

Days-of- Week Effect on Tehran Stock Exchange Returns: An Empirical Analysis

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Abstract

The purpose of this study is to concentrate on the investigation of days-of-week effect on Tehran Stock Exchange and its comparison with other emerging markets. Using Classical Linear Regression (CLR) as well as Autoregressive Conditional Heteroskedasticity (ARCH) models it is indicated that there is significantly positive total return on Saturdays and significantly negative total return on Sundays. There is no significant return on the other days of the week. So, one may suggest that it would be reasonable to sell on Saturday and buy it on Sunday. Comparing this result with that of other emerging stock markets, it can be concluded that days-of-week effect on returns of Tehran Stock Exchange is different from other emerging markets.

Keywords: days-of-week effect, Classical linear regression, Autoregressive Conditional Heteroskedasticity model, Tehran Stock Exchange.

I- Introduction

The Days of week effect is a phenomenon that derived from the efficient capital markets theory. According to this phenomenon, the average daily return of the market is not the same for all days of week, as we would expect on the

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the efficient market theory. Empirical studies have showed that days of week effect appears not only in developed markets like the United States, England, France, Canada, Australia, Japan, but also in the emerging markets (Malaysia, Hong Kong). The researchers have shown that for most of the western economies (U.S.A., England, and Canada) the market has statistically significant negative returns on Mondays, while statistically significant positive returns on Fridays. The highest negative returns appear on Tuesdays in markets such as Japan, France, Australia, and Singapore.

The most satisfactory explanation that has been given for the negative returns on Mondays is that usually the most unfavorable news appears during the weekends. These unfavorable news influence the majority of the investors negatively, causing them to sell on the coming Monday. The sale of stocks increases the supply having as a consequence the negative returns of the shares on that specific day. In addition, many analysts believe that the investors' psychology can play an important role in causing this anomaly. Monday is regarded by most investors as the worst days of week, because it is the first working days of week. In addition they regard Friday as the best day, because it is the last working day of the week. In fact, they feel pessimistically on Mondays and optimistically on Fridays, they proceed on sales and purchases, respectively. Consequently, the prices fall on Monday, due to the increasing supply and rising on Friday, because of increasing demand.

The most satisfactory explanation that has been given for Tuesday's negative returns is that the bad news of the weekend affecting the USA's market, influence negatively some markets lagged one day. However, the investors can take advantage of this phenomenon and adjust their buying and selling strategies according to increase their returns due to better timing (e.g. Buy on Mondays and sell on Fridays).

It should be noted that the above explanations are not fully adequate to explain the phenomenon of days of week anomaly. Based on the literature, no explanations were fully adequate. This is what makes this market anomaly object for more research. Therefore; the purpose of this study is to investigate whether days-of- week effect anomaly, which has been observed in many other stock exchange markets, appears in Tehran Stock Exchange or not.

2- Literature Review

Osborne (1962) was the first one who saw market anomalies. He observed that there is strong evidence that stock prices fall on Mondays, and rise on other days. He relates this regularity mainly with the activities of individual investors, arguing that individual investors are more active on Mondays as they have more time to concentrate on personal financial analysis and planning during the weekend. On the other hand, institutional investors are less active on Mondays, since they usually deal with strategic analysis and planning issues.

Fama (1965) states that Monday's variance is about 20% higher than other weekday returns without making a comparison among weekdays.

Most researchers in the United States, the United Kingdom and Canada such as Cross (1973), Gibbons & Hess (1981), Keim & Stambaugh (1984), Theobald and Price (1984), Jaffe & Westerfield (1985), Harris (1986), Smirlock & Starks (1986), Board and Sutcliffe (1988), Kohers and Kohers (1995), Tang and Kwok (1997) for six indices [Dow Jones Industrial Average Index (US), Financial Times Index (UK), Nikkei Average Index (Japan), Hang Seng Index (Hong Kong), FAZ General Index (Germany) and All Ordinary Index (Australia)] and many others have come to the conclusion that Mondays' average returns are negative and Fridays' are positive. In other words, the stock exchange market starts downwards and ends upwards. However, some others like Condoyanni, O'Hanlon & Ward (1987), Chamberlain (1988), Solnik & Bousquet (1990) in the French stock market; Athanassakos & Robinson (1994) in the Canadian market, Jaffe & Westerfield (1985) in the stock markets of Australia and Japan, Kim (1988) in the stock markets of Japan and Korea, Aggarwal & Rivoli (1989) in the stock markets of Hong Kong, Singapore, Malaysia and Philippines, Ho (1990) in the stock markets of Australia, Hong Kong, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan and Thailand, Wong, Hui and Chan (1992) in the markets of Singapore, Malaysia, Hong Kong and Thailand, Dubois & Louvet (1996) in the stock markets of Japan & Australia, Agrawal and Tandon (1994) for eighteen countries and many others, the negative average returns are observed on Tuesdays. Also, for the Istanbul stock exchange there were negative average returns on Tuesdays [Aydoan (1994), Balaban (1995), Bildik (1997) and Ozmen (1997)].

Therefore, the most significant days of the week effect in the various stock markets of the world has been Mondays, Tuesdays, and Fridays. On the other hand, studies on the Spanish stock market have revealed that either there is no days of the week effect, [Santemases (1986), Pena (1995) and Gardeazabal and Regulez (2002)], or that on Mondays, the average returns are positive [Abascal (1993)]. Regarding the Greek stock market for the existence of days-of-week effect the results depend on the time period of researches: During the period 1985-1994, there were negative average returns on Tuesdays and positive during all the other days, with the highest being on Fridays, [Alexakis and Xanthakis (1995)]. During the period 1989-1995, there were negative average returns on Tuesdays and on Wednesdays, [Nikou (1997)]. During the period 1994-1999, there were negative returns on Thursdays, while on Mondays, Wednesdays and Fridays there were significant positive returns, [Lyroudi, Subeniotis and Komisopoulos (2002)].

Lyroudi, Dasilas, Patev & Kanaryan (2004) examines the presence of days-of-week effect anomaly in the Central and Eastern European stock markets. They consider the Romanian, Hungarian, Latvian, Czech, Russian, Slovakian, Slovenian and Polish stock markets during the period 22nd of September 1997 to 29th of March 2002. The results indicated that the Czech and Romanian markets have significant negative returns on Monday, while the Slovenian market has significant positive returns on Wednesday and has non-significant negative returns on Fridays. The Polish and Slovakian markets have no days-of-week effect anomaly. They applied the GARCH –M (1, 1) model to test whether days-of-week effect is influenced by the stock market risk.

Al-Rjoub (2004) examines the robustness of evidence on the weekend anomaly in stock return after accounting for the impact of possible measurement errors and sample sizes. He declared that Start-of-the-week day's returns are negatively insignificant across during different periods. The Average returns for the day, right after the beginning of the working week, are negatively significant. After controlling for the change of the working week to start on Sunday's results show that Thursday return (end of the week) tend to be positive and the highest, while Monday return is a "downer" (negative and the worst). The result is consistent with previous results documented in the literature. Possible explanations for the high significant positive return on Thursday is the possible settlement practices, which imply unusually high closing on Thursdays and

consequently lower closing on Mondays. He argues that Professional market watchers who are aware of the daily return pattern should adjust the timing of their buying and selling to take advantage of the effect. The new logical implication is “Don’t Sell Stocks on the Second Days of the Week”.

3- Data Description and Methodology

In order to investigate days-of-week effect, daily observations of Tehran Stock Price Index during March 1998-March 2005 (Farvardin 1377-Esfand 1383) are employed. Stock price Index is a weighted index using closing prices, published by Tehran Stock Exchange (TEPIX). Unconditional logarithmic returns, including 1696 observations are computed as follows:

$$R_t = \ln(I_t / I_{t-1}) \quad (1)$$

Where I_t , R_t and I_{t-1} refer to stock price index, return on stock price index on day t and stock price index on day $t-1$, respectively. Returns for each days of the week are separately calculated for each year as well as for the whole period¹. As it is shown in table (2), average daily returns have been positive in every years concerned, except during March 1998-March 1999. In general, the average daily returns during March 1998- March 2005 were about 0.05 percent; minimum return -1.86 percent and maximum return 2.21 percent.

In this paper, days-of-week effects are estimated using Classical Linear Regression (CLR) as well as Autoregressive Conditional Heteroskedasticity (ARCH) and GARCH models. The hypotheses to be tested are:

$$\begin{cases} H_0 : \beta_i = 0 & , i = 1, 2, 3, 4, 5 \\ H_1 : \beta_i \neq 0 & , i = 1, 2, 3, 4, 5 \end{cases}$$

1 - The above formula can be written as $R_t = \ln\left(\frac{I_t + D_t}{I_{t-1}}\right)$, where D_t is dividend. But, according to Fische, Gosnel & Lasser (1993), D_t doesn't have any significant effect on the daily anomaly.

Table 1: Literature Survey of days-of-the-week effect on returns of different stock markets

No	Researcher(s)	Year of the research	Markets	Period of research	Results
1	Osborne,Cross,Harris,Gibbons & Hess , Kiem& Stambaugh , Theobald & price , Jaffe & Westerfield ,Smirlock & Starks , Board & Sutcliffe,Kohers & Kohers , Tang & Kwok , Fische,Gosnel & Lasser	1962 , 1973,1986,1981, 1984,1985,1986,1988, 1995,1997,1993	USA (except Tang & Kwok: USA, England , Hong Kong , Japan , Germany & Australia)	1960-62 , 1953-70 , 1980-86 , 1962-78 , 1928-82 , 1972-82 , 1980-85 , 1974-86 , 1980-88 , 1986-95 , 1988-96, 1988-93	Significant positive and negative returns found on Fridays and Mondays respectively.
2	Condoyanni-O'Hanlon & Ward , Chamberlain, Solnik & Bosquet , Athanasakos & Robinson , Jaffe & Westerfield , Kim , Aggrawal & Rivoli , Ho ,Wong-Hui & Chan, Dubois & Louvet , Aggrawal&Tandon, Aidooan , Balaban , Bildik , Ozmen , Alexakis & Xanthakis	1987 ,1988, 1990 , 1994 , 1985 ,1988 , 1989 ,1990,1992 , 1996 ,1994 ,1994 , 1995 ,1997 ,1997, 1995	USA, USA, France, Canada, Australia & Japan, Japan & Korea ,East Asia, Pacific countries, Japan & Australia, 18 countries, Turkey, Turkey , Turkey, Turkey, Greece	1980-87 , 1978-88 , 1978-87 , 1981-95 , 1980-85 , 1980-88 , 1982-89 , 1980-90 , 1975-84 , 1985-96 , 1985-94 , 1990-94 , 1988-94 , 1990-97 , 1988-92, 1988-94	Significant positive and negative returns found on Fridays and Tuesdays respectively.
3	Santemases , Pena , Gardeazabal & Regulez	1986, 1995 , 2002	Spain	1977-85 , 1970-95 , 1970-95	No significant daily effect was found.
4	Abascal	1993	Spain	1975-93	Significant & positive Monday returns
5	Nikou	1997	Greece	1989-95	Daily effect is time dependent
6	Lyroudi , Dasilas, Patev & Kanaryan	2004	Eastern Europe	1997-2002	Different countries have different daily effect results.
7	Samer Al-Rjoub	2004	Jordan	1992-2002	It's better not to Sell Stocks on the Second Days of the Week.
8	Holden , Thompson & Ruangrit	2005	Thailand	1995-2000	the inclusion of calendar effects improves the forecast accuracy

Where β_1 denotes the first working days of week, β_2 to β_5 are the mean returns for Sunday through Wednesday, respectively. The following Classical Linear Regression (CLR) for the whole period is run to test whether there is any statistically significant different among index return on different days of the week. Testing methodology of days-of-week effect is to estimate the following standard model¹:

$$R_t = \beta_1 + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + \beta_5 D_{5t} + u_t \quad (2)$$

Where D_i 's are binary dummy variables of Sunday through Wednesday. The stochastic disturbance term is indicated by u_t . The same regression is repeated for each individual year and for two sub-periods (March 1998-March 2001 and April 2001-March 2005) to detect whether days of the week effect, if any, is stable through different periods. The same hypotheses were tested using Autoregressive Conditional Heteroskedasticity (ARCH) model in order to recheck the stability of CLR results. ARCH model to be tested is as follows²:

$$R_t = \beta_1 + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + \beta_5 D_{5t} + \sum_{i=1}^n \beta_i R_{t-i} + u_t \quad (3)$$

$$h_t^2 [\varepsilon_t \sim (0, h_t^2)] \quad , \quad h_t = V_c + \sum_{j=1}^q V_j \varepsilon_{t-j}^2$$

Where D_{2t}, \dots, D_{5t} are dummy variables of Sunday through Wednesday. $D_{2t} = 1$ if day t is a Sunday and 0 otherwise; $D_{3t} = 1$ if t is a Monday and 0 otherwise; and so on. The coefficient β_1 denotes the first working days of the week in Iran.

4- Empirical Findings

4-1- Days-of-Week Effect on TSE Using CLR

Using CLR model, the results are shown in table (3). As seen in table (3), there has been no significant days-of-week effect during March 1998- March 1999.

In April 1999-March 2000, we have only seen positively significant daily returns on Saturdays.

1- Balaban, Ercan, (1995).

2 - Engle, (1982).

Table 2: Statistical results of daily returns of Tehran Stock Exchange during the examined period

Periods	Data	Number of Observations	Average daily returns	Standard deviation of daily returns	Coefficient of variations	Maximum of returns	Minimum of returns
March 1998- March 1999		244	-0.000129504	0.0010627	-8.2058965	0	-0.0056316
April 1999 – March 2000		242	0.0006485	0.0009093	1.4021526	0.0043053	-0.0058329
April 2000 – March 2001		241	0.000540901	0.0011682	2.1597924	0.0051145	-0.0039286
April 2001 – March 2002		244	0.000414275	0.0015077	3.6392871	0.0052228	-0.0060828
April 2002 – March 2003		243	0.00053227	0.0016231	3.0494424	0.0068507	-0.0069787
April 2003 – March 2004		240	0.0014655	0.00383537	2.6170259	0.0221159	-0.0185581
April 2004 – March 2005		242	0.000112123	0.002029274	18.09858038	0.006843426	-0.007466631
March 1998 – March 2001		727	0.0003517	0.001105746	0.4974766	0.0051145	-0.0058329
April 2001 – March 2005		969	0.000628782	0.002478039	3.941015915	0.022115942	-0.01855814
March 1998 – March 2005		1696	0.000510011	0.0020123	3.9456199	0.0221159	-0.0185581

* March 1998 equals Farvardin 1377.

Table 3: Coefficients of CLR Regression in Different Sub Periods

DAILY EFFECTS YEARS	β_1	β_2	β_3	β_4	β_5	AR(1)*	AR(2)**	P VALUE FOR "F"	R ²
March1998-March1999	-0.000241 (-0.674878) [0.5004]	-0.000328 (-0.818493) [0.4139]	-7.01E-06 (-0.015356) [0.9878]	-7.70E-05 (-0.168166) [0.8666]	0.000147 (0.362213) [0.7175]	0.345237 (5.642578) [0.0000]	-----	0.000007	0.123882
April1999-March2000	0.001309 (4.118761) [0.0001]	0.000321 (0.855991) [0.3929]	0.000640 (1.803811) [0.0725]	4.02E-05 (-0.113533) [0.9097]	2.59E-05 (0.069493) [0.9447]	0.138801 (2.205922) [0.0284]	0.269951 (4.290032) [0.0000]	0.000033	0.120373
April2000-March2001	0.001620 (3.971543) [0.0001]	8.38E-05 (0.167946) [0.8668]	-0.000692 (-1.445476) [0.1497]	-0.000175 (-0.358833) [0.7200]	-0.001141 (-2.252926) [0.0252]	0.139896 (2.179075) [0.0303]	0.191084 (2.962034) [0.0034]	0.001061	0.090233
April2001-March2002	0.001515 (2.991294) [0.0031]	-0.000645 (-1.308183) [0.1921]	-0.000655 (-1.133811) [0.2580]	-0.001137 (-1.998271) [0.0468]	-0.000327 (-0.668237) [0.5046]	0.489541 (8.638359) [0.0000]	-----	0.000000	0.249170
April2002-March2003	0.001891 (3.413652) [0.0008]	-0.001178 (-2.241988) [0.0259]	-0.000631 (-1.005454) [0.3157]	-0.000995 (-1.583091) [0.1147]	-0.000388 (-0.722593) [0.4706]	0.492448 (8.603607) [0.0000]	-----	0.000000	0.247219
April2003-March2004	0.003605 (2.691656) [0.0076]	-0.003125 (-2.147249) [0.0328]	1.55E-05 (0.010793) [0.9914]	0.000749 (0.519068) [0.6042]	0.001431 (0.951635) [0.3423]	0.241083 (3.760300) [0.0002]	0.218305 (3.400173) [0.0008]	0.000000	0.160121
April2004-March2005	0.000548 (0.801255) [0.4238]	-0.000848 (-1.317241) [0.1890]	-0.001380 (-1.840285) [0.0670]	7.16E-06 (0.009675) [0.9923]	0.000569 (0.868802) [0.3858]	0.509336 (0.868802) [0.0000]	-----	0.000000	0.284288

1- * and **: we use ILS instead of OLS in order to remove the auto correlation problem.

2- Number in parenthesis denotes t-statistics and number in brackets denotes probability of the test.

In April 2000-March 2001, Saturday average returns were positively significant, while Wednesday average returns were negatively significant. Other working days did not show any significant days-of-week effect. This is absolutely different from the results of developed stock markets.

In April 2001-March 2002, Saturday average returns were positively significant and Tuesday average returns were negatively significant.

In April 2002-March 2003, positive and negative significant average returns were seen on Saturdays and Sundays, respectively.

The results of April 2003-March 2004 period were exactly the same as April 2002-March 2003 and the results of April 2004-March 2005 were the same as March 1998-March 1999.

According to the results, all Saturdays have significant positive returns, but significant negative returns were not the same. For further research, different periods are tested in order to check the stability of daily effect in Tehran stock exchange. In general, table (3) shows that there is no daily effects in March 1998-March 1999; and Saturday positive effects in April 1999-March 2000, April 2000-March 2001, April 2001-March 2002, April 2002-March 2003, April 2003-March 2004 and April 2004-March 2005.

The results of different periods are shown in table (4). As the table is shown, there weren't any significant days-of-week effect in the period March 1999-March 2001. These results are thoroughly compatible with the results of foregoing periods.

In the period April 2002-March 2005, Saturday average returns were positively significant and Sunday returns were negatively significant. These results are approximately consistent with each of these years.

In general, there are positively significant returns on Saturdays and negatively significant returns on Sundays, but there are no significant positive or negative returns on other days of week. So, one may suggest that it would be reasonable to sell on Saturday and buy it on Sunday. Moreover, it can be concluded that daily effects exist on returns of Tehran stock exchange, but it is different from other emerging markets.

4-2- Days-of-Week effect in TSE using ARCH and GARCH

In order to use ARCH and GARCH model, White Heteroskedasticity test should be done. The results of this test show Heteroskedasticity only in April 2000- March 2001

Table 4: Coefficients of CLR Regression in Different Periods

DAILY EFFECTS PERIODS	β_1	β_2	β_3	β_4	β_5	AR(1)*	AR(2)**	P VALUE FOR "F"	R^2
March1998-March2001	0.000886 (3.928248) [0.0001]	9.38E-05 (0.382112) [0.7025]	5.71E-07 (0.002382) [0.9981]	-6.46E-05 (-0.267229) [0.7894]	-0.000288 (-1.166303) [0.2439]	0.233364 (6.487668) [0.0000]	0.229204 (6.0364995) [0.0000]	0.000000	0.144033
April2002-March2005	0.001874 (4.303310) [0.0000]	-0.001457 (-3.325666) [0.0009]	-0.000663 (-1.453312) [0.1465]	-0.000308 (-0.678096) [0.4979]	0.000326 (0.733278) [0.4636]	0.331565 (10.43217) [0.0000]	0.170333 (5.359533) [0.0000]	0.000000	0.191723
March1998-March2005	0.001467 (5.457437) [0.0000]	-0.000807 (-2.946147) [0.0033]	-0.000387 (-1.369587) [0.1710]	-0.000221 (-0.783848) [0.4332]	3.33E-05 (0.120243) [0.9043]	0.318361 (13.29810) [0.0000]	0.176440 (7.370070) [0.0000]	0.000000	0.179329

1- * and **: we use ILS instead of OLS in order to remove the auto correlation problem.

2- Number in parenthesis denotes t-statistics and number in brackets denotes probability of the test.

Table (5): Coefficients of GARCH Model in Different Sub Periods

DAILY EFFECTS YEAR	β_1	β_2	β_3	β_4	β_5	AR(1)*	AR(2)**	P VALUE FOR "F"	R ²
April2000-March2001	0.001216 (2.665312) [0.0077]	0.000350 (0.790273) [0.4294]	-0.000237 (-0.578180) [0.5631]	7.32E-05 (0.136523) [0.8914]	-0.000844 (-1.767269) [0.0772]	0.219217 (2.786355) [0.0053]	0.216826 (3.165437) [0.0015]	0.024983	0.077937

1- * and **: we use AR (1) and AR (2) in order to remove the auto correlation problem.

2- Number in parenthesis denotes t-statistics and number in brackets denotes probability of the test.

(0.04 probability). Therefore the only period that we can test ARCH and GARCH in order to remove Heteroskedasticity is April 2000-March 2001. For other periods CLR results have been used. GARCH results for April 2000-March 2001 are shown in table (5).

The results of this period indicated that Sundays have significant positive returns and other days of week don't show any significant daily effect.

5- Conclusions

This paper examines days-of-week effect concerning Tehran Stock Exchange, during the period 27 March 1998 and 17 March 2005. In order to investigate the effect, CLR, ARCH and GARCH models have been used. After using White test, Heteroskedasticity was seen only in April 2000-March 2001 period. Therefore, we use GARCH test for this period in order to remove Heteroskedasticity. For other periods, CLR model was used. The results are consistent and sensitive to the period under investigation. In general, concerning March 1998-March 2005, significant positive return on Saturdays and significant negative returns on Sundays have been observed. It seems the main explanation that has been given to Tehran stock exchange for these results is that, short term perspective is dominating TSE or the main stockholders try to hold the majority part of their assets in order to speculate them. Therefore the beginning working days of week will have a positive return. But due to lack of motivation to hold the stocks, the market trend tends to be downward and total returns will gradually decrease day by day. Hence, one may suggest that it would be reasonable to sell on Saturday and buy it on Sunday.

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