

The Day-of-the-Week Effect in the Saudi Stock Exchange: A Non-Linear Garch Analysis

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ABSTRACT

It is a well-known fact that the day-of-the-week effect in stock markets is one of the most prominent puzzling seasonal anomalies in finance and has been increasingly attracting attention from researchers and practitioners, as well as academics. This paper scrutinizes the day-of-the-week effect in the emerging equity market of Saudi Arabia, TADAWUL. By using a non-linear GARCH model and covering the data from January 2001 to December 2009, the findings of the study reveal that the returns on the five trading days follow different process. This confirms that mean daily returns are significantly different from each other and validates the day-of-the-week effect in TADAWUL.

Keywords: *Day of the week effect; GARCH; Saudi stock exchange*

Introduction

Financial markets have witnessed the presence of calendar anomalies, which have been documented extensively for the last two decades. The most prominent ones are definitely the January Effect and the Day of the Week Effect. The day of the week effect in stock markets has been attracting attention from researchers and practitioners, as well as academics and thus has been investigated extensively in different markets. Cross (1973), French (1980), Keim and Stambaugh (1984) Rogalski (1984), Aggarwal and Rivoli (1989) studied the week effect in different stock markets and revealed that the distribution of stock returns varies according to the day of the week. For example, they generally found that the average return on Monday is significantly less than the average return over the other days of the week. The day of the week regularity is not limited to a few equity markets. It is well documented that the day of the week regularity is present in other international equity markets (Jaffe and Westerfield 1985; Solnik and Bousquet 1990; Barone 1990, among others) and other financial markets including the futures market, Treasury bill market, and bond market (Gibbons and Hess, 1981; Cornell 1985; Dyl and Maberly 1986).

Although the majority of the studies has centered on the seasonal pattern in mean return, many recent empirical studies have also tried to investigate the time series behavior of stock prices in terms of volatility by using variations of the generalized autoregressive conditional heteroscedasticity (GARCH) models (French, Schwert, and Stambaugh 1987; Akgiray 1989; Baillie and DeGennaro 1990; Hamao, Masulis, and Ng 1990; Nelson 1991). French and Roll (1986) proposed that the variances for the days following an exchange holiday should be larger than other days. Harvey and Huang (1991) observed higher volatility in the interest rates and foreign exchange futures markets during the first trading hours on Thursdays and Fridays.

Needless to say, it is important to know whether there are variations in volatility of stock returns by day-of-the-week patterns and whether there is a connection between high (low) return and a corresponding high (low) return for a given day. Obviously, having such knowledge may allow investors to adjust their portfolios by taking into account day of the week variations in volatility. For instance, Engle (1993) argued that investors who dislike risk may adjust their portfolios by reducing their investments in those assets whose volatility is expected to increase. Finding definite patterns in volatility may be helpful in many ways, including but not limited to the use of predicted volatility patterns in hedging and speculative purposes and use of predicted volatility in valuation of certain assets, specifically stock index options.

The-day-of-the week effect is regularity in the stock market that usually takes the form of considerably negative mean returns on the first day of the trading week and peculiarly high mean returns on the last day of the trading week. Settlement procedures, bid-ask spread biases, dividend patterns, negative information release, thin trading, measurement errors, specialists behavior, and the concentration of certain investment decisions at the weekend have been considered as partially main factors of the day of the week effect phenomenon by several studies like Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishok and Levi (1982), Keim and Stanbaugh (1984), Rogalski (1984), Jaffe and

Westerfield (1985), Smirlock and Starks (1986), Penman (1987), Damodaran (1989), Al-Loughani and Chappell (2001) and Tonchev and Kim (2004).

The purpose of this study is to investigate the presence of day-of-the-week effect in emerging stock market of Saudi Arabia, TADAWUL. To the best of our knowledge, there is no previous study that has tested the presence of the day-of-the-week effect in TADAWUL. The paper contributes to the literature by documenting the presence of the day-of-the-week effect patterns by using non-linear GARCH analysis in TADAWUL, which has not been investigated by any earlier studies.

Literature Review

There is a huge literature on day-of-the-week effect for the stock returns. Among studies investigating the day-of-the-week anomaly for the U.S. market, Cross (1973) studied the returns on the S&P 500 Index over the period of 1953 and 1970. His findings showed that the mean return on Friday is higher than the mean return on Monday. French (1980), who also studied the S&P 500 index for the period from 1953 to 1977, revealed similar results. Gibbons and Hess (1981) found negative Monday returns for 30 stocks of Dow Jones Industrial Index. Keim and Stambaugh (1984) examined the weekend effect by using longer periods for diverse portfolios. Their results confirmed the findings of previous studies. There are many studies that try to explain the Monday effect. We can cite, among them but not limited to, calendar time hypothesis (French 1980), the delay between trading and settlements in stocks (Gibbons and Hess 1981; Lakonishok and Levi 1982), and measurement errors (Gibbons and Hess 1981; Keim and Stambaugh 1984). These studies mainly measure Monday return between the closing price on Friday and the closing price on Monday. Rogalski (1984) tried to respond to the question of whether prices fall between Friday close and Monday opening or during the day on Monday. He incorporated daily returns into trading and non-trading day returns and discovered that all of the average negative returns from Friday close to Monday close take place during the non-trading hours. Average trading day returns (open to close) are alike for all days.

Other U.S. markets are not exceptions to day-of-the-week patterns. The Treasury bill market, the futures market, and the bond market present a similar pattern to that of the equity market (Cornell 1985; Dyl and Maberly 1986). Several studies showed that other stock markets around the world have also witnessed the day-of-the-week effect. Among them, Jaffe and Westerfield (1985) scrutinized the weekend effect in four developed markets, namely Australia, Canada, Japan and the U.K. Their results indicated the presence of the weekend effect in all countries studied. In contrast to earlier studies of the U.S. market, surprisingly, the lowest mean returns for both Japanese and Australian stock markets were found to be on Tuesday. Solnik and Bousquet (1990) investigated day-of-week-effect for Paris stock exchange, and revealed a strong and persistent negative return on Tuesday, which is in line with studies on Australia and Japan. Barone (1990) exposed similar results for the Italian stock market, with the biggest decline in stock prices taking place in the first two days of the week and more pronounced on Tuesday. Furthermore, Agrawal and Tandon (1994), Alexakis and Xanthakis (1995), and Balaban (1995) also showed that the distribution of stock returns varies by day-of-the-week for various countries. Overall, the day-of-the-week effect in stock returns is a

common phenomenon and has been documented in different countries and different stock markets.

Some empirical studies examined the time series behavior of stock prices in terms of volatility by using variations of GARCH models (French, Schwert, and Stambaugh 1987; Akgiray 1989; Baillie and DeGennaro 1990; Hamao, Masulis, and Ng 1990; Nelson 1991; Campbell and Hentschel 1992; Glosten, Jagannathan, and Runkle 1993). French, Schwert and Stambaugh (1987) studied the relationship between stock prices and volatility and confirmed that unexpected stock market returns are negatively correlated with unexpected changes in volatility. Campbell and Hentschel (1992) revealed similar findings. They showed that an increase in stock market volatility increases required stock returns, and thus decreases stock prices. Nelson (1991) and Glosten, Jagannathan, and Runkle (1993), in contrast, found that positive unanticipated returns brought about reduction in conditional volatility, while negative unanticipated returns caused upward movements in conditional volatility. Baillie and DeGennaro (1990) reported no evidence of a relationship between mean returns on a portfolio of stocks and the variance or standard deviation of those returns. These findings were also confirmed by Chan, Karolyi and Stulz (1992), who reported a significant foreign influence on the time-varying risk premium for U.S. stocks but no significant relation between the conditional expected excess return on the S&P 500 and its conditional variance.

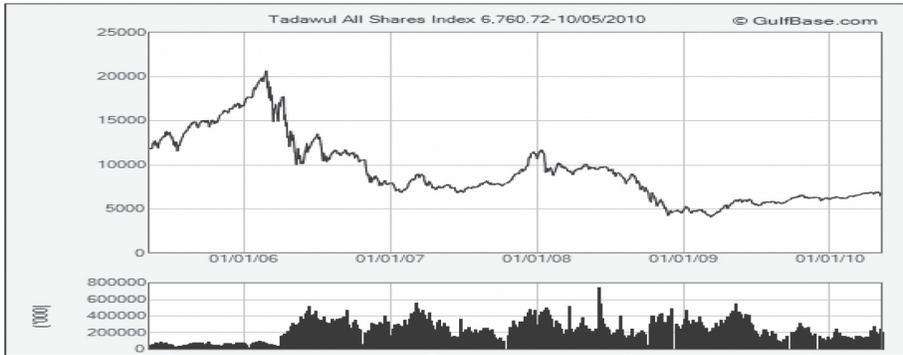
Moreover, Corhay and Rad (1994) and Theodossiou and Lee (1995) examined the behavior of stock market volatility and its relationship to expected returns for major European stock markets. Both studies displayed the presence of significant conditional heteroscedasticity in stock price behavior found no relationship between stock market volatility and expected returns.

The Saudi Stock Exchange

The Saudi stock exchange, known as the TADAWUL, is the largest not only in the Gulf Community Council (GCC) countries, but also in the entire Arab World. By December 2009, its market capitalization was around \$313 billion. The next largest is the Kuwait stock exchange, which had a market cap of \$94 billion. As a percentage of GDP, the TADAWUL's market cap was around 67% of 2008 GDP and around 82% of 2009 GDP. It is technologically advanced, and introduced the world's first fully-electronic market in the 1990s, comprising trading, clearing, settlement and depository (The Saudi Stock Market: Structural Issues, Recent Performance and Outlook, December, 2009, SAMBA.)

The main index, the TADAWUL All Share Index (TASI) reached its peak on 25th of February 2006, when it closed at 20,635. It was severely affected by the 2008 global crisis, like all the stock markets all over the world, and saw below 4000. It is currently trading around 6300.

Figure 1. TADAWUL All Share Index for the last 5 years



Source: Gulfbase.com

Figure 2. TADAWUL All Share Index for the Last 3 Months



Source: Gulfbase.com

The Saudi Arabia Monetary Agency (SAMA) was responsible for supervising the market from 1984 until 2003. In July 2003, authority was handed over to the newly formed Capital Market Authority (CMA). The CMA is now the sole regulator and supervisor of Saudi Arabia's capital markets, and issues the necessary rules and regulations to protect investors and ensure fairness and efficiency in the market.

For many years, the TADAWUL was open only to Saudi nationals. In December 2007, as part of the move to establish a GCC common market, the TADAWUL was opened to GCC nationals, though their participation remains limited as they have tended to focus on their domestic markets. Until 2008, non-Arab foreigners who were not resident in the Kingdom could only participate through a few mutual funds. However, in August 2008 the CMA approved new rules that allowed non-Arab foreigners to participate in share trading through swap arrangements with local CMA-approved and

licensed intermediaries.

The Saudi stock market currently lists 138 companies, divided into fifteen sectors. Financials and Basic Materials sectors are the dominant sectors, together accounting for around 70% of market capitalization. The biggest two companies by market share are Al RAJHI Bank and SABIC, a petrochemical producer, both of which command around 11% of the market. Some of the smaller sectors have larger numbers of companies: for example, the Consumer Goods sector contains 16 companies, despite accounting for just 4% of the market's value.

GCC and other Arab citizens accounted for 3% of buys, while foreign residents in the Kingdom registered just 0.2%. Foreign residents outside the Kingdom placed 1.2% of buy orders with a small number of transactions.

Between 2003 and its peak in February 2006, the index gained a staggering 700%, with market capitalization soaring to \$800 billion - around two-and-a-half times nominal GDP. At its peak, the TADAWUL was the world's tenth largest stock market by value, despite having only 78 listed stocks, many with a limited free float.

In July 2009, the US Dow Jones Index became the first international index provider to offer indices on the TADAWUL. Dow is now providing four Saudi indices based on real time data and prices from the Kingdom. Standard & Poor's and Bloomberg have also reached similar agreements to provide indices.

The run-up in the stock market during the middle part of the decade saw the TASI soar well above global equity benchmarks as speculators ignored fundamentals and gambled that prices would keep on rising. The subsequent crash saw the TASI lag behind global benchmarks for over a year. Since the beginning of 2008, the index has basically realigned itself with the direction of global equity markets.

This realignment did not prevent another serious period of turbulence in 2008. Surging global equity markets and oil prices in the first part of the year prompted a spike in activity on the TADAWUL. However, this was followed by an abrupt collapse in the second half as the global financial system seized up. Although not as severe as the correction in 2006, the TASI still shed 49% between June and December, ending the year at 4800. Market capitalization fell to \$244 billion. The biggest loser by sector was petrochemicals, which lost 63% of its value during the course of the year, with investors concerned about a global supply glut and an apparent shortage of gas feedstock in Saudi Arabia.

The TASI continued to track emerging equity markets very closely in the first quarter of 2009. Performance was subdued as the global economic recession hardened and oil prices also tracked lower. In the second quarter, global economic conditions began to improve, with the first signs that financial markets had stabilized and the real economy was nearing, or at, its trough. Oil prices also began to move upwards again.

Although the TASI initially tracked the benchmark higher, its recovery stalled in May 2009 as concerns about debt problems in the Saudi corporate sector began to emerge. The scale of these problems is almost impossible to quantify given a lack of publicly available data. Nevertheless, this opacity itself unsettled investors; the TASI remained subdued, adding just 19% during the second quarter.

Data and Methodology

The data we used is daily return data that covers January 2001 to December 2009, except the official religious holidays. The Saudi Stock Exchange operates from Saturday to Wednesday, while Thursday and Friday are the official weekend in which there is no transaction. The returns are one-day logarithmic returns. If the following day is a non-trading day, then the return is calculated using the closing price indices of the latest trading day and that day.

The earlier studies of the day-of-the-week effect can be divided into four categories based on the methodology employed. The first category employs the methodology by calculating returns means and variances for each day of the trading week, or estimating the coefficients of the equation (1) below and using standard t and F test or ANOVA to check the significance and equality of mean returns, without paying attention to the time series properties of the sample data (Santesmases, 1986; Solnik and Bousquet, 1990; Athanassakos and Robinson, 1994; and Balaban, 1995).

The second category of studies calculates mean daily returns or estimates the coefficients of equation (1). They, on the other hand, carry out hypothesis testing using t-statistics and χ^2 , calculated by using heteroscedasticity-consistent standard errors, proposed by White (1980). This approach does not inspect the distributional properties of the data used (Chang, 1993; Peiro, 1994; Abraham and Ikenberry, 1994). However, it should be mentioned that Chang, 1993) performed a more thorough investigation of the time series properties of the sample data using the Jarque-Bera test of normality and Breusch-Pagan-Godfrey test for heteroscedasticity and found that regression residuals are non-normal, heteroscedastic and auto-correlated. Therefore, they employ tests that adjust regression errors for departures from conventional assumptions.

The third category tests the normality of returns via the Kolmogorov-Smirnov D Statistic. If the returns are found to be normally distributed, the t and F-tests or ANOVA are employed. Otherwise, non-parametric tests are used to test for the existence of the day-of-the-week effect (Board and Sutcliffe, 1998; Wong, 1992).

The fourth category begins with reporting descriptive statistics of the distributional properties of the return series. These statistics show that the series are highly leptokurtic relative to the normal distribution. Then, this outcome is used as a justification for the use of a GARCH (generalized autoregressive conditional heteroscedasticity) model to examine the presence of the day-of-the-week effect (Najand and Yung, 1994; Alexakis and Xanthakis, 1995).

In this study, we extend the works of the fourth category by explicitly testing for independently and identically distributed (IID) in the empirical residuals. We first utilize a standard method to test for daily seasonality in stock market returns by estimating the following regression (the basic model):

$$R_t = \beta_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + U_t \tag{1}$$

where R_t is the rate of return on day t , $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are parameters, $D_2, D_3, D_4,$ and D_5 are binary dummy variables for Sunday, Monday, Tuesday, and Wednesday (i.e. $D_2 = 1$ if t is Sunday, 0 otherwise) and U_t is a stochastic error term. To be able to confirm the existence of the day-of-the-week effect, at least two coefficients must be statistically significant and unequal. Standard t and F statistics are used to test these hypotheses. Obviously, the values of these test statistics are insignificant if the conventional assumptions about OLS error terms are violated. Daily stock returns are likely to violate these assumptions (Chang, 1993).

The estimate of β_1 is the sample mean return for Saturdays, while the estimates of the remaining coefficients are equal to the difference between the sample mean of the corresponding day and the sample mean for Saturday. Under the null hypothesis of no the-day-of-the-week effect, $\beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ and residual should be IID random variables. This approach is equivalent to regressing the returns on five daily dummies, with no constant term, and testing for the equality of all parameters. We will examine the IID assumption through the application of the Brock, Dechert and Scheinkman (BDS) test proposed by Brock (1987).

BDS statistics gives a statistical test of IID within a time series, and is based upon the correlation dimension (Grassberger and Procaccia, 1983). Brock (1987) shows that for a time series which is IID, the BDS statistic is asymptotically $N(0, 1)$. Let

$$W_m(\epsilon) = \sqrt{n} [C_m(\epsilon) - C_1^m(\epsilon)] / \sigma_m(\epsilon) \tag{2}$$

where $C_m(\epsilon)$ represents the fraction of all m -tuples in the series which are “close” to (within ϵ of) each other and $\sigma_m(\epsilon)$ is an estimate of the standard deviation. $W_m(\epsilon)$ is the BDS statistic and provides a formal test of the IID assumption.

If the null hypothesis of IID can be rejected at this stage, then the implication is that the residuals contain some hidden, possibly non-linear, structure. We will illustrate that this is indeed the case, and it is due to the time varying volatility of stock returns data. To check this possibility, we will employ a GARCH model (Bollerslev, 1987) to the returns series. The model to be employed is of the form:

$$R_t = \beta_1 + \sum_{i=2}^5 \beta_i D_i + \sum_{i=6}^k \beta_i R_{t-i+5} + \sum_{i=6}^k \sum_{j=2}^5 \gamma_{ij} D_j R_{t-i+5} + \beta_q R_{t-1}^2 + U_t \tag{3}$$

$$U_t / \Omega_{t-1} \sim N(0, \sigma_t^2) \tag{4}$$

$$\sigma_t^2 = \alpha_1 + \alpha_2 u_{t-1}^2 + \alpha_3 \sigma_{t-1}^2 \tag{5}$$

We then carry out the BDS tests on the normalized residuals from the GARCH model to check for any remaining unexplained structure.

We further carry our analysis by checking for the existence of relationships between groups of parameters of the GARCH model. For that purpose, Wald tests of coefficient restrictions are employed. The existence of a relationship between the parameters of two variables makes it possible to express one variable in terms of the other, thus simplifying the model and increasing the degree of freedom.

In the final step, the GARCH model is re-estimated with the accepted coefficient restrictions being imposed. Once again, we subject the normalized residuals from the restricted GARCH model to the BDS testing. If these residuals turn out to be IID, then this final model is used to derive separate equations for each day of the trading week. If the specifications of these equations are not identical, it follows that the five daily returns are drawn from different distributions, and hence a day-of-the-week effect does indeed exist.

Empirical Results

Equation 6 shows the results of estimating the basic model.

$$R_t = 0.003265 - 0.003167\beta_2 - 0.003021\beta_3 - 0.002556\beta_4 - 0.2602\beta_5 + U_t \quad (6)$$

(5.98) (-3.89) (-3.97) (-3.37) (-3.91)

(R² = 0.091)

As it is clearly seen from the results, all t-statistics of the estimated parameters are greater than the critical value at the 5% significance level. This confirms that all of the differences between the mean returns of Saturday and each other trading day are significantly different from zero. Therefore, the results are supportive of the day-of-the-week effect.

Table (1) reports the results of applying the BDS test to the residuals of the basic model. The calculated test statistics are quite high, indicating that the null hypothesis of the IID is rejected at the 5% level. This finding suggests that variations in daily returns cannot be explained by the basic linear model.

Table 1. BDS tests on the basic model residuals

ϵ	m = 4	m = 5	m = 6	m = 7	m = 8
0.042	7.876	8.879	10.002	11.378	14.056
0.084	8.148	9.067	10.117	11.109	12.067
0.168	9.657	10.112	10.302	10.598	10.675

The results of the BDS test suggest that we should fit a GARCH model. Table (2) reports the final results of estimating a GARCH model using general to specific modeling. The results show that the GARCH model provides a better explanation than the basic model.

The results of performing the BDS tests on the standard residuals of the GARCH model are given in Table (3). It is absolutely clear that these residuals are indeed IID.

Table 2. Maximum Likelihood Estimates of the GARCH (1,1) model

$$R_t = \beta_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \beta_6 R_{t-2} + \beta_7 D_3 R_{t-1} + \beta_8 D_4 R_{t-1} + \beta_9 D_2 R_{t-2} + \beta_{10} D_3 R_{t-2} + \beta_{11} D_4 R_{t-2} + \beta_{12} D_5 R_{t-2} + \beta_{13} R_{t-1}^2 + U_t$$

$$\sigma_t^2 = \alpha_2 u_{t-1}^2 + \alpha_3 \sigma_{t-1}^2$$

β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9
0.0021	-0.0026	-0.0020	-0.0020	-0.0022	0.2963	0.3623	0.2940	-0.4298
(5.60)	(-5.19)	(-3.78)	(-4.09)	(-3.87)	(4.37)	(4.89)	(3.88)	(-4.70)

β_{10}	β_{11}	β_{12}	β_{13}	α_2	α_3	R^2
-0.3427	-0.4487	-0.2401	7.5127	0.1664	0.7589	0.075
(-3.37)	(-4.50)	(-2.39)	(2.29)	(6.41)	(22.08)	

Table 3. BDS tests on the GARCH (1,1) model residuals

ϵ	m = 4	m = 5	m = 6	m = 7	m = 8
0.059	-1.031	-0.809	-0.468	-0.478	-1.029
0.119	-1.288	-1.175	-0.967	-0.940	-1.009
0.229	-0.335	-0.267	-0.196	-0.249	-0.359

Table (4) reports the results of applying various Wald tests of restrictions on the parameters of the GARCH model. These results suggest that variable terms in the original GARCH model should be replaced by a new set of dummy variables, namely D1, D34, and D24, such that, D1 = 1 if day t is a Saturday and 0 otherwise, D34 = 1 if day t is a Monday or Tuesday and 0 otherwise, and D24 = 1 if day t is a Sunday or a Tuesday and 0 otherwise.

Table (5) shows the estimates of the GARCH model with new dummy variables. The change in the model specification slightly increases the explanatory power of the model. The final model explains about 8% of the variation in daily returns.

The BDS test statistics were calculated for the residuals of this final model and the results are reported in Table (6). Again, the null hypothesis of IID cannot be rejected. This result indicates that the final GARCH model can adequately describe the daily return process of the TADAWUL stock price index.

Table 4. Wald tests for coefficient restrictions

Null Hypothesis	χ^2	P
$\beta_1 + \beta_2 = 0$	2.255	0.133
$\beta_1 + \beta_3 = 0$	0.067	0.802
$\beta_1 + \beta_4 = 0$	0.038	0.853

$\beta_1 + \beta_5 = 0$	0.034	0.867
$\beta_6 + \beta_9 = 0$	4.128	0.042*
$\beta_6 + \beta_{10} = 0$	0.339	0.0576
$\beta_6 + \beta_{11} = 0$	4.597	0.031*
$\beta_6 + \beta_{12} = 0$	0.588	0.0436
$\beta_1 = \beta_2$	0.043	0.0834

* Significant at the 5% level

Table 5. Maximum Likelihood Estimation of the GARCH (1,1) model (the coefficient restriction imposed)

$$R_t = \beta_1 D_1 + \beta_2 D_{34} R_{t-1} + \beta_3 D_1 R_{t-2} + \beta_4 D_{24} R_{t-1} + \beta_5 R_{t-1}^2 + U_t$$

$$\sigma_t^2 = \alpha_2 u_{t-1}^2 + \alpha_3 \sigma_{t-1}^2$$

β_1	β_2	β_3	β_4	β_5	α_2	α_3	R^2
0.003	0.335	0.299	-0.157	6.838	0.166	0.753	0.078
(5.70)	(6.68)	(4.38)	(-3.19)	(2.37)	(6.37)	(22.13)	

Table 6. BDS tests on the restricted GARCH (1,1) model residual

ϵ	m = 4	m = 5	m = 6	m = 7	m = 8
0.059	-0.840	-0.728	-0.338	-0.598	-0.187
0.118	-1.178	-1.137	-0.967	-1.079	-1.248
0.231	-0.177	-0.132	-0.082	-0.148	-0.267

In Table (5), the GARCH coefficient α_3 is highly significant. This implies that a significant part of the current volatility of TADAWUL stock index returns can be explained by past volatility, and that the past volatility tends to persist over time. The parameter estimates of the final GARCH model can be used to construct the equations from 7 to 11 for five days of the trading week.

Saturday
$$\bar{R}_t = 0.002 + 0.297 \bar{R}_{t-2} + 6.923 \bar{R}_{t-1}^2 \tag{7}$$

Sunday
$$\bar{R}_t = -0.153 \bar{R}_{t-2} + 6.923 \bar{R}_{t-1}^2 \tag{8}$$

Monday
$$\bar{R}_t = 0.335 \bar{R}_{t-1} + 6.923 \bar{R}_{t-1}^2 \tag{9}$$

Tuesday
$$\bar{R}_t = 0.335 \bar{R}_{t-1} - 0.153 \bar{R}_{t-2} + 6.923 \bar{R}_{t-1}^2 \tag{10}$$

Wednesday
$$\bar{R}_t = 6.923 \bar{R}_{t-1}^2 \tag{11}$$

The five returns equations clearly reveal that the mean daily returns are significantly different from each other. Consequently, based on the results of Table (5), we can confirm the presence of day-of-the-week effect on daily stock returns in the Saudi Stock Exchange.

Conclusion

The presence of the day of the week effect in stock market returns has been one of the hotly debated issues in the finance literature. Settlement procedures, bid-ask spread biases, dividend patterns, negative information release, thin trading, measurement errors, specialists' behavior, and the concentration of certain investment decisions have been considered as main factors behind the day of the week effect phenomenon in the empirical studies.

In this study, covering the daily stock return data from January 2001 to December 2009 and employing a non-linear GARCH model, we intended to test the presence of the day-of-the-week effect in the Saudi Stock Exchange (TADAWUL), which is a recently modernized stock market and offers a unique opportunity to test for seasonal anomalies. It should be noted that trading takes place from Saturday to Wednesday in TADAWUL as opposed to the more traditional Monday through Friday trading.

The empirical results of the study confirm that all of the differences between the mean returns of Saturday and each other trading day are significantly different from zero, which are supportive of the day-of-the-week effect (Equation 6). Furthermore, the findings (Equations 7-11) reveal that the returns on the five trading days follow different processes, which obviously confirms the presence of day-of-the-week effect in daily stock returns in TADAWUL. This implies that there is room for investors to adjust their portfolios by taking into account day of the week variations in volatility in the Saudi Stock Exchange.

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