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Presence of Calendar Anomalies in Indian Commodity Markets: Empirical Evidence on Nkrishi and MCX-Agri

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Abstract

The presence of calendar anomalies in financial markets challenges the notion of market efficiency and provides opportunities to the market participants for earning abnormal returns based on past prices and the available information. The present study deals with testing of wide range of 12 different calendar anomalies in Indian commodity market using daily closing prices of 2 commodity market indices namely Nkrishi of NCDEX and MCX-Agri of MCX commodity exchanges over a period from 2009 to 2019. The results from dummy regression analysis revealed the presence of week of the month effect, month of the year effect, semi-month effect and turn of the tax year effect in Indian commodity market and indicates that Indian commodity market is weakly inefficient.

Keywords: Calendar anomalies, Week of the month effect, Month of the year effect, Semi-month effect, Turn of the tax year effect, Commodity markets

JEL Classification: G14, Q14

Introduction

The worldwide developments and rise in global uncertainties have resulted in various advancements in financial markets. The preference of the market players to reduce market uncertainty has further led to continuous developments of new methods of analyzing risk and simultaneous development of technologies and financial products. As an important segment of the financial market, the commodity market acts as an alternative source of investment. In an efficient commodity futures markets, the futures contracts facilitate price discovery for the commodity and enables the current futures prices to reflect the expected spot price on the date of the maturity and thus, allow market participants to manage their price risk. If such efficiency exists, this would result in asset prices that are appropriate in terms of current knowledge and information (Fama, 1965), the idea commonly known as Efficient Market Hypothesis (EMH). The market where the current futures price reflects all the market information available for predicting the future spot price is said to be an efficient market. But if the market is inefficient, it opens up opportunities for market participants to beat the market and earn risk-adjusted abnormal returns based on past prices and the available information. A vast amount of literature has been dedicated towards testing of market efficiency in financial markets. The empirical studies have found the irregularities in stock prices which happen at surprising regularity. Although the asset pricing models like Capital Asset Pricing Model has been able to explain these irregularities, yet many of the anomalies in stock prices remained unexplained. Anomalies indicate inefficiency in the market as they are inconsistent to established theories of asset pricing. Calendar anomaly is the tendency of the asset returns to display cyclical or time-based patterns. These variations may help in earning abnormal return in security markets. The various forms of calendar anomalies include day of the week effect, weekend effect, month of the year effect, turn of the month effect, turn of the year effect and holiday effect. Calendar anomalies are a well-documented phenomenon in financial markets and majority of the studies have focused on testing of anomalies in equity markets (Cross, 1973; Lakonishok and Levi, 1982; Pearce, 1996; Gupta and Aggarwal, 2004; Gao and Kling, 2005; Chatzitzisi *et al*, 2019). Some studies have also documented the presence of calendar anomalies in commodity markets (Ma, 1986; Lucey and Tully, 2006; Lee *et al*, 2013; Borowski, 2015a; Borowski, 2015b; Burakov and Freidin, 2018). Still discovery of calendar anomalies in commodity markets is a developed economy phenomenon, which has largely remain untouched in developing countries like India.

The history of commodity futures trading in India can be traced back to 19th century with initiation of organized trading in cotton, through the establishment of Bombay Cotton Association Ltd. in 1875. Further, various other commodities

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were allowed to be traded in futures exchanges over a period of time. However, various factors affect the growth of commodity trading like years of foreign rule, periods of droughts and scarcity, policies of the government etc. (Rani and Gupta, 2020). The commodity "futures" trading was resumed in 2003 by lifting prohibition against futures trading in all the commodities by Indian government and granting recognition to electronic exchanges namely National Multi Commodity Exchange of India (NMCE), Multi Commodity Exchange of India (MCX) and National Commodity and Derivatives Exchange (NCDEX) as national multi commodity exchanges. Therefore, the commodity derivative market in India was initially an under developed commodity market and futures market trades were merely used as risk management mechanism. But, owing to the globalization on one hand and dominance of agriculture and commodity sectors in Indian economy on other hand, the Indian commodity market has witnessed an exceptional growth. Therefore, academicians and researchers have become interested in testing the informational market efficiency of commodity markets and the presence of calendar anomalies in these markets, presence of which may challenge the notion of market efficiency.

The calendar anomalies have been most extensively investigated not only for their existence but also for their well-documented persistence in the financial markets. Day of the week effect is one of the most documented calendar anomaly and is referred to as the tendency of asset returns to differ significantly across different trading days of the week. Specifically trading returns have been found to be positive on Friday and negative on Monday (Gibbons and Hess, 1981; Cross, 1973) and thus this effect is also sometimes referred to as weekend effect (Lakonishok and Levi, 1982; Davidsson, 2006). The researchers have also documented the existence of day of the week effect in commodity markets. Borowski (2015c) has observed the presence of Tuesday and Thursday effects in various agricultural commodities. Further, day of the week effect has also been reported for various non-agricultural commodities. Yu and Shih (2011) observed the presence of positive Wednesday effect in oil market and positive Thursday effect in gold market. On the other hand, negative Monday effect has been observed in gold and silver (Lucey and Tully, 2006). Similarly, different daily effects have been found by different researchers for different commodities like Monday effect in gold (Tuna, 2013), Thursday effect in rubber (Borowski, 2015b), Friday effect in silver (Gorska and Krawiec, 2014) etc.

Month of the year effect occurs when returns on traded asset significantly varies across different months of the year. A large number of studies have found mean returns to be significantly different particularly in the month of January as compared to other months of the year in stock markets of different countries (Agrawal and Tandon, 1994; Greenstone and Oyer, 2000; Haug and Hirschey, 2006). Hence, this effect is also termed as the January effect. Apart from January effect, the studies have also documented other month of the year effects for equity markets of different countries like February effect (Kaur, 2004; Gao and Kling, 2005), March effect (Pandey, 2002), April effect (Wickremasinghe, 2007; Gu, 2015), May effect (Coutts and Sheikh, 2002; Mouselli and Al-Samman, 2013), June effect (Ahsan and Sarkar, 2013), July effect (Al-Saad and Moosa, 2005), September effect (Davidsson, 2006) November effect (Patel, 2008), and December effect (Kumar and Jawa, 2017). Month of the year effect has also been documented by some researchers for commodity markets. For example February and June effects have been reported in Frozen concentrated orange juice futures (Borowski, 2015 a); April, August, October effects have been observed in various agricultural commodities (Lee *et al*, 2013); January and September effects have been found in precious metals (Gorska and Krawiec, 2014). Different monthly effects have also been found in energy futures like heating oil, natural gas, gas oil, crude oil, brent oil etc. (Borowski, 2016).

Evidences has also been found reporting higher mean returns during winter period as compared to summer period thereby indicating the presence of 'Halloween effect' in agricultural commodities (Arendas, 2017; Burakov and Freidin, 2018) and energy futures (Burakov *et al*, 2018). Further, semi-month effect has also been observed in commodity market where average returns for first half of the month significantly differs from that of rest half of the month (Borowski, 2015a). In addition, the mean returns during period starting on last trading day of the month to first three trading days of the following month have been observed to be significantly different as compared to rest of the month in case of some metals indicating the existence of turn of the month effect in commodity market (Qadan *et al,* 2019). Qadan *et al* (2019) also observed seasonality in natural resources futures returns around public holidays like Independence Day, Christmas, New Year's Day etc. The present study is motivated by availability of limited literature on the presence of calendar anomalies in the commodity markets particularly in the Indian context.

Data Sources and Methodology

The main objective of the study was to test the presence of different calendar anomalies in returns of selected Indian commodity market indices. The research design for the study is descriptive and exploratory in nature as it attempts to describe and explore the various forms of calendar anomalies. For the purpose of achieving the research objectives, secondary data was collected comprising of daily closing values of two commodity market indices namely Nkrishi index of National Commodity and Derivatives Exchange (NCDEX) and MCX-Agri index of Multi Commodity exchange (MCX). The data was collected from the official websites of both the exchanges i.e. www.ncdex.com and

www.mcxindia.com over the period from January 1, 2009 to December 31, 2019. The study has tested a wide range of 12 calendar anomalies namely day of the week effect, weekend effect, week of the month effect, month of the year effect, January effect, April effect, quarter of the year effect, semi-month effect, turn-of-the month effect, turn of the year effect, turn of the tax year effect and holiday effect in commodity market indices. The study used daily log returns (Jaisinghani, 2016; Chhabra and Gupta, 2020) to test the presence of calendar anomalies in commodity market using the following formula:

$$R_t = \ln (P_t / P_{t-1})$$

Where,

R_t = daily log return on day't'
P_t = closing value of index on day't'
P_{t-1} = closing value of index on day't-1'
ln = natural logarithm

Further, these daily log returns were used in the dummy regression models to test the presence of calendar anomalies. In order to examine day of the week effect in returns of selected commodity indices, the term dummy variable in regression model denotes day of the week that takes value 1 for the specific day and 0 otherwise. The regression model for examining day of the week effect is given as:

Table 1. Regression models for calendar anomalies in returns of commodity market indices

Calendar Anomaly	Regression Model	Details of the dummies included in regression model
Day of the week effect	$R_{it} = \alpha + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \mu_{it}$	Dummy variables D_1 to D_4 represents the days from Tuesday to Friday.
Weekend effect	$R_{it} = \alpha + \beta_1 D_1 + \mu_{it}$	Dummy variable D_1 represents the last trading day of the week i.e. Friday.
Week of the month effect	$R_{it} = \alpha + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \mu_{it}$	Dummy variables D_1 to D_4 represents different trading weeks of the month from week 2 to week 5.
Month of the year effect	$R_{it} = \alpha + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \beta_6 D_6 + \beta_7 D_7 + \beta_8 D_8 + \beta_9 D_9 + \beta_{10} D_{10} + \beta_{11} D_{11} + \mu_{it}$	Dummy variables D_1 to D_{11} represents the months of the year from February to December.
January effect	$R_{it} = \alpha + \beta_1 D_{Jan} + \mu_{it}$	Dummy variable D_{Jan} represents the January.
April effect	$R_{it} = \alpha + \beta_1 D_{Apr} + \mu_{it}$	Dummy variable D_{Apr} represents the April.
Semi-month effect	$R_{it} = \alpha + \beta_1 D_1 + \mu_{it}$	Dummy variable D_1 represents first-fortnight of the month.
Quarter of the year effect	$R_{it} = \alpha + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \mu_{it}$	Dummy variables D_1 to D_3 represents the 2nd, 3rd & 4th quarters of the year.
Turn of the month effect	$R_{it} = \alpha + \beta_1 D_{TOM} + \mu_{it}$	Dummy variable D_{TOM} represents the turn of the month period i.e. either (-1 to +3 trading days) where -1 stands for last trading day of the previous month and +1 to +3 stands for first trading day to third trading day of the current month.
Turn of the year effect	$R_{it} = \alpha + \beta_1 D_{TOY} + \mu_{it}$	Dummy variable D_{TOY} represents the turn of the year period (i.e. -10 to +10 trading days) where -10 to -1 means last ten trading days of December and +1 to +10 means first ten trading days of January.
Turn of the tax year effect	$R_{it} = \alpha + \beta_1 D_{TTY} + \mu_{it}$	Dummy variable D_{TTY} represents the turn of the tax year (TTY) (i.e. -10 to +10 trading days) where -10 to -1 means last ten trading days of March and +1 to +10 means first ten trading days of April.
Holiday effect	$R_{it} = \alpha + \beta_1 D_{PRE} + \beta_2 D_{POST} + \mu_{it}$	Dummy variables D_{PRE} represents the last trading day before a public holiday and D_{POST} represents the first trading day after a public holiday.

$$R_{it} = \alpha + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \mu_{it}$$

Here, R_{it} represents the daily log returns of index *i* at time *t*. In the regression equation, Monday is taken as the benchmark day thus, the dummy variables D_1 to D_4 represents days from Tuesdays to Fridays such that D_1 =1 for Tuesday and 0 otherwise; D_2 =1 for Wednesday and 0 otherwise and so on. In the equation, α is the constant term that represents mean returns on Mondays and the coefficients β_1 to β_4 represents the difference the mean returns of that particular day and mean returns of Monday; and μ_{it} is the error term. If the coefficient of a specific dummy variable is significant then it can be concluded that there is significant difference between mean returns of that particular day and mean returns of Monday. Similar kinds of equations have been developed for all rest of the calendar anomalies and the details are given in Table 1.

Results and Discussion

To study the distribution pattern of the daily logarithmic returns from selected commodity market indices, descriptive statistics for the entire sample have been computed and are shown in Table 2.

Table 2 depicts descriptive statistics of daily log returns of selected commodity market indices. Both the indices yield a positive mean daily log return i.e. in case of Nkrishi Mean = 0.0006, S.D.= 0.0085 and in case of MCX-Agri = 0.0002, S.D.=0.0104. The returns have been found to be negatively skewed for both the selected indices, indicating asymmetric

Table 2. Descriptive statistics of daily log returns in selected commodity market indices

Indicess/ Parameters	Nkrishi	MCX-Agri
Mean	0.0006	0.0002
Median	0.0006	0.0001
Maximum	0.0378	0.1010
Minimum	-0.0442	-0.2148
Std. Dev.	0.0085	0.0104
Skewness	-0.0481	-4.8159
Kurtosis	4.5239	110.2249
Jarque-Bera	268.0341	1357954.7697
Probability	<0.0001	<0.0001
Observations	2759	2812

Table 3. Day of the week effect in selected commodity market indices

Indices		Constant (Monday)	Tuesday	Wednesday	Thursday	Friday	F-Stats (p-value)
Nkrishi	Coefficient	0.0005	-0.0006	0.0004	0.0004	0.0001	1.3846 (0.2367)
	t-stat (p-value)	1.4594 (0.1446)	-1.1776 (0.2391)	0.8384 (0.4019)	0.8612 (0.3892)	0.1847 (0.8535)	
MCX-Agri	Coefficient	0.0004	0.0006	-0.0007	-0.0001	0.0003	0.8717 (0.4800)
	t-stat (p-value)	0.9582 (0.3380)	-1.0407 (0.2981)	-1.0683 (0.2855)	-0.1606 (0.8724)	0.4278 (0.6688)	

Table 4. Weekend effect in selected commodity market indices

Indices		Constant (Rest of Week)	Weekend (Friday)	F-Stats (p-value)
Nkrishi	Coefficient	0.0006	0.0001	0.0052 (0.9426)
	t-stat (p-value)	3.2791 (0.0011)	0.0720 (0.9426)	
MCX-Agri	Coefficient	0.0001	0.0006	1.5664 (0.2108)
	t-stat (p-value)	0.3089 (0.7574)	1.2516 (0.2108)	

Table 5. Week of the month effect in selected commodity market indices

Indices		Constant (Week 1)	Week 2	Week 3	Week 4	Week 5	F-Stats (p-value)
Nkrishi	Coefficient	0.0005	0.0006	0.0007	-0.0004	-0.0009	3.5314 (0.0070)
	t-stat (p-value)	1.2508 (0.2111)	1.1421 (0.2535)	1.3405 (0.1802)	-0.7038 (0.4816)	-1.5851 (0.1131)	
MCX-Agri	Coefficient	0.0017	-0.0018	-0.0016	-0.0011	-0.0031	5.2511 (0.0003)
	t-stat (p-value)	3.4367 (0.0006)	-2.7738 (0.0056)	-2.5153 (0.0119)	-1.7617 (0.0782)	-4.4249 (0.0001)	

nature of the commodity returns. Further, the kurtosis of the distribution have been found to be greater than 3, implying that the distribution is fat tailed and the returns do not follow normal distribution as indicated by Jarque-Bera test statistic. The results of dummy regression models for different calendar anomalies have been discussed in the following paragraphs.

Day of the week effect refers to the phenomenon when the average daily returns of the traded assets significantly differ on the different trading days of the week.

Table 3 depicts results of dummy regression analysis for day of the week effect in commodity market indices. During none of the days results were observed to be significantly different as compared to Monday in any of the selected indices at 5% level of significance. This indicates the absence of day of the week effect in both the selected commodity market indices. Weekend effect is a phenomenon in which average trading returns on assets are significantly different at weekend as compared to rest of the week.

Table 4 depicts results of dummy regression analysis for weekend effect in commodity market indices. The mean returns during weekend were observed to be significantly higher as compared to rest of the week in both of the selected indices, though insignificant at 5% level of significance. This indicates the absence of weekend effect in both the selected commodity market indices. Week of the month effect refers to the phenomenon when returns on trading assets significantly differ across different weeks of a month.

Table 5 depicts results of dummy regression analysis for week of the month effect in commodity market indices. The returns for week 2 and week 5 were observed to be significantly lower as compared to week 1 in case of MCX-Agri index at 1% level of significance. Also, the returns for week 3 were observed to be significantly lower as compared to week 1 in case of MCX-Agri index at 5% level of significance. However, no significance was observed for any week with respect to week of the month effect in case

Table 6. Month of the year effect in selected commodity market indices

	Nkrishi			MCX-Agri		
	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
Constant (January)	-0.0001	-0.2442	0.8071	0.0005	0.7623	0.4459
February	0.0011	1.3465	0.1783	0.0008	0.7857	0.4321
March	0.0013	1.6380	0.1015	-0.0012	-1.2392	0.2154
April	0.0013	1.6826	0.0926	-0.0004	-0.3971	0.6913
May	0.0002	0.2213	0.8249	-0.0020	-2.0590	0.0396
June	0.0010	1.2459	0.2129	-0.0002	-0.2310	0.8173
July	0.0016	2.0903	0.0367	0.0003	0.2848	0.7758
August	0.0001	0.0393	0.9686	-0.0006	-0.6349	0.5255
September	-0.0008	-0.9727	0.3308	-0.0016	-1.6283	0.1036
October	0.0016	2.0482	0.0406	0.0004	0.4609	0.6449
November	0.0010	1.2229	0.2215	-0.0001	-0.1162	0.9075
December	0.0005	0.6098	0.5420	0.0007	0.7541	0.4509
F-Stats (p-value)		1.7972 (0.0492)			1.6733 (0.0733)	

Table 7. Monthly effects in selected commodity market indices

Calendar Effects	Indices		Constant (Rest of Year)	January	F-Stats (p-value)
January Effect	Nkrishi	Coefficient	0.0007	-0.0008	1.8904
		t-stat	3.9365	-1.3749	(0.1693)
		(p-value)	(0.0001)	(0.1693)	
	MCX-Agri	Coefficient	0.0002	0.0004	0.2542
		t-stat	0.7787	0.5042	(0.6142)
		(p-value)	(0.4362)	(0.6142)	
April Effect	**Indices**		**Constant (Rest of Year)**	**April**	**F-Stats (p-value)**
	Nkrishi	Coefficient	0.0005	0.0007	1.2294
		t-stat	3.2327	1.1088	(0.2676)
		(p-value)	(0.0012)	(0.2676)	
	MCX-Agri	Coefficient	0.0002	-0.0001	0.0072
		t-stat	0.9494	-0.0846	(0.9326)
		(p-value)	(0.3425)	(0.9326)	

of Nkrishi index. This indicates the presence of week of the month effect in case of MCX-Agri index only. Month of the year anomaly states that mean returns on traded assets are statistically different across different months of the year.

Table 6 depicts results of dummy regression analysis for month of the year effect in commodity market indices. The returns for July and October were observed to be significantly higher as compared to January in case of Nkrishi index at 5% level of significance. However, the returns for May were observed to be significantly lower as compared to January in case of MCX-Agri index at 5% level of significance. This indicates the presence of month of the year effect in both the selected commodity market indices.

January effect implies that average trading returns on traded assets are significantly different in the month of January as compared to rest of the year.

Table 7 depicts results of dummy regression analysis for January effect in commodity market indices. The mean returns during the month of January as compared to rest of the year were found to be lower in case of Nkrishi index and higher in case of MCX-Agri index, though this effect was found to be insignificant at 5% level in both the selected indices. This indicates the absence of January effect in both the selected commodity market indices. April effect implies that average trading returns on traded assets are significantly different in the month of April as compared to rest of the year. Table 7 depicts results of dummy regression analysis for April effect in commodity market indices. The mean returns during the month of April as compared to rest of the year were found to be higher in case of Nkrishi index and lower in case of MCX-Agri index, though this effect was found to be insignificant at 5% level in both the selected indices. This indicates the absence of April effect in both the selected commodity market indices.

Quarter of the year effect occurs when average trading returns on securities are statistically different in different quarters of the year.

Table 8 depicts results of dummy regression analysis for quarter of the year effect in commodity market indices. The returns during none of the quarters were observed to be

Table 8. Quarter of the year effect in selected commodity market indices

Indices		Constant (Quarter 1)	Quarter 2	Quarter 3	Quarter 4	F-Stats (p-value)
Nkrishi	Coefficient	0.0006	0.0001	-0.0005	0.0002	0.8257
	t-stat	1.9869	0.0797	-1.0012	0.5094	(0.4796)
	(p-value)	(0.0470)	(0.9365)	(0.3168)	(0.6105)	
MCX-Agri	Coefficient	0.0004	-0.0007	-0.0005	0.0005	1.8870
	t-stat	0.9030	-1.2785	-0.8280	0.9218	(0.1296)
	(p-value)	(0.3666)	(0.2012)	(0.4077)	(0.3567)	

Table 9. Semi-month effect and turn of the month effect in selected commodity market indices

Calendar Effects	Indices		Constant (Rest of Month)	Semi-month (First Fortnight)	F-Stats (p-value)
Semi-month Effect	Nkrishi	Coefficient	0.0001	0.0011	10.8869 (0.0010)
		t-stat (p-value)	0.3236 (0.7462)	3.2995 (0.0010)	
	MCX-Agri	Coefficient	-0.0001	0.0006	2.6438 (0.1041)
		t-stat (p-value)	-0.4533 (0.6504)	1.6260 (0.1041)	
Turn of the Month Effect	**Indices**		**Constant (Rest of Month)**	**Turn of the month**	**F-Stats (p-value)**
	Nkrishi	Coefficient	0.0005	0.0003	0.4870 (0.4853)
		t-stat (p-value)	3.0222 (0.0025)	0.6979 (0.4853)	
	MCX-Agri	Coefficient	0.0001	0.0007	2.0891 (0.1485)
		t-stat (p-value)	0.2470 (0.8049)	1.4454 (0.1485)	

significantly different as compared to quarter 1 in any of the selected indices at 5% level of significance. This indicates the absence of quarter of the year effect in both the selected commodity market indices.

Semi-month effect states that returns over first fortnight of the month are significantly different from those of second fortnight of the month. Table 9 depicts results of dummy regression analysis for semi-month effect in commodity market indices. The returns during first fortnight of the month as compared to second fortnight were found to be higher in case of both the selected indices, though this effect was found to be significant at 1% level in case of Nkrishi index only. This indicates the presence of semi-month in case of Nkrishi index only.

Turn of the month effect refers to the phenomenon when average daily returns of traded assets during period starting from last few trading days of the month to first few trading days of the following month have been observed to be significantly different as compared to rest of the month. For testing the presence of turn of the month effect, the study used event window of -1 to +3 trading days (-1 means last trading of the previous month and +1 to +3 means first three trading days of current month) as used in some of the empirical studies (Ariel, 1987; Lakonishok and Smidt, 1988). Table 9 depicts results of dummy regression analysis for turn of the month effect in commodity market indices. The returns during turn of the month period as compared to rest of the month were found to be higher in both the selected indices, though this effect was found to be insignificant at 5% level in both the selected indices. This indicates the absence of turn of the month effect in both the selected commodity market indices.

Turn of the year effect refers to the phenomenon when average daily returns of traded assets during period starting from last few trading days of the December to first few trading days of the following January have been observed to be significantly different as compared to rest of the year. The study has used approach as advocated by Sander and Veiderpass (2013) for defining turn of the year period as -10 to +10 trading days where -10 to -1 means last ten trading days of December and +1 to +10 means first ten trading days of January.

Table 10 depicts results of dummy regression analysis for turn of the year effect in commodity market indices. The returns during turn of the year period as compared to rest of the year were found to be lower in case of Nkrishi index and higher in case of MCX-Agri index, though this effect was found to be insignificant at 5% level in both the selected indices. This indicates the absence of turn of the year effect in both the selected commodity market indices. Turn of the tax year effect refers to the phenomenon when average daily returns of traded assets during period starting from last few trading days of the March to first few trading days of the following April have been observed to be significantly different as compared to rest of the year. Table 10 depicts results of dummy regression analysis for turn of the tax year effect in commodity market indices. The table shows that returns during turn of the tax period are significantly higher as compared to rest of the year in case of Nkrishi index at 5% level indicating the presence of turn of the tax year effect. However, turn of the tax year effect was found to be negative but insignificant in case of MCX-Agri index.

Holiday effect occurs when average returns on trading days before or after public holidays are statistically different

Table 10. Turn of the year effect and turn of the tax year effect in selected commodity market indices

Calendar Effects	Indices		Constant (Rest of Year)	Turn of the year	F-Stats (p-value)
Turn of the Year Effect	Nkrishi	Coefficient	0.0006	-0.0001	0.0509 (0.8215)
		t-stat (p-value)	3.6197 (0.0003)	-0.2257 (0.8215)	
	MCX-Agri	Coefficient	0.0001	0.0015	3.7129 (0.0541)
		t-stat (p-value)	0.4169 (0.6768)	1.9269 (0.0541)	
Turn of the Tax Year Effect	**Indices**		**Constant (Rest of Year)**	**Turn of the tax year**	**F-Stats (p-value)**
	Nkrishi	Coefficient	0.0005	0.0012	4.3770 (0.0365)
		t-stat (p-value)	2.9570 (0.0031)	2.0921 (0.0365)	
	MCX-Agri	Coefficient	0.0002	-0.0001	0.0186 (0.8915)
		t-stat (p-value)	0.9648 (0.3347)	-0.1365 (0.8915)	

Table 11. Holiday effect in selected commodity market indices

Indices		Constant (Rest of Days)	Pre-holiday	Post-holiday	F-Stats (p-value)
Nkrishi	Coefficient	0.0005	0.0001	0.0009	0.9905 (0.3715)
	t-stat (p-value)	3.0369 (0.0024)	0.1765 (0.8599)	1.3980 (0.1622)	
MCX-Agri	Coefficient	0.0001	0.0005	0.0008	0.7722 (0.4621)
	t-stat (p-value)	0.4587 (0.6465)	0.6898 (0.4904)	1.0433 (0.2969)	

from those of rest of the trading days.

Table 11 depicts results of dummy regression analysis for holiday effect in commodity market indices. The table shows that returns on pre-holidays and post-holiday are higher as compared to rest of the trading days, though insignificant. This indicates the absence of holiday effect in commodity market indices.

Conclusion and Policy Implications

A wide range of 12 calendar anomalies have been tested for their presence in 2 selected commodity market indices namely Nkrishi index and MCX-Agri index over a period from 2009-2019 using dummy regression analysis. The findings of the study revealed the presence of only 4 calendar anoamlies namely week of the month effect, month of the year effect, semi-month effect and and turn of the tax year effect. Further, no evidences have been found for the presence of day of the week effect, weekend effect, January effect, April effect, quarter of the year effect, turn of the month effect, turn of the year effect and holiday effect in selected commodity market indices. The presence of month of the year effect and semi-month effect in commodity market is consistent with the findings of Borowski (2016) who documented the existence of these calendar anomalies in commodity market. Further, the presence of calendar effects in agricultural commodity market indices indicates that Indian commodity markets are weakly inefficient that may impact the price-discovery function of these markets. Therefore, the results of the study can be beneficial for the different market participants like farmers, traders, brokers, commodity exchange participants for making their decisions of purchase and sale; for policy makers in formulating policies; and also for investors in designing trading strategies and evaluating performance of their portfolios.

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