE FROM INDIA

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ABSTRACT:
The study examines volatility and liquidity spillovers between future and spot commodity markets for Channa, Gaur Seed, Soyabean, Kapas, Pepper, Potato, Refined Soy Oil and Wheat. Volatility is modelled using EGARCH whereas spillovers are examined by Granger causality test. Empirical results show that except for Pepper, Potato and Soybean it is the Spot Volatility that causes future volatility. Also, for five commodities including channa, gaur seed, soybean, pepper and refined soy oil the unexpected spot trading volume leads the unexpected future trading volume.

INTRODUCTION

The future market plays a dominant role in the process of price discovery of assets (Fligewski, 1981, Bessembinder and Seguin, 1992). The trading system of the future market is designed in such a way that it leads to smoother and effective commodity trading. The electronic platform, lower transaction costs, lack of short sale restrictions and presence of market makers removes trading frictions present in the spot market. It also improves the informational efficiency of a scattered spot market. The increased informational efficiency of the future market helps in better price formation of the commodity traded in the spot market. It also spreads the risk among a large number of investors, thereby transferring the risk from those hedging their spot position to professional speculators who are ready to bear the same for a return. The future trading improves market depth, helps in risk transfer and effective price discovery of the commodity. The process of Price discovery includes information transmission and the convergence of commodity price towards its underlying value. According to the literature, price discovery function[1] can be determined by examining return[2] and volatility[3] spillover[4] between spot and future market of the underlying asset. Researchers have pointed out that new information is reflected more in volatility than in returns (Kyle, 1985). Hence, the study tries to determine information spillovers by examining volatility spillovers. The literature on volatility spillovers for financial and commodity markets has been quite diverse, with some researchers focusing on first and second moments, Nath and Lingareddy (2008), Roy (2008) and Bekiros and Diks (2008) to examine return and volatility spillovers across markets. Volatility spillovers are also estimated among multiple financial markets using the multivariate GARCH model, Yang and Awokuse, (2002); Bala and Premaratne, (2004); Worthington et al., (2005). Multivariate approach models volatility of all the markets simultaneously. Others have applied VAR Model, Chng, (2008) to see economic linkages among unrelated commodities in a common industry. A large body of literature is available dealing with volatility spillovers between financial markets. However, limited work has been done on volatility spillover between future and spot market for agricultural commodities. This study uses EGARCH to model volatility and then examines volatility spillovers between spot and future market using granger causality test. It also fills the gap in the present stream of literature on volatility spillover for agricultural commodities in Indian context.

The study adds another dimension to the analysis of information inter-linkages by examining liquidity[5] spillover between spot and future market. Liquidity commonality[6] in markets plays a key role in inventory risk management and inter-temporal changes in liquidity. Thereby, trading activity in one commodity market has inter-temporal response in the other market. Any unanticipated change in trading volume in one market affects the trading volume of the other market. So, it becomes important to study the change in liquidity in one market brought about by change in liquidity in the other market.

Empirical work on liquidity has been more on market commonalities. Chordia et al., (2005) explored cross market liquidity (bid-ask spread, depth, and order flow in the markets) between stock and bond market using a Vector Autoregressive model. Researchers have also examined liquidity shock spillover across financial and real estate market by employing a VAR methodology (Ambrose and Park, 2012). Whereas Marshall et al., (2013) examine liquidity commonalities in sixteen commodity futures markets using market

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[1]In the dynamic sense, the price discovery process describes how information is processed and transmitted across the markets.

[2] Return for the purpose of this study is ln P_t/P_{t-1}

[3] Volatility is conditional variance of return

[4]According to Gallo and Otranto (2007), spillover refers to a situation where change in the order of a dominating market leads to a change in the order of dominated market with a lag.

[5]Liquidity is the quantity of contracts bought and sold

[6] Liquidity commonality is defined as liquidity co-movements across markets.

model[7] and component analysis. Brockman et al., (2009) studies commonality in liquidity across 47 stock exchanges using the market model. Different studies have examined liquidity characteristics across different markets or for different assets of the same market. However, research work on liquidity spillover between future and spot market for agricultural commodity has been almost negligent. The present study attempts to fulfill this research gap by using data from Indian markets. An important contribution of this work is for the market participants who take marketing and production decisions amid risk and uncertainty. The study gives an overall understanding of market behavior, transmission of risk and shocks across spot and future market.

DATA

Data and Data Source

The data consists of daily closing spot and futures prices, also spot and future trading volume for eight commodities channa, gaur seed, kapas, soybean, pepper, potato, refined soya oil and wheat. Both the spot and future price and trading volume series has been compiled from National Commodity & Derivative Exchange Limited (NCDEX) for data period from January 2003 to December 2013.The daily spot and future prices are converted to spot return ($\ln P_{st}/P_{st-1}$) and future return ($\ln P_{ft}/P_{ft-1}$) series for further analysis. The return series are examined for stationarity using ADF test. And both the spot and future return series are stationary. Trading volume is used as a proxy for liquidity in the study.

Descriptive Statistics

Descriptive statistics of the future and spot return series is reported in **Table 1**. The average prices of all future returns are higher than spot returns except for Gaur seed and Pepper. The pattern exhibits a market situation known as the Contango whereby for almost all the commodities the market traders are net long and the future prices would fall over the life of the contract. Whereas for Gaur seed and Pepper returns exhibit Backwardation a situation when market traders are net short and are trying to hedge the risk.

An analysis of return volatility as shown by standard deviation reveals that for most agricultural commodity markets like channa, gaur seed, pepper, refined soya oil, soybean, potato and wheat the future markets are more volatile than the spot market. Whereas higher return volatility have been observed for kapas in the spot market.

All the return series exhibit asymmetric distribution with kapas spot returns, pepper spot returns, refined soya oil spot return, potato future and spot returns series being positively skewed implying that the return series has a longer right tail and most of the distribution is concentrated on the left. Whereas other than those mentioned above most of the returns series are negatively skewed with longer left tail and mostly concentrated on the right.

The statistical Kurtosis which measures thickness of the tails reveals that all the

[7]The market model regresses percentage change in liquidity measure for a commodity on percentage change in liquidity measure of a market.

distributions have a K higher than three indicating thicker tails and leptokurtic distribution. And channa spot returns, pepper future and spot returns being the only series closer to normal distribution. The return series exhibits the pattern of small changes that would happen less frequently as there is clustering around the mean and a more likely large variation with fat tails.

VOLATILITY SPILLOVER BETWEEN SPOT AND FUTURE MARKET

Empirical analysis is performed in two parts: Part 1 deals with volatility modeled on EGARCH and volatility spillover between spot and future market and Part 2 involves liquidity modeled on unexpected trading volume and liquidity spillover between spot and future market.

The present section deals with the volatility spillover i.e. change in the conditional variance of return in one market led by a change in the conditional variance of return of another.

Previous literature has modeled volatility as conditional on time due to presence of heteroscedastic error terms. The error terms of asset returns exhibit varying variances and these unequal variances may be autoregressive over a period of time. Engle (1982) introduced Autoregressive Conditional Heteroscedastic (ARCH) model for time varying pattern of variances, the error terms in this model are conditioned on information available at lagged square error terms and the disturbance term is distributed as:

$$\varepsilon_t \sim N[0, (\gamma_0 + \sum_{i=1}^{p} \gamma_i \, \varepsilon_{t-i}^2)] \qquad (1)$$

ε_t being normally distributed with zero mean and variance of error terms being:

$$\sigma_t^2 = \gamma_0 + \sum_{i=1}^{p} \gamma_i \, \varepsilon_{t-i}^2 \qquad (2)$$

The ARCH model portrays volatility as the clustering of large shocks to the dependent variable. The model was further extended by Bollerslev (1986) to Generalized Autoregressive Conditional Heteroscedasticity (GARCH). The GARCH models not only on the past squared error terms but also on the past conditional variances. The model can be represented as:

$$\sigma_t^2 = \gamma_0 + \sum_{i=1}^{p} \gamma_i \, \varepsilon_{t-i}^2 + \sum_{i=1}^{q} \omega_i \sigma_{t-i}^2 \qquad (3)$$

Where σ_t^2, variance of error terms is a function of lagged values of ε_t^2 and itself. $\{\gamma_i\}$ i= 1, 2…., p and $\{\omega_i\}$ $i = 1,2,….,$q are non-negative constants. However, the study does not use the GARCH model due to its inherent assumptions that positive and negative error terms have symmetric effect on volatility. The assumption implies that arise and fall in the market will have the same outcome. The second problem of the GARCH model is that it imposes a restriction of positive coefficients. It has been documented that volatility transmission are asymmetric and spillovers are more pronounced for bad than good news Booth, Martikeinan and Tse (1997). To overcome these shortcomings the study examines time varying pattern of spot and future volatility on Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) introduced by Nelson (1991). The model captures asymmetric impact of shocks and does not impose non negativity restrictions on GARCH parameters. It also envisages fall in prices as more influential for predicting volatility than the rise. It is represented as follows:

$$\log \sigma_t^2 = \gamma_0 + \sum_{i=1}^{p} \gamma_i \frac{|\varepsilon_{t-i}|}{\sigma_{t-i}} + \sum_{i=1}^{p} \theta_i \frac{\varepsilon_{t-i}}{\sigma_{t-i}} + \sum_{i=1}^{q} \omega_i log \, \sigma_{t-i}^2 \qquad (4)$$

The above equation allows $\varepsilon_t$to have positive and negative values and impact volatility differently.
The study models EGARCH (p,q) for the following spot and future mean equation:

$$\Delta y_{spot,t} = \alpha_{1i} + \beta_{1i}\Delta y_{spot,t-1} + e_{ti} \qquad (5)$$

$$\Delta y_{futures,t} = \alpha_{2j} + \beta_{2j}\Delta y_{futures,t-1} + e_{tj} \qquad (6)$$

Where $\Delta y_{spot,t}$and $\Delta y_{futures,t}$ is the spot and future return series with 1-day lag term as the autoregressive variable and e_{ti}, e_{tj} are the error terms for spot return and future return equation respectively. The terms p and q i.e. ARCH and GARCH order is chosen in accordance with the minimization rule of SIC (Schwarz Information Criterion). The results of the selected EGARCH model are exhibited in **Table 2.**
For the purpose of determining volatility spillovers between the spot and futures market for all the agricultural commodities the study applies granger causality test. Granger (1969) examines if the past values of dependent variable (y) and the lagged values of independent variable (x) can improve the explanation for the current (y). When the test examines the statement 'x granger causes y' it only implies the precedence of information content and not the effect or result. It determines the lead lag relationship using the following specifications:

$$\sigma_{f,t} = \alpha_1 + \sum_{i=1}^{p} \beta_{1i}\sigma_{f,t-i} + \sum_{j=1}^{q} \gamma_{1j}\, \sigma_{s,t-j} + \varepsilon_{1,t} \qquad (7)$$

$$\sigma_{s,t} = \alpha_2 + \sum_{i=1}^{p} \beta_{2i}\sigma_{s,t-i} + \sum_{j=1}^{q} \gamma_{2j}\, \sigma_{f,t-j} + \varepsilon_{2,t} \qquad (8)$$

Where σ_f is the futures volatility, σ_s spot volatility and $\varepsilon_{1t}$and $\varepsilon_{2t}$are white noise residuals. The granger causality test involves testing the following null hypothesis using the F-Statistic:

$$\gamma_{11} = \gamma_{12} = \ldots = \gamma_{1q} = 0 \qquad (9)$$

$$\gamma_{21} = \gamma_{22} = \ldots = \gamma_{2q} = 0 \qquad (10)$$

The granger causality test is applied of lag p=2 and lag q=2 in accordance with the minimization criteria of SIC. The test examines if spot volatility granger causes future volatility and vice versa if future volatility granger causes spot volatility. The results ofthe granger test between spot and future returns are exhibited in **Table 3**.
The results of volatility spillover between spot and future markets show significant bivariate causality in atleast four out of eight commodities including channa, pepper, refined soy oil and wheat. Gaurseed and kapas show univariate causal relationship with spot volatility leading volatility in the future market. The parameter estimates of granger causality tests show that rise in the volatility in spot market leads to rise in the volatility in the future market. Potato and soybean exhibit stronger causal direction from futures to spot market. The direction of lead lag behavior for these commodities shows that the spot market becomes volatile for any new information generated in the futures market. Result of Pepper shows that although both the markets influence each other, future volatility has a stronger influence over the volatility in the spot market. Whereas in case of Channa, Refined soy oil and Wheat future volatility reacts to the flow of information in the spot market. Also, the parameter estimates show a positive relationship between future volatility and spot volatility. Thereby a rise in the spot volatility in channa, refined soy oil and wheat market leads to a rise in the future volatility. It has been generally documented

in research studies that price discovery happens from future to spot due to structural advantages of trading in futures market (Mahalik, Acharya and Babu, 2009). For the two commodities Potato and Gaurseed which does not back this theory, the results shows that the nature of commodity markets is backward where the commodity producers do not participate in the derivative trading. They don't take risks and are only interested in subsistence exchange. The one commodity Kapas which do not show any kind of lead lag behavior indicates lack of depth and volume in these markets.

LIQUIDITY SPILLOVER BETWEEN SPOT AND FUTURE MARKET

According to Bollerslev and Jubinski (1999) unexpected good and bad news results in a price increase and price decrease respectively. Both the news types are followed by an above average trading activity as it adjusts to a new equilibrium. The unexpected trading shocks lead to a volatile asset market, Bessembinder and Seguin (1993). The study examines the interaction of unexpected trading shocks between spot and future markets. Following the literature Bessembinder and Seguin, 1992 and 1993 and Yang et al., 2005 the study uses 21 day moving average of trading volume as the expected trading volume and the difference between expected and actual as the unexpected trading volume. The test examines bidirectional causality between spot and future unexpected trading volume. It inspects if spot unexpected trading volume granger causes future unexpected trading volume and vice-versa. To determine liquidity spillovers across spot and future markets the study uses Granger causality test with the following equation:

$$y_{fv,t} = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} y_{fv,t-i} + \sum_{j=1}^{q} \gamma_{1j}\, y_{sv,t-j} + \varepsilon_{1,t} \qquad (10)$$

$$y_{sv,t} = \alpha_2 + \sum_{i=1}^{p} \beta_{2i} y_{fv,t-i} + \sum_{j=1}^{q} \gamma_{2j}\, y_{sv,t-j} + \varepsilon_{2,t} \qquad (11)$$

Where $y_{fv}$is the unexpected future trading activity, y_{sv} unexpected spot trading activity and $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$ are white noise error residuals. The granger causality test is applied of lag p=2 and lag q=2. The results for the granger causality test are reported in **Table 5.**

Table 5 shows significant bidirectional causality in only one out of all the eight commodities which exhibit lead lag behavior. For Potato, although bidirectional causal feedback exists between spot liquidity and future liquidity it is stronger from future market to spot market. The unexpected spot trading volume has strong influence on the trading activity in futures market for almost all commodities including Channa, Gaur seed, Soybean, Pepper and Refined Soy Oil. The parameter estimates show that a rise in the unexpected trading volume in the spot market leads to a fall in the unexpected trading volume in the future market and vice-versa. Kapas and Wheat indicates unidirectional causality from Futures market liquidity to Spot market liquidity.

SUMMARY AND CONCLUSION

Volatility spillover in agricultural commodities has received less focus in financial literature. And until recently liquidity spillover between asset markets had not researched. This chapter studies price discovery function in agricultural commodity markets by analyzing volatility and liquidity spillover between spot and future market. The analysis is done in two parts. Part 1 deals with volatility spillover, where volatility is modeled on time varying pattern using EGARCH and spillover is analyzed by granger causality test. Part 2 deals with liquidity spillover measured by granger causality test between unexpected spot trading volume and unexpected future trading volume.

It is found that for three commodities pepper, potato and soybean future volatility drives spot volatility whereas for the other five commodities channa, gaur seed, kapas, refined soy oil and wheat it is the spot volatility which leads volatility in the future markets. Although the results are mixed but they are in contrast to the studies which believe that future market leads in transmitting new information to the spot market (Zapata et al., 2005 and Fu and Qing, 2006). However, they are in conformity with Mahalik et al., 2009, for metal and energy commodities volatility in future market leads spot market but for agricultural commodities the spot leads future in India. The reason can be attributed to underdevelopment of Indian agricultural derivative markets.

Further the result of liquidity spillovers are in conformity with the volatility spillover and for five commodities including channa, gaur seed, soybean, pepper and refined soy oil that the unexpected spot trading volume leads the unexpected future trading volume. However, the parameter results also show that when there is a rise in volatility in spot market the future volatility rises, but there is a fall in liquidity of future market if the liquidity of spot market rises. The burst of trading activity in spot market leads the future market.

The findings are relevant for investors to analyse volatility and liquidity transmission across spot and future markets to estimate risk associated with the agricultural commodities and develop various hedging techniques. From academic point of view, the study documents spillover of volatility and liquidity between spot and future market as arrival and transmission of new information in Indian agricultural commodity markets. The study contributes to the literature on information transmission for Indian market.

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Tables

Table 1: Descriptive Statistics

Return series	Mean	Std. dev.	Skewness	Kurtosis
Channa futures returns	0.000262	0.015324	-1.27592	16.20248
Channa spot returns	0.00025	0.013517	-0.04511	5.811579
Gaur seed future returns	0.000616	0.029257	-16.1136	533.7049
Gaur seed spot returns	0.001395	0.019552	-0.52882	13.29458
Kapas future returns	0.001871	0.029975	-1.65581	65.79809
Kapas spot returns	0.000978	0.032324	13.86836	290.1442
Soybean future returns	0.000328	0.014645	-0.93351	19.98
Soybean spot returns	0.000316	0.012692	-4.15578	66.08046
Pepper future returns	0.000567	0.016727	-0.03731	4.928924
Pepper spot returns	0.000668	0.010221	0.185033	7.962562

Potato future returns	0.000343	0.044453	0.619753	161.9819
Potato spot returns	0.000152	0.042651	5.701955	306.5665
Refined soya oil future returns	0.000155	0.011521	-4.01153	126.7824
Refined soya oil spot returns	0.000141	0.008036	0.100544	12.0076
Wheat future returns	0.000414	0.010958	-1.50971	21.90146
Wheat spot returns	0.000338	0.010776	-1.22503	17.67057

Table 2: EGARCH (p,q) modeled for mean equation; $\Delta y_{spot,t} = \alpha_{1i} + \beta_{1i}\Delta y_{spot,t-1} + e_{ti}$ and $\Delta y_{futures,t} = \alpha_{2j} + \beta_{2j}\Delta y_{futures,t-1} + e_{tj}$ of spot and future return series.

Commodity	EGARCH (future return series)	EGARCH (spot return series)
CHANNA	EGARCH(1,4)	EGARCH(2,3)
GUAR SEED	EGARCH(4,4)	EGARCH(1,1)
KAPAS	EGARCH(2,4)	EGARCH(1,0)
SOYBEAN	EGARCH(4,4)	EGARCH(3,3)
PEPPER	EGARCH(1,1)	EGARCH(1,1)
REFINED SOYA OIL	EGARCH(1,4)	EGARCH(1,1)
WHEAT	EGARCH(3,3)	EGARCH(3,3)
POTATO	EGARCH(0,4)	EGARCH(4,4)

TABLE 3

Panel A: Granger Causality Test; H_0: Spot volatility does not granger cause future volatility, against H_a: spot volatility granger causes future volatility

Agricultural commodity	f-statistic	Prob. value	significance
Channa	108.628	8.00E-46	*
Gaur seed	137.27	8.00E-57	*
Kapas	4.60812	0.0108	**
Soybean	0.30786	0.735	
Pepper	17.4303	3.00E-08	*
Potato	1.98369	0.1384	
Refined soya oil	270.223	2.00E-107	*
Wheat	20.2572	2.00E-09	*

*Significance Level At 1% and ** significance level at 5%

Panel B: Granger Causality Test; H_0: future volatility does not granger cause Spot volatility, against H_a: future volatility granger causes spot volatility

Agricultural commodity	f-statistic	Prob. value	significance
Channa	25.2664	1.00E-11	*
Gaur seed	0.86215	0.4224	
Kapas	1.23778	0.2918	

Soybean	12.3424	5.00E-06	*
Pepper	121.872	3.00E-51	*
Potato	3.43848	0.0327	**
Refined soya oil	3.44637	0.032	**
Wheat	7.83381	0.0004	*

*Significance Level At 1%and ** significance level at 5%

Panel C: Parameter estimateγ_{2j} for Granger causality test; Direction: FV ⟶ SV

Parameter estimate			
	FV(t-1)	FV(t-2)	R^2
Channa	0.090715 (0)*	-0.0325 (0.0482)**	0.745045
Gaur seed	-0.00587 (0.3378)	0.007202 (0.2389)	0.965541
Kapas	-0.00341 (0.8605)	0.025158 (0.1955)	0.038875
Soybean	-0.50174 (0.0255)**	0.879423 (0.0001)*	0.086845
Pepper	0.323667 (0)*	-0.30174 (0)*	0.893926
Potato	18.27694 (0.2271)	28.20526 (0.0629)	0.05654
Refined soya oil	0.00484 (0.1467)	0.00361 (0.2756)	0.907215
Wheat	0.113969 (0.0193)**	0.101953 (0.0362)**	0.520848

*Significance Level At 1% and ** Significance level at 5%

Panel D: Parameter estimateγ_{1j} for Granger causality test; Direction: SV⟶FV

Parameter estimate			
	SV(t-1)	SV(t-2)	R^2
Channa	0.054439 (0.0082)*	0.130965 (0)*	0.854103
Gaur seed	0.92919 (0)*	-0.68021 (0)*	0.469956
Kapas	-0.38467 (0.0261)**	-0.29837 (0.0813)	0.444683
Soybean	0.000554 (0.6652)	-0.00095 (0.4591)	0.898566
Pepper	0.059204 (0.002)*	-0.00811 (0.6738)	0.966321
Potato	-4.85E-05	0.000167	0.277763

	(0.5659)	(0.0476)**	
Refined soya oil	0.933153 (0)*	-0.03061 (0.7688)	0.586247
Wheat	0.027228 (0.0195)**	0.035611 (0.0023)*	0.29359

*Significance Level At 1% and ** Significance level at 5%

TABLE 4

Panel A: Granger Causality Test; H_0: Spot (unexpected) trading volume does not granger cause future (unexpected) trading volume, against H_a: Spot (unexpected) trading volume does granger cause future (unexpected) trading volume

Agricultural commodity	f-statistic	Prob. value	significance
Channa	58.7332	1.00E-25	*
Gaurseed	97.0399	4.00E-41	*
Kapas	0.5194	0.5954	
Soybean	24.4127	3.00E-11	*
Pepper	35.6209	5.00E-16	*
Potato	3.68897	0.0254	**
Refined soya oil	33.852	3.00E-15	*
Wheat	2.01601	0.1335	

*Significance Level At 1% and ** Significance level at 5%

Panel B: Granger Causality Test; H_0: Futures (unexpected) trading volume does not granger cause spot(unexpected) trading volume, against H_a: Futures (unexpected) trading volume does granger cause spot (unexpected) trading volume

Agricultural commodity	f-statistic	Prob. value	significance
Channa	0.56959	0.5658	
Gaur seed	0.32476	0.7227	
Kapas	5.7768	0.0034	*
Soybean	0.67495	0.5093	
Pepper	0.18468	0.8314	
Potato	5.09384	0.0063	*
Refined soya oil	0.68943	0.5019	
Wheat	3.81762	0.0222	**

*Significance Level At 1% and ** Significance level at 5%

Panel C: Parameter estimateγ_j for Granger causality test; Direction: FUTV ⟶ SUTV

Parameter estimate			
	FUTV(t-1)	FUTV(t-2)	R^2
Channa	0.016181 (0.016181)**	-0.03649 (0.3853)	0.273024

Gaur seed	0.000356 (0.9909)	0.013019 (0.6758)	0.245724
Kapas	-0.03067 (0.0564)	0.005384 (0.7412)	0.314051
Soybean	0.048193 (0.2461)	-0.03651 (0.3797)	0.226591
Pepper	-0.02233 (0.5573)	0.014695 (0.699)	0.232746
Potato	-0.12048 (0.0237)**	-0.0154 (0.7735)	0.351821
Refined soya oil	0.045844 (0.3096)	-0.01573 (0.727)	0.15637
Wheat	-0.02008 (0.59)	-0.05969 (0.11)	0.366827

*Significance Level At 1% and ** Significance level at 5%

Panel D: Parameter estimateγ_j for Granger causality test; Direction: SUTV ⟶ FUTV

Parameter estimate			
	SUTV(t-1)	SUTV(t-2)	R^2
Channa	-0.49243 (0)*	0.27178 (0)*	0.405158
Gaur seed	-0.5717 (0)*	0.262452 (0)*	0.498436
Kapas	-0.20893 (0.3091)	0.099086 (0.6172)	0.759606
Soybean	-0.27568 (0)*	0.061562 (0.1813)	0.316944
Pepper	-0.30114 (0)*	0.044066 (0.341)	0.408768
Potato	0.16498 (0.0141)**	-0.16617 (0.0132)**	0.330004
Refined soya oil	-0.30564 (0)*	-0.01146 (0.8191)	0.288661
Wheat	-0.06483 (0.1439)	0.088381 (0.0459)	0.401644

*Significance Level At 1% and ** Significance level at 5%