Impact of the Futures Ban on Spot Prices of Soybean and its Derivatives in India: An Empirical Study

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Abstract— This study aims to analyze the ban imposed by the NCDEX on the future trading of soybeans and their derivatives. In December 2021, all sorts of new futures contracts were banned in India for seven commodities, including soybean and its derivatives. The study is aimed to capture the possible breaks which may be responsible for this ban, its consequences on the financial market for agricultural commodities in India, and finally, its effect on future and spot prices. Therefore, suitable policy measures can be proposed for better outflow in the market. The study tends to analyze the temporal variation in spot and futures markets for 2003-2021 and the price volatility after the post-ban period in futures contracts. In accordance with the test [1] [2], we intended to analyze unknown structural breaks in commodity prices, we used Johansen cointegration methodology to study the long-term relationship between the future and spot prices. To check the causality relationships in prices, we used the Granger's causality test within each sub-period to identify the influence on ban of futures contracts on changes in spot prices.

This paper envisages the possible effect of trading bans of futures for Soybean's derivatives and provides empirical evidence for the same. The harbinger of this study is to focus on two major market dimensions: price discovery and spot price volatility. Furthermore, the destabilization hypothesis is also addressed to assess the influence of futures on price volatility before and after suspension. To conclude, we conclude that the ban on futures trading in 2008 had affected price discovery and risk management in the long term majorly had led to destabilization in the spot market hence, the ban of 2021 may be relevant to curb inflation and price instability in the long run but will destabilize the spot market.

Index Terms—Soybean and its derivatives, Spot volatility, Futures, Co-integration, India

I. INTRODUCTION

India is driven by agriculture as a significant sector that contributes about 17-18% of the country's GDP and provides employment opportunities to over 53% of the total population [7]. For an agricultural economy such as India, where the majority of the country still relies on the agriculture sector for employment and subsistence, the producers are exposed to yield and pricing risks. The stability and sustainability of agricultural pricing are of paramount significance. The pricing scenario of agricultural commodities tends to be highly volatile due to many micro and macroeconomic factors. . Especially in agriculture, the progressive market of commodity derivatives play a pivotal role in price risk management but also create

exposure for trading and speculation. Commodity derivatives are considered significant price discovery and risk hedging measures. The gap in the study on futures and spot prices fluctuations for agricultural commodities is of particular interest given the current global food security crisis, which has raised awareness of the potential role that speculation and futures could play in driving up the price of various agricultural commodities. Every time the economy has slowed, there has been some stimulus, particularly from central banks and the government. Various factors might cause this slowdown or recession; in 2001, 9/11 was to blame, while in 2009, the global financial crisis may be a reason. This led to a significant spurt in the prices of some agricultural commodities and inflation caused by the excess speculation in the commodity futures trade, which was a matter of concern for both the government and the general public. In reaction, some of the future trade of agricultural commodities were de-listed. The current COVID-19 crisis, which hit the international economy in 2019, particularly at the beginning of 2020, is sending it into a plunge. Later on, on December 20, 2021, all sorts of new futures contracts were banned in India for seven commodities, including soybean and its derivatives, to curb inflation. Soybean is a major oilseed crop in India, mostly farmed as a rainfed crop grown during the Kharif season (June-October), primarily in Madhya Pradesh, Maharashtra, and Rajasthan, on Vertisols and associated soils [15].

As of 2021-22, soybean production forecast globally is about 383.63 million tons, especially in India, where the projected production forecast is 12.72 million tonnes from a 12.2 million hectare area. Soybean is considered a highly domestic utilization and export commodity. However, producers of this commodity particularly face a typical problem of price ruling below the minimum support price (MSP) after the harvest period. As a result, starting in 2021–2022, the government has raised the minimum support price by 1.8 percent. These initiatives have contributed to raising the price of soybeans and their derivatives. As a result, the return volatility of soybean futures contracts has been slowly rising from June to July, then declining until September 2021, just before harvest, but increasing in October due to new arrivals in the mandies in both October and November contracts. December 20, 2021, Soybean futures on the National Commodities and Derivatives Exchange (NCDEX) fell rapidly after SEBI banned futures and options trading of seven agricultural commodities, including mustard seed, soybean, and its derivatives. This prompted researchers to examine the effects of the ban on soybean's derivatives spot prices in India from past bans [18].

II. REVIEW OF LITERATURE

A. The nexus between spot and futures prices

The futures contracts in a financial market for a pre-determined value and time period are determined using the spot price of any commodity, where the spot price is the face value/price of any commodity, which is to be sold/bought immediately. These futures contracts are legal derivative contracts that bind two parties to honor the specifics mentioned in the contract. The price specified in this agreement is called the futures price. The number of futures contracts traded depends on the current market scenario, which impacts future spot prices. Therefore it can be hypothesized

that there can be an existence of an association between spot and futures prices [11].

As per economic theory, we expect a positive correlation between these two variables. Reference [13] investigated the evidence of price discovery for various agricultural commodities, and a relationship was established for spot, futures, and mandi prices for soybean seeds. For cotton seeds, there was an inverse relationship of mandi prices for futures and spot prices. In the study [8], the author called the futures price "a biased estimator of the future spot price due to the presence of a positive risk premium." The causal relationship between the commodities prices were examined using the Nonparametric Granger causality test and Linear Granger causality test from which they concluded that a nexus exists between the prices, and is rather dominated by future prices. It was discovered that the spot prices move towards the future prices, and vice-versa is not that recurrent. Similar inferences were drawn by [19], [3] and [4] with respect to weather shocks like rainfall.

B. Spot price volatility was impacted by imposition of the ban on future's trading.

Once a relationship is established, the question of the extent of impact one has on another is reached. Only a few studies have tried to explore this domain in the Indian context. Reference [20] has given a detailed analysis of the spot price volatility due to the ban imposition followed by the 2007-08 crisis. The analysis is divided into three parts: pre and post-ban, and post-relaunch for five commodities, including soybean derivatives. It was observed that for soybean and its derivatives, the spot price volatility was very high post-ban. Hence the purpose of restraining futures trading was not fulfilled. This shows the impact of economic policies on commodity markets. Similar concerns were raised a while ago by [17] with regard to producers "there are price fluctuations that give rise to economic uncertainty and adversely affect production plans." However, no significant impact was found between 2008-09 for refined soybean oil by Kaur and Rao [11].]. The study entangles the key insight on how open interest and volume impact spot price volatility. Based on the most popular financial theories, a futures contract's price is constantly impacted by the spot price of its underlying asset or by the anticipated future spot price on the information set [14]. Because of future contract's enticing qualities of hedging and speculating, futures trading draws more information into the market. As futures trading is more consolidated and has reduced transaction costs, traders may effectively exchange and share information.

III. MATERIALS AND METHODS

A. Data

The derivative market in India for commodities has observed tremendous development since the trading of commodity futures was made legal in 2003. The numbers of futures contracts traded have significantly increased since the introduction in 2003 which also led to increase in prices. The market faced criticism during 2008-09 due to inflation, and its contribution towards the stabilization of spot prices was intensely debated [12]. The daily futures and spot prices for soybean and its derivatives are taken from the National Commodity and Derivative Exchange Limited (NCDEX),

which is India's largest agricultural derivatives exchange market The selection of this commodity is based on the data provided by the Ministry of Statistics and Programme Implementation (MOSPI) for Area, Productivity, and Yield analysis done for the entire country. In that analysis, Soybean was the commodity that contributed the highest. When state-wise contribution was analyzed, it was found that Soybean derivatives are majorly produced in Madhya Pradesh, Maharashtra, and Rajasthan hence, we selected Indore as our spot market. Data is collected from 2003 - 2022 for daily data of NCDEX-SYOREFIDR. In accordance with the NCDEX circular, the futures trading of this commodity was suspended on May 08, 2008, and the ban was revoked on December 04, 2008, of the same year. Therefore, the data is sampled into three segments: Pre and Post-ban and its relaunch. The sample for pre-ban is from the year the commodity trading started to the trading was suspended. Similarly, the ban period for the timeline of the complete ban of the futures trading is from May 08, 2008, to December 04, 2008, and the relaunch was taken from December 05, 2008, to September 24, 2013.

B. Empirical Methodology

This section is bifurcated into three sub-sections in accordance with the objectives of our study. Breaks in the agriculture commodity market are evident; hence, analyzing those breaks is crucial. To capture the possible structural breaks, we used the Bai -Perron test (2003) [2] and GARCH model.

I. *Bai-Perron test:*

To investigate the multiple structural breaks, we used the Bai-Perron test (2003) [2] for the entire data series of spot and future prices of the commodity. The generalized serial correlation, heteroscedasticity, lagged dependent variables, trending regressors, and various distributions of the errors and regressors over segments are allowed in the model by Bai and Perron .Additionally, they consider the broader scenario of a "partial structural change model", where all the coefficients are not subject to changes. The degrees of freedom can be reduced using a partial change model, which is helpful when dealing with several changes [10]. If no breaks are discovered, continuous analysis of the overall period may result in forecast inaccuracies and draw the suggested model into doubt. We have applied the L+1 against L sequentially determined breaks.

Additionally, the augmented Dickey-Fuller (ADF) unit root test will be used to test for stationarity with respect to each sub-period partitioned according to the dates of a break in the series.

II. *Short-run and Long-run relationship between spot and futures using Johansen procedure, VECM model, and Granger causality*

According to the majority of the research, there is a link between information, expected prices, and spot price volatility. The information content is defined as knowledge about random disturbances that have an influence on demand in the actual economy. Hence, the spot-futures parity may determine the nexus between future and spot prices. This relationship suggests that prices should move in lockstep over time to prevent ongoing chances for arbitrage [9]. Hence, to examine the long-price fluctuations, we used Cointegration tests based on the existing to analyze the long-run equilibrium between future and spot prices of the commodity. Johansen

Cointegration model investigates the short-term and long-run nexus between the spot and futures markets for the chosen commodity. We employ log returns of futures and spot price [log (P t /P t-1)].The Augmented dicky and Phillips-Perron tests are used to confirm the stationarity. The Schwarz Information Criterion was also used to determine the requisite series lag length (SC). After the variables are integrated in the same order, the long-run relationships between them are examined using the Johansen Cointegration test. The following is a presentation of the lead-lag relationship between the two:

VECM short-run causality:

$$SP_t = a_1 + \sum_{i=1}^{n} b_i FP_{t-i} + \sum_{i=1}^{n} c_i SP_{t-i} + v_{1t} \quad (1)$$

$$FP_t = a_2 + \sum_{i=1}^{n} d_i SP_{t-i} + \sum_{i=1}^{n} f_i FP_{t-i} + v_{2t} \quad (2)$$

SP_t are our spot prices and FP_t are our futures price. b_i, c_i, d_i, f_i are short-run parameters, and v_{1t} and v_{2t} are respective error terms. b_i and f_i gives the extent of Granger's cause of futures on the spot and spot on futures prices, respectively.

III. Relaunch on the spot and future market

To analyse the ban's impact and introduction of futures trading on the spot, we use the GARCH (1,1) model. At the outset, the ARMA (p, q) model for the spot price was first developed. This was carried out using autoregressive and partial autoregressive plots and subsequently ARCH LM test. Each series was re-evaluated for the ARCH effect after using the GARCH (1,1) model to see whether the ARCH effects had been eliminated.

The following is a representation of a model with errors that follow a GARCH (p, q) process:

$$\mu_t = \alpha_0 + \alpha_1 Y_{t-1} + \epsilon_t ; \epsilon_t | \theta_{t-1} \sim N(0, \phi) \quad (3)$$

$$\phi_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 \ \epsilon_{t-1}^2 + \sum_{j=1}^{l} \beta_j \ \phi_{t-j} \quad (4)$$

This study employs the GARCH model. By adding a ban and introduction of the commodity dummies for the appropriate dates for the commodity in their respective variance equations.

$$\mu_t = \alpha_0 + \alpha_1 Y_{t-1} + \epsilon_t ; \epsilon_t | \theta_{t-1} \sim N(0, \phi) \quad (5)$$

$$\phi_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 \ \epsilon_{t-1}^2 + \sum_{j=1}^{l} \beta_j \ \phi_{t-j} + \delta_1 DB + \delta_2 DI \quad (6)$$

Where ϵ_t is the error term, β_j is the coefficient that relates the present volatility to the volatility of the previous period. In the variance equation, ϵ_{t-1}^2 is the ARCH effect and ϕ_{t-j} is the GARCH effect.

DB is a dummy variable taking 0 value before and 1 after the ban on commodities futures, while DI is a dummy variable taking value 0 before and 1 after the relaunch of the futures trading.

IV. ANALYSIS

A. Descriptive statistics

Table I. Descriptive summary of the spot and future returns for the bifurcated samples

Variable	Period	N	Mean	SD	Variance	Min	Max	Skewness	Kurtosis	Jarque - Bera	Prob
Spot Returns	**Pre-ban**	631	0.000	0.06	0.004	-0.468	0.497	0.385	32.68	23178.63	0.000
	Ban	169	-0.000	0.079	0.006	-0.347	0.252	-0.309	6.047	68.098	0.000
	Relaunch	1037	0.001	0.043	0.002	-0.675	0.684	0.067	122.129	613204.5	0.000
Future Returns	**Pre-ban**	631	0.001	0.027	0.001	-0.225	0.236	-0.605	37.554	31431.30	0.000
	Ban	169	-0.001	0.027	0.001	-0.026	0.047	-5.779	55.519	20363.84	0.000
	Relaunch	1037	0.001	0.018	0.000	-0.191	0.178	-0.998	28.524	282321.64	0.000

B. Bai-Perron test

For soybean spot and futures price series, the Bai and Perron L+1 technique identifies breaks that are determined sequentially [2]. Both the soybean series have two close-by structural break dates, which fall in late 2007 and early 2012. The probable reason for the break in 2007 may be the global financial market. Generally, the agriculture commodity market is volatile and runs on the simple mechanism of demand and supply, as the government has banned the import of soybean seeds in order to safeguard Indian growers; the price of soybeans in India is mainly protected. Prices rose due to strong domestic demand for soybean oil and a robust global market for soy meal. Hence, the ban in 2008 was implemented to control price instability for soybean oil. In March 2012, a second break in the soybean series happened to take place shortly before the commodity's price rose sharply based on robust spot market demand. In the producing areas, lesser sowing due to a drop in rainfall resulted in limited oilseed stockpiles and high competition [6].

Table II. Bai-Perron test statistics for spot and future prices

Variables	Bai-Perron statistics	Probability
Spot	22.761	0.000
Futures	3.565	0.000

Table III. Structural breaks based on Bai-Perron test for spot and future prices

Variables	Break test	F statistic	Critical value**	Break dates	Sequential	Repartition
Spot	**0 vs 1***	296.031	8.58	1	29-03-2012	17-12-2007
	1 vs 2*	401.945	10.13	2	17-12-2007	04-02-2012
	2 vs 3	9.908	11.14	-	-	-
Futures	**0 vs 1***	11.473	8.58	1	29-03-2012	12-15-2007
	1 vs 2*	41.659	10.13	2	15-12-2007	03-31-2012
	2 vs 3	0.599	11.14	-	-	-

* → Significant at 5%
** → Bai-Perron (2003) critical values

Table IV. Significant breaks and possible reasons based on literature

Break Phase	Spot Break Phase	Futures Break Phase	Possible reasons
Phase 1	17-12-2007	15-12-2007	Financial crisis
Phase 2	29-03-2012	29-03-2012	Weather shocks

C. Johansen cointegration test

This test analyses the spot and future parity in the long run. Through this, we have observed that the commodity has at most one cointegration relation with a significance level which suggests that both have a long-run relationship and move together and means of future price discovery.

Table V. Johansen cointegration test statistics

Unrestricted Cointegration Rank Test (λ_{trace})				
Hypothesized Number of cointegration equations	**Eigenvalue**	λ_{trace}	**Critical Value at 5%**	**p-value****
None *	0.055	199.893	15.495	0.000
At most 1	0.001	2.570	3.841	0.108
Unrestricted Cointegration Rank Test (λ_{max})				
Hypothesized Number of cointegration equations	**Eigenvalue**	λ_{max}	**Critical Value at 5%**	**p-value****
None *	0.554	197.323	14.265	0.000
At most 1	0.001	2.57	3.841	0.108

* → Rejection of null at 5%
**→ M-H-M (1999) p-values

Table VI. Long-run analysis using Johansen cointegration test

Long run estimates **Dependent Variable: Spot prices**		
Variable	**Coefficient**	**S.E.**
FP_t	0.964	0.008
Log likelihood	-42585.62	

Table VII. Short-run analysis using VECM

Vector Error Correction Estimates				
Variable	**Coefficient**	**S.E.**	**t statistics**	**Probability**
C	1.009	2.846	0.355	0.723
ΔSP_{t-1}	-0.410	0.200	-20.331	0.000
ΔSP_{t-2}	-0.202	0.017	-11.523	0.000
ΔFP_{t-1}	0.348	0.037	9.495	0.000
ΔFP_{t-2}	0.178	0.035	5.024	0.000
ECT	-0.227	0.017	-12.994	0.000

D. Granger causality test

We can observe that the futures cause a spot in each phase, but spot returns do not Granger cause the future returns in the relaunch phase.

Table VIII. Granger causality test analysis inferring the causation with direction

Null hypothesis	**Futures returns do not cause spot returns**			**Spot returns do not cause future returns**		
Phase	**F statistic**	***p* -value**	**Inference**	**F statistic**	***p*-value**	**Inference**
Pre-ban	19.816*	0.000	FR → SR	3.291*	0.037	SR → FR
Ban	4.248**	0.015	FR → SR	7.529*	0.000	SR → FR
relaunch	38.510*	0.000	FR → SR	2.254	0.105	No causality

*, ** → Significant at 1% and 5% level of significance respectively

E. GARCH model

The implementation of the GARCH model with ban and introduction of the commodity dummies in variance equation. The model suggests that the suspension of futures trading had a detrimental effect on spot volatility. In the above table, we can imply that volatility increases during the ban period with a positive and significant dummy coefficient. The introduction of the commodity before the suspension positively affected the commodity spot volatility and declined after the introduction of futures trading.

Table IX. Inferences of GARCH model

Mean Equation			
	Coefficient	**SE**	**Prob**
Constant	0.003	0.000	0.000
AR(1)	0.133	0.034	0.000
MR(1)	-0.461	0.025	0.000
Variance Equation			
	Coefficient	**SE**	**Prob**
Constant	0.000	0.000	0.000
ARCH Effect	0.651	0.063	0.000
GARCH Effect	0.019	0.008	0.017
Dummy Ban	0.001	0.000	0.000
Dummy Introduction	-0.001	0.000	0.000
Akaike information criterion		-3.602	
Schwarz criterion		-3.570	
Hannan-Quinn criterion		-3.593	

This study underlines the destabilization hypothesis, which weakens in the post-ban/relaunch period, and emphasizes the significance of futures markets for efficient hedging and favourable price discovery. Because there are intrinsic variations in the form and degree of government interference for each commodity, the mixed findings for the destabilization hypothesis show that each incidence of a price increase in a commodity should be examined individually.

V. EDITORIAL POLICY

The authors declare that the work requires no ethical consent/approval for publication.

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CONCLUSION

The government's intention towards expanding agricultural commodity markets has paved the way for this research and can provide critical insights. In 2003-2004 the Indian government took significant steps to develop the commodity market scenario. Therefore, NCDEX (National Commodity and Derivative Exchange Limited) came into existence. The government of India implemented a multi-commodity exchange with the expansion of the list of commodities permitted in trading. For all agricultural commodities, futures markets have been seen to be a significant key for price discovery as the futures contract has a relationship between the spot price and the expected price. The spot-futures parity, which argues that spot and futures prices should move together over time to eliminate ongoing arbitrage opportunities based on the spot-futures linkages, might potentially be used to infer the relationship between spot and futures prices. Prohibition on futures contracts has proven to raise spot price volatility during the prohibition period, emphasizing the constructive function of the futures market. This study

presents solid evidence to policymakers that agricultural futures trading would improve the efficiency of the price discovery process and aid in adequate risk management techniques in favor of farmers. The futures market also allows farmers to price soybeans outside of the harvesting season. Hedging with futures contracts entails producers selling contracts on the futures exchange for the month their products will be sold. The insights could also be helpful for farmers to effectively manage price risk and dealers to capitalize on speculative or arbitrage possibilities.

"Before the ban, we could get a clear indication about how prices would hold, say, three months from harvest. That allowed us to either sell outright or offload in tranches. Without any data point, this year is going to be tricky" [5]. In accordance with the current harvesting, is the period of the suspension of trading (December 21, 2021) relevant to soybean and its derivatives in this study, we firmly believe that the relaunch of the commodity will destabilize the spot market. In accordance with the recent price discovery, this ban is long due to the impact of various macro and microeconomic factors that have affected the volatility of this commodity [16]. In our study, we conclude that the ban on futures trading in 2008 had affected price discovery and risk management in the long term majorly had led to destabilization in the spot market hence, the ban of 2021 may be relevant to curb inflation and price instability in the long run but will destabilize the spot market.

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