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The Disappearing Day-of-the-Week Effect in Australia and New Zealand Stock Markets: Evidence from TAR-GARCH Model

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Abstract

This study examined the existence of the daily pattern of calendar anomalies and asymmetrical behavior in Australia and New Zealand stock markets over the period 2002 to 2014. This study found disappearing of day-of-the-week effect in the return of both Australia and New Zealand stock markets. By using the TAR-GARCH model, this study uncovered that there appear asymmetrical market reaction on the positive and negative news in both of the stock markets. It is believed that the consistent of these findings have useful implications for trading strategies and investment decisions. Thus, investors should use the information to avoid and reduce the risk when investing in these markets.

Keywords: asymmetrical effect; day-of-the-week effect; TAR-GARCH model

1 Introduction

The presence of seasonality effect in stock returns has attracted the attention of researchers to challenge the appropriateness of the theory of weak-form market efficiency since the last century. If seasonality effects in organized stock markets exist, market inefficiency is present and investors should be able to earn abnormal rates of return by market timing strategies[1]. As a result, these studies have shown that the average return on Monday is significantly less than the average returns of other days or namely, Monday effect. See, Cross (1973), French (1980), Gibbons and Hess (1981) and Lakonishok and Levi (1982) who are the pioneer researchers detected empirical evidence of abnormal yield distribution in U.S. stock market.

In particular, Jaffe and Westerfield (1985) obtained evidence of the weekend effect for the markets in Canada, Australia, Japan and the United Kingdom. This study found that these markets exhibit statistically negative average Monday returns and high average Friday returns. This is consistent with the results obtained by Keim and Stambaugh (1984). Besides, Wong and Ho (1986) investigated the day-of-the-week effect on the Singapore stock market by using the SES All-Share index and the six

[1]See, Jarrett and Kyper (2005) and Yakob et al. (2005) for details. On the other hand, Chan et al. (1996) provide evidence that investors can obtain positive returns even after accounting for transaction costs.

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sector indices, and found a strong negative Monday return and a high positive Friday return. A few groups of researchers such as Lakonishok and Smidt (1988), Connolly (1989) and Lakonishok and Maberly (1990) also documented that there are significant negative Monday returns in U.S. stock market. Consistent with previous studies in developed countries, Ho and Kok (1995), Arsad and Coutts (1996), Hui (2005) and Apolonario et al. (2006) reported a negative mean return on Monday for the case of developed countries and less developed countries. Furthermore, Gupta (2006) and Ramesh et al. (2008) further documented evidence in support of the significant high returns on Fridays and the lowest for Mondays in Indian stock market.

On the other hand, there is some contrasting evidence that showed no significant negative Monday returns in various stock markets. For example, a negative Tuesday effect has been found in France (Solnik and Bousquet, 1990), Belgium, the Nethrlands and Sweden (Agrawal and Tandon, 1994), Spain (Pena, 1995), and Greece (Alexakis and Xanthakis, 1995). Besides, Lucey (2000) examined the day-of-the-week effect for Irish Stock Market over the period of 1973 to 1998 and found no negative Monday or Tuesday returns. In sharp contrast, persistent and positive Wednesday returns were reported instead. However, Brooks and Persand (2001) reported negative Tuesday returns in both Thailand and Malaysia stock markets for the sample period ranging from 1989 to 1996. Suppotive of Lucey (2000), Bayar and Kan (2002) also found higher returns on Wednesday in their studies using 19 countries stock markets during July 1993 to July 1998[2]. Recent international studies argue that this market anomaly seems to have disappeared in developed stock markets (Kohers et al., 2004; Hui, 2005).

To date, the day-of-the-week effect continues to be one of the most interesting studies all around the world. Negative average returns are observed on both Mondays and Tuesdays with the lowest return being observed on Tuesdays[3]. It is important to point out that, Davidson and Faff (1999) re-investigated the day-of-the-week effect in Australian market for the period January 1983 to December 1994 found day-of-the-week effect has disappeared in recent years. According to Kohers et al. (2004), Monday returns tend to be the lowest of any day of the week in Japan and Australia stock markets. However, this effect has disappeared in more recent years when the study examined the period from January 1991 to June 2002. In a study of the New Zealand market during 1992-97, Bartholdy (1997) showed that returns on Monday were on the average lower than on any other day of the week. Besides, Etebari and Lont (2001) also found Monday and Tuesday returns were generally small or negative, while returns on Thursdays and Fridays were positive. Furthermore, this study also observed the largest positive return on Wednesdays.

[2]The 19 countries stock markets including, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom and United States.

[3] See, Jaffe and Westerfield (1985), Condoyanni *et al*. (1987) Ball and Bowers (1988) and Easton and Faff (1994) for more details.

In reviewing the related literature, few observations are remarkable. First, it is noticed that the time series behavior of the stock market in terms of volatility has received substantially less attention as compared to mean returns (Lucey, 2000; Choudhry, 2000; Al-Loughani and Chappel, 2001; Kiymaz and Berument, 2003; Yakob et al., 2005). Nonetheless, according to Engle (1993), finding of certain patterns in volatility may be useful in several ways, including the use of predicted volatility patterns for hedging and speculative purposes and in valuation of certain assets specifically stock index option. For example, risk adverse investors may adjust their portfolio by reducing their investment in those assets whose volatility is expected to increase. Besides, it is important to know whether a high (low) return is associated with the corresponding high (low) return for a given day. This is because such knowledge may allow investors to adjust their investment portfolio by taking into account of the day-of-the-week variations in volatility.

Second, it has been argued with some evidence in the literature that investors may exhibit asymmetrical behavior when dealing with stock investment. For instance, Black (1976) observed that there is a tendency for the stock volatility to fall when there is good news and to rise when there is bad news in the stock market. Engle and Ng (1993) points out that the market reaction on bad and good news tends to be asymmetry in nature. Yet, another commonly observed asymmetric behavior is that the negative returns are followed by a higher volatility than the positive returns (Engle, 2001). Evidence of asymmetric behavior is also reported in Alexakis and Xanthakis (1995), and Apolonario et al., (2006).

Besides, Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models, which are useful to account for the time varying volatility of the stock returns in the calendar effect, are commonly adopted in studies. Nonetheless, GARCH models only take into account the magnitude of return. It has ignored important information on the direction of returns, which has been found to have substantial impact on stock return volatility as mentioned above. To rectify the problem, asymmetric GARCH models, Threshold Autoregressive GARCH (TAR-GARCH) model of Zakoian (1994) had been put forward. Nevertheless, although these methods are useful, only limited studies had employed the asymmetric GARCH models to examine the asymmetric behavior in the stock market returns. Few exceptional studies that come to our knowledge are Apolonario et al., (2006). Thus, more works are needed to study the day-of-the-week effect using asymmetric GARCH models for a better understanding of stock market behaviors.

Third, the presence of day-of-the-week effect in the stock markets can be a clear sign for the investors to design their international portfolios. Besides, if certain patterns in stock return volatility can be identified, then investors would make investments decisions based on both return and risk easier. Uncovering certain volatility patterns in returns might also benefit investors in valuation, portfolio optimization, option pricing and risk management. Furthermore, if both Australia and New Zealand stock markets (Figure 1) are found to exhibit the same characteristics or patterns, it might be helpful to remind the investors regarding the diversification issues[4]. As this nature of study have various important implications to stock market participants, thus, it is important to examine the existence of day-of-the-week effects in mean stock returns and their variances in Australia and New Zealand stock markets by employing the asymmetric TAR-GARCH model.

The paper is organized as the following order. The following section provides the data description and then a discussion of methodology used to carry out the empirical analysis. The results are analyzed subsequently and the final section provides a summary and concluding remarks.

2 Methodology

The following ordinary least squares (OLS) model with dummy variables, constancy of the residual variance, is preliminary used to test for the daily seasonality in stock market returns:

$$(1) \qquad R_t = \alpha_0 + \sum_{i=1}^{4} \alpha_i \delta_t + \sum_{i=1}^{k} \alpha_{4+i} R_{t-i} + \varepsilon_t$$

where $R_t = 100 \times (\ln I_t - \eta\ I_{t-1})$ denotes market return at day t. I_t and I_{t-1} are the market indices for days t and $t-1$, respectively[5]. $\delta_{1t}, \delta_{2t}, \delta_{3t}$ and δ_{4t} are dummy variables corresponding to Monday, Tuesday, Thursday and Friday. ε_t is the error term. It is worth noting that the residuals obtained from the regression model can be autocorrelated, thus creating errors in the inference. Therefore, this study introduces the returns with a day (R_{t-1}) delay into the regression model to solve the autocorrelated problem.

In Equation (1), α 's parameters of interest. α_0 measures the percentage of mean return for Wednesday; whereas $\alpha_1, \ldots, \alpha_4$ represent the difference of average return of the stock index for Monday, Tuesday, Thursday and Friday respectively as compared to the Monday's mean return. The model is to test if the returns are indifferent of the day-of-the-week. The null hypothesis of no day-of-the-week effect in this test (

[4] According to Dekker et al. (2001) and Fraser et al. (2008), Australia and New Zealand stock markets were closely linked in the periods of their studies. On the other hand, Lok and Kalev (2006) investigated the dual-listed stocks in both Australia and New Zealand markets. Their study showed arbitrage opportunities are not available in both markets.

[5] In the case of a day following a non-trading day (holiday), the return is calculated using the closing price indices of the latest trading day. Besides, Wednesday's dummy variable is excluded from the equation is to avoid the dummy variable trap (Kiymaz and Berument, 2003).

$H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$) is tested against the alternative hypothesis of the presence of day-of-the-week effect ($H_A : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$).

To take into account of volatility and asymmetry behavior of the stock market, the following TAR-GARCH model of autoregressive order p and moving average order q is estimated accordingly in this study:

(2) $$\sigma_t^2 = \beta_0 + \sum_{j=1}^{p} \gamma_j \sigma_{t-j}^2 + \sum_{i=1}^{q} \beta_i \xi_{t-i}^2 + \sum_{i=1}^{4} \alpha_i \delta_t + \phi \xi_{t-1}^2 N_{t-1}$$

where σ_t^2 is the conditional variance of the residuals obtained from Equation (1). N_t which takes on value 1 for negative R_t and 0 for positive R_t.

In this specification, ϕ is use to capture the asymmetrical effect of bad news (decrease in stock indices, hence negative R_t) and good news (increase stock indices, hence positive R_t). If $\phi \neq 0$ by the t test of significance, then it can be concluded that the impact of news is asymmetric. Moreover, positive value of ϕ indicates the existence of a leverage effect in that bad news increases volatility. Besides, good news has an impact of β_i, while bad news has an impact of ($\beta_i + \phi$). In other words, the asymmetric TAR-GARCH model is used to confirm the existence or absence of any asymmetric behavior, which is known as the leverage effect.

3 Data and Results

The data consist of the daily pries indexes of Australia Morgan Stanley Capital International (MSCI) Index and New Zealand MSCI Index from June, 2002 to May, 2014. All of the data are in US dollars so that international investment decisions are from the perspective of an international investor who willing to trade internationally (Basher and Sadorsky, 2006). Table 1 reported the mean, standard deviation, minimum and maximum of the returns for Australia MSCI Index and New Zealand MSCI Index. The highest mean returns are observed on Monday for Australia and Wednesday for New Zealand. On the other hand, the lowest returns are observed on Friday for both Australia and New Zealand. Besides, Figure 1 showed the performance for both indexes in this study.

Table 1 Descriptive statistics of the returns by days

	Australia MSCI Index				New Zealand MSCI Index			
	Mean	**Standard deviation**	**Minimum**	**Maximum**	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
Monday	0.0738	1.7069	-11.9578	8.8080	0.0436	1.3630	-10.0655	5.3097
Tuesday	0.0217	1.4996	-8.9361	7.4922	0.0328	1.3118	-5.3903	10.2022
Wednesday	0.0251	1.5861	-12.6464	8.0546	0.0467	1.4015	-7.7715	7.1218
Thursday	0.0551	1.6940	-10.2519	6.0504	0.0230	1.4258	-8.6088	6.6005
Friday	-0.0056	1.5955	-15.9749	7.7970	-0.0256	1.3772	-8.9671	4.9221

Table 2 reported the day-of-the-week effects and stock market volatilities for these two markets. The estimated coefficients of the Monday's to Friday's dummy variables for both Australia and New Zealand are reported positive and insignificant, respectively. Among the estimated coefficients, only Friday's dummy variables in New Zealand is negative and insignificant.

In Table 2, this study also reported the estimated results of the TAR-GARCH coefficients. b_0 is the estimated coefficient of the constant term for the conditional variance equation, while g_1 is the estimated coefficient of the lagged value of the squared residual term. b_1 represents the lagged value of the conditional variance. Both of these coefficients (g_1 and b_1) are statistically significant and positive for each market under consideration. The sum of the g_1 and b_1 coefficients is less than one implies that conditional variance are always positive and are not explosive in our sample. The results (variance equation) showed lowest significant volatility occurs on Fridays for Australia (-0.6915) and Mondays for New Zealand (-0.2558).

Furthermore, the leverage effect term, f , which is statistically positive for Australia (0.1148) and New Zealand (0.0469) stock markets, reflects the existence of a leverage effect in that bad news increase volatility of returns. The sum of f and b_1 for the Australia and New Zealand markets are respectively, 0.1333 and 0.061 and this finding is consistent with the conjecture that bad news give more impact to volatility of returns compared to good news. Therefore, asymmetrical reactions on positive and negative stock returns are uncovered for these markets. Besides, the Ljung-Box Q^2 statistics and ARCH-LM tests indicated that there is no autocorrelation and no ARCH effect for both of the indexes. Lastly, the null hypotheses for the Wald tests (Mean Equation and Variance Equation) are rejected in both Australia and New Zealand MSCI Indexes.

Table 2 Day-of-the-week effect on TAR-GARCH model

	Australia MSCI Index		New Zealand MSCI Index	
	Mean Equation			
	Coefficient	Prob.	Coefficient	Prob.
α_0	-0.0002	0.9975	0.0169	0.7237
α_1, Monday	0.0685	0.2927	0.0552	0.3885
α_2, Tuesday	0.0490	0.4512	0.0520	0.4292
α_3, Thursday	0.0925	0.1843	0.0246	0.7186
α_4, Friday	0.0217	0.7224	-0.0097	0.8848
α_5, R_{t-1}	0.0421**	0.0291	0.0303	0.1090
	Variance Equation			
β_0	0.3268*	0.0000	0.1183	0.1392
γ_1	0.9052*	0.0000	0.9443*	0.0000
ϕ	0.1148*	0.0000	0.0469*	0.0000
β_1	0.0185**	0.0361	0.0147**	0.0421
α_1, Monday	-0.2396**	0.0163	-0.2558**	0.0137
α_2, Tuesday	-0.2057	0.1107	0.0101	0.9355
α_3, Thursday	-0.3355**	0.0218	0.0155	0.9183
α_4, Friday	-0.6915*	0.0000	-0.2384**	0.0418
ARCH-LM Statistic (p-value)				
10 lags	0.3541		0.0713	
20 lags	0.5031		0.1667	
Ljung-Box Q^2 Statistic (p-value)				
10 lags	0.3650		0.0750	
20 lags	0.5420		0.1780	
Mean Equation - Wald Test (p-value) - $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$				
F-statistic	0.6656		0.7940	
Chi square	0.6656		0.7940	
Variance Equation - Wald Test (p-value) - $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$				
F-statistic	0.0000		0.0015	
Chi square	0.0000		0.0015	

Notes: *, ** and *** denote significant at 1, 5 and 10% level respectively. Numbers in parentheses depict p-values.

4 Concluding Remarks

This study examines the day-of-the-week effect on the daily returns of Australia and New Zealand stock markets using the OLS models under both the constant and time-varying variances assumption. Due to the absence of the day-of-the week effect, both markets may be more suitable for those passive international investors who willing to adopt buy-and-hold strategy for long-term investment purpose.

On the other hand, Threshold GARCH (TAR-GARCH) models are employed to deal with the time-varying variances of the daily stock returns. The TAR-GARCH models helps to provide information with regard to stock returns and market risks. As a results, the leverage effect term, f , which is statistically positive in these markets, reflects the existence of a leverage effect in that bad news increase volatility of the returns. Therefore, investors may adjust their portfolios by reducing their commitments to assets whose volatility is expected to increase due to the bad news. Hence, investors can perhaps improve their returns by timing their investments in buy-and-sell activities.

As a conclusion, these empirical findings showed that the day-of-the-week effect is a country specific phenomenon whereby different types of effects are observed for the different stock markets under consideration. An understanding of the stock market volatility may be very helpful to investors who are risk adverse to reduce the risk in their portfolio of investment to avoid unnecessary loss in the stock markets.

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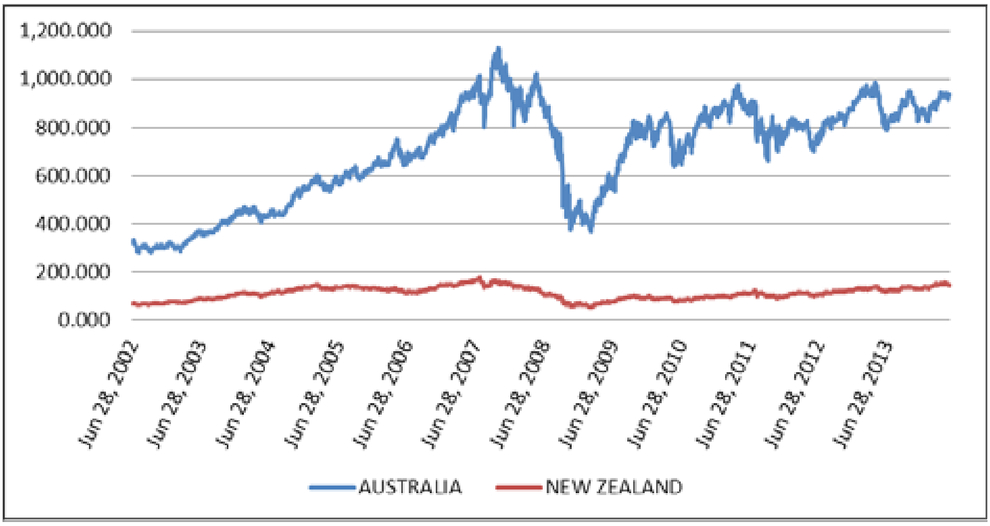

Source: Author's plot.

Figure 1 Daily Australia MSCI Index and New Zealand MSCI Index