

Calendar Anomalies in Indian Foreign Exchange Market

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ABSTRACT - Calendar anomalies or the day of the week effect refers to recognized empirical patterns in terms of the returns on the first day of the week or month. This empirical study examined the existence of such calendar anomalies pertaining to the Day of the Week Effect in the Indian foreign exchange market during the study period from 1st January 2008 to 31st December 2017. The data were hand collected from Reserve Bank of India exchange rate archives. Statistical tools such as regression and correlation were used to study the calendar anomalies and processed using E-views-7. It was found that the Indian foreign exchange market demonstrated that Monday rates had significant impact on exchange rates than other days of the week. The results of the study would help the government and investment community to understand the working of the Indian Foreign Exchange Markets and identify the defining characteristics of this market for an insight on how to operate in such markets.

Keywords: Forex market, foreign currency, Correlation and Regression

I. INTRODUCTION

The financial market have shown considerable calendar anomalies as stated by the many empirical studies on the stock market, debt securities, currencies and other financial assets. Calendar anomalies have been studied under the week of the day, turn of the month and turn of the year effect. Though there were weak evidences of such occurrences in some market, researchers are of the consensus that such occurrences do take place. Foreign Exchange rate is the price of one currency denominated in terms of one other currency or a group of currencies of other countries. Changing the money denominated in one nation's currency for that denominated in another nation's currency is referred to as foreign exchange. In other words, a foreign exchange transaction is a shift of funds from one country and currency to another. Foreign exchange in short form is called Forex and a market dealing with international currencies is referred to as Forex Market or Currency market.

As in any financial markets, there are some implications and assumptions under which the forex market works and when these assumptions are not evidenced in the operation of the market or when the market behavior seem to be opposing the established norms, there is said to be anomaly in the market. Anomalies associated with a particular time period are termed as calendar or seasonal or time anomalies. Calendar anomalies contradict market efficiency, and possibility exists for investors to earn

abnormal return. The Efficient Market Hypothesis claim that any anomalies in the financial markets will be eliminated as soon as there are profitable transactions reported as arising from such events. The Calendar Anomalies may be grouped into two types. The first is the 'Monday/Weekend Effect', where the closing exchange rate of Monday would be less than the closing exchange rate of the immediately preceding Friday. This is also termed as 'reverse weekend effect'. In the Indian context it has been empirically observed that the Monday returns were higher than other days. A possible explanation to this is the typical settlement period of Indian markets, which runs through¹ Monday to Friday. The second anomaly is the 'Month of the Year Effect-January Effect'. This refers to 'the tendency for exchange market to have larger returns in January than in other months of the year'. This seasonality is conspicuous in the month January when they observed large returns, when compared to other months of the year. Hence it was named January effect. The third type of anomaly is called 'Turn-of-the-Month Effect'. According to this anomaly, the mean returns in early days of the month are found to be higher than the other days².

¹ Vyuptakesh Sharan "International Financial Management" 4th Edition Prentice Hall of India Private Limited, New Delhi – 110 001, 2006

² Joseph Anbarasu "Global Financial Management" Ane'Student Edition, Ane Books Pvt. Ltd. New Delhi – 110 002, 2010.

II. REVIEW OF LITERATURE

Geoffrey Booth (2003) investigated the presence of calendar anomalies in the Turkish foreign exchange market. The findings of the study reveal that free market rates exhibit day-of-the-week and week-of-month effects and that the total value of foreign exchange denominated deposits reached that of TL deposits. **Nobuyoshi Yamoria and Yutaka Uriharab (2004)** investigated the day-of-the-week affecting foreign currency markets; test the significance of such effect in 29 foreign currencies markets. The results of the study are consistent with the continuing development of foreign currency markets. **Hakan Berumenta, M. Nejat Coskumb, et al. (2007)** assessed the day of the week effect of the daily depreciation of the Turkish lira (TL) against the US dollar (USD) and its volatility. The study concluded that the day of the week effect on both conditional mean and variance is present in the Turkish foreign exchange market. **Piti Disyatat and Gabriele Galati (2007)** attempted to provide a comprehensive overview of the effectiveness of foreign exchange intervention in emerging market countries. It was found that intervention had no significant influence on implied volatility, indicating that, in general, central bank intervention was not followed by an increase in uncertainty in the market about future exchange rate movements. **Stephen Hall and Geroge Hondroyiannis, et al. (2010)** investigated the effect of real exchange rate volatility and export on 10 EMEs and eleven other developing countries that were not classified as EMEs over the estimation period. The findings of the study suggests that the open capital markets of EMEs have reduce the effects of exchange rate fluctuation on export compared with those effect in the cases of other developing countries. **Gagari Chakrabarti and ChitrakalpaSen (2011)** documented financial market, particularly stock market anomalies question the efficiency of financial market and hence hint towards inadequacy of the underlying model. The study found that five volatility regimes and strong presence of day-of-the week effect could be documented during the phases of high volatility. **Shangkari V. Anusakumar and NurAdiana Hiau Abdullah (2014)** determined whether the foreign exchange market overreacts. The results lend support to the overreaction hypothesis, under reaction hypothesis, and uncertain information hypothesis. Although calendar anomalies may not have much influence, researchers may need to ascertain whether these variables truly do not have a bearing on the returns. The study indicated that the Day of the Week effect could be due to the difference between the trading and settlement time. Usually a stock purchased on a particular day other than Friday would take eight days for the price to be debited to the purchasers account. However if the trade took place on a Friday it would only be processed on the next Monday to automatically take more

than the normal eight days. So the buyer is expected to pay more for trades done on a Friday than any other days as he keeps the credit for at least two more days. The situation is opposite for sellers, which means the expected returns on Friday would be higher than any other day of the week.

Satish Kumar (2016) examined the day-of-the-week, the January, and the turn-of month effects in developed, advanced and emerging currencies. The results indicated that the calendar anomalies have disappeared in the recent times and the markets have become efficient. However this analogy seldom works in a foreign exchange market as in this market the payments are made without the need for clearing houses. Thus understanding the anomalies in a foreign exchange market calls for systematic study. Empirical studies as reviewed above have shown evidences that anomalies do exist in the foreign exchange market the world over.

Kumar and Pathak (2016) examine calendar anomalies in the Indian currency market and found significant positive returns from Monday to Wednesday and significant negative returns on Thursday and Friday. They observed the price movement of four currencies; the US dollar, the Euro, The British Pound and the Japanese Yen. Monday always shows the highest returns and Friday the lowest returns.

The previous studies made by other researchers analysed the calendar anomalies present in stock markets and foreign exchange market of various countries. The present study made an attempt to bridge the research gap of analyzing the calendar anomalies of USD against Indian Rupee.

Statement of the Problem

An efficient exchange market can instantaneously process the information which would be reflected on exchange rates. In the present globalised context, the prices of foreign assets, goods and other factors of production, depends upon the exchange rate. The stock markets with notable number of international portfolio investors, reflects the volatility in foreign exchange market, as they view foreign exchange aspects as a source of potential gains and losses. The volatility in exchange rate has its impact in other financial markets and leads to Government intervention. It is important to note that there are variations in Volatility of exchange rate returns by the Day-of-the Week, Month of the Year and Semi-Month. Besides, a high (low) return is associated with a correspondingly high (low) volatility for a given day. International Investors, who wish to reduce their tax liability, may sell the loss making shares before filing their tax returns in order to off-set capital losses against capital gains. This would reduce the exchange rate further. It is against this background that an attempt has been made in this study to examine Calendar Anomalies in Indian foreign exchange Market afresh so as to remove the ambiguity in results, if any.

Need of the Study

The effect of Calendar Anomalies may hike or depress the exchange rate on a particular day/week or month as compared to the mean. The present study would be useful to the Native and Foreign Investors, Traders and Arbitrageurs who can formulate profitable Trading Strategies. This study is of great use to predict the exchange rate behavior, if Anomalies are properly understood. The exchange rate behavior in one market spreads slowly to the other developing and developed markets. The presence of Calendar Anomalies in stock markets across the country is widely reported and these Anomalies should be investigated in India. The detailed investigation of this Calendar Anomaly would help all the stakeholders in India and outside India to plan their investment. Further, the periodical study of this nature is of use to all types of users, including the Market Participants.

Objectives of the Study

- To investigate the existence of Day of the Week Effect in the Indian exchange market.
- To summarize the findings and suggestions of the study.

Hypothesis of the Study

Based on the above objectives, following hypotheses of the study were framed.

- **NH1:** There is no relationship between USD/INR exchange rates among various days of the week.
- **NH2:** There is no significant impact of Monday returns on other days of the week.

III. METHODOLOGY OF THE STUDY

Sample Selection

Among the foreign currency exchange rates, USD/INR is taken as sample, since these currencies has highest volume in the foreign exchange market. In addition USD/INR is considered to be the most important exchange rate from the context of the level of trade and power that USD holds in the international exchange markets. This market is

Table 1: Results of Descriptive Statistics showing the normality analysis of USD/INR from 1st January 2008 to 31st December 2017

	YEAR	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Mean	2008	43.5828	43.18085	43.54769	43.07095	43.63163
	2009	48.47244	48.31854	48.33245	48.37176	48.2575
	2010	45.66922	45.7432	45.79714	45.72708	45.7525
	2011	46.61741	46.6479	46.68995	46.60755	46.79556
	2012	53.48803	53.39369	53.31809	53.75784	53.51984
	2013	58.45096	58.69287	58.67571	58.6264	58.69999
	2014	61.00738	61.09777	61.05508	60.92086	61.05034
	2015	64.223	64.24236	64.12409	64.09145	64.0727
	2016	67.18056	67.22508	67.23895	67.20381	67.21595
2017	65.14405	65.13398	65.15401	65.04347	65.1053	

considered to be the most efficient as compared to other currencies or basket of currencies.

Tools used for the Study

- Returns: To compute the daily returns for each of the index series, the following formula was used:

$$Return = \frac{Ending\ Price - Starting\ Price}{Starting\ Price} \times 100$$

- Descriptive Statistics is used to analyse the normality.
- Correlation is used to evaluate the relationship between USD and INR.
- Multiple Regression analysis is to study the impact of USD on INR.

Data Sources

The study mainly depended upon secondary data and used closing value of sample exchange rates. The required data was hand collected from Reserve Bank of India and computed using E-views-7

Period of the Study

The study covers the period of ten years from 1st January 2008 to 31st December 2017. The daily USD/INR exchange rates were collected.

Limitations of the Study

- This study was based mainly on secondary data.
- This study used certain limited statistical tools which have certain inherent limitations.

IV. DATA ANALYSIS AND DISCUSSION

a) Analysis of Normality for USD/INR from 1st January 2008 to 31st December 2017

Descriptive statistics were used to specify the normality of the collected data and render it suitable for the correlation and regression analysis as required for the study.

Std. Dev.	2008	3.562514	3.416709	3.623825	3.282694	3.612629
	2009	1.48158	1.3694	1.417106	1.458086	1.358536
	2010	0.894167	0.900312	0.918416	0.899678	0.878028
	2011	2.679373	2.705346	2.86171	2.853427	2.825741
	2012	2.171461	2.4022	2.349261	2.216437	2.321213
	2013	3.762022	3.938138	4.124773	4.054772	3.910635
	2014	1.164493	1.149538	1.09628	1.086912	1.134196
	2015	1.645397	1.660736	1.619255	1.589279	1.618278
	2016	0.643703	0.633383	0.649412	0.634165	0.601957
	2017	1.332063	1.283209	1.268366	1.186829	1.268078
Skewness	2008	0.506758	0.677688	0.524509	0.771153	0.486429
	2009	0.479533	0.430285	0.385672	0.390303	0.484098
	2010	-0.09748	-0.01622	-0.12028	-0.22473	-0.30842
	2011	1.164262	1.266248	1.138304	1.333628	1.068476
	2012	-0.7364	-0.51767	-0.4272	-0.72816	-0.656285
	2013	0.02423	0.063765	0.247374	0.164222	0.09299
	2014	-0.04362	0.280611	0.170059	-0.03682	-0.149735
	2015	0.180838	0.124576	0.11491	0.219864	0.212899
	2016	0.772778	0.578357	0.536792	0.677629	0.779609
	2017	1.26814	1.311421	1.276212	1.365775	1.355458
Kurtosis	2008	1.875978	2.212028	1.840046	2.597576	1.852132
	2009	2.725464	2.656378	2.612453	2.67708	2.894791
	2010	1.770554	1.695068	1.934758	1.853293	1.766113
	2011	2.939772	3.294297	2.869937	3.411819	2.652315
	2012	2.359023	1.874802	1.914678	2.412455	2.113821
	2013	1.472909	1.604035	1.960118	1.775662	1.658947
	2014	2.687012	2.792988	2.731726	2.377917	2.596761
	2015	1.705605	1.771303	1.795092	1.896163	1.842958
	2016	2.727101	2.344795	2.257067	2.527308	2.825372
	2017	3.231705	3.410003	3.390868	3.683119	3.604022
Jarque-Bera	2008	4.772167	4.81347	5.29952	4.446142	4.622438
	2009	1.865958	1.717315	1.521381	1.516452	1.738867
	2010	3.29278	3.549792	2.434911	3.033884	3.805934
	2011	11.07738	13.27113	10.18305	14.26421	9.374891
	2012	5.375021	4.676028	3.815863	4.829399	5.12081
	2013	4.765975	4.257461	2.541751	3.347667	3.589647
	2014	0.206746	0.700738	0.39094	0.735768	0.494055
	2015	3.763061	3.209037	3.071935	2.764808	2.91343
	2016	4.721164	3.534566	3.480087	4.292005	4.923309
	2017	12.70254	14.09481	14.16874	16.18637	15.1064

Source: Data collected from Reserve Bank of India and computed using E-views-7

Table 1 presents the results of descriptive statistics for USD/INR from 1st January 2008 to 31st December 2017. The mean value was highest during the year 2016. Wednesday (67.23895), indicating the buying pressure. The highest standard deviation was recorded in the year 2013 for Wednesday (4.124773) followed by Thursday (4.054772) revealing the wider fluctuations in exchange rates during these two days. The skewness was positive for all the variables except during the year 2010, 2012 and 2014 for Monday. The kurtosis value was lesser than the normal distribution value 3 which indicates platykurtic distribution for all the variables namely Monday, Tuesday, Wednesday, Thursday, and Friday during the years 2008, 2009, 2010, 2012, 2014, 2015 and 2016. In the year 2011, Monday and Wednesday alone exhibited platykurtic distribution. The Jarque-Bera was lesser than 5 which indicate the non-normality of distribution for the variables namely Monday, Tuesday, Wednesday, Thursday and Friday except during the year 2008 for the variable Wednesday. The returns on Monday during the years 2011, 2012, and 2017 exhibited Normality of the distribution as the Jarque- Bera value was greater than 5.

b) Analysis of Relationship between USD and INR

The next step was to analyze the correlation values of the first day of the week for each of the study years. The idea was to correlate the Monday returns with the other days of the week to identify any relationship between these day specific returns.

Table 2: Results of Correlation showing the relationship between USD/INR from 1st January 2008 to 31st December 2017

YEAR		TUES	WED	THUR	FRI	
2008	MON	Pearson Correlation	0.955**	0.956**	0.930**	0.983**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2009	MON	Pearson Correlation	0.831**	0.890**	0.836**	0.696**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2010	MON	Pearson Correlation	0.789**	0.742**	0.676**	0.789**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2011	MON	Pearson Correlation	0.979**	0.940**	0.973**	0.953**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2012	MON	Pearson Correlation	0.930**	0.927**	0.882**	0.938**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2013	MON	Pearson Correlation	0.958**	0.941**	0.967**	0.910**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2014	MON	Pearson Correlation	0.930**	0.797**	0.903**	0.800**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2015	MON	Pearson Correlation	0.946**	0.943**	0.931**	0.929**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2016	MON	Pearson Correlation	0.619**	0.713**	0.509**	0.687**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000
2017	MON	Pearson Correlation	0.953**	0.933**	0.922**	0.940**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Data collected from Reserve Bank of India and computed using SPSS 16

Table 2 depicts the result of correlation analysis revealing the relationship between USD/INR rates during the days namely Monday, Tuesday, Wednesday, Thursday, and Friday from 1st January 2008 to 31st December 2017. Among the correlation result, 97.9% relationship was recorded as the highest value between Monday and Tuesday during the year 2011. This indicates that Tuesday rates have influence on Monday rates. Therefore the NH1 “There is no relationship between USD/INR exchange rates among various days of the week” is rejected.

c) Analysis of Model fitness showing the Impact of USD on INR

Regression analysis served two purposes in this study, firstly it embraced the goodness of fit and secondly it tried to measure the extent of impact of the Monday Returns on the returns on other days. The study indicates both these aspects from the following table.

Table 3: Result of Model Summary of the Regression Analysis of USD/INR from 1st January 2008 to 31st December 2017

YEAR	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
2008	0.987	0.973	0.971	0.512	2.312
2009	0.901	0.812	0.793	0.717	1.263
2010	0.834	0.695	0.667	0.599	1.889
2011	0.980	0.961	0.958	0.495	1.871
2012	0.962	0.926	0.919	0.636	1.581
2013	0.975	0.951	0.947	0.868	2.100
2014	0.936	0.876	0.864	0.421	2.093
2015	0.961	0.923	0.916	0.448	2.578
2016	0.795	0.632	0.596	0.468	1.777
2017	0.977	0.954	0.950	0.306	2.151

a. Predictors: (Constant), TUESDAY, WEDNESDAY, THURSDAY, FRIDAY

b. Dependent Variable: MONDAY

Source: Data collected from Reserve Bank of India and computed using SPSS 21.0

Table 3 exhibits the result of model fitness for the regression analysis with Monday USD/INR exchange rate as dependent and the remaining exchange rates as independent variables. It is noted from the above table that 0.987, 0.901, 0.834, 0.980, 0.962, 0.975, 0.936, 0.961, 0.795 and 0.977 were the R values during the study period. Further, the R square values were high and indicated that the model was good except for the year 2010 and 2016.

d) Analysis of Variance showing the Impact of USD on INR

The Analysis of Variance is considered to be an important tool which provides insight on the relationship between the variables in a study.

Table 4: ANOVA Result of USD/INR from 1st January 2008 to 31st December 2017

YEAR	F	Sig.
2008	338.324	0.000
2009	42.208	0.000
2010	24.502	0.000
2011	261.300	0.000
2012	131.193	0.000
2013	200.887	0.000
2014	70.679	0.000
2015	122.889	0.000
2016	17.586	0.000
2017	218.377	0.000

a. Dependent Variable: MONDAY

b. Predictors: (Constant), FRIDAY, TUESDAY, THURSDAY, WEDNESDAY

Source: Data collected from Reserve Bank of India and computed using SPSS 21.0

Table 4 shows the results of analysis of variance for USD/INR exchange rates for the period from 1st January 2008 to 31st December 2008. The F statistic value was found to be 338.324, 42.208, 24.502, 261.300, 131.193, 200.887, 70.679, 122.889, 17.586 and 218.377. The p values were found to be .000 which is less than 0.05 indicating the significance at 5% level. Hence NH2: “There is no significant impact of Monday returns on other days of the week during the study period” is rejected.

e) Co-efficient Analysis showing the Impact of USD on INR

Table 5: Coefficient Results for USD/INR from 1st January 2008 to 31st December 2017

YEAR	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
2008	0.419	0.006	0.530	0.000
2009	0.537	0.005	0.105	0.853
2010	0.003	0.424	0.806	0.008
2011	0.000	0.365	0.001	0.789
2012	0.061	0.158	0.022	0.082
2013	0.002	0.924	0.006	0.252
2014	0.000	0.525	0.014	0.699
2015	0.011	0.097	0.208	0.630
2016	0.170	0.003	0.153	0.005
2017	0.002	0.000	0.079	0.175

a. Dependent Variable: MONDAY

Source: Data collected from Reserve Bank of India and computed using SPSS 21.0

Table 5 explains the co-efficient results of the regression analysis for USD/INR for the period from 1st January 2008 to 31st December 2017. It is to be noted from the results that Tuesday witnessed significant “p” value during the year 2010, 2011, 2013, 2014, 2015 and 2017 which was found to

be 0.003, 0.000, 0.002, 0.000, 0.011 and 0.002. Wednesday witnessed significant “p” values of 0.006, 0.005, 0.003 and 0.000 during the years 2008, 2009, 2016 and 2017. Thursday witnessed significant “p” value during the years 2011, 2012, 2013 and 2014 which was found to 0.001,

0.022, 0.006 and 0.014. Similarly Friday witnessed significant “p” value of 0.000 during the year 2008 and 0.005 during the year 2016 Hence Ho2 “There is no significant impact of Monday returns on other days of the week” is rejected.

V. FINDINGS

- The study investigates the calendar anomalies in Indian foreign exchange market during the study period 1st January 2008 to 31st December 2017.
- The standard deviation was recorded highest for Wednesday.
- Kurtosis value was lesser than 3 and indicated platykurtic distribution except for certain variables.
- The variable Monday exhibited Normality of the distribution as the Jarque- Bera value was greater than 5 during 2012.
- The result of correlation analysis shows significant relationship between the Monday, Tuesday, Wednesday, Thursday, and Friday rates of the exchange rate USD/INR.
- The regression result shows the significant impact of Monday on Tuesday, Wednesday, Thursday, and Friday exchange rates.

VI. CONCLUSION

The study examined the existence of calendar anomalies in Indian foreign exchange market. The study investigates the calendar anomalies in Indian foreign exchange market during the study period 1st January 2008 to 31st December 2017. The standard deviation was recorded highest for Wednesday. Kurtosis value was lesser than 3 and indicated platykurtic distribution except for certain variables. The variable Monday exhibited Normality of the distribution as the Jarque- Bera value was greater than 5 during 2012. The result of correlation analysis shows significant relationship between the Monday, Tuesday, Wednesday, Thursday, and Friday rates of the exchange rate USD/INR. The regression result shows the significant impact of Monday on Tuesday, Wednesday, Thursday, and Friday exchange rates. The study concluded that Monday rates had significant impact on exchange rates of other days of the week. This detailed investigation of this calendar anomaly would help all the stakeholders in India and outside India to plan their investment.

The implication of the study that there was significant evidences of the existence of calendar anomalies in the Indian Foreign Exchange markets indicates that the Foreign exchange markets of India are not yet strongly efficient. In the recent years calendar anomalies have almost disappeared from most developed markets. When there is calendar anomaly in the market, it gives the investor an opportunity to earn abnormal returns as they can exploit such inconsistencies in the market. Some study also

indicates that financial crises have forced the uninformed investors to change their investment patterns and made them more cautious. But the Indian Foreign Exchange market was not frequented by uninformed investors since their inception, so there was not much change in the demography and decision pattern of investors here. Finally the study indicates that despite the nonstop operation of the Foreign Exchange markets of India, there was considerable Monday Effects seen in this market.

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