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Calendar anomalies in the returns of the commodity futures market: Empirical Evidence from India

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Abstract
Purpose: This paper investigates calendar anomalies in commodity futures returns empirically in the context of developing economies such as India.
Design/methodology/approach: Data from 2004 to 2024 was acquired from MCX and NCDEX. Employing a dummy variable OLS regression model, the study examines the volatility of daily returns for the following commodities: energy (crude oil), base metals (aluminium, copper), bullion (gold, silver), and agriculture (guar seed).
Findings: The month of the year effect, day of the week effect, Diwali effect and autumn effect are evaluated, and the results show that there is evidence of significant anomalies in returns of several commodity futures markets in India.
Practical Implications: Calendar anomalies can be used by market participants to build trading strategies, control risk, and make informed decisions that improve the efficiency of the commodity market. Market players can use this information to optimize resource allocation, promote inclusive market participation, and promote sustainable growth in the commodity futures market.
Originality/Value: Studies on calendar anomalies in global commodities markets have been conducted in great detail; however, few studies have thoroughly investigated the calendar anomalies in returns of commodity futures in emerging economies, such as India, using different sectors of the commodity in a detailed manner. By examining the presence of these anomalies in the Indian context, this study provides significant insights into the unique characteristics and dynamics of the Indian commodity futures market.

Keywords: Volatility, commodity futures, calendar anomalies, OLS regression, returns

Introduction

A wide spectrum of market participants, including traders, investors, speculators, and hedgers, have been drawn to the Indian commodities futures market in recent years due to its notable expansion and development. Understanding calendar anomalies and their impact on pricing is crucial since this market undergoes continuous evolution. An anomaly means an unusual occurrence of an event. When an anomaly is related to a particular time, it is called a Calendar Anomaly. Calendar Anomalies are unusual patterns of returns based on the calendar year (Amarnani & Vaidya, 2014). These anomalies have been thoroughly investigated in worldwide financial markets, including currencies, bonds, and stocks (see Qadan, Aharon and Eichel (2019); Auer, (2014); Borowski and Lukasik (2015) [1, 3, 18]; Cross (1973); Brooks and Persand (2001); Schmidbauer and Rösch (2018) [4, 20]. On the other hand, not much study has been done exclusively on calendar anomaly in the Indian commodities futures market.

There are several reasons why it is crucial to study calendar anomaly in the Indian commodity futures market. First of all, it offers insightful information on the dynamics and patterns of commodity pricing. Commodity-based sectors, such as agriculture, energy, and metals, are essential for India's economy and its rapid growth. Investors and traders can benefit from an understanding of calendar impacts as it will help them plan their trades more effectively, time their transactions, and effectively manage risk. Market players may be able to take advantage of these anomalies to increase their profit margin by spotting recurrent patterns.

Secondly, examining calendar anomalies in the Indian commodity futures market adds to the body of knowledge already available on market efficiency. Prices in efficient markets accurately reveal all available information, creating it difficult for players to consistently generate abnormal profits. Calendar anomalies, on the other hand, point to the possibility of inefficiencies in the market. Examining these anomalies can give information on the effectiveness of the Indian commodities futures market as well as reveal the causes behind price fluctuations.

Thirdly, understanding calendar anomaly in the Indian commodity futures market has implications for policymakers. To promote transparency and fair trade, commodity markets are governed by several laws and policies. Policymakers can learn more about how market restrictions may affect pricing dynamics and market behaviour by analyzing calendar anomaly effects. This information can help drive the creation of appropriate regulations that improve liquidity, support market stability, and protect market players' interests.

Calendar anomalies in international commodity markets have been researched in extensive detail, but studies focusing on the Indian market are limited. Therefore, it is crucial to research calendar anomalies in the Indian commodities futures market. This study offers important insights into the distinctive features and dynamics of the Indian commodities futures market by examining the existence of these anomaly in the Indian environment. This research included a broad variety of commodities futures, such as those in the energy, metals, agricultural, and bullion sectors. Filling the research gap in the Indian context aids policymakers in formulating appropriate laws, adds to the knowledge of market efficiency and offers insights into the dynamics of commodity prices. The Indian commodities futures market may experience sustained development, enhanced investor trust, and greater market efficiency by investigating these anomalies and helping policymakers to make better decisions.

The remaining section of this particular study is organized as follows: Section 2 discusses the related literature study on the calendar anomalies in the commodities futures market; Section 3 provides details on the data and methodology; and Section 4 represents the results and discussion. Section 5 has a summary and conclusion.

Literature Review

Irregular return patterns that are dependent on the calendar year are known as calendar anomalies. Borowski & Lukasik (2015) [3] show some common calendar anomalies are the day of the week effect, a month of the year effect, and other seasonal effects (weekend effects, holidays effects, within the month effects, turn of the month effects, etc.). Qadan *et al*. (2019) [18] explore how seasonal patterns and calendar abnormalities influence valuable metals as well as other natural resources. The study uses OLS regressions and GARCH models and detected evidence in the commodity market supporting the presence of the day of the week, January, Halloween, turn of the month, Independence Day, Christmas Day, and Good Friday effects. Auer (2014) [1] investigated that volatility on Monday is significantly greater than on all other weekdays, but returns have a tendency to to be lower on Monday using the dummy-augmented GARCH Model. Borowski (2015) [3] indicates that the monthly impact for canola occurs in September, for soybean oil in February, September and July, and for soybean meal in September and October. For rough rice, the day-of-the-week impact was observed on Thursdays and Tuesdays for canola. Singh & Singh (2015) investigate that the crops' seasonality pattern has an impact on the efficiency of the chana futures market. Baur (2013) [10] analyzes the autumn influence on gold and discovers that the months with favorable and significant gold prices are September and November. Jain (2020) [14] displays the Day of the Week, Month of the Year, Friday and Saturday effect on the markets regarding crude oil and gold. Compton *et al*. (2013) [8] observed that the Russian stock and bond markets exhibit significant TOM impact.

Chhabra & Gupta (2022) [6] show in their research that the Indian commodities market is significantly inefficient because the market exhibits calendar anomalies. Acharya *et al*. (2024) discovered that the September impact in both stock market return series. The key finding is that, when monthly dummies are present, the historical return has a big influence on determining the current return. Borowski & Lukasik (2015) [3] proves that the monthly impact on the markets for copper, silver, gold and platinum is absent. In the palladium market, the seasonality impact occurred in September. In the gold and copper markets, the weekend influence was noticeable. Badhani & Tripathy (2010) [2] investigated that no day of the week influence was observed in returns with the adoption of the rolling settlement mechanism. Camilleri (2008) [5] identifies that the MSE has a January effect, implying that volatility is often greater in the month of January as compared to the remaining months of the year. Another result showed that April through October had the least volatility on the MSE. Mangala & Dhawan (2009) [17] explore a day of the week effect on the stock markets of six different countries. Based on the findings, developed stock markets don't show any weekly calendar discrepancies. The Indian and Brazilian stock markets are two examples of developing stock markets where day-of-the-week effects are noticeable.

Schmidbauer & and Rösch (2018) [20] has been determined that certain holidays, such as Ramadan Eid, Chinese New Year, Christmas, Dussehra, and Akshaya Tritiya, affect how gold prices are distributed. Goyal *et al*. (2016) [13] demonstrated that the Nifty does not experience a festival impact and moves in the same way as the indexes of Brazil, Russia, China, and South Africa. Pote (2023) finding revealed that the September to November festival season in India has a big influence on the economy. Consumers should take advantage of the likelihood of increased sales, and businesses should seize it by pointing more consumers in the correct way as they pursue substantial and enticing discounts and special offers. Kushwah & Munshi (2017) [16] attempted to discover that Diwali and calendar-year events had a negative association with Nifty returns. Although there is a favourable association between the introduction of the budget and changes in financial year events and Nifty results in the stock market.

Based on the studies, there is some contradicting information in the literature on calendar anomalies in the Indian commodity futures market. While the calendar anomaly has attracted significant study internationally, the Indian commodity market has gotten relatively less attention. The work under discussion is prompted by this information gap.

Data and Methodology

The key objective of this research is to analyse the calendar anomalies in the return for commodity futures in the context of emerging economies like India. National Commodity Derivative Exchange (NCDEX) and Multi-Commodity Exchange (MCX) official websites were used to gather the data for the study on commodity futures. The study includes the years from 2004 [19] to 2024 and evaluates the daily settlement prices of futures contracts. Energy, bullion, base metals and agriculture were the four sectors from which data was gathered. Following futures commodities such as copper, aluminium, silver, gold, crude oil and guar Seedwere chosen for examination.

Compound percentage return is calculated by calculating the logarithmic first difference of closing price using the daily close price of futures traded on the MCX and NCDEX.

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) * 100 \quad (1)$$

In equation (1), $R_{i,t}$ represents the return on a commodity i on day t, $P_{i,t}$ represents the closing price of a commodity i on day t, $P_{i,t-1}$ represents the closing price of a commodity i on day t-1. The Augmented Dickey-Fuller (ADF) test is used to evaluate the stationarity of the data series.

1. OLS Methodology

a. Day of the week effect

The day of the week effect is examined in empirical finance research using the OLS regression technique. (Kumar, 2015;

Faizan *et al*., 2018; Jain, 2020) [12, 14, 15] are among the literature that have used this technique. The day of the week effect is investigated using OLS regression employing dummy variables, which are represented symbolically as follows:

$$Rt = \alpha 1 + \beta 2d2t + \beta 3d3t + \beta 4d4t + \beta 5d5t + \varepsilon t \quad (2)$$

Rt stands for commodity market futures return, α1 represents the constant term and return on Friday, d2t represents the returns on Monday, d3t represents the return on Tuesday, d4t represents the return on Wednesday, and d3t represents the return on Thursday. The difference between Monday's return and Tuesday's, Wednesday's, Thursday's, and Friday's return is shown by β2, β3, β4, and β5, respectively. Regression equation residuals or the error term are represented by εt. For the OLS regression equation, the following is the null hypothesis:

$$H_0: \alpha 1 = \beta 2 = \beta 3 = \beta 4 = \beta 5 \quad (3)$$

Under this null hypothesis, the returns of the commodity futures market index (Rt) are assumed to remain constant over all days of the week. In other words, it implies that the constant term (α1) and the variations in returns (β2, β3, β4, β5) between Friday and the remaining weekdays (Monday, Tuesday, Wednesday and Thursday) are equivalent to one another. If the null hypothesis is rejected, then there are significant differences in the futures returns for the commodity market across weekdays.

b. Month of the year effect

When a month's mean return differs from the mean returns of the other months in the year, this is known as the month of the year effect. The month of the year effect on commodity futures is tested using the following formulation of the OLS regression model:

$$Rt = \alpha 1 + \beta 2D2 + \beta 3\ D3 + \beta 4\ D4 + \beta 5\ D5 + \beta 6\ D6 + \beta 7\ D7 + \beta 8\ D8 + \beta 9\ D9 + \beta 10\ D10 + \beta 11\ D11 + \beta 12\ D12 + \mu t \quad (4)$$

Where, Rt represents the selected commodity's daily return at time t, and the months of February to December are represented by the dummy variables D2 to D12. The constant term α denotes the mean return for January, and the coefficients β indicate the difference between the mean return for January and the mean return of the particular month, whereas the error term is µt.

For the OLS regression equation, the following is the null hypothesis:

$$\mathbf{H_0}: \alpha 1 = \beta 2 = \beta 3 = \beta 4 = \beta 5 = \beta 6 = \beta 7 = \beta 8 = \beta 9 = \beta 10 = \beta 11 = \beta 12 \quad (5)$$

A statistically significant value of β's indicates a substantial change in the mean monthly returns, demonstrating the existence of the month of the year effect. If the null hypothesis is disproved, then there are significant differences in the returns on commodities market futures across months.

c. Diwali effect

To examine the Diwali Effect, the mean returns on Diwali have been calculated by taking into consideration the daily returns from two weeks before and two weeks after Diwali. The Diwali Effect's OLS regression function with a dummy variable is stated as follows:

$$Rt = \alpha 1 + \beta 2d2t + \varepsilon t \quad (6)$$

where β2 is a dummy variable that reflects the daily returns of the two weeks prior to and two weeks afterwards Diwali, D is a dummy variable that has a value of 0 other than Diwali and 1 during the specified period, the intercept denoted by α, is the anticipated value outside the Diwali period, rt is the daily market return, and ε is a random error term.

H_0: There is no significant difference in the distribution of mean returns of commodity futures series during the Diwali period and mean returns for the rest of the year.

A statistically significant value of β's indicates the Diwali effect.

a. Autumn effect

To examine the Autumn Effect, the daily returns for the three months of October through November were taken into account while calculating the mean returns for the Autumn season.

The Autumn Effect's OLS regression function with a dummy variable is stated as follows:

$$Rt = \alpha 1 + \beta 2d2t + \varepsilon t \quad (7)$$

where β2 is a dummy variable that reflects the daily returns of the Autumn season, D is a dummy variable with a value of 1 assigned to the days that fall within the given range (October to November) and 0 assigned to all other days, the anticipated value outside of the autumn season is the intercept, represented by α and rt is the daily market return, and ε is a random error term.

H_0: There is no significant difference in the distribution of mean returns of commodity futures series during the autumn season and mean returns for the rest of the year.

A statistically significant value of β's indicates the autumn effect.

Results and Discussion

The study's descriptive statistics for returns on commodities futures are presented in Table 1, which were computed using daily closing values. Crude oil exhibited the highest volatility based on standard deviation, while gold futures had the highest average returns. All returns were negatively skewed, except for guarseed, indicating a lower likelihood of producing returns above the mean. The returns distribution of futures was found to be leptokurtic (>3) in terms of kurtosis, which implies a fat tail in the return sequence. The outcomes of the Jarque-Bera test indicated that none of the returns of commodity futures followed a normal distribution. Each test statistic's p-value is extremely low, demonstrating that the null hypothesis can be rejected at any reasonable level of significance.

Table 1: Descriptive Statistics for Returns on Commodity Futures

	Mean	Standard Deviation	Kurtosis	Skewness	Jarque-Bera	ADF
Copper	0.0364	1.4709	4.4720	-0.1549	3937.2*	-91.813*
Aluminium	-0.0231	1.2264	3.6297	-0.0513	2471.6*	-67.650*
Crude Oil	-0.0418	2.2913	38.4014	-1.0976	285744.3*	-31.732*
Gold	0.0439	1.0090	28.9304	-0.5248	150622.9*	-69.821*
Silver	0.0179	1.6003	12.9237	-1.1759	34351.9*	-70.810*
Guarseeds	0.0109	1.7921	1.7189	0.3019	251.4*	-43.340*

Source: Author's calculations. Note: * Statistical significance at the 1% level. ADF-test indicates the stationarity of the variables. Jarque-bera statistics shows the normality of the variables.

To examine the data series' stationarity, a unit root test has been employed. The Augmented Dickey-Fuller (ADF) test confirms the stationary nature of the return series under the unit root null hypothesis. The existence of mean reversion in the futures of the commodity market is indicated by the fact that all the return series are stationary. This shows that over time, prices have a propensity to return to their long-term average. This data may be used by investors to measure the success of their holdings and see whether they are producing returns that are consistent with the long-term patterns in commodity markets.

The results of an ordinary least squares (OLS) regression examination that investigated the day-of-the-week effect on several variables are shown in Table 2. The table contains the coefficients, p-values, R-squared values, and F-values for each variable.

Table 2: OLS Regression Results of Day of the Week Effect in Commodity Futures

Variable	**Gold**		**Silver**		**Crude oil**	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
Constant	0.0746	0.0028***	0.0634	0.1471	0.0203	0.7476
Monday	-0.0154	0.6971	-0.0194	0.7818	-0.2056	0.0401**
Tuesday	-0.0784	0.0473**	-0.0573	0.4127	-0.0439	0.6612
Wednesday	-0.0757	0.0553*	-0.0542	0.4377	-0.0461	0.6451
Thursday	-0.0568	0.1510	-0.1223	0.0803*	-0.0468	0.6404
R-Square	0.0013		0.0007		0.0009	
F-Value	1.6096	0.1689	0.8420	0.4983	1.1274	0.3415
Variable	Copper		Aluminium		Guarseed	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
Constant	0.0997	0.0126**	-0.0235	0.5015	-0.0145	0.8683
Monday	-0.0499	0.4292	-0.0538	0.3290	-0.2355	0.0604*
Tuesday	-0.1101	0.0814*	0.0285	0.6046	0.0108	0.9312
Wednesday	-0.0741	0.2403	0.0646	0.2401	0.1566	0.2095
Thursday	-0.1884	0.0029**	-0.0357	0.5170	0.1920	0.1244
R-Square	0.0020		0.0011		0.0070	
F-Value	2.4178	0.0465	1.2631	0.2821	3.5612	0.0067

Source: Author's calculations.

Note: * Statistical significance at the 10% level, ** Statistical significance at the 5% level, *** Statistical significance at the 1% level. The intercept term denotes the month of Friday.

The results of an ordinary least squares (OLS) regression examination that investigated the month of the year effect on several variables are shown in Table 3. The table contains the coefficients, p-values, R-squared values, and F-values for each variable.

Table 3: OLS Regression Results of Month of the Year Effect in Commodity Futures

Variable	**Gold**		**Silver**		**Crude oil**	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
Constant	0.0870	0.0543*	0.1083	0.1844	-0.1479	0.2077
February	-0.0155	0.8109	0.0241	0.8370	0.2174	0.1913
March	-0.1505	0.0180**	-0.1648	0.1484	0.0178	0.9127
April	-0.0378	0.5604	-0.1000	0.3865	0.1122	0.4987
May	-0.0845	0.1849	-0.0763	0.5013	0.2633	0.1060
June	-0.0675	0.2918	-0.2232	0.0502*	0.3121	0.0565*
July	-0.0469	0.4594	0.0354	0.7539	0.0619	0.7033
August	0.0477	0.4553	-0.0173	0.8793	0.1723	0.2926
September	-0.0990	0.1218	-0.2141	0.0603*	0.0638	0.6970
October	-0.0866	0.1753	-0.1025	0.3674	-0.0014	0.9933
November	-0.0232	0.7148	-0.1243	0.2738	-0.0011	0.9946
December	-0.0745	0.2432	-0.1124	0.3287	0.0550	0.7386
R-Square	0.0029		0.0027		0.0021	
F-Value	1.3385	0.1959	1.1755	0.2982	0.9201	0.5196
Variable	Copper		Aluminium		Guarseed	
	Coefficient	P-Value	Coefficient	P-Value	Coefficient	P-Value
Constant	-0.0385	0.6914	0.0123	0.8454	-0.0725	0.5923

February	0.2060	0.1391	0.0407	0.6524	-0.0882	0.6502
March	0.0608	0.6564	-0.0998	0.2602	0.1024	0.5939
April	0.2162	0.1221	0.0745	0.4105	0.3822	0.0520*
May	0.0131	0.9235	-0.1163	0.1900	-0.1016	0.5984
June	0.0899	0.5093	-0.0512	0.5659	0.1277	0.5074
July	0.1856	0.1700	0.0016	0.9859	0.1388	0.4660
August	0.0594	0.6620	-0.0070	0.9373	0.4693	0.0152**
September	0.0060	0.9648	-0.0804	0.3684	-0.0918	0.6346
October	-0.2347	0.0852*	-0.0669	0.4523	0.1927	0.3216
November	0.0720	0.5971	-0.0855	0.3341	-0.2458	0.2035
December	0.0330	0.8078	-0.0175	0.8431	0.1326	0.4908
R-Square	0.0036		0.0021		0.0119	
F-Value	1.5371	0.1111	0.8569	0.5827	2.2092	0.0119

Source: Author's calculations.
Note: * Statistical significance at the 10% level, ** Statistical significance at the 5% level, *** Statistical significance at the 1% level. The intercept term denotes January.

The results of an ordinary least squares (OLS) regression examination that investigated the Diwali effect on several variables are shown in Table 4. The table contains the coefficients, p-values, R-squared values, and F-values for each variable.

Table 4: OLS Regression Results of the Diwali Effect in Commodity Futures

Variable		Rest of the year	Diwali	R-Square	F-Value
Gold	Coefficient	0.0343	-0.0093	0.0000	0.0418
	P-Value	0.0122	0.8380		0.8380
Silver	Coefficient	0.0234	-0.0611	0.0001	0.5781
	P-Value	0.3343	0.4471		0.4471
Crude oil	Coefficient	-0.0302	-0.1285	0.0003	1.2358
	P-Value	0.3848	0.2663		0.2663
Copper	Coefficient	0.0348	-0.1316	0.0007	3.2734
	P-Value	0.1115	0.0705*		0.0705
Aluminium	Coefficient	-0.0186	-0.0487	0.0001	0.5641
	P-Value	0.3284	0.4527		0.4527
Guarseed	Coefficient	0.0176	-0.0773	0.0001	0.2987
	P-Value	0.6724	0.5848		0.5848

Source: Author's calculations.
Note: * Statistical significance at the 10% level.

The results of an ordinary least squares (OLS) regression examination that investigated the Autumn effect on several variables are shown in Table 5. The table contains the coefficients, p-values, R-squared values, and F-values for each variable.

Table 5: OLS Regression Results of Autumn Effect in Commodity Futures

Variable		Rest of the year	Autumn	R-Square	F-Value
Gold	Coefficient	0.0388	-0.0210	0.0001	0.4863
	P-Value	0.0103	0.4856		0.4856
Silver	Coefficient	0.0372	-0.0756	0.0004	2.0321
	P-Value	0.1656	0.1541		0.1541
Crude oil	Coefficient	-0.0129	-0.1147	0.0005	2.2626
	P-Value	0.7371	0.1326		0.1326
Copper	Coefficient	0.0449	-0.0872	0.0007	3.3035
	P-Value	0.0624	0.0692*		0.0692
Aluminium	Coefficient	-0.0084	-0.0569	0.0004	1.8478
	P-Value	0.6876	0.1741		0.1741
Guarseed	Coefficient	0.0548	-0.1775	0.0018	3.6996
	P-Value	0.2326	0.0546*		0.0546

Source: Author's calculations.
Note: * Statistical significance at the 10% level, ** Statistical significance at the 5% level.

Results and discussion

The results reported in Table 2 indicate that some commodities' returns seem to show consistent trends depending on the day of the week. Particularly, Fridays have a statistically substantial positive relationship with returns on the prices of copper and gold. However, Mondays exhibit a distinct pattern, with statistically significant negative coefficients for guarseed and crude oil and insignificant for the rest of the commodity futures. It was initially discovered (Cross, 1973) that, on average, Mondays show lower returns, whereas Fridays often provide higher returns. (Qadan *et al*., 2019) [18] demonstrated that Fridays have been linked to positive returns in copper, gold, and palladium. (Auer, 2014; Jain, 2020) [1, 14] supported the outcomes of the negative Monday effect of crude oil futures. Gold's positive Friday effect is in line with the discoveries of (Faizan *et al*., 2018) [12] and in contrast with the reported negative Friday effect of (Chhabra & Gupta, 2022). (Sarma, 2004) [6, 19] found positive deviation in the Monday-Friday set for three indexes (SENSEX, NATEX, and BSE200), suggesting that there is a chance to consistently generate unusual returns by employing a trading technique that involves purchasing on Mondays and selling on Fridays. Moreover, no statistically significant day of week influence has been detected for aluminium. Likewise, (Borowski & Lukasik, 2015) [3] reported that the Indian metal market was Not impacted by the weekend effect. (Badhani & Tripathy, 2010) [2] observed no signs of a day of the week influence on the Indian Nifty returns.

(Mangala & Dhawan, 2009) [17] found that Two developing stock markets that demonstrate the existence of the day of the week impact are the Indian and Brazilian stock markets.

The findings of the month of the year effect are presented in Table 3.The monthly impact was initially noted in the U.S. stock market by (Wachtel, 1942), and other researchers in established and emerging economies later expanded on this discovery. This study found the presence of significant monthly effect in gold (positive January effect and negative March effect); silver (negative June and September effect); crude oil (positive June effect); copper (negative October effect); guarseed (positive April and August effect). Aluminium futures do not exhibit the month of the year effect. (Chia, 2012) [7] detected the November Impact along with its volatility in the Nikkei 225 index for the Japanese stock market. (Deo & Sharma, 2014) [11] showed a notable April Effect in the CNX midcap and smallcap indexes, with a comparatively low return in March. (Coutts & Sheikh, 2000) discovered no proof of either monthly seasonality or a January influence on the all-gold index on the Johannesburg Stock Exchange.

Table 4 reported the Diwali effect. The term "Diwali effect" describes a phenomenon wherein financial markets exhibit certain patterns or anomalies about the Diwali festival, a significant Hindu festival celebrated in India and other countries. This effect is frequently linked to behavioural, psychological, and cultural elements that impact market participants throughout the festival season. Table 4 indicates that only copper futures have a significant Diwali influence. This suggests that there is a regular trend or anomaly in the price or returns of copper futures during the Diwali season. This result implies that some variables influence supply, demand, or trading patterns of copper futures around Diwali, which has a predictable effect on copper prices. Other commodities, including gold, silver, aluminium, crude oil and guarseed, do not exhibit any significant change during this period. However, this does not mean that there aren't any particular forces operating during the festival season just because there is not a noticeable Diwali influence in other commodities. The findings of the research imply that not all commodities experience the Diwali effect in the same way and that various factors could have an influence on the price dynamics of each commodity during the festival.

Table 5 reported the autumn effect. The term "autumn effect" is a phenomenon that can be observed in financial markets when particular patterns or anomalies appear between September to November, which is the time of year when autumn occurs. According to the research, there is a significant autumn effect in the futures of copper and guarseed, but not in the case of other commodities like gold, silver, aluminium and crude oil. Market participants can benefit from an understanding of the autumn effect by gaining significant insights into seasonal market dynamics. This will help them manage risk, make better investment decisions, and create trading strategies that capitalize on patterns or anomalies that are noticed during the autumn season.

Calendar anomalies shed light on reoccurring patterns and anomalies connected to particular calendar years or events. Market players can create trading strategies that take advantage of the markets' predictable behaviour at specific periods by understanding these patterns. Anomalies in the calendar can help control risk as well. Market players can modify their risk exposure and position themselves appropriately by recognising times of increased volatility or certain risk concerns linked to particular calendar events. The month of the year impact, for example, might highlight periods of historically high or low volatility in the pricing of commodities futures. During times of increased volatility, traders can reduce potential losses by modifying their risk management strategies, such as position size or the use of derivatives. Market efficiency can be enhanced and price discovery more precisely when players are aware of repetitive patterns or anomalies linked to particular calendar periods. This data improves the transparency of markets and reduces disparities in information, which is advantageous to all parties involved.

Market participants may effectively allocate resources, promote equitable market participation, and promote sustainable development by utilising their understanding of calendar irregularities.

For instance, knowledge of the Indian commodities futures market's autumn impact might shed light on the dynamics of supply and demand during certain seasons. With this information, merchants and producers may better allocate resources and promote sustainable agricultural practices by coordinating their distribution, storage, and procurement plans with the harvest seasons.

Summary and Conclusion

This study aims to investigate calendar anomalies in commodity futures returns within the framework of developing nations such as India. The official websites of the Multi-commodities Exchange (MCX) and the National Commodity Derivative Exchange (NCDEX) were utilized to collect the data for the commodities futures research. An analysis of futures contract daily settlement prices is conducted, covering the years 2004 [19] through 2024. Using an OLS regression model with a dummy variable, the research examined the daily return volatility of the following commodities: base metals (aluminium, copper), energy (crude oil), bullion (gold, silver), and agricultural (guar seed). The findings show that there is a notable day of the week effect in futures: crude oil and guarseed have a negative Monday effect; gold and copper have a negative Tuesday effect; gold has a negative Wednesday effect; silver and copper have a negative Thursday effect; and gold and copper have a positive Friday effect. In the case of aluminium future, there is no day of the week effect. Significant monthly effects were observed in the following: guarseed (positive April and August effect); gold (positive January effect and negative march effect); silver (negative June and September effect); copper (negative October effect) and crude oil (positive June effect). In aluminium futures, there is no month of the year effect. The findings show that the only commodity with a significant Diwali effect is copper futures. The research discloses that there is a significant autumn effect for the futures of copper and guarseed, but not for other commodities like crude oil, gold, silver and aluminium.

Market players can utilize calendar anomalies to develop trading strategies, manage risk, and make well-informed choices that enhance the stability and efficiency of the commodities market. Participants in the commodities futures market may employ this knowledge to encourage fair market participation, resource allocation, and sustainable market growth.

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