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Calendar Effects in Currency: An Empirical Investigation of Foreign Exchange Market

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Abstract: ***The purpose of this study is to test the day of the week effect, the month of the year effect and holiday effect in the foreign exchange market, specifically in the case of USD/GBP. The study's empirical findings suggest a positive impact of the Monday on the USD/GBP return rate. Hence, this confirms the presence of the anomaly in the exchangemarket where a significant positive return can be generated on Monday, which is an opening day of the week. However, previous studies have found a negative effect of Monday on the returns of stocks and currencies. In addition, the results further confirm the anomaly that the January effect means in January the returns are less than other months' returns. It is true and demonstrated in the present study where the impact has been found negative and significant, indicating that there is very low or no effect of January on the return of the USD/GBP. Lastly, it has also been found that pre-holiday return is negative and significant, which allows to reject the proposed hypothesis and does not meet with findings of the other scholars who found a positive effect of pre-holiday on the returns.***

Keywords: forex trade, finance, stock, equity, governance, Monday, return rate

1. Introduction

Calendar impacts are irregularities in stock market returns related to the calendar, including day of the week, months of each year, and holiday effect or weekend effect. Furthermore, two well-known illustrations of calendar impacts in stock market returns are the Monday impact and the January effect. Minor calendar irregularities do not have to violate the no-arbitrage rule, but the rationale for their presence, if they occur, is significant. Although much effort has gone into determining the importance of calendar impacts, the literature has still not concluded, mainly since the finding of the calendar impacts could be the outcome of data analysis. Furthermore, since the universe of probable calendar impacts is not provided from theories (ex-ante), the only way to evaluate if a calendar impact is statistically significant is to account for all calendar impacts that have been studied (Szymański & Wojtalik, 2020). For instance, various scholars have undertaken the empirical investigation of the day of the week, months of each year, and holiday effects together in a given period. Some other effects have also been checked at the same time.

Furthermore, a study conducted by Chiah and Zhong (2021) tried to develop a practical test to assess the importance of calendar impacts. The study analysed stock market returns from ten regions and uncovered strong evidence that calendar impacts are statistically significant. Similarly, another study was conducted by Rodriguez (2012), Ţilică and Oprea (2014), Tsai (2019) in the stock market and also found mixed results. They could not confirm the Monday and holiday effects as previously existing anomalies. However, fewer studieshave been conducted on the foreign exchange market, which has allowed to undertake this study on the foreign exchange market, specifically on USD/GBP, to test the market anomalies in the foreign exchange market. Therefore, this study aims to test the day of the week effect, the month of the year effect and holiday effect in the foreign exchange market and based on this following research questions have been established, which will be addressed in the present.

- What is the market anomaly in the foreign exchange market?
- What is the effect of the day of the week, the month of the year and holiday on the return of USD/GBP?
- What is the implication for future studies?

2. Literature Review

Qadan & Eichel (2021) states that the January effect may be considerable in a smaller universe but negligible in a huge universe. The study included a total of 181 sample calendar impacts in the research and chose them based on effects that have been studied in the literature. Although more effects may have been investigated, for example, in unreported papers, the universe is sufficiently large and encompasses all-important calendar impacts. It can be believed that an expansion would have far-fetched repercussions that would be difficult to defend intellectually, even ex-post.

In the paper of Szymański & Wojtalik (2020), empirical evidence attempted to determine the calendar impacts in the most recent series. End-of-year results often cause the highest abnormalities, but these impacts are primarily minor in our assessment of normalised returns. Thus they do not appear to have much economic relevance. Calendar impacts are often significant throughout countries and subsets in examining small-cap stock indexes, where we discovered the most consistent relevance. The study also looks at two smaller samples with 17 and 5 potential calendar impacts, respectively.

In addition, Satish (2017) states that an alternate way for controlling the universe of possible effects is a Bonferroni boundary test. Since the Bonferroni bound overlooks the correlation pattern of the examined items, resulting in a highly cautious test, our test surpasses Bonferroni determined approaches in terms of power. However, data mining canbe managed by challenging unexpected results in one data collection with irregularities found in other data sets. The $\chi 2$ test of calendar impacts is connected to several new approaches for evaluating the prediction model developed by (Khuntia & Pattanayak, 2021). These analyses

use statistical evidence about the reliance across the forecasting methods being assessed indirectly. This is similar to the test, which is predicated on the presence of a specific correlation pattern among calendar impacts. Several articles have studied calendar impacts, with many citations in (Zaremba & Karathanasopoulos, 2021). Although most works on data mining use Bonferroni bound approaches or cross country investigations to assess the relevance of calendar impacts, STW uses Henderson and Wang (2015) reality checks in their research. The work by STW is thus the one most similar to ours; nonetheless, our assessment varies from STW's in three significant respects.

The first variation is in respect of what characterises a calendar irregularity. Our null hypothesis is that all calendars dating approaches have the same required return or standardised returns. This contrasts with STW's research, which looked into whether a specific set of calendar-based trade laws might produce higher (standardised) returns than a buy-and-hold approach. Their system of trade laws included calendar-based regulations that allowed them to execute short, neutral or long holdings. Our method, we feel, is more suited to determining the importance of calendar impacts. For example, the January effect suggests that anticipated returns are greater in January than the duration of each year. However, this does not indicate that having a long strategy in January and a short or neutral strategy the rest of the year will result in an extra return (Floros & Salvador, 2014). Similarly, the holidayeffect suggests that pre-holiday days tend to generate more return than post-holiday days, which means the investors tend to engage in higher trading, which affects overall return positively.

Data

In the following paper, the data was collected for the exchange rate of USD/GBP from yahoo finance from 1 December 2003 to 13 December 2021, in daily frequency. Therefore, empirical tests were conducted on the sample of 19 years which is a large enough to capture the variances and patterns in the data. Meanwhile, source of data was Yahoo finance which is an authentic data source that provides real-time and accurate data from the source information. Three types of datasets were constructed from the data collected, which includes as follows along with a brief description.

Dataset	Range	Frequency
Day of the Week Effect	1 December 2003 to 13 December 2021	Daily
The month of the Year Effect	1 December 2003 to 13 December 2021	Monthly
Holiday Effect	1 December 2003 to 13 December 2021	Daily

The day of week effect is proposed hypothesis that when stock or commodity opens on Monday, it makes a negative return, and so in the case of the exchange rate of USD/GBP. Similarly, the month of the year effect suggests that in January, stocks havelower returns than other months of the year. However, this anomaly may and may not be accurate in the case of the exchange market, where the effect tends to differ, and this is also reason to undertake this empirical investigation to confirm the presence of an anomaly. In addition to the holiday effect to the anomaly that stocks market activity may increase before the holiday or the weekend, which tends to increase the stocks' returns as well. However, this may also not be true in the case exchange market for which the following study has been undertaken. Furthermore, descriptive statistics have been calculated for all three data sets to summarise the data as follows.

Table 1: Average Returns Summary of Data

Average Returns					
Day of Week Effect		Holiday Effect		The month of the Yeareffect	
Monday	0.06%	Post-Holiday	0.06%	Jan	-0.27%
Tuesday	-0.02%	Pre-Holiday	-0.21%	Feb	0.27%
Wednesday	0.02%			Mar	0.55%
Thursday	-0.02%			Apr	-1.36%
Friday	-0.21%			May	0.73%
				Jun	0.20%
				Jul	-0.40%
				Aug	0.83%
				Sep	0.44%
				Oct	0.20%
				Nov	0.26%
				Dec	0.61%

Table 1 provides the average returns for the day of the week effect, holiday effect and month of the year effect. From the table, it can be stated that the average return on Monday is positive and also more significant than other days in the week. Hence, to some extent, this may disconfirm the anomaly that average returns on Monday are less than average returns of the other weekdays. Similarly, the in holiday effect, the average return on pre-holiday is positive and higher than pre-holiday trading days, and this is against the anomaly that before the weekend average share price is greater than post-holiday. However, it is only a summaryof the statistics but not the confirmed or empirical results. Thus conclusions cannot be drawn based on the summary statistics.

3. Methodology

In the empirical analysis and specifically when testing the hypothesis and market anomalies, the ordinary least square (OLS) regression has been widely used by scholars due to its simplicity and comprehensiveness. Similarly, in the following paper, the regression tests have been used to test the market anomalies, (1) day of the week effect, (2) month ofthe year effect and (3) holiday effect. Therefore, the

following three hypotheses have been tested as follows

(1) ***Day of the week effect***

H10: The mean return on Monday is not greater than the mean return of the other weekdaysH11: The mean return on Monday is greater than the mean return of the other weekdays

(2) ***Month of the year effect***

H10: The mean return in January is not greater than the mean return of the other months H11: The mean return in January is greater than the mean return of the other months

(3) ***Holiday effect***

H10: The mean return on the Pre-Holiday is not greater than the mean return of the post-holiday

H11: The mean return on the Pre-Holiday is greater than the mean return of the post-holiday To test the hypothesis, in each of the effects, it was imperative to construct the dummy variables for which details are given as follows in table 2

Table 2: Variables of the Study

Variables	
Day of the Week Effect	
Return	Dependent
Dummy variable D1	Monday
Dummy variable D2	Tuesday
Dummy variable D3	Wednesday
Dummy variable D4	Thursday
Dummy variable D5	Friday
The month of the Year Effect	
Return	Dependent
Dummy variable D1	January
Dummy variable D2	February
Dummy variable D3	March
Dummy variable D4	April
Dummy variable D5	May
Dummy variable D6	June
Dummy variable D7	July
Dummy variable D8	August
Dummy variable D9	September
Dummy variable D10	October
Dummy variable D11	November
Dummy variable D12	December
Holiday Effect	
Return	Dependent
Dummy Variable D1	Post-Holiday
Dummy Variable D2	Pre-Holiday

Table 2 provides the summary of the variables of all effects to be tested, for which the regression equations are provided as follows

$$Day\ of\ the\ Week\ Effect = \alpha + \beta_{D1} + \beta_{D2} + \beta_{D3} + \beta_{D4} + \beta_{D5} + \epsilon$$

$$Month\ of\ the\ year\ effect = \alpha + \beta D1 + \beta D2 + \beta D3 + \beta D4 + \beta D5 + \beta D6 + \beta D7 + \beta D8 + \beta D9 + \beta D10 + \beta D11 + \beta D12 + \epsilon$$

$$Holiday\ Effect = \alpha + \beta_{D1} + \beta_{D2} + \epsilon$$

In equations, α refers to the fixed or constant of the model, whereas the β refers to the independent variable representing a specifically associated dummy variable and ϵ refers to the error term automatically accounted by the regression model during calculations. Meanwhile, in the equation, the dummy variable 1 represents the Monday; otherwise, 0 represents the other day of the week in the first equation, and D2 represents the next day of the week, etc. Similarly, in the second equation, the dummy variable 1 represents the January denoted 1 otherwise 0 for months other than January and D2 represents the next month of the calendar etc. However, in the case of a third regression equation, 1 represents post-holidayand 0 refers to the other days, whereas D2 represents the pre-holiday denoted by 1 otherwise 0 represents other days. Furthermore, referring to the statistical software then MicrosoftExcel has been used as statistical software to conduct regression analysis.

4. Results

Day of the Week Effect

The day of the effect refers to the anomaly that the first day of the week means Monday has lower average returns as compared to the other days in the week. To test this anomaly, the regression has been conducted and the results of the regression as provided as follows

Table 3: Regression for Day of The Week

Summary Output

Regression Statistics

Multiple R	0.043
R Square	0.0019
Adjusted R Square	0.0008
Standard Error	0.0214
Observations	4705

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.004	0.001	2.178	0.054
Residual	4700	2.161	0		
Total	4705	2.165			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.002	0.001	-3.002	0.003
Monday	0.003	0.001	2.736	0.006
Tuesday	0.002	0.001	1.93	0.054
Wednesday	0.002	0.001	2.275	0.023
Thursday	0.002	0.001	1.871	0.061
Friday	0	0	65535	#NUM!

Table 3 presents the regression out for the day of the week effect, where it can be determined that the R-Square of the model is 0.0019 indicating that only 0.19% variance of the return of USD/GBP can be interpreted or estimated by Monday, Tuesday, Wednesday, Thursday and Friday and remaining variance of the regression models turns to be residual of the model that other factors could explain. The regression model is significant at 0.1 or 10%, and the coefficient estimation reveals that the effect of the Monday on the USD/GBP return is positive and statistically significant (C=0.003 and P-value=0.003) indicating the effect of Monday on the returns is positive. Meanwhile, the effect of all other days is also positive and significant at 10% except for the Friday for which the model could not estimate the p-value. However, based on the results of the regression can be asserted that Monday positively contributed to the return of the USD/GBP and this also suggests rejecting the null hypothesis and accepting the

alternate hypothesis that states that the mean return on Monday is greater than mean the return of the other weekdays.

The month of the Year Effect

The month of the year effect refers to the anomaly that the first month of the year means January has lower average returns as compared to the other months in the year. To test this anomaly, the regression has been conducted and the results of the regression as provided as follows

Table 4: Regression For Month of the Year

Summary Output

Regression Statistics

Multiple R	0.229
R Square	0.052
Adjusted R Square	-0.003
Standard Error	0.025
Observations	216

ANOVA

	df	*SS*	*MS*	*F*	*SignificanceF*
Regression	12	0.0072696	0.0006058	1.031957	0.4208485
Residual	204	0.1306439	0.0006404		
Total	216	0.1379135			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.003	0.006	0.4553	0.6494
Jan	-0.005	0.0084	-0.6425	0.5213
Feb	0	0	65535	#NUM!
Mar	0.003	0.0084	0.3311	#NUM!
Apr	-0.016	0.0084	-1.9361	0.0542
May	0.005	0.0084	0.5472	0.5848
Jun	-0.001	0.0084	-0.0883	0.9297
Jul	-0.007	0.0084	-0.7922	0.4291
Aug	0.006	0.0084	0.6611	0.5093
Sep	0.002	0.0084	0.1944	0.846
Oct	-0.001	0.0084	-0.0832	0.9338
Nov	0	0.0084	-0.0099	0.9922
Dec	0.003	0.0084	0.396	0.6926

Table 3 presents the regression output for the month of the year effect, where it can be determined that R-Square of the model is 0.052 indicating that only 5.2% variance of the return of USD/GBP can be interpreted or estimated by the January, February, March, April, May, June, July, August, September, October, November and December but the remaining variance of the regression models turns to be residual of the model that other factors could explain. The regression model is insignificant and the coefficient estimation reveals that effect of the January on the USD/GBP return is negative and statistically insignificant (C=-0.005 and P-value=0.5213) indicating the effect of January on the returns is negative and insignificant. Meanwhile, the effect of February, March, May, August, September, November and December is positive but not statistically significant, whereas the remaining months' effect is positive to be negative and statistically insignificant. Therefore, based on the results of the regression can be asserted that January negatively contributed to the return of the USD/GBP but not significantly and this also suggests accepting the null hypothesis that states that the mean return on January is not greater than the mean return of the other months in a year.

Holiday Effect

The holiday effect refers to the anomaly that pre-holiday trading day generates higher returns than post-holiday, which means before holiday stocks or commodities tend to have higher returns than post-holidays. To test this anomaly, the regression has been conducted and the results of the regression as provided as follows

Table 5: Regression For Holiday Effect

Summary Output

Regression Statistics

Multiple R	0.043
R Square	0.002
Adjusted R Square	0.001
Standard Error	0.021
Observations	4705

ANOVA

	df	*SS*	*MS*	*F*	*SignificanceF*
Regression	2	0.004	0.002	4.262	0.014
Residual	4702	2.161	0		
Total	4704	2.165			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0	0	-0.239	0.811
Post-Holiday	0.001	0.001	0.87	0.384
Pre-Holiday	-0.002	0.001	-2.481	0.013

Table 5 presents the regression output for the holiday effect, where it can be determined that R-Square of the model is 0.002 indicating that only 0.2% variance of the return of USD/GBP can be interpreted or estimated by the post-holiday and pre-holiday but remaining variance of the regression models turns to be residual of the model that other factors could explain. The regression model is statistically significant and the coefficient estimation reveals that the effect of the post-holiday on the USD/GBP return is positive and statistically insignificant (C=0.001 and P-value=0.384) indicating the effect of post-holiday on the returns is positive and insignificant. Meanwhile, the effect of pre-holiday is negative and statistically significant (C=-0.002 and P-value=0.013). Therefore, based on the results of the regression can be asserted that pre-holiday negatively contributed significantly to the return of the USD/GBP. This also suggests accepting the null hypothesis that the mean return on the Pre-Holiday is not greater than the mean return of the post-holiday.

5. Summary and Conclusion

The study's empirical findings suggest a positive effect of the Monday on the USD/GBP return. This confirms the presence of the anomaly in the exchange market where a greater return can be generated on Monday, which is an opening day of the week. However, previous studies have found a negative effect of Monday on the returns of stocks and currencies. In addition, results further confirm the anomaly that January effect means in January the returns are less than other months' returns, and it is, and truly confirmed in the present study where the effect has been found negative and significant indicating that there is very low or no effect of January on the return of the USD/GBP. Lastly, it has also been found that pre-holiday return is negative and significant, which allows to reject the proposed hypothesis

and does not meet with findings of the other scholars who found a positive effect of pre-holiday on the returns. However, the discrepancy in the results may be because the present study was conducted on the currency rate of USD/GBP, but previous studies were mainly conducted on the stock and commodity markets. Hence, this is also one of the major limitations of the study that it only consists of USD/GBP, but if at the same time stock market's data was also included in the study, then this could be improved results and would have allowed to cross-check and compare the results. Therefore, it is suggested for future studies to undertake a comparative study in which data of the stock market, currency market and commodity market is used to conduct analysis and this will allow a comparative study.

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