“Day-of-the-week effect and January effect examined in gold and silver metals”

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Abstract

This study examined the day-of-the-week effect and January effect in the precious metals gold and silver for the period January 1, 1980 through October 12, 2012. The results of this study indicate the presence of the day-of-the-week effect in gold markets and week presence of day-of-the-week effect in silver markets. The results of this study also indicate that there may be a daily seasonality in the variance of these metals. However, the findings of this study show presence of very week January effect in the gold returns, absence of January effect in silver returns and no seasonality in monthly variance of gold and silver.

Keywords: anomalies, weekend effect, January effect, precious metals.

Introduction

Over the last 50 years or so, one of the most investigated and analyzed area of equity and currency markets research has been the calendar related anomalies globally. Two of the most prominent calendar related anomalies are weekend effect and January effect. In general, weekend effect indicates significantly lower equity returns over the period between Friday's close and Monday's close; while January effect shows higher returns during January than in any other month of the year.

Researchers have also examined weekend effect and January effect in precious metals markets. This study re-examines weekend and January effects in the gold and silver return during the period 1980 through 2012 – a much longer and recent period than the previous studies.

1. Literature review

1.1. Day-of-the-week effect in equity and currency markets. *Day-of-the-week effect* is a well documented seasonal anomaly in the US equity, international equity and in foreign exchange markets. According to the *day-of-the-week effect*, the daily returns in financial markets on different days of week are statistically not the same. Specifically, Mondays' returns are observed to be significantly negative, while Fridays' returns are found to be statistically positive. For example, Aggarwal and Rivoli (1989), Dyl and Maberly (1992), Kohli (1996), and Pettengill, Wingender and Kohli (2004) have found the existence of the *day-of-the-week effect* in the U.S. and in overseas equity markets. McFarland, Pettit and Sung (1982) have investigated the *day-of-the-week effect* in one of the earliest studies in foreign exchange markets. MPS observed that the distribution of price changes on Mondays was different from the distribution of price changes on other days of the week. Interestingly, MPS findings indicate negative price changes on Fridays and positive price changes on Mondays which are opposite to general findings of the *weekend effect* in the equity markets. Similarly, Jaffe and Westerfield (1985, 1985) report a higher than average return on Wednesday and a lower than average return on Friday for all currencies. Yamori and Kurilhara (2004) report the presence of the *day-of-the-week effect* in some currencies in 1980s and absence of the effect in most currencies. Aydogan and Booth (2005) report presence of the *day-of-the-week effect* in Turkish and German Markets. Kohli (2004, 1995) explored seasonal anomalies in selected and dominant currencies.

1.2. January effect in equity and currency markets. In the economic and finance literature, *January effect* is also reported in the US equity, international equity and currency markets. McFarland, Pettit and Sung (1982), Jaffe and Westerfield (1985, 1985) in some of the earliest studies of January effect, report the presence of this seasonal anomaly in domestic and overseas equity markets. The *January effect* states that the mean monthly returns during January are greater than the mean monthly returns during any other month of a year. For example, Kohers and Kohli (1991) have provided supporting evidence for the presence of a robust *January effect* in major international stock markets including the United States. Kohli (1996) observed presence of January effect in the foreign exchange markets. In another article, Kohli (1996) reported higher returns in January than the other months in the international equity markets.

1.3. Day-of-the-week effect in gold and silver markets. Precious metals (gold, silver and platinum) possess similar characteristics to money and medium of exchange and unit value (Goldman, 1956; Solt and Swanson, 1981; Dooley, Israd and Taylor, 1995). Ball, Torous and Tschoegl (1982) observed weekend effect in London fixing gold prices from January 1975 through June 1979. Ma

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(1986) examined gold markets and reports positive weekend returns prior to 1981 and negative Monday returns during the period 1981 through June 1985.

Lucey and Tully (2006) examined seasonality in the conditional and unconditional mean and variance of daily gold and silver contracts over the 1982-2002 periods. Using COMEX cash and futures data, they find weak evidence for the mean returns and strong evidence for the variance. They report negative Monday effect in both gold and silver, across cash and futures markets. Using a GARCH framework, they report that the Monday seasonal does not disappear, indicating that it is not a risk-related artefact, the Monday dummy in the variance equations being significant also.

Blose and Gondhalekar (2012) examined the gold market for the period 1975 through 2011. They report that returns on the weekend are negative and significantly lower than the average returns during the week. They further examined the gold weekend effect during bull and bear market phases. During bull markets, the difference between weekday and weekend returns is not significant. However, their findings show negative returns on the weekend which are significantly less than returns during the week during the bear market.

1.4. January effect in gold markets. Baur (2013) investigated monthly seasonal effect in gold returns for each month from 1980 to 2010 and report that September and November are the only months with positive and statistically significant gold price changes. This "autumn effect" holds unconditionally and conditional on several risk factors. Baur did not find monthly return pattern in the silver prices. Coutts and Sheikh (2002) found no evidence of weekend effect or January effect on all gold indexes on the Johannesburg Stock Exchange during the period 1987 through 1997.

The current study examines two calendar related seasonal anomalies (*day-of-the-week effect* and *January effect*) in cash gold and cash silver markets over the period January 1980 through September 2012. This study examines both calendar related anomalies simultaneously for recent and longer period. The results indicate day-of-the-week effect in gold markets, weak day-of-the-week effect in silver markets and absence of January effect in gold and silver markets.

2. Data and methodology

The daily closing price data for the commodities (gold and silver) are collected from Bloomberg for the period January 1, 1980 through October 12, 2012. Similarly, the monthly closing price data for the commodities (gold and silver) are collected from Bloomberg for the period January 1, 1980 through September 30, 2012. The daily closing price is used to analyze day-of-the-week effect while monthly closing price is used to examine the January effect in the above commodities.

The following methodology is commonly used for examining seasonal anomalies in equity markets of US equity markets, international equity markets and foreign exchange markets. This paper uses the same methodology for analyzing calendar related anomalies in gold and silver markets.

2.1. Day-of-the-week effect. Equation (1) is used to compute daily returns for each commodity.

$$R_{it} = (P_{it} - P_{it\text{-}1}) / P_{it\text{-}1} \quad (i = 1, 2), \tag{1}$$

where P_{it} and $P_{it\text{-}1}$ are the closing price per troy ounce of the commodity i (in US dollars) for day_t and $day_{t\text{-}1}$, respectively. The following equation (2) is used to test for the presence of the day-of-the-week effect in precious metals:

$$R_{it} = \beta_{iM} D_{iMt} + \beta_{iT} D_{iTt} + \beta_{iW} D_{iWt} + \beta_{iR} D_{DiRt} + \\ + \beta_{it} D_{iFt} + e_{it} \quad (i = 1, 2), \tag{2}$$

where, the D_j terms are used to represent the process describing the mean return on any day of the week. For example, β_{iM} indicates the mean return on Monday. Similarly, β_{iT}, β_{iW}, β_{iR}, and β_{iF} represent mean daily returns on Tuesday through Friday, respectively. If the mean return on any day is not significantly different than zero then estimates of β_{iM} through β_{iF} will be zero, and the F-statistic measuring the joint significance of dummy variables should be insignificant.

2.2. January effect. Monthly returns on both metals are calculated using the following equation (3):

$$R_{jt} = (P_{jt} - P_{jt\text{-}1}) / P_{jt\text{-}1} \quad (j = 1, 2), \tag{3}$$

where P_{jt} and $P_{jt\text{-}1}$ are closing price per troy ounce of the commodity j (in US dollars) for $month_t$ and $month_{t\text{-}1}$, respectively. Next, the following equation (4) is used to test for the presence of the January effect in the commodities:

$$R_{jt} = \beta_{jJ} D_{jJt} + \beta_{jF} D_{jFt} + \beta_{jM} D_{jMt} + \ldots \\ + \beta_{jD} D_{iDt} + e_{it} \quad (j = 1, 2), \tag{4}$$

where R_{jt} is the average return during calendar month (j) for commodity j. Thus, the random variable to be tested is the R_{ij}. D_j terms are used to represent the process describing the mean monthly return in month of the year. For example, β_{iJ} indicates the mean monthly return in January. Similarly, β_{jF}, β_{jM} through β_{jD} represent mean monthly returns during February, March through December, respectively. If the mean monthly return during any month

is significantly different than zero then estimates of β_{iJ} through β_{iD} will be zero, and the F-statistic measuring the joint significance of dummy variables should be insignificant.

3. Results

3.1. Day-of-the-week effect. The results of the above analysis are reported in Tables 1 through 4. Basic statistics shown in Table 1 indicate that the gold returns are negative on Monday, Tuesday and Thursday; and positive on Wednesday and Friday. Standard deviations of returns for Monday to Friday are 0.012444, 0.012471, 0.012371, 0.011874 and 0.012225, respectively. Monday gold returns have the lowest kurtosis and the lowest and negative skewness.

Table 1. Moments of the distribution by day-of-the-week from January 1, 1980 through October 12, 2012

		Mean	Std. dev.	Kurtosis	Skewness
Gold	Monday	-.00046804	.012444596	10.268	-.742
	Tuesday	-.00002253	.012471092	13.545	-.323
	Wednesday	.00055137	.012371356	13.815	1.001
	Thursday	-.00001222	.011874137	14.776	.681
	Friday	.00104764	.012225997	14.887	.972
Silver	Monday	-.00078784	.020557151	11.857	-.057
	Tuesday	.00003245	.022600880	15.954	.230
	Wednesday	.00114161	.022525414	21.434	1.663
	Thursday	.00000419	.021241119	11.922	-1.371
	Friday	.00078781	.020354334	11.744	-.418

Table 2 shows the regression results for weekend effect in gold returns. For example, Mondays' mean daily returns on gold are -.000468 with *p*-value of 0.115, suggesting a probability of 11.5% that the mean daily gold returns on Monday are statistically zero. Similarly, mean daily returns on Tuesday, Wednesday, Thursday and Friday are -0.000023 (*p*-value 0.93), 0.000551 (*p*-value 0.063), -0.000012 (*p*-value 0.96), and 0.001048 (*p*-value 0.0004) respectively. Overall *F*-value of the regression is 3.679 with significance level of 0.003 indicating that mean daily returns for different days of the week on gold are statistically different from each other.

Table 2. Daily return data from January 1, 1980 through October 12, 2012

Day-of-the-week effect results for mean daily returns on gold					
$R_{it} = \beta_{iM} D_{iMt} + \beta_{iT} D_{iTt} + \beta_{iW} D_{iWt} + \beta_{iR} D_{iRt} + \beta_{iF} D_{iFt} + e_{it}$					
Day of the week	Unstandardized coefficients		Standardized coefficients	*t*	*p*-value*
	B	Std. err.	Beta		
Monday	-0.000468	0.000297	-0.017030	-1.576176	0.115022
Tuesday	-0.000023	0.000297	-0.000820	-0.075866	0.939528
Wednesday	0.000551	0.000297	0.020068	1.857349	0.063296
Thursday	-0.000012	0.000297	-0.000445	-0.041168	0.967163
Friday	0.001048	0.000297	0.038129	3.529068	0.000419
F-value	3.679	Sig. F**	0.003	N=	8,553

Notes: *denotes probability that $\beta_{ij} = 0$; **denotes probability that $\beta_{iM} = \beta_{iT} = \beta_{iW} = \beta_{iR} = \beta_{iF}$.

The analysis reported in Table 2 indicates presence of the day-of-the-week effect in gold returns. Specifically, the mean daily gold returns on Monday, Tuesday and Thursday are negative but statistically insignificant while the daily returns on Wednesday and Friday are statically significant and positive. Thus, the weekend pattern found stereotypically in equity markets follows in the gold market and is in line with Ma (1986).

Basic statistics in Table 1 shows the negative Monday returns on silver with negative skewness. Results for day-of-the-week effect on silver are shown in Table 3. The daily returns on silver from Monday through Friday are -0.000788 (*p*-value 0.129), 0.000032 (*p*-value 0.950), 0.0001142 (*p*-value 0.027), 0.000004 (*p*-value 0.993), and 0.000788 (*p*-value 0.129) respectively. Overall *F*-value of the regression is 1.888 with significance level of 0.093 indicating that mean daily returns for different days of the week on silver are statistically different but very weak. However, the mean daily silver return on Wednesday is statically positive and the returns on other four days of the week are statistically indifferent from zero. Thus, the results in Table 3 indicate an extremely weak presence of the day-of-the-week effect in silver returns.

Table 3. Daily return data from January 1, 1980 through October 12, 2012

Day-of-the-week effect results for mean daily returns on silver					
$R_{it} = \beta_{iM} D_{iMt} + \beta_{iT} D_{iTt} + \beta_{iW} D_{iWt} + \beta_{iR} D_{iRt} + \beta_{iF} D_{iFt} + e_{it}$					
Day of the week	Unstandardized coefficients		Standardized coefficients	*t*	*p*-value*
	B	Std. err.	Beta		
Monday	-0.000788	0.000519	-0.016398	-1.516940	0.129319
Tuesday	0.000032	0.000519	0.000675	0.062480	0.950182
Wednesday	0.001142	0.000519	0.023768	2.198725	0.027924
Thursday	0.000004	0.000519	0.000087	0.008075	0.993558
Friday	0.000788	0.000519	0.016402	1.517313	0.129225
F-value	1.888	Sig. F**	0.093	N=	8,553

Notes: *denotes probability that $\beta_{ij} = 0$; **denotes probability that $\beta_{iM} = \beta_{iT} = \beta_{iW} = \beta_{iR} = \beta_{iF}$.

Table 4 shows the results for the presence of seasonality in the second moment. We can reject the null of homogeneity of variance across days of the week in both gold and silver. The results in Table 4 indicate that there may be a daily seasonality in the variance of these metals.

Table 4. Levene's test for homogeneity of variance for day-of-the-weak effect

	Levene stat.	Significance
Gold	6.693	.010
Silver	4.855	.028

3.2. January effect. The results of January effect for gold and silver are reported in Tables 5 to 8. Basic statistics shown in Table 5 indicate negative monthly returns on gold for January (-0.0034, skewness is 0.7109); March (-0.0103, skewness is -1.2079); April (-0.0071, skewness is -0.7179); and November (-0.0086, skewness is -1.1011). The average monthly gold returns in December is the highest, while the remaining seven months of the year have positive returns.

Table 5. Moments of the distribution by month of the year from January 1980 through September 2012

		Mean	Std. dev.	Kurtosis	Skewness
Gold	January	-0.003439	0.049256	1.999112	0.710911
	February	0.015579	0.080407	5.892960	1.514461
	March	-0.010341	0.048244	4.587336	-1.207978
	April	-0.007137	0.059539	2.526734	-0.717976
	May	0.007372	0.046601	0.264816	0.561020
	June	0.005036	0.049253	1.763180	0.439825
	July	-0.002337	0.047745	6.039393	1.145333
	August	0.001084	0.043997	1.549393	0.773757
	September	0.014974	0.052914	1.078565	0.428342
	October	0.023140	0.059215	2.628510	0.735273
	November	-0.008666	0.046660	3.111023	-1.101136
	December	0.019527	0.044179	0.538022	0.529763
Silver	January	-0.003840	0.093438	0.217577	0.086622
	February	0.029761	0.088587	2.841064	0.936084
	March	0.002177	0.089563	2.113564	0.173640
	April	0.004671	0.128787	7.280469	-1.802058
	May	-0.001927	0.109071	1.957850	-0.199054
	June	-0.000133	0.092680	1.159725	0.525556
	July	-0.024642	0.068756	1.830192	0.222175
	August	0.020754	0.080298	0.749177	0.652817
	September	-0.000612	0.077809	1.604057	-0.558187
	October	0.021214	0.108799	2.936112	0.158325
	November	-0.015748	0.087428	1.875428	0.192114
	December	0.024109	0.072810	-0.664362	0.528649

Table 6 shows the regression results for January effect in gold markets. The mean monthly return for February (0.015579) is significant at 10 percent while mean monthly return for October (0.023140) is significant at 5 percent. The overall *F*-value of 1.647 (*p*-value 0.077) shows a very week January effect indicating that the monthly returns for February and October are statistically positive while mean returns for other months of the year are statistically insignificant. The results show an extremely weak presence of the January effect in gold return during the analysis period.

Table 6. Monthly return data from January 1980 through September 2012

January effect results for mean monthly returns on gold					
$R_{it} = \beta_{iJ} D_{iJt} + \beta_{iF} D_{iFt} + \ldots.. + \beta_{iD} D_{iDt} + e_{it}$					
Month	Unstandardized coefficients		Standardized coefficients	*t*	*p*-value*
	B	Std. error	Beta		
January	-0.003439	0.009420	-0.018239	-0.365125	0.715221
February	0.015579	0.009276	0.083893	1.679465	0.093881
March	-0.010341	0.009276	-0.055690	-1.114860	0.265613
April	-0.007137	0.009276	-0.038433	-0.769386	0.442141
May	0.007372	0.009276	0.039701	0.794776	0.427239
June	0.005036	0.009276	0.027119	0.542906	0.587512
July	-0.002337	0.009276	-0.012583	-0.251891	0.801261
August	0.001084	0.009276	0.005838	0.116873	0.907022
September	0.014974	0.009276	0.080637	1.614288	0.107293
October	0.023140	0.009276	0.124610	2.494582	0.013033
November	-0.008666	0.009420	-0.045953	-0.919930	0.358192
December	0.019527	0.009420	0.103552	2.073011	0.038843
F-value	1.647	Sig F**	0.077	N=	393

Notes: *denotes probability that $\beta_{ij} = 0$; **denotes probability that $\beta_{iJ} = \beta_{iF} = \ldots. = \beta_{iD}$.

The results of January effect on silver in Table 7 show an insignificant *F*-value of the regression indicating mean monthly returns for different months of the year are not statistically different from each other. In addition, except for February (mean return 0.029761 with *p*-value of 0.066828), *p*-values for each of the remaining months is statically non-significant. Therefore, the results of this paper show absence of the January effect in silver market for the period analyzed.

Table 7. Monthly return data from January 1980 through September 2012

January effect results for mean monthly returns on silver					
$R_{it} = \beta_{iJ} D_{iJt} + \beta_{iF} D_{iFt} + \ldots.. + \beta_{iD} D_{iDt} + e_{it}$					
Month	Unstandardized coefficients		Standardized coefficients	*t*	*p*-value*
	B	Std. error	Beta		
January	-0.003840	0.016443	-0.011777	-0.233553	0.815458
February	0.029761	0.016192	0.092685	1.838087	0.066828
March	0.002177	0.016192	0.006779	0.134437	0.893128
April	0.004671	0.016192	0.014546	0.288465	0.773148
May	-0.001927	0.016192	-0.006001	-0.119015	0.905326
June	-0.000133	0.016192	-0.000416	-0.008240	0.993429
July	-0.024642	0.016192	-0.076742	-1.521923	0.128858
August	0.020754	0.016192	0.064633	1.281784	0.200698
September	-0.000612	0.016192	-0.001905	-0.037776	0.969886
October	0.021214	0.016192	0.066067	1.310219	0.190911
November	-0.015748	0.016443	-0.048294	-0.957753	0.338795
December	0.024109	0.016443	0.073936	1.466261	0.143402
F-value	1.024	Sig F**	0.425	N=	393

Notes: *denotes probability that $\beta_{ij} = 0$; **denotes probability that $\beta_{iJ} = \beta_{iF} = \ldots. = \beta_{iD}$.

Table 8 shows the results for the presence of seasonality in the second moment. We cannot reject the null of homogeneity of variance across months of the year in both gold and silver. The results in Table 8 indicate that there is no seasonality in monthly variance of these metals.

Table 8. Levene's test for homogeneity of variance for January effect

	Levene stat.	Significance
Gold	.777	.378
Silver	.291	.590

Conclusion

The analysis of the daily returns in gold and silver markets shows presence of day-of-the-week effect in gold and very week presence of this effect in silver market. The mean daily returns in gold are significantly positive for Wednesday and Friday which is consistent with the common day-of-the-week effect in equity markets. Monday's daily return in gold is negative but statistically insignificant. The results of this paper show week presence of the day-of-the-week effect in silver market and only

Wednesday's returns are significantly positive. The results of this study also indicate that there may be a daily seasonality in the variance of these metals.

The results of this study show presence of very week January effect in the gold and indicate absence of January effect in silver markets. These results indicate that the January effect in gold returns is disappearing and moving towards October.

The findings of this study indicate that there is no seasonality in monthly variance of gold and silver.

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