Day of the Week Anomaly for Istanbul Gold Exchange: Gold and Silver Data

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ABSTRACT

This study investigates the day of the week effect on gold and silver, return and volatility, for Istanbul Gold Exchange (IGE) through the period August 2008 and December 2011 using reference exchange rates. For gold, the empirical results provide evidence for the existence of the days of the week anomaly for return and volatilities. For silver, days of the week anomaly is found only for volatility but not for return. When we compare gold and silver volatility, we find that gold is more volatile than silver. We also find that gold and silver volatility gives different reactions to good and bad news. This will be the first study on the calendar anomalies on gold and silver, return and volatility, for Istanbul Gold Exchange using GARCH methodology. The findings of this study has implications for local and international investors for designing trading strategies, drawing investment decisions, risk management and portfolio performance evaluation.

Anahtar Kelimeler: *Days of the week, volatility, GARCH, EGARCH.*

JEL Sınıflandırması: *G11, G12, G15*

İstanbul Altın Borsası Altın ve Gümüş Referans Fiyatları İçin Haftanın Günü Anomalisi

ÖZET

Bu çalışma İstanbul Altın Borsası altın ve gümüş referans fiyatlarını kullanarak, Ağustos 2008 ve Aralık 2011 tarih aralığı için getiri ve oynaklıkta haftanın günü etkisini araştırır. Altın için getiri ve oynaklıkta haftanın günü etkisine rastlanmıştır. Gümüş için ise sadece oynaklıkta haftanın günü etkisine rastlanmıştır. Altın ve gümüş oynaklıkları karşılaştırıldığında altın daha oynak bulunmuştur. Altın ve gümüş oynaklıklarının olumlu ve olumsuz haberlere verdikleri tepki farklı olmuştur. Bu çalışma İstanbul Altın Borsası altın ve gümüş referans fiyatları için haftanın günü anomalisini GARCH metodolojileri kullanarak inceleyen ilk çalışmadır. Bu çalışmanın bulguları ulusal ve uluslararası yatırımcıların işlem stratejilerini belirlemesi, yatırım kararlarını alması, risk yönetimi ve portföy performansının değerlendirilmesi açısından etkiler taşımaktadır.

Keywords: *Haftanın günleri, oynaklık, GARCH, EGARCH*

Jel Classification*: G11, G12, G15*

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1. INTRODUCTION

Numerous studies have explored the investment benefits of adding precious metals to portfolios. There is evidence that these metals can play a useful role in diversifying risk, as well as being an attractive investment. Thus, one might expect that the prices share similar dynamics. Gold has good diversification properties in a portfolio because the price of gold behaves in a completely different way than the prices of stocks or bonds.

The presence of calendar anomalies has been documented extensively for many years in financial markets. Among these, the most common ones are the weekend effect and the days of the week effect. Previous works in the literature searched for anomalies in Istanbul Stock Exchange for equity markets. It is interesting therefore to examine the extent and nature of this seasonality in the precious metal markets in Istanbul Gold Exchange (IGE). This study investigates the days of the week effect on return and volatility for gold and silver data with GARCH, EGARCH models from August 2008 to December 2011. The results show that calendar anomalies still exist.

For gold, the empirical results provide evidence for the existence of the days of the week anomaly for return and volatilities. For silver, days of the week anomaly is found only for volatility but not for return. When we compare gold and silver volatility, we find that gold is more volatile than silver. We also find that gold and silver volatility gives different reactions to good and bad news. Taking into account commodities' sensitivities to bad and good news, gold is not sensitive to bad news making it good investment in anticipation of bad times such as crises, wars and high inflation times.

The remainder of this paper continues as follows. We discuss relevant literature in Section 2. Section 3 provides the data and Section 4 discusses methodological issues. We discuss our findings regarding days of the week for return and return volatilities in Section 5. Finally, we finish by summarizing our main findings.

Istanbul Gold Exchange

It took a long time to bring gold which has important social and economic roles in Turkey into its current financial situation. With the amendments in Decree number 32 concerning the Protection of the Value of Turkish Currency in 1993, determination of the gold price, gold export and import are liberalized. The decisions aimed at liberalization of gold helped import and export processes. The rapid growth seen in gold sector due to these developments accelerated new decisions concerning gold which has a great economic potential. These new decisions aimed at restructuring gold sector. In 1995 the Istanbul Gold Exchange (IGE) was opened (IGE Book, 2012: 1).

The establishment of the IGE in 1995 was a key event in channeling gold into the financial system, by allowing gold trading within one organized market. The authority to import gold was given to members of the IGE in addition to Central Bank of The Republic of Turkey, allowing local gold prices to fall into line with international gold prices.

Istanbul Gold Exchange has three types of markets: Precious Metals Market includes the spot trade of standard and non-standard gold, silver, platinum and palladium metals. Precious Metal Lending Market provide lending and certificate transactions of defined precious metals. Diamond and Precious Stones Market provides transactions of diamond and precious stones (IGE Book, 2012: 6).

Turkey is an important gold market, both in terms of global exports and local demand. Today the country's gold jewellery demand is ranked fifth in the world and it is the eighth largest market for retail investment. With investment products ranging from the basics – such as coins and a gold ETF – to more innovative services like gold deposit accounts and gold ATMs, this demand source has significant potential (World Gold Council, 2012:4).

2. LITERATURE

The days of the week effect and weekend effect as calendar anomalies have been widely studied in finance literature. These studies were first carried out in U.S. Stock Market and later in other international financial markets. Researchers also examine the returns on Real Estate Investment Trusts (REIT) for evidence of some of these calendar anomalies.

Gold has been analyzed by Ball, Torous and Tschoegl (1982) and Ma (1986). Chang and Kim (1988), Chamberlain, Cheun and Kwan (1990) and Johnston and Kracaw (1991) all investigate gold futures markets. Ball, Torous et al. (1982) investigate the morning and afternoon fixings of gold in the London metal exchange over the 1975-1979 period. They find little evidence of either a daily seasonal or a negative Monday effect.

Ma (1986) found significant negative Monday effects in the gold market. Tully and Lucey (2005) confirm this finding for cash gold but not for the futures market. The Monday effect in cash gold appears to be weak and statistically not robust. They also provide the first evidence of daily seasonality in silver prices.

Muradoglu and Oktay (1993), Balaban (1995), Bildik (2000), Oguzsoy and Guven (2003), Berument et al (2004), Kiyilar and Karakas (2005), Tuncel (2007), Dicle and Hassan (2007), Aktas and Kozaoglu (2007), Ergul et al (2009) all report the days of the week anomaly for ISE. In Table 1, studies and their findings for days of the week anomaly for ISE are listed. Berument et al (2004) investigate the days of the week effect on return and volatility for ISE through the period 1986 and 2003 with ISE 100 index. For volatility of return, they find highest volatility on Monday and lowest volatility on Friday. For return, Friday has the highest return and Monday has the lowest return. To the best of our knowledge, there have not been any studies on the calendar anomalies on gold and silver return and volatility for IGE.

Table 1: Study of days of the week anomalies in ISE

		Study period & Main Findings
Muradoglu & Oktay	1993	1988-1992 Tuesday has negative return Friday has positive return
Balaban	1995	1988-1994 Tuesday has the lowest return (Statistically insignificant) Friday has the highest return
Bildik	2000	1988-1999 Tuesday has negative return Friday has the highest return
Oguzsoy & Guven	2003	1988-1999 Tuesday has the lowest return Friday has the highest return
Berument, Inamlik & Kiymaz	2004	1986-2003 Days of the week anomaly observed
Kiyilar & Karakas	2005	1988-2003 Monday has the lowest return Thursday and Friday have the highest return
Tuncel	2007	2002-2005 Monday has the lowest return Friday has the highest return
Dicle & Hassan	2007	1987-2005 Monday has negative return Thursday and Friday have positive return
Aktas & Kozoglu	2007	2001-2007 Thursday and Friday (Statistically significant) Days of the week anomaly observed
Ergul, Akel & Dumanoglu	2009	1997-2007 Friday has the highest return

3. DATA

The data used in this paper consists of daily reference exchange data for the period August 2008 – December 2011 from IGE. Daily return is calculated as the percentage logarithmic change in the value of metal compared to previous day's reference value as in the following:

$$Y_t = \ln (P_t / P_{t-1})*100$$

Skewness is a measure of asymmetry of the distribution of the series around its mean. The skewness of a symmetric distribution, such as the normal distribution, is zero. Kurtosis measures the peakedness or flatness of the distribution of the return series. A normal distribution has a kurtosis value equal to three. If it exceeds three, the distribution is peaked relative to the normal; on the other hand, if it is less than three, the distribution is flat relative to the normal. Hence, it captures the excess probability of abnormal returns, regardless of the sign of the returns.

Table 2 gives the summary statistics for daily gold markets returns for the entire period. As it can be noticed from Table 2, the kurtosis for returns is either higher or lower than three. Friday has negative returns. In addition, the volatility of the returns in terms of standard deviation is the highest for Tuesday and Friday.

Table 3 gives the summary statistics for daily silver markets returns for the entire period. As it can be noticed from Table 3, the kurtosis for returns is either higher or lower than three. Monday and Thursday have negative returns. In addition, the volatility of the returns in terms of standard deviation is the highest for Tuesday and Friday.

A visual perspective on the volatility of returns can be gained from the plots of daily returns for each series in Figure 1. It should be noted that all returns are time varying with volatility clusters.

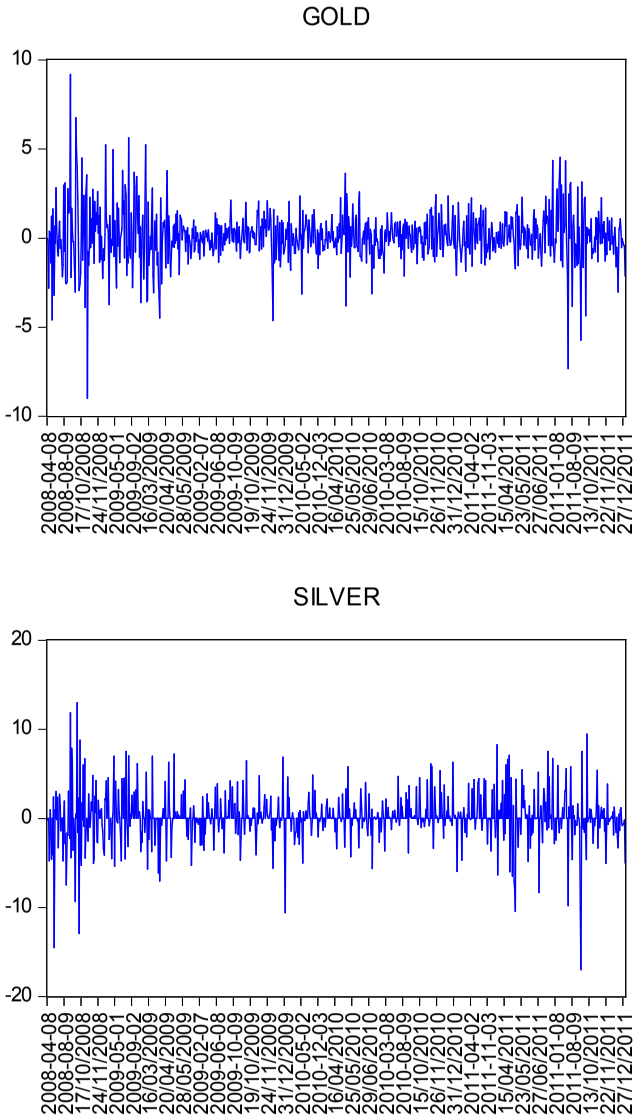
Table 2: Summary statistics for gold returns

	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	0.043531606	0.356060616	0.061063517	0.160394042	-0.018602243
Standard Error	0.112509364	0.118083085	0.103857988	0.100743285	0.116831616
Median	-0.027339536	0.383472968	-2.51102E-05	0.202241943	-0.045027441
Mode	0	#N/A	#N/A	#N/A	#N/A
Standard Deviation	1.47554648	1.539615062	1.358119429	1.309662703	1.527771619
Sample Variance	2.177237414	2.370414539	1.844488383	1.715216396	2.334086119
Kurtosis	3.157645563	3.72253707	2.026146031	1.516756516	16.29921396
Skewness	0.86417594	-0.128316497	0.279271544	-0.292606711	-0.457760637
Range	9.523690852	12.48913452	9.461462403	8.394871897	18.19198191
Minimum	-3.895656232	-5.733706245	-4.583525286	-4.366776453	-9.006794755
Maximum	5.628034621	6.755428277	4.877937117	4.028095445	9.185187158
Count	172	170	171	169	171

Table 3: Summary statistics for silver returns

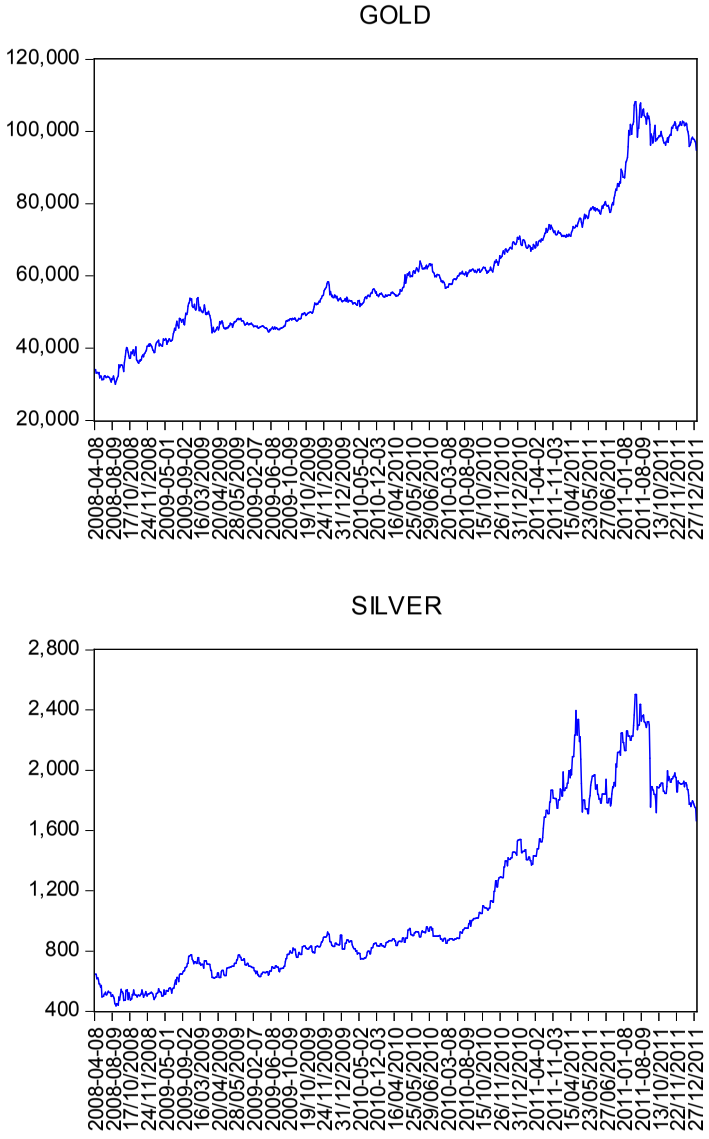
	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	-0.087167058	0.31774424	0.231416176	-0.028895418	0.125541519
Standard Error	0.204886841	0.254858066	0.116516865	0.171476238	0.240137595
Median	0	0.520018312	0	0	0
Mode	0	0	0	0	0
Standard Deviation	2.687065731	3.322942638	1.523655716	2.229191098	3.140206531
Sample Variance	7.220322244	11.04194777	2.321526742	4.969292951	9.860897054
Kurtosis	9.192552586	5.022310341	14.39030242	9.253768839	1.050292261
Skewness	-1.557967066	-1.131991515	2.664984818	1.174695588	0.191617267
Range	23.98973262	24.88211247	14.76791417	20.43315836	21.67811515
Minimum	-14.52611656	-16.98644869	-5.987135949	-7.460247692	-9.810962174
Maximum	9.463616058	7.895663775	8.780778223	12.97291067	11.86715297
Count	172	170	171	169	171

Figure 1: Time series plots of daily returns



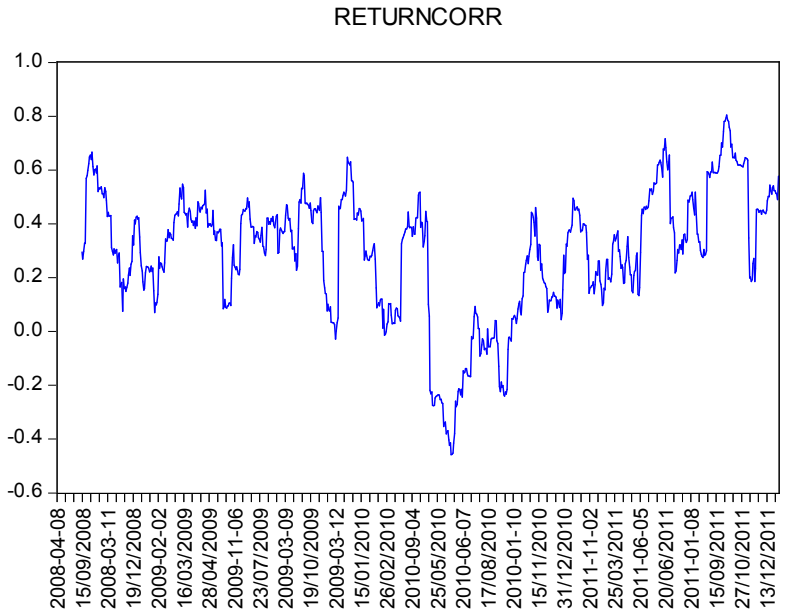
When we look at Figure 2, we can see that there is an upward trend both for gold and silver prices.

Figure 2: Time series plots of daily closing prices



In Figure 3, rolling correlations with 30 days windows for returns is presented. The correlation coefficient between gold return and silver return is 0.37 for the total period. There is positive correlation between gold and silver return. In 2010 it seems that this correlation has weakened.

Figure 3: Rolling Correlations with 30 days windows for returns



4. METHODOLOGY

In our study we apply generalized autoregressive conditional heteroscedasticity (GARCH) model proposed by Bollerslev (1986) which allows for the conditional variance to be linearly dependent on the past behavior of the squared residuals and a moving average of the past conditional variances. The lagged squared error terms imply that if past errors have been large in absolute value, they are likely to be large in the present, leading to volatility clustering. The model used here will follow the simple GARCH (1,1).

Following Berument and Kiymaz (2001), the GARCH model with dummy variables representing the days of the week is adopted:

$$Y_t = \beta_0 + B_1 Y_{t-1} + m_1 d_{1,t} + m_2 D_{2,t} + m_3 D_{3,t} + m_4 D_{4,t} + m_5 D_{5,t} + \varepsilon_t$$

$$\varepsilon_t \mid \Omega_{t-1} \sim N(0, h_t)$$

Y_t is the index return on day t. $D_{1,t}$ through $D_{5,t}$ are days of the week dummies that are either 0 or 1 ($D_{1,t}$ =1 for Monday and 0 otherwise and so on). ε_t is the random error term for day t. If m_1 is positive and significant, this suggests that the average return on Monday is significantly higher than zero. Similar interpretation is applied to m_1, m_2, m_3, m_4, m_5.

We model the conditional variability of index returns by incorporating the days of the week effect into our volatility equation. The coefficients V_1 through V_5 represent the volatility on Monday to Friday. If V_1 is positive and significant, this suggests that the volatility on Monday is significantly higher than zero.

$$h_t = \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} + V_1 D_{1,t} + V_2 D_{2,t} + V_3 D_{3,t} + V_4 D_{4,t} + V_5 D_{5,t} + V_c$$

This specification requires $\alpha_i + \beta_j < 1$ in order to satisfy the non-explosiveness of the conditional variance. An important restriction of GARCH model is about the symmetric response of volatility to positive and negative shocks. However, it can be observed that "bad" news or a negative shock to financial time series has larger effects on volatility than "good" news or a positive shock does. The tendency of such a negative correlation between volatility and returns is often called the leverage effect. A model that allows this asymmetric effect of shocks is the exponential-GARCH (EGARCH) model. Nelson (1991) proposed a specification that does not require the non-negativity of model parameters which is another advantage over the standard GARCH model. The specification of the conditional variance equation can be expressed by

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{p} \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^{q} \alpha_i \frac{|\varepsilon_{t-i}|}{\sqrt{\sigma_{t-i}^2}} + \sum_{i=1}^{q} \gamma_i \frac{\varepsilon_{t-i}}{\sqrt{\sigma_{t-i}^2}}$$

To eliminate the possible multicollinearity problems we dropped one of the dummies in regression equations for days of the week.

5. EMPIRICAL RESULTS

For GARCH (1,1) model, the sum of the coefficients in the conditional variance equation, ($\alpha + \beta$), must be less than unity for the process to be stationary. This sum also indicates the level of persistence in the volatility shocks. A sum close to unity is favorable for providing evidence of a persistent volatility process (Bollerslev 1986).

The results of GARCH (1,1) and modified GARCH (1,1) analyses are reported for gold in Table 4. We dropped dummy for Tuesday in regression equation. Only Monday and Friday are significant and negative for GARCH(1,1). The returns on Friday (-0.17005) are higher than the returns on Monday (-0.23974). When the modified GARCH (1,1) is estimated for gold return and volatility, the coefficients of Monday (-0.31761), Wednesday (-0.82607) and Friday (-0.40549) for volatility equation are significant. The volatility for Monday is the highest. The results of EGARCH (1,1) and modified EGARCH (1,1) analysis are reported for gold on Table 4 and the results appear to be consistent with GARCH (1,1) results for gold.

The results of GARCH (1,1) and modified GARCH (1,1) analyses are also reported for silver on Table 5. We dropped dummy for Tuesday in regression equation. All the coefficients are insignificant. Although insignificant, the returns on Friday are higher than the returns on Monday. When the modified GARCH (1,1) is estimated for silver return and volatility, all the coefficients for volatility equation are significant. Friday (-1.528446) has the highest volatility followed by Thursday (-2.914406) and Monday (-3.744348). The results of EGARCH (1,1) and modified EGARCH (1,1) analyses are reported for silver in Table 5, as well. Results are consistent with GARCH (1,1) results for silver.

In EGARCH model α parameter represents a magnitude effect or symmetric of the model, the "GARCH "effect. The β measures the persistence in conditional volatility. When β is relatively large, the volatility takes a long time to die out following a crisis in the market. If $\gamma=0$, the model is symmetric. When $\gamma<0$, then positive shocks (good news) generate less volatility then negative shocks (bad news).

When we look at the Table 4, β is high (for EGARCH 0.989553, for modified EGARCH 0.989048) and close to one showing the persistence in conditional volatility for gold. Volatility takes long time to die out. According to the results γ is different than zero which shows leverage effects. The parameter γ (for EGARCH 0.07473, for modified EGARCH 0.069815) is positive and greater than zero which means good news generates more volatility than bad news. The possible reason is that gold market has special characteristics different than stock market.

When we look at the Table 5, β is high (for EGARCH 0.97135, for modified EGARCH 0.927469) and close to one showing the persistence in conditional volatility for silver. Volatility takes long time to die out. According to the results γ is different than zero which shows leverage effects. The parameter γ (for EGARCH -0.008933, for modified EGARCH -0.012608) is negative and less than zero which means bad news generates more volatility than good news. Gold is more volatile than silver. Gold and silver volatility gives different reactions to good and bad news.

Table 4: Regression results for Gold

	GARCH(1,1)		Modified GARCH(1,1)			EGARCH(1,1)			Modified EGARCH(1,1)	
Return Equation	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Return Equation**	**Coefficient**	**p-value**	**Return Equation**	**Coefficient**	**p-value**
Monday(m_1)	-0.23974	0.0217**	-0.23482	0.0535*	Monday(m_1)	-0.23536	0.0305**	Monday(m_1)	-0.22966	0.0467**
Wednesday(m_3)	-0.15908	0.1789	-0.14423	0.2294	Wednesday(m_3)	-0.166371	0.1531	Wednesday(m_3)	-0.16124	0.1794
Thursday(m_4)	-0.04782	0.6556	-0.01744	0.8909	Thursday(m_4)	-0.085558	0.3944	Thursday(m_4)	-0.05995	0.5991
Friday(m_5)	-0.17005	0.0927*	-0.15164	0.1789	Friday(m_5)	-0.263406	0.0103**	Friday(m_5)	-0.24949	0.0245**
β_0	0.206714	0.0029***	0.192189	0.0356**	β_0	0.290727	0.0001***	β_0	0.284046	0.0012***
β_1	-0.01759	0.6498	-0.00836	0.8293	β_1	-0.028367	0.4287	β_1	-0.02229	0.5377
Variance Equation										
V_c	0.024182	0.0010***	0.365518	0.0016***						
α	0.09767	0.0000***	0.089872	0.0000***						
β	0.892737	0.0000***	0.896691	0.0000***						
Monday(V_1)			-0.31761	0.0693*	**Variance Equation**			**Variance Equation**		
Wednesday(V_3)			-0.82607	0.0002***	V_c	-0.09338	0.0000***	V_c	0.182995	0.0748*
Thursday(V_4)			-0.13694	0.3292	α	0.128134	0.0000***	α	0.129102	0.0000***
Friday(V_5)			-0.40549	0.0034***	γ	0.07473	0.0000***	γ	0.069815	0.0000***
					β	0.989553	0.0000***	β	0.989048	0.0000***
								Monday(V_1)	-0.32859	0.0342**
								Wednesday(V_3)	-0.60144	0.0027***
								Thursday(V_4)	-0.15699	0.2959
								Friday(V_5)	-0.29755	0.0343**

Note : - ***, ** and * indicate the level of significance at the 1 percent, 5 percent and 10 percent level, respectively. To eliminate the possible multicollinearity problems, dummies for Tuesday is dropped in regression equations.

Table 5: Regression results for Silver

	GARCH(1,1)		Modified GARCH(1,1)			EGARCH(1,1)			Modified EGARCH(1,1)	
Return Equation	**Coefficient**	**p-value**	**Coefficient**	**p-value**	**Return Equation**	**Coefficient**	**p-value**	**Return Equ**	**Coefficient**	**p-value**
Monday(m_1)	-0.162069	0.5469	-0.304388	0.3782	Monday(m_1)	-0.204432	0.424	Monday(m_1)	-0.423881	0.1288
Wednesday(m_3)	-0.134302	0.7581	-0.289588	0.3963	Wednesday(m_3)	-0.179106	0.6408	Wednesday(m_3)	-0.357864	0.1686
Thursday(m_4)	-0.093154	0.709	-0.228322	0.4431	Thursday(m_4)	-0.09144	0.7118	Thursday(m_4)	-0.267165	0.3028
Friday(m_5)	-0.017604	0.9208	-0.108261	0.7014	Friday(m_5)	0.006917	0.9692	Friday(m_5)	-0.124335	0.6162
β_0	0.252858	0.0547*	0.366288	0.1149	β_0	0.283034	0.027**	β_0	0.477496	0.0141**
β_1	-0.046634	0.2261	-0.070734	0.1203	β_1	-0.043288	0.2372	β_1	-0.054774	0.0692*
AR(18)	0.061038	0.0184**						AR(1)	-0.054774	0.0692*
AR(8)			0.078341	0.017**				AR(3)	-0.074469	0.0162**
AR(3)			-0.079838	0.0231**				AR(7)	0.059989	0.0664*
AR(4)			-0.051202	0.2094				AR(18)	0.081309	0.003***
AR(19)			0.102193	0.0002***						
AR(7)			0.045329	0.1508						
Variance Equation										
V_c	0.16005	0.0002***	5.495007	0.0000***						
α	0.056299	0.0000***	0.124072	0.0000***						
β	0.920021	0.0000***	0.520514	0.0000***						
Monday(V_1)			-3.744348	0.0000***	**Variance Equ**			**Variance Equ**		
Wednesday(V_3)			-8.120235	0.0000***	V_c	-0.029136	0.025**	V_c	0.564258	0.0000***
Thursday(V_4)			-2.914406	0.0000***	α	0.13151	0.0000***	α	0.194023	0.0000***
Friday(V_5)			-1.528446	0.0025***	β	0.97135	0.0000***	β	0.927469	0.0000***
					γ	-0.008933	0.4491	γ	-0.012608	0.4789
								Monday(V_1)	-0.97493	0.0000***
								Wednesday(V_3)	-2.147288	0.0000***
								Thursday(V_4)	0.163359	0.153
								Friday(V_5)	0.124481	0.3318

Note : - ***, ** and * indicate the level of significance at the 1 percent, 5 percent and 10 percent level, respectively. To eliminate the possible multicollinearity problems, dummies for Tuesday is dropped in regression equations.

6. CONCLUSION

This study examined the possible existence of days of the week effect on return and volatility of gold and silver daily reference exchange data. For gold, the empirical results provide evidence for the existence of the days of the week anomaly for return and volatilities. For silver, days of the week anomaly is found only for volatility but not for return. When we compare gold and silver volatility, we find that gold is more volatile than silver. We also find that gold and silver volatility gives different reactions to good and bad news. Taking into account commodities' sensitivities to bad and good news, gold is not sensitive to bad news making it good investment in anticipation of bad times such as crises, wars and high inflation times.

Gold and silver are not driven by the same performance factors as stocks and bonds, they have the power to maintain or increase their value even when economic markets are volatile. War, inflation, high oil price, and other cause of stock fall may increase gold price instead. Silver is a unique metal that may win whether the economy is going well or is in bad shape. The investor buys it as a hedge against the downturn in the economy and the markets. And if the economy improves, then the industrial demand increases for silver. This may explain the different reactions that gold and silver give to good and bad news in terms of volatility. Gold future contracts are also traded in Turkish Derivative Exchange since 2006. Gold futures trading might also lead to increased volatility for gold compared to silver.

This will be the first study on the calendar anomalies on gold and silver, return and volatility, for Istanbul Gold Exchange. Gold and silver prices are driven primarily by the same principles that drive costs in all areas of the free market: supply and demand. The results of this study show that investor's expectations also affect gold and silver prices. The findings of this study has implications for local and international investors for designing trading strategies, drawing investment decisions, risk management and portfolio performance evaluation.

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APPENDIX

Heteroskedasticity Test Result for Gold Return

Heteroskedasticity Test: ARCH

F-statistic	19.26653	Prob. F(1,851)	0.0000
Obs*R-squared	18.88427	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/22/12 Time: 09:55
Sample (adjusted): 2 854
Included observations: 853 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.783263	0.212310	8.399316	0.0000
RESID^2(-1)	0.148802	0.033901	4.389365	0.0000

R-squared	0.022139	Mean dependent var	2.093967
Adjusted R-squared	0.020990	S.D. dependent var	5.908322
S.E. of regression	5.845987	Akaike info criterion	6.371730
Sum squared resid	29083.41	Schwarz criterion	6.382864
Log likelihood	-2715.543	Hannan-Quinn criter.	6.375994
F-statistic	19.26653	Durbin-Watson stat	2.015672
Prob(F-statistic)	0.000013		

Heteroskedasticity Test Result for Silver Return

Heteroskedasticity Test: ARCH

F-statistic	28.82830	Prob. F(1,851)	0.0000
Obs*R-squared	27.94925	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/22/12 Time: 10:00
Sample (adjusted): 2 854
Included observations: 853 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.791759	0.725192	7.986518	0.0000
RESID^2(-1)	0.181096	0.033729	5.369199	0.0000

R-squared	0.032766	Mean dependent var	7.065747
Adjusted R-squared	0.031629	S.D. dependent var	20.33851
S.E. of regression	20.01428	Akaike info criterion	8.833111
Sum squared resid	340886.3	Schwarz criterion	8.844245
Log likelihood	-3765.322	Hannan-Quinn criter.	8.837375
F-statistic	28.82830	Durbin-Watson stat	2.006469
Prob(F-statistic)	0.000000		