UDC: 336.76;336.764/.768;519.866
JEL Classification: C22, G10, G12
Keywords: day of the week effect; volatility; E-GARCH-M; emerging market economies

The Day-of-the-Week Effect on Stock-Market Volatility and Return: Evidence from Emerging Markets*

Yeliz YALCIN** – Eray M. YUCEL***

1. Introduction

Calendar anomalies in stock-market returns, such as weekend, day of the week, and January effects, have been of considerable interest. Equity, foreign exchange and T-bill markets have been widely examined by many researchers. For an investor it is important to know not only the variations in asset returns, but also the variances in returns. Engle (1993) argues that risk-averse investors should reduce their investments in assets with higher return volatilities. Therefore, the investigation of return and volatility patterns is a useful exercise. Most of these patterns are associated with the day--of-the-week (DOW) effects, as discussed in the next section.

This study addresses the key relationships between the days of the week and returns and volatility by examining the DOW effect in the stock exchanges of 20 emerging market economies. (For a recent treatment of 15 European stock markets, see (Savva – Osborn – Gill, 2005). They found that the DOW effect is not significant in returns (the mean equation) but present for the variances of returns in the majority of European stock markets).

Efforts to analyze stock-market returns and variances have recently been combined in a way compatible with the classical portfolio theory, so any rational decision maker with risk-averse attitudes should consider both returns and variances of financial assets. For instance, Kiymaz and Berument (2003) analyzed the stock-market returns and variances for five developed countries using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) specifications.

In this study, our approach for analyzing the day-of-the-week (hereinafter referred to as "DOW") effects follows Kiymaz and Berument (2003). Here we employ an Exponential Generalized Autoregressive Conditional Heteroskedasticity-in-Mean (EGARCH-M) framework, which allows us to capture possible DOW effects, as well as possible asymmetries in the variance

* All the views expressed in this paper belong to the authors and do not represent the views of the Central Bank of the Republic of Turkey, or its staff. The authors thank the members of the Pazar11 discussion group for their suggestions.

** Department of Econometrics, Gazi University, Ankara, Turkey (yyeliz@gazi.edu.tr)

*** (the corresponding author) Research and Monetary Policy Department, Central Bank of the Republic of Turkey, Ankara, Turkey and Department of Economics, Bilkent University, Ankara, Turkey (eray.yucel@tcmb.gov.tr)

generating process. We perform our analysis on the stock markets of 20 emerging market economies, where DOW effects are present in market returns for only 3 countries, in market volatility for only 5 countries, and in both for only one country, when the estimates are evaluated at the 1-percent level of significance. Therefore, the empirical analysis of this paper mainly suggests that there are practically no DOW effects in our sample countries. However, this finding must be read as "the DOW effect is not strongly present in the sample". As the level of significance decreases, more DOW effects may become observable. At these lower levels of statistical significance, the common qualitative patterns in the estimates are revealed in such a way that higher returns are concentrated around Fridays, whereas the volatility is higher on Mondays and the lowest on Tuesdays and Fridays.

In this paper, we have also looked for possible institutional or geographical explanations for the revealed DOW effects. To this end, geographical grouping of the countries in terms of Pacific Rim countries and the post-communist states was considered first. Then we elaborated on the possible effects of Account Settlement Days on our estimates. However, neither of these exercises yielded regular patterns.

The contribution of this study to the literature is that it provides further evidence for the presence/absence of the DOW patterns in return or volatility equations. We review the earlier literature in the next section. Section 3 presents our empirical analysis and estimates. The estimates are further discussed in Section 4 before concluding the paper in Section 5.

2. A Brief Review of the Literature

Earlier literature (Cross, 1973), (French, 1980), (Gibbons – Hess, 1981), (Keim – Stambaugh, 1984), (Lakonishok – Levi, 1982) and (Rogalski, 1984) has documented DOW effects on stock-market returns. Cross (1973) and French (1980) revealed that the mean return between the closing of a week and the closing of the first trading day of the following week is negative and the lowest of the week. This is called the "weekend effect" in the literature. French (1980) as well as Lakonishok and Smidt (1988) reported the "holiday effect" as another calendar anomaly, where the stock returns behave differently both before and after holidays. The mean stock return on the first trading day after a holiday is relatively low. Ariel (1990), in contrast, showed that the mean return on the last trading day before a holiday tends to be unusually high. The "day of the month effect" was also reported by Ariel (1987), who pointed out the phenomenon that all stock returns accumulate during the first half of the month. A summary of all these return seasonalities (or anomalies) that were originally detected using US stock-market data is given in (Lauterbach – Ungar, 1995).

Published research for the US and Canada found that daily stock returns tend to be lower on Mondays and higher on Fridays (French, 1980), (Gibbons – Hess, 1984), (Rogalski, 1984), (Flannary – Protopapadakis, 1988). In contrast, daily returns in Pacific Rim countries tend to be the lowest on Tuesdays (Jaffe – Westefield, 1985), (Dubois – Louvet, 1996), (Brooks – Per-

sand, 2001). Lin and Lim (2001) argued that there might be a link between the US Monday seasonal and the Asia-Pacific DOW effect as they are one--day out of phase due to their different time zones. They found evidence that the anomaly in Australia is induced by the weekend effect in the US. However, some other Pacific Rim countries such as Indonesia, Malaysia and Thailand display the same seasonality as the US, UK, Canada and Switzerland; i.e. Mondays have significantly negative average returns (Choudhry, 2000).

Many researchers have investigated other markets, such as equity, fixed--income and derivative markets. Aggarwal and Rivoli (1989), Athanassakos and Robinson (1994), Chang, Pinegar and Ravichandran (1993), Dubois (1986), and Solnik and Bousquet (1990) showed that DOW effects exist in foreign stock returns. Corhay, Fatemi and Rad (1997), Flannary and Protopapadakis (1988), Gay and Kim (1987) and Gesser and Poncet (1997) demonstrated that the distribution of returns in the futures and foreign--exchange markets is also subject to DOW effects.

There have also been studies investigating the time-series behavior of stock prices in terms of volatility. Among these, we can mention French et al. (1987), Campbell and Hentschel (1992), Glosten et al. (1993), Nelson (1991), Baillie and DeGennaro (1990), Chan, Karolyi and Stulz (1992), and Corhay and Rad (1994). French et al. (1987) reported that unexpected stock--market returns are negatively associated with unexpected changes in return volatility. Similarly, Campbell and Hentschel (1992) argued that the required rate of return on common stocks increases with an increase in stock--market volatility, thus lowering stock prices. Glosten et al. (1993) and Nelson (1991) reported that positive unanticipated returns decrease the conditional volatility while negative ones increase it.[1]

Berument and Kiymaz (2001) used the S&P 500 index data and reported that there are differences in stock market volatility across the days of the week, the highest volatility being observed on Fridays. A recent study, (Kiymaz – Berument, 2003) investigated whether the observed return volatilities on various days of the week are related to trading volume for five developed countries.

In the literature, there are numerous explanations for the causes of DOW effects. Two of these are the "absence of brokers' advice over the weekend" (Miller, 1988) and "high incidence of unfavourable news arriving at the weekend" (Penman, 1987), (Dyl – Maberly, 1988), (Berument – Kiymaz, 2001). Bell and Levin (1998) further examined three institutional factors in order to understand the underlying sources of the DOW effects. These factors can be listed as (i) financing discontinuities associated with the account-settlement period, (ii) relative scarcity of funds while finance is held in banks' suspense and transmission accounts on settlement day and (iii) firms' reluctance to hold money during non-trading periods. Kiymaz and Berument (2003) also considered the influnce of public (i.e. macroeconomic and political news) and private information as well as unanticipated

[1] The rest of the listed studies find no significant relationship between stock-market volatility and expected returns. In most of these, expected returns in stock markets are time-varying and contain conditional heteroskedasticity.

returns among the reasons for DOW effects on market volatility. It should also be noted that these studies mostly remain inconclusive in describing the DOW-effects in terms of institutional and/or country specific features. Berument, Inamlik and Kiymaz (2004) also point out the absence of evidence based on structural-institutional factors.

The DOW effects appear to conflict with the Efficient Market Hypothesis since they imply that investors could develop trading strategies to benefit from return regularities. However, when transaction costs and time-varying stock-market risk premia are taken into account, the predictability of stock returns does not necessarily translate into market inefficiencies (Kohers et al., 2004). Recently, a number of studies revealed that the DOW effects have been disappearing – see for instance, (Kohers et al., 2004), (Davidson – Faff, 1999).

3. Empirical Analysis

3.1 Variable Definitions and Modeling Approach

Our data set consists of the daily stock market indices for 20 countries, which are compiled by DataStream.[2] Returns in each market, denoted R_t, are computed as the first difference in the natural logarithms of the stock market indices as $R_t = [\log(P_t) - \log(P_{t-1})] \cdot 100$, where P_t is the index level at time t.

We employ an Exponential GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model with an ARCH-in-mean term, the so-called EGARCH-M model.[3] Our approach resembles that of (Kiymaz – Berument, 2003) in that the DOW dummy variables are introduced into both return and variance specifications. The use of an EGARCH specification to handle possible asymmetries, on the other hand, distinguishes the current study. Our model is defined by Equations 1 through 4:

$$R_t = \alpha_0 + \alpha_M M_t + \alpha_T T_t + \alpha_H H_t + \alpha_F F_t + \Sigma_{i=1}^{n} \alpha_i R_{t-i} + \mu\sqrt{h_t} + u_t \quad (1)$$

$$u_t = \sqrt{h_t} e_t, \quad e_t \sim i.i.d.(0,1) \quad (2)$$

[2] The indices included and the respective time spans for each index are as follows: (1) Bulgaria (BSE SOFIX, 20. 10. 2000 to 01. 03. 2005); (2) China (CHINA DS MARKET, 30. 12. 1994 to 01. 03. 2005); (3) Colombia (COLOMBIA CSE INDEX, 16. 07. 2001 to 01. 03. 2005); (4) Czech Republic (PX GLOBAL INDEX, 30. 12. 1994 to 01. 03. 2005); (5) Estonia (ESTONIA BALTIC 30, 19. 05. 1997 to 01. 03. 2005); (6) Hungary (BUDAPEST [BUX], 18. 03. 1999 to 01. 03. 2005); (7) India (S&P CNX NIFTY (50), 23. 04. 1996 to 01. 03. 2005); (8) Indonesia (JAKARTA SE COMPOSITE, 27. 05. 1999 to 01. 03. 2005); (9) Israel (TEL AVIV SE GENERAL, 18. 03. 1999 to 01. 03. 2005); (10) Lithuania (LITHUANIAN LITIN, 04. 01. 1999 to 01. 03. 2005); (11) Malaysia (KUALA LUMPUR SE EMAS, 30. 12. 1994 to 01. 03. 2005); (12) Mexico (MEXICO IPC [BOLSA], 30. 12. 1994 to 01. 03. 2005); (13) Poland (WARSAW GENERAL INDEX, 30. 12. 1994 to 01. 03. 2005); (14) Russia (RSF EE MT [RUR] INDEX, 11. 06. 1998 to 01. 03. 2005); (15) South Africa (FTSE/JSE ALL SHARE, 30. 06. 1995 to 01. 03. 2005); (16) South Korea (KOREA SE COMPOSITE [KOSPI], 30. 12. 1994 to 01. 03. 2005); (17) Slovenia (SLOVENIAN EXCH. STOCK [SBI], 30. 12. 1994 to 01. 03. 2005); (18) Taiwan (TAIWAN SE WEIGHTED, 30. 12. 1994 to 01. 03. 2005); (19) Thailand (THAILAND DS MARKET, 18. 03. 1999 to 01. 03. 2005); (20) Turkey (ISE NATIONAL 100, 30. 12. 1994 to 01. 03. 2005).

$$h_t = \exp\left[C + V_M M_t + V_T T_t + V_H H_t + V_F F_t + Q\log g_{t-1} + P\log h_{t-1}\right] \quad (3)$$

$$g_t = |e_t| - E|e_t| - Le_t \quad (4)$$

where e_t has identically independent generalized error distribution, with L and D standing for the asymmetry term and the scale parameter. In the return equation, α_0 is the constant term; α_M, α_T, α_H and α_F capture the DOW effect on returns; α_1 to α_n are the coefficients of the lagged return terms; n being the lag order determined for each country by the Final Prediction Error Criterion[4]; and μ is the coefficient on the ARCH-in-mean term. The coefficient μ is the market price of risk, and $\mu\sqrt{h_t}$ is the market risk premium for expected volatility. Assuming investors are risk-averse, μ is expected to be positive. In the variance equation, *exp* stands for the inverse of the natural logarithm operator; C stands for the constant term; V_M, V_T, V_H and V_F measure the DOW effect on volatility; Q is the coefficient on the lagged squared residual; and P is the coefficient on the lagged squared variance. The benefits of using such a specification are three-fold. Firstly, it allows us to account for the DOW effect on both return and variance specifications. Secondly, we measure the ARCH-in-mean effects. Finally, we can assess the asymmetric effects of surprises on the volatility of returns.

EGARCH specifications have some advantages over the GARCH models. First, since we employ the logarithm of the ε_t term, the variance h_t will take positive values regardless of the values of the coefficients in the variance specification. Thus, no restrictions need to be imposed on Equation 3 for es-

[3] Most studies investigating the day of the week effect on returns employ the Least Squares estimation method by regressing returns on five daily dummy variables. See for instance, (Cross, 1973), (French, 1980), (Lakonishok – Levi, 1982), (Gibbons – Hess, 1981), (Keim – Stambough, 1984), (Jaffe – Westerfield, 1985), (Smirlock – Starks, 1986), (Abraham – Ikenberry, 1994), and (Agrawal – Tandon, 1994). (Aydogan, 1994) and (Balaban, 1995) can also be examined for the day of the week effect on the Turkish stock market. This has, however, two drawbacks. Firstly, the errors in the model may be autocorrelated, which may result in misleading inferences. This problem can be addressed by including the lagged values of the returns, thus presenting the returns in terms of a constant term, lagged terms of return and the day-of-the-week dummy variables. The second drawback is that the error variances may not be constant over time. This can be addressed by allowing variances of errors to be time dependent to include a conditional heteroskedasticity. Thus, error terms now have a mean of zero and a time-changing variance of h_t, i.e. $\varepsilon_t \sim (0, h_t)$. Different models for conditional variances are suggested in the literature. Engle (1982) allows the forecasted variances of return to change with the squared lagged values of the error terms from the previous periods, which is known as Autoregressive Conditional Heteroskedastic Model (q) (ARCH (q)). The generalized version of ARCH (q) is suggested by Bollerslev (1986) and makes the conditional variance, h_t, a function of lagged values of both h_t and ε_t^2. This specification is known as GARCH (p, q) modeling. It is possible that the conditional variance, as a proxy for risk, can affect stock-market returns. The ARCH-in-Means (ARCH-M) method allows the conditional standard errors (or variance) to affect returns. The model of Kiymaz and Berument (2003) allows for extracting the day-of-the-week effect in the return equation. Following Hsieh (1988) and Karolyi (1995), Kiymaz and Berument (2003) model the conditional variability of stock returns by incorporating the day-of-the-week effect into their volatility equation.

[4] The Final Prediction Error criterion determines the lag length such that the errors are no longer autocorrelated. This is crucial because if the errors are autocorrelated, then Engle's (1982) ARCH-LM test may suggest the presence of the ARCH effect even if there is none. (Cosimano – Jansen, 1989) can be seen for further details.

timation except that of $P < 1$ for EGARCH, which makes numerical computation simpler. Secondly, the leverage effect can be captured by the coefficient L. As noted in (Hamilton, 1994, pp. 668–9), evidence on asymmetry in stock-price behavior has been found by many researchers. Negative surprises seem to increase volatility more than positive surprises do. Since a lower stock price reduces the value of equity relative to corporate debt, a sharp decline in stock prices increases corporate leverage and could thus increase the risk of holding stocks. The general notion is that ε_t has a normal distribution, which is clearly too strong an assumption. Therefore, we have assumed that ε_t has a generalized error distribution.

3.2 Estimates

The *Efficient Market Hypothesis* suggests that stock-market returns are unpredictable. Therefore, stock returns should be regressed only on the constant term. However, due to market micro structure and institutional features (such as settlement days and information release days), the DOW effect is often present in the stock-market returns.

The estimates of the specifications[5] on the market returns and volatilities for 20 countries are presented in ***Table 1***. In *Panel I*, the coefficient α_0 is the constant term of the return specification. α_1 to α_{10} measure the autoregressive behavior of returns; that is, they are the estimated coefficients on the lagged terms of market return.[6] The row headings Monday, Tuesday, Thursday and Friday designate the DOW-effect coefficients in the return specification. The coefficient on the ARCH-in-mean term (μ) measures the risk premium in the return equation.

In *Panel II*, the estimates of the variance specification are reported. The terms C, Q, P, L and D are as explained in Section 3.1. The rows Monday, Tuesday, Thursday and Friday convey the estimated DOW effect for stock market volatility. The skewness and kurtosis for the original (i.e. non-standardized) residuals and the diagnostic tests for our specification of return and variance equations are reported in the same panel.

Based on the estimates of the return specification, which are reported in *Panel I* of Table 1, we reveal the following: At the 1-percent level of significance, the returns are not significantly different from those of Wednesdays in the cases of Bulgaria, China, Colombia, Estonia, Indonesia, Malaysia, Poland, Slovenia, Taiwan, Thailand and Turkey. In the cases of the Czech Republic, Hungary, Israel, Russia, and South Africa, Wednesdays

[5] The RATS code by Norman Morin (2001) has been employed while obtaining our estimates. The code is accessible at http://www.estima.com/ARCH-GARCH.shtml.

[6] The Efficient Market Hypothesis suggests that stock-market returns are unpredictable. Therefore, stock returns should be regressed only on constant term. However, due to market microstructure the day-of-the-week effect is often present in the stock-market returns. However, the data is auto-correlated. Cosimano and Jansen (1988) argue that even if the ARCH effect is not present, ARCH-LM tests suggest the ARCH effect for autocorrelated error terms. Hence, we only included lag dependent variable to address the autocorrelation. Specification and result might change but since the purpose of our specification (of return) is to eliminate the autocorrelation AR component series, we did not include MA terms (that do not address autocorrelation), but only the lagged values of the dependent variable.

have the minimum returns during the week. For India, Lithuania, Mexico, and South Korea, Wednesdays display the maximum returns. In India, Tuesdays have significantly lower returns than Wednesdays. The minimum returns are on Mondays in Lithuania. In Russia, Thursdays and Fridays provide the highest returns in the week. In fact, DOW effects are not widespread in our sample at the 1-percent level of significance.[7]

In *Panel I* of Table 1, the estimates of the coefficient μ are also given. The estimate of μ is statistically significant only for the Czech Republic, Estonia, Malaysia and Thailand. However, it is not positive for any of these countries; i.e. the investors tend not to be risk-averse.

The estimates of the variance specification of stock market returns are provided in *Panel II* of Table 1.[8] Based on the estimated coefficients and maintaining the 1-percent level of statistical significance, it can be said that the variances for the other days of the week do not differ significantly from Wednesdays in Bulgaria, China, Colombia, the Czech Republic, Estonia, Hungary, Indonesia, Lithuania, Malaysia, Mexico, Poland, Russia, South Africa, Slovenia, and Thailand. In the case of Bulgaria and Hungary, the highest volatility of returns is observed on Wednesdays; whereas in Colombia the lowest volatility is observed on Wednesdays. At the 1-percent level of significance, Tuesdays have lower volatility than Wednesdays in India and Mondays have lower volatility than Wednesdays in Israel. In South Korea, Tuesdays have lower volatility than Wednesdays. In the case of Taiwan, Mondays and Tuesdays have higher and lower volatilities than Wednesdays, respectively. The case of Turkey resembles that of Taiwan with the addition of lower volatility on Fridays than on Wednesdays.[9]

In *Panel II* of Table 1, we also report the estimates of Q, P, L and D. The estimate of Q is positive and statistically significant at 1 % for all sample countries. L has a negative sign for Bulgaria, Colombia, Lithuania, and Slovenia; however, none of these is statistically significant. In the rest of our sample, China, Hungary, India, Indonesia, Israel, Malaysia, Mexico,

[7] When the results are interpreted at the 5-percent level of significance, further DOW effects on returns are observed in Colombia (Thu/positive, Fri/positive), in India (Mon/negative, Fri/negative), in Indonesia (Mon/negative), in Israel (Mon/positive), in Poland (Fri/positive), in Russia (Mon/positive), in South Africa (Mon/positive), in Slovenia (Mon/negative), in Thailand (Mon/negative) and in Turkey (Tue/negative, Fri/positive). If the level of significance is further increased to 10-percent, additional return DOW effects are observed for Bulgaria (Thu/negative), for India (Thu/negative), for Lithuania (Tue/negative, Thu/negative), for Malaysia (Mon/negative), for Poland (Mon/positive, Thu/positive), for Thailand (Fri/positive) and for Turkey (Mon/positive).

[8] In order to determine the day-of-the-week effect, one must test whether the variables for all four days are jointly zero. However, due to the high degree of non-linearity of the model and the high correlation among the day-of-the-week dummy variables, following Kiymaz and Berument (2003), we assess the day-of-the-week effect if any day's return (or volatility) is different from any other day, rather than every single day's return (or volatility) being equal to that of the others.

[9] When the variance-specification estimates are reconsidered using the 5-percent level of significance, we observe some DOW effects for Bulgaria (Mon/negative), China (Mon/positive, Fri/negative), Malaysia (Mon/positive), Poland (Mon/positive), South Korea (Mon/positive), and Thailand (Thu/negative). If the level of significance is taken to be 10 %, further effects are observed for Bulgaria (Thu/negative), Israel (Fri/positive), Malaysia (Fri/negative), Russia (Fri/negative), and Slovenia (Mon/positive).

TABLE 1 Panel I – Day of the Week Effects on Return Equation

	Bul	Chi	Col	Cze	Est	Hun	Indi	Indo	Isr	Lit	Mal	Mex	Pol	Rus	S. Afr	S. Kor	Sloven	Tai	Thai	Tur
α_0	0.036	-0.113	-0.093	0.112**	0.140***	0.070	0.199	0.209	-0.194	0.179***	0.086*	0.162*	0.023	-0.039	0.013	0.012	0.007	0.060	0.310*	0.173
	(0.159)	(0.176)	(0.322)	(0.032)	(0.005)	(0.746)	(0.156)	(0.178)	(0.197)	(0.010)	(0.053)	(0.058)	(0.794)	(0.810)	(0.830)	(0.892)	(0.802)	(0.566)	(0.089)	(0.339)
α_1	0.042***	0.140***	0.272***	0.156***	0.069***	-0.004	0.062***	0.076***	0.041*	0.082***	0.106***	0.120***	0.101***	0.061***	0.117***	0.049***	0.314***	-0.004	0.055**	0.016
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.864)	(0.002)	(0.002)	(0.066)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.004)	(0.000)	(0.791)	(0.024)	(0.368)
α_2	0.033***	-0.028	-0.015	0.014	0.013	-0.050**	0.004		0.000	0.063***	0.020	-0.038**		0.020	0.055***	-0.015	-0.053***	0.036**	0.053**	0.017
	(0.001)	(0.128)	(0.678)	(0.439)	(0.501)	(0.037)	(0.845)		(0.987)	(0.005)	(0.233)	(0.037)		(0.376)	(0.004)	(0.389)	(0.003)	(0.031)	(0.027)	(0.336)
α_3	0.023***	0.018		0.009	-0.007		0.031		-0.008	-0.029	0.009			-0.021	-0.050***	0.001	-0.032*	-0.005	-0.039	0.002
	(0.001)	(0.319)		(0.617)	(0.692)		(0.114)		(0.713)	(0.204)	(0.580)			(0.342)	(0.009)	(0.949)	(0.075)	(0.752)	(0.106)	(0.910)
α_4	0.005	0.011		0.028	0.028		0.061***		0.013		-0.010			0.004		-0.002	0.009	-0.033**	-0.019	0.023
	(0.354)	(0.526)		(0.125)	(0.123)		(0.002)		(0.547)		(0.559)			(0.858)		(0.924)	(0.616)	(0.042)	(0.436)	(0.179)
α_5	0.010	-0.016		0.006	0.009		0.006		-0.022		0.010			-0.030		-0.020	0.004	0.021	0.054**	-0.023
	(0.227)	(0.370)		(0.751)	(0.606)		(0.760)		(0.332)		(0.538)			(0.185)		(0.261)	(0.779)	(0.229)	(0.022)	(0.194)
α_6	0.011***	-0.031*			0.048***		-0.069***		-0.015		-0.014			-0.015			-0.003		-0.035	-0.007
	(0.002)	(0.077)			(0.007)		(0.000)		(0.453)		(0.367)			(0.185)			(0.840)		(0.141)	(0.665)
α_7	0.002	0.001			0.033*		-0.028		0.000					-0.009			0.017		-0.019	0.001
	(0.654)	(0.976)			(0.055)		(0.133)		(0.992)					(0.678)			(0.249)		(0.416)	(0.930)
α_8	-0.009*	-0.024			0.075***		-0.003		0.067***								0.017		0.031	0.026
	(0.056)	(0.160)			(0.000)		(0.863)		(0.001)								(0.245)		(0.188)	(0.122)
α_9	-0.012***	-0.017			0.036**		0.039**		0.021								0.035***			0.024
	(0.002)	(0.301)			(0.031)		(0.030)		(0.294)								(0.008)			(0.139)
α_{10}		0.014			0.029*		0.021													0.005
		(0.409)			(0.077)		(0.257)													(0.781)
$\alpha_{M,\text{Monday}}$	-0.026	0.048	0.026	0.057	-0.057	0.134	-0.194**	-0.213**	0.138**	-0.169***	-0.089*	-0.098	0.123*	0.302**	0.117**	-0.051	-0.069**	0.059	-0.228**	-0.274*
	(0.211)	(0.531)	(0.728)	(0.254)	(0.210)	(0.165)	(0.027)	(0.021)	(0.049)	(0.003)	(0.051)	(0.161)	(0.100)	(0.038)	(0.019)	(0.598)	(0.013)	(0.491)	(0.046)	(0.057)
$\alpha_{T,\text{Tuesday}}$	0.032	-0.017	-0.014	0.045	0.035	0.069	-0.300***	-0.076	0.010	-0.103*	-0.043	-0.013	-0.025	0.135	0.035	-0.118	-0.034	-0.108	-0.001	-0.250**
	(0.248)	(0.810)	(0.858)	(0.365)	(0.429)	(0.476)	(0.000)	(0.369)	(0.886)	(0.060)	(0.320)	(0.846)	(0.720)	(0.350)	(0.501)	(0.131)	(0.229)	(0.112)	(0.992)	(0.045)
$\alpha_{H,\text{Thursday}}$	-0.050*	0.035	0.173**	0.064	0.063	0.155	-0.154*	-0.097	0.090	-0.101*	-0.020	-0.011	0.130*	0.416***	0.078	-0.081	-0.012	0.012	-0.110	0.105
	(0.065)	(0.634)	(0.026)	(0.201)	(0.155)	(0.114)	(0.054)	(0.270)	(0.192)	(0.064)	(0.647)	(0.869)	(0.052)	(0.005)	(0.120)	(0.318)	(0.661)	(0.859)	(0.328)	(0.429)
$\alpha_{F,\text{Friday}}$	0.018	0.111	0.193**	0.046	0.038	0.083	-0.169**	0.080	0.126	-0.060	0.036	-0.038	0.134**	0.485***	0.037	-0.008	0.040	0.048	0.190*	0.259**
	(0.565)	(0.110)	(0.012)	(0.329)	(0.369)	(0.390)	(0.033)	(0.343)	(0.177)	(0.256)	(0.389)	(0.572)	(0.050)	(0.001)	(0.450)	(0.920)	(0.136)	(0.489)	(0.094)	(0.034)

TABLE 1 (continued) Panel II – Day of the Week Effects on Variance Equation

	Bul	Chi	Col	Cze	Est	Hun	Indi	Indo	Isr	Lit	Mal	Mex	Pol	Rus	S. Afr	S. Kor	Sloven	Tai	Thai	Tur
C	0.511*** (0.006)	0.092 (0.359)	-0.212 (0.281)	-0.004 (0.967)	-0.030 (0.825)	0.128 (0.343)	0.232** (0.033)	0.123 (0.391)	0.272** (0.051)	0.135 (0 .358)	0.083 (0.484)	0.081 (0.430)	-0.072 (0.482)	0.155 (0.245)	-0.063 (0.538)	0.167 (0.147)	-0.149 (0.170)	0.205* (0.082)	0.270* (0.055)	0.168 (0.144)
Q	0.661*** (0.000)	0.283*** (0.000)	0.540*** (0.000)	0.193*** (0.000)	0.260*** (0.000)	0.109*** (0.000)	0.227*** (0.000)	0.231*** (0.000)	0.170*** (0.000)	0.150*** (0 .000)	0.194*** (0.000)	0.164*** (0.000)	0.198*** (0.000)	0.210*** (0.000)	0.208*** (0.000)	0.114*** (0.000)	0 .437*** (0.000)	0.155*** (0.000)	0.194*** (0.000)	0.236*** (0.000)
P	0.786*** (0.000)	0.965*** (0.000)	0.836*** (0.000)	0.980*** (0.000)	0.967*** (0.000)	0.967*** (0.000)	0.918*** (0.000)	0.873*** (0.000)	0.919*** (0.000)	0.984*** (0.000)	0.989*** (0.000)	0.979*** (0.000)	0.973*** (0.000)	0.985*** (0.000)	0.974*** (0.000)	0.994*** (0.000)	0 .946*** (0.000)	0.968*** (0.000)	0.961*** (0.000)	0.952*** (0.000)
L	-0.124 (0.163)	0.145** (0.011)	-0.046 (0.641)	0.143** (0.034)	0.081 (0.241)	0.335** (0.015)	0.425*** (0.000)	0.551*** (0.000)	0.508*** (0.003)	-0.175* (0.079)	0.330*** (0.000)	0.553*** (0.000)	0.125* (0.069)	0.114 (0.139)	0.295*** (0.000)	0.314*** (0.002)	-0.029 (0.527)	0.515*** (0.000)	0.081 (0.361)	0.153** (0.014)
V_M, Monday	-0.532** (0.041)	0.365** (0.011)	0.105 (0.692)	0.159 (0.279)	0.263 (0.157)	-0.106 (0.582)	0.181 (0.232)	0.265 (0.170)	-1.322*** (0.000)	0.066 (0.733)	0.343** (0.037)	0.085 (0.547)	0.305** (0.033)	0.017 (0.925)	0.209 (0.139)	0.402** (0.014)	0.266* (0.086)	0.429*** (0.008)	-0.244 (0.201)	0.567*** (0.000)
V_T, Tuesday	-0.108 (0.736)	-0.203 (0.257)	0.488 (0.111)	0.062 (0.732)	-0.082 (0.729)	-0.077 (0.740)	-0.615*** (0.000)	-0.250 (0.308)	-0.057 (0.804)	-0.178 (0.444)	-0.294 (0.135)	-0.091 (0.607)	-0.070 (0.693)	-0.127 (0.574)	0.196 (0.275)	-0.850*** (0.000)	0.196 (0.269)	-0.867*** (0.000)	-0.235 (0.329)	-0.501*** (0.008)
V_H, Thursday	-0.522* (0.089)	-0.087 (0.617)	0.257 (0.449)	0.027 (0.881)	0.041 (0.861)	-0.123 (0.606)	-0.178 (0.365)	-0.005 (0.983)	-0.324 (0.189)	-0.263 (0.331)	-0.160 (0.442)	-0.124 (0.484)	0.048 (0.789)	-0.197 (0.384)	0.046 (0.790)	-0.205 (0.272)	0.190 (0.318)	-0.276 (0.183)	-0.526** (0.032)	0.066 (0.727)
V_F, Friday	-0.382 (0.131)	-0.361** (0.013)	0.068 (0.806)	-0.218 (0.153)	-0.073 (0.695)	-0.238 (0.220)	-0.242 (0.121)	-0.239 (0.235)	0.365* (0.075)	-0. 327 (0.128)	-0.283* (0.072)	-0.203 (0.170)	0.176 (0.220)	-0.345* (0.056)	-0.138 (0.347)	-0.150 (0.353)	-0.041 (0.784)	-0.174 (0.274)	-0.167 (0.387)	-0.494*** (0.001)
μ	0.020 (0.231)	0.051 (0.269)	0.133 (0.175)	-0.140*** (0.001)	-0.130*** (0.006)	-0.077 (0.610)	0.000 (0.998)	-0.091 (0.413)	0.155 (0.258)	-0.055 (0.432)	-0.104*** (0.005)	-0.058 (0.296)	-0.049 (0.415)	-0.011 (0.841)	-0.024 (0.674)	0.028 (0.558)	0.049 (0.125)	-0.053 (0.421)	-0.169* (0.087)	-0.009 (0.884)
D	0.659*** (0.000)	1.172*** (0.000)	1.149*** (0.000)	1.261*** (0.000)	1.023*** (0.000)	1.351*** (0.000)	1.259*** (0.000)	1.161*** (0.000)	1.176*** (0.000)	1.183*** (0.000)	1.087*** (0.000)	1.279*** (0.000)	1.290*** (0.000)	1.291*** (0.000)	1.299*** (0.000)	1.215*** (0.000)	1.019*** (0.000)	1.179*** (0.000)	1.270*** (0.000)	1.207*** (0.000)
Skewness kurtosis	-0.392 15.787	0.087 2.884	-0.111 2.450	-0.072 3.293	-0.961 12.546	0.015 1.253	-0.321 3.160	0.083 2.161	-0.054 2.399	0.273 2.413	0.283 5.624	-0.060 2.137	0.0206 1.820	-0.182 1.676	-0.244 3.169	-0.194 2.110	-1.837 24.646	-0.097 1.930	0.206 2.270	-0.167 2.895
Function value-	-1864.8	-4973.0	-968.0	-3786.8	-2723.5	-2607.0	-4065.3	-2518.7	-2172.6	-2038.9	-3885.3	-4628.1	-4641.0	-3998.6	-3512.4	-5258.7	-2943.5	-4727.8	-2863.8	-6266.8
Function value of restricted model	-2313.7	-5336.1	-1000.2	-4086.1	-3107.8	-2671.4	-4247.7	-2627.4	-2316.4	-2169.1	-4689.6	-4956.4	-4902.0	-4345.1	-3774.8	-5667.2	-3552.2	-4997. 5	-2947.1	-6529.8
Presence of DOW effect for conditional variance	448.8	363.0	32.1	299.3	384.2	64.4	182.4	108.7	143.7	130.1	804.3	328. 3	260.9	346.5	262.3	408.4	608.6	269.6	83.2	263.0

TABLE 1 (continued) Panel III – Specification Tests

	Bul	Chi	Col	Cze	Est	Hun	Indi	Indo	Isr	Lit	Mal	Mex	Pol	Rus	S. Afr	S. Kor	Sloven	Tai	Thai	Tur
Sign bias test	-1.056	0.187	-1.138	0.114	1.057	-1.006	1.278	0.723	0.987	-0.355	-1.784*	0.582	-0.365	0.283	-1.672*	1.029	-1.302	0.034	-1.706*	0.699
	(0.291)	(0.851)	(0.255)	(0.909)	(0.290)	(0.314)	(0.201)	(0.469)	(0.323)	(0 .722)	(0.074)	(0.560)	(0.714)	(0.777)	(0.094)	(0.303)	(0.193)	(0.972)	(0.088)	(0.484)
Negative size	-0.710	-0.675	-1.313	-0.213	-0.086	-0.407	0.007	0.180	1.521	-2.481**	-1.330	-1.349	-2.114**	-0.415	-1.974**	0.322	-0.623	0.961	-0.520	-0.693
Bias test	(0.477)	(0.499)	(0.189)	(0.831)	(0.931)	(0.683)	(0.999)	(0.856)	(0.128)	(0.013)	(0.183)	(0.177)	(0.034)	(0.677)	(0.048)	(0.747)	(0.532)	(0.336)	(0.602)	(0.488)
Positive size	-0.372	0.364	-0.687	0.124	0.843	-0.400	0.813	1.539	-1.190	1.067	0.746	0.608	1.157	-0.184	-0.969	-0.436	-0.342	-1.747*	-1.794*	1.570
Bias test	(0.709)	(0.715)	(0.491)	(0.900)	(0.398)	(0.688)	(0.412)	(0.123)	(0.234)	(0.285)	(0.455)	(0.543)	(0.247)	(0.853)	(0.332)	(0.662)	(0.731)	(0.080)	(0.072)	(0.116)
Joint test	0.418	0.266	0.758	0.036	0.505	0.361	0.704	0.819	1.824	2.485*	1.955	1.307	1.941	0.250	1.658	0.855	0.585	1.474	1.364	1.017
	(0.739)	(0.849)	(0.517)	(0.990)	(0.678)	(0.781)	(0.546)	(0.483)	(0.140)	(0.059)	(0.118)	(0.270)	(0.120)	(0.860)	(0.174)	(0.463)	(0.624)	(0.219)	(0.252)	(0.383)
Q(5)	4.556	12.514**	6.035	1.137	9.671*	3.817	1.213	9.693*	6.531	3.355	27.978***	6.277	14.058**	8.343	6.118	4.980	13.171**	8.062	5.748	9.240*
	(0.472)	(0.028)	(0.302)	(0.950)	(0.085)	(0.575)	(0.944)	(0.084)	(0.257)	(0.645)	(0.000)	(0.280)	(0.015)	(0.138)	(0.294)	(0.418)	(0.021)	(0.152)	(0.331)	(0.099)
Q(10)	18.102*	13.281	13.363	6.575	16.957*	11.464	3.082	11.384	8.633	7.739	29.151***	8.726	16.205*	13.158	10.904	7.999	18.770**	12.295	6.765	11.944
	(0.053)	(0.208)	(0.204)	(0.764)	(0.075)	(0.322)	(0.979)	(0.328)	(0.567)	(0.654)	(0.001)	(0.558)	(0.093)	(0.214)	(0.365)	(0.628)	(0.043)	(0.265)	(0.747)	(0.288)
Q(20)	38.217***	27.833	19.919	20.033	26.678	18.347	11.974	24.034	23.916	19.039	40.089***	20.686	23.565	22.280	16.191	13.638	23.291	27.055	22.395	26.497
	(0.008)	(0.113)	(0.462)	(0.455)	(0.144)	(0.564)	(0.917)	(0.240)	(0.246)	(0.519)	(0.005)	(0.415)	(0.261)	(0.325)	(0.704)	(0.848)	(0.274)	(0.133)	(0.319)	(0.149)
Q(30)	55.419***	40.383*	31.009	27.386	39.458	21.455	21.392	32.062	27.930	33.801	48.317**	29.005	31.126	36.812	29.385	24.562	35.361	34.323	29.707	39.266
	(0.003)	(0.097)	(0.414)	(0.602)	(0.115)	(0.873)	(0.874)	(0.364)	(0.574)	(0.288)	(0.018)	(0.517)	(0.409)	(0.182)	(0.497)	(0.745)	(0.229)	(0.268)	(0.480)	(0.119)
Q(60)	86.869**	74.596*	61.434	56.382	76.039*	38.394	68.760	57.079	72.024	56.898	69.170	79.575**	78.849*	68.958	50.469	55.712	75.086*	57.209	62.706	56.013
	(0.013)	(0.097)	(0.424)	(0.608)	(0.079)	(0.986)	(0.186)	(0.583)	(0.137)	(0.589)	(0.195)	(0.046)	(0.051)	(0.200)	(0.804)	(0.633)	(0.090)	(0.578)	(0.380)	(0.622)
ARCH-LM(5)	2.947	2.058	2.042	6.805	2.390	2.617	7.749	4.156	8.082	4.532	5.631	15.425***	12.757**	12.424**	13.635**	4.242	0.627	3.170	2.170	9.454*
	(0.708)	(0.840)	(0.843)	(0.235)	(0.792)	(0.759)	(0.167)	(0.527)	(0.152)	(0.475)	(0.343)	(0.003)	(0.025)	(0.029)	(0.018)	(0.515)	(0.986)	(0.673)	(0.825)	(0.092)
ARCH-LM(10)	8.356	4.881	5.074	12.085	5.795	6.860	10.675	14.529	9.386	6.347	8.508	17.551	16.916*	16.732*	16.891*	10.859	1.358	7.381	9.084	13.324
	(0.594)	(0.898)	(0.886)	(0.279)	(0.832)	(0.739)	(0.378)	(0.150)	(0.496)	(0.785)	(0.579)	(0.063)	(0.076)	(0.081)	(0.076)	(0.368)	(0.999)	(0.689)	(0.524)	(0.206)
ARCH-LM(20)	45.435***	16.469	11.845	16.368	7.529	15.850	23.956	21.821	20.410	11.990	14.904	23.589	31.797**	23.668	22.541	15.255	2.254	12.660	33.988**	20.225
	(0.000)	(0.687)	(0.921)	(0.693)	(0.994)	(0.726)	(0.242)	(0.350)	(0.433)	(0.916)	(0.781)	(0.260)	(0.045)	(0.257)	(0.311)	(0.761)	(1.000)	(0.891)	(0.026)	(0.443)
ARCH-LM(30)	52.125***	24.788	15.286	25.157	9.487	27.962	33.817	34.562	38.118	35.287	21.260	33.779	40.207*	28.349	29.536	18.620	3.020	19.592	53.738***	24.910
	(0.000)	(0.735)	(0.988)	(0.717)	(0.999)	(0.572)	(0.287)	(0.259)	(0.147)	(0.232)	(0.879)	(0.289)	(0.100)	(0.552)	(0.489)	(0.947)	(1.000)	(0.926)	(0.005)	(0.729)
ARCH-LM(60)	156.789***	65.041	47.519	37.766	17.088	53.618	55.835	64.444	69.038	50.751	37.369	63.494	85.488**	47.744	128.275***	42.019	6.473	39.476	80.233**	52.836
	(0.000)	(0.305)	(0.878)	(0.989)	(1.000)	(0.707)	(0.629)	(0.324)	(0.199)	(0.796)	(0.990)	(0.354)	(0.017)	(0.874)	(0.000)	(0.962)	(1.000)	(0.981)	(0.041)	(0.732)

Note: *p*-values are reported in parentheses under the corresponding coefficient. (*), (**) and (***) correspond to significance at 10%, 5% and 1% levels.

TABLE 2 Panel I – Day of the Week Effects on Return Equation

	Bul	Chi	Col	Cze	Est	Hun	Indi	Indo	Isr	Lit	Mal	Mex	Pol	Rus	S. Afr	S. Kor	Sloven	Tai	Thai	Tur
α_0	0.037	-0.102	-0.091	0.108**	0.142***	-0.008	0.137	0.187	-0.225	0.174***	0.084**	0.157*	0.027	-0.042	0.015	0.008	0.006	0.039	0.271*	0.196
	(0.346)	(0.204)	(0.335)	(0.034)	(0.004)	(0.922)	(0.325)	(0.219)	(0.126)	(0 .008)	(0.050)	(0.054)	(0.768)	(0.775)	(0.806)	(0.935)	(0.810)	(0.713)	(0.100)	(0.285)
α_1	0.039***	0.140***	0.271***	0.156***	0.066***	0.036**	0.070***	0.076***	0.050**	0.085***	0.107***	0.120***	0.102***	0.060***	0.114***	0.052***	0.313***	0.001	0.054**	0.022
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.039)	(0.001)	(0.002)	(0.030)	(0.000)	(0.000)	(0.000)	(0.000)	(0.009)	(0.000)	(0.003)	(0.000)	(0.954)	(0.027)	(0.217)
α_2	0.035***	-0.027	-0.015	0.015	0.015	-0.003	0.008		0.004	0.066***	0.022	-0.039**		0.019	0.052***	-0.007	-0.052***	0.035**	0.056**	0.023
	(0.001)	(0.136)	(0.669)	(0.430)	(0.423)	(0.884)	(0.676)		(0.857)	(0.004)	(0.181)	(0.033)		(0.406)	(0.006)	(0.669)	(0.005)	(0.034)	(0.020)	(0.207)
α_3	0.022***	0.017		0.008	-0.006	-0.006	0.034*		0.001	-0.029	0.010			-0.020	-0.050***	0.002	-0.030*	-0.002	-0.040*	0.003
	(0.004)	(0.354)		(0.653)	(0.766)	(0.721)	(0.085)		(0.974)	(0.213)	(0.565)			(0.372)	(0.009)	(0.897)	(0.090)	(0.919)	(0.098)	(0.860)
α_4	0.005	0.015		0.028	0.028		0.064***		0.012		-0.010			0.005		0.000	0.007	-0.028*	-0.019	0.021
	(0.438)	(0.410)		(0.134)	(0.122)		(0.001)		(0.590)		(0.526)			(0.823)		(0.983)	(0 .693)	(0.090)	(0.436)	(0.236)
α_5	0.003	-0.015		0.006	0.008		0.009		-0.025		0.009			-0.029		-0.013	0.004	0.022	0.049**	-0.017
	(0.305)	(0.388)		(0.745)	(0.654)		(0.656)		(0.244)		(0.570)			(0.194)		(0.431)	(0 .777)	(0.179)	(0.035)	(0.317)
α_6	0.018**	-0.029*			0.048***		-0.069***		-0.005		-0.015			-0.015			-0.002		-0.036	-0.008
	(0.025)	(0.100)			(0.007)		(0.000)		(0.797)		(0.345)			(0.518)			(0.903)		(0.130)	(0.630)
α_7	0.005	-0.001			0.033*		-0.025		0.003					-0.010			0.018		-0.019	0.004
	(0.572)	(0.966)			(0.055)		(0.190)		(0.901)					(0.653)			(0.239)		(0.407)	(0.811)
α_8	-0.013*	-0.023			0.074***		-0.006		0.070***								0.017		0.029	0.030*
	(0.054)	(0.182)			(0.000)		(0.744)		(0.001)								(0.241)		(0.222)	(0.073)
α_9	-0.013**	-0.018			0.034**		0.045**		0.023								0.035***			0.025
	(0.019)	(0.284)			(0.045)		(0.013)		(0.266)								(0.007)			(0.148)
α_{10}		0.014			0.029*		0.021													0.009
		(0.400)			(0.075)		(0.248)													(0.575)
$\alpha_{M,}$ Monday	-0.026	0.054	0.015	0.060	-0.064	0.143	-0.196**	-0.222***	0.094	-0.167***	-0.097**	-0.093	0.113	0.304**	0.121**	-0.040	-0.068**	0.029	-0.197*	-0.285**
	(0.452)	(0.451)	(0.843)	(0.214)	(0.139)	(0.128)	(0.012)	(0.009)	(0.166)	(0 .002)	(0.021)	(0.166)	(0.108)	(0.027)	(0.014)	(0.620)	(0.014)	(0.676)	(0.062)	(0.025)
$\alpha_{T,}$ Tuesday	0.042	-0.013	-0.005	0.046	0.030	0.076	-0.291***	-0.081	-0.015	-0.102*	-0.039	-0.008	-0.029	0.136	0.034	-0.120	-0.033	-0.092	0.028	-0.242*
	(0.256)	(0.852)	(0.942)	(0.336)	(0.488)	(0.415)	(0.000)	(0.340)	(0.824)	(0.053)	(0.356)	(0.902)	(0.677)	(0.313)	(0.481)	(0.149)	(0.235)	(0.194)	(0.791)	(0.060)
$\alpha_{H,}$ Thursday	-0.048	0.034	0.174**	0.063	0.061	0.156*	-0.143*	-0.102	0.077	-0.099*	-0.017	-0.009	0.131*	0.415***	0.077	-0.078	-0.010	0.023	-0.069	0.117
	(0.148)	(0.635)	(0.021)	(0.187)	(0.161)	(0.091)	(0.072)	(0.230)	(0.239)	(0.056)	(0.692)	(0.890)	(0.064)	(0.002)	(0.113)	(0.352)	(0.705)	(0.745)	(0.512)	(0.361)
$\alpha_{F,}$ Friday	0.041	0.098	0.190**	0.058	0.042	0.092	-0.162**	0.093	0.156**	-0.055	0.048	-0.026	0.132*	0.489***	0.041	-0.008	0.037	0.057	0.222**	0.255*
	(0.370)	(0.171)	(0.012)	(0.231)	(0.333)	(0.333)	(0.044)	(0.275)	(0.017)	(0.305)	(0.262)	(0.703)	(0.061)	(0.000)	(0.411)	(0.920)	(0.181)	(0.416)	(0.035)	(0.052)

TABLE 2 (continued) Panel II – Variance Equation (specified without the DOW effects)

	Bul	Chi	Col	Cze	Est	Hun	Indi	Indo	Isr	Lit	Mal	Mex	Pol	Rus	S. Afr	S. Kor	Sloven	Tai	Thai	Tur
C	0.214***	0.034***	-0.025	0.002	-0.001	0.019**	0.061***	0.079***	0.008	-0.005	0.004	0.015***	0.019***	0.025**	0.000	0.007	-0.027***	0.029***	0.037**	0.085***
	(0.000)	(0.000)	(0.324)	(0.578)	(0.912)	(0.040)	(0.000)	(0.002)	(0.226)	(0.171)	(0.224)	(0.002)	(0.002)	(0.025)	(0.905)	(0.104)	(0.002)	(0.000)	(0.016)	(0.000)
Q	0.662***	0.274***	0.519***	0.192***	0.257***	0.108***	0.219***	0.233***	0.160***	0.145***	0.194***	0.165***	0.198***	0.212***	0.203***	0.114***	0.433***	0.150***	0.195***	0.218***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
P	0.775***	0.967***	0.845***	0.981***	0.968***	0.967***	0.920***	0.873***	0.930***	0.985***	0.988***	0.979***	0.973***	0.985***	0.975***	0.994***	0.946***	0.966***	0.960***	0.958***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L	-0.090	0.138**	-0.066	0.142**	0.077	0.347**	0.434***	0.545***	0.453***	-0.199*	0.328***	0.550***	0.119*	0.107	0.311***	0.309***	-0.035	0.544***	0.095	0.155**
	(0.289)	(0.017)	(0.495)	(0.031)	(0.256)	(0.013)	(0.000)	(0.000)	(0.009)	(0.052)	(0.000)	(0.000)	(0.084)	(0.157)	(0.000)	(0.001)	(0.422)	(0.000)	(0.274)	(0.017)
μ	0.016	0.043	0.134	-0.138***	-0.131***	-0.089	0.037	-0.074	0.192	-0.051	-0.104***	-0.058	-0.050	-0.009	-0.027	0.028	0.049	-0.042	-0.161	-0.022
	(0.389)	(0.349)	(0.171)	(0.001)	(0.005)	(0.558)	(0.681)	(0.500)	(0.157)	(0.467)	(0.005)	(0.292)	(0.408)	(0.875)	(0.633)	(0.545)	(0.127)	(0.517)	(0.105)	(0.730)
D	0.655***	1.158***	1.136***	1.257***	1.017***	1.352***	1.233***	1.140***	1.109***	1.183***	1.082***	1.274***	1.280***	1.282***	1.291***	1.164***	1.019***	1.124***	1.270***	1.172***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Skewness	0.014	-0.004	-0.163	-0.077	-1.024	0.011	-0.339	0.054	-0.109	0.270	0.279	-0.054	0.009	-0.228	-0.261	-0.203	-1.954	-0.093	0.207	-0.197
kurtosis	16.122	2.780	2.674	3.385	13.623	1.180	3.846	2.713	2.501	2.398	5.351	2.227	1.785	1.670	3.244	2.242	27.506	2.121	2.234	3.513
Function value	-1869.8	-4982.0	-969.7	-3789.9	-2725.3	-2608.1	-4075.0	-2521.6	-2205.5	-2041.5	-3892.9	-4630.1	-4646.2	-4001.3	-3516.5	-5285.1	-2946.0	-4756.2	-2866.8	-6287.5
Function value of restricted model	-2319.8	-5372.8	-1004.2	-4074.9	-3013.2	-2672.2	-4234.3	-2627.7	-2336.3	-2158.8	-4679.2	-4951.4	-4859.1	-4355.7	-3804.4	-5669.8	-3263.7	-5004.5	-2969.5	-6527.8
Presence of DOW effect for the return	449.9	390.8	34.4	284.9	287.8	64.0	159.3	106.0	130.8	117.2	786.2	321.3	212.9	354.3	287.9	384.7	317.7	248.2	102.7	240.2

TABLE 2 (continued) Panel III – Specification Tests

	Bul	Chi	Col	Cze	Est	Hun	Indi	Indo	Isr	Lit	Mal	Mex	Pol	Rus	S. Afr	S. Kor	Sloven	Tai	Thai	Tur
Sign bias test	-0.946 (0.343)	-0.042 (0.965)	-1.057 (0.290)	0.130 (0.896)	1.031 (0.302)	-1.142 (0.253)	1.112 (0.265)	0.885 (0.375)	1.214 (0.224)	-0.429 (0.667)	-1.283 (0.199)	0.644 (0.519)	-0.168 (0.866)	0.363 (0.715)	-1.778* (0.075)	0.951 (0.341)	-1.140 (0.254)	-0.268 (0.788)	-1.704* (0.088)	1.288 (0.197)
Negative size Bias test	-0.791 (0.428)	-0.976 (0.328)	-1.226 (0.220)	-0.187 (0.851)	-0.032 (0.974)	-0.512 (0.608)	-0.037 (0.969)	0.062 (0.950)	1.404 (0.160)	-2.491** (0.012)	-1.270 (0.204)	-1.246 (0.212)	-1.956** (0.050)	-0.226 (0.820)	-2.215** (0.026)	0.221 (0.824)	-0.529 (0.596)	1.074 (0.282)	-0.464 (0.642)	0.323 (0.746)
Positive size Bias test	-0.521 (0.602)	0.407 (0.683)	-0.721 (0.470)	0.120 (0.903)	0.825 (0.409)	-0.417 (0.676)	0.613 (0.539)	1.630 (0.103)	-1.055 (0.291)	1.027 (0.304)	1.197 (0.231)	0.605 (0.545)	1.304 (0.192)	-0.171 (0.863)	-1.067 (0.285)	-0.312 (0.754)	-0.249 (0.803)	-1.999** (0.045)	-1.745* (0.081)	1.516 (0.129)
Joint test	0.400 (0.752)	0.406 (0.748)	0.688 (0.559)	0.033 (0.991)	0.462 (0.708)	0.464 (0.706)	0.565 (0.637)	0.887 (0.446)	1.865 (0.133)	2.454* (0.061)	1.788 (0.147)	1.229 (0.297)	1.853 (0.135)	0.202 (0.894)	2.044 (0.105)	0.685 (0.560)	0.457 (0.712)	1.752 (0.154)	1.327 (0.263)	0.886 (0.447)
Q(5)	4.730 (0.449)	13.314** (0.020)	5.834 (0.322)	1.110 (0.953)	9.177 (0.102)	3.782 (0.581)	1.091 (0.954)	9.919* (0.077)	6.598 (0.252)	3.210 (0.667)	26.564*** (0.000)	5.969 (0.309)	13.377** (0.020)	7.967 (0.158)	6.362 (0.272)	4.233 (0.516)	13.432** (0.019)	7.851 (0.164)	5.186 (0.393)	8.047 (0.153)
Q(10)	19.174** (0.038)	14.244 (0.162)	12.402 (0.259)	6.589 (0.763)	16.692* (0.081)	11.531 (0.317)	2.498 (0.990)	11.739 (0.302)	9.401 (0.494)	7.276 (0.699)	27.969*** (0.001)	8.643 (0.566)	15.384 (0.118)	12.702 (0.240)	11.046 (0.353)	7.946 (0.634)	18.893** (0.041)	13.477 (0.198)	6.198 (0.798)	10.120 (0.429)
Q(20)	40.772*** (0.004)	29.247* (0.083)	18.286 (0.568)	19.514 (0.488)	26.714 (0.143)	18.281 (0.568)	11.112 (0.943)	24.912 (0.204)	25.562 (0.180)	17.904 (0.593)	37.783*** (0.009)	20.561 (0.423)	22.447 (0.316)	22.219 (0.328)	16.280 (0.699)	13.799 (0.840)	23.378 (0.270)	27.392 (0.124)	21.774 (0.352)	25.655 (0.177)
Q(30)	56.238*** (0.003)	42.053* (0.070)	29.423 (0.495)	26.906 (0.628)	39.487 (0.115)	21.459 (0.872)	20.283 (0.908)	34.000 (0.280)	30.880 (0.421)	33.507 (0.300)	47.403** (0.022)	28.876 (0.524)	30.210 (0.454)	36.985 (0.177)	29.833 (0.474)	25.148 (0.717)	35.863 (0.212)	34.649 (0.255)	28.527 (0.542)	37.721 (0.157)
Q(60)	90.804*** (0.006)	77.507* (0.063)	59.390 (0.497)	55.556 (0.638)	75.676* (0.083)	38.021 (0.988)	68.229 (0.217)	60.866 (0.444)	72.375 (0.131)	56.580 (0.601)	68.170 (0.219)	79.684** (0.045)	80.590** (0.039)	70.133 (0.174)	51.523 (0.773)	55.660 (0.634)	75.778* (0.082)	55.156 (0.652)	59.692 (0.486)	54.117 (0.689)
ARCH-LM(5)	2.707 (0.745)	3.712 (0.592)	2.299 (0.806)	7.637 (0.177)	2.073 (0.838)	2.950 (0.708)	6.432 (0.266)	2.998 (0.700)	15.718*** (0.008)	4.469 (0.484)	6.336 (0.274)	13.661** (0.017)	13.004** (0.023)	12.109** (0.033)	15.534*** (0.000)	5.420 (0.366)	0.535 (0.990)	3.380 (0.641)	1.975 (0.853)	8.645 (0.124)
ARCH-LM(10)	10.592 (0.390)	6.234 (0.795)	3.921 (0.950)	13.050 (0.220)	5.022 (0.889)	7.624 (0.666)	9.258 (0.507)	11.102 (0.350)	17.741* (0.060)	6.179 (0.800)	8.801 (0.551)	15.748 (0.107)	17.378* (0.066)	16.881* (0.077)	18.850** (0.042)	11.955 (0.288)	1.198 (0.999)	10.008 (0.439)	9.623 (0.474)	16.819** (0.078)
ARCH-LM(20)	39.149*** (0.000)	17.032 (0.651)	9.740 (0.972)	17.266 (0.635)	6.552 (0.997)	17.343 (0.631)	24.820 (0.208)	21.811 (0.351)	37.865*** (0.009)	11.630 (0.928)	16.672 (0.674)	21.889 (0.346)	31.140* (0.053)	24.289 (0.230)	23.789 (0.251)	16.722 (0.670)	1.971 (1.000)	19.593 (0.483)	34.652** (0.022)	25.582 (0.180)
ARCH-LM(30)	44.368** (0.044)	27.321 (0.606)	13.103 (0.996)	26.193 (0.665)	8.479 (1.000)	29.078 (0.514)	37.777 (0.155)	32.016 (0.367)	49.132** (0.015)	35.447 (0.226)	23.188 (0.807)	31.836 (0.375)	40.005 (0.104)	29.320 (0.501)	31.634 (0.384)	21.199 (0.881)	2.640 (1.000)	28.275 (0.555)	52.192*** (0.007)	29.812 (0.475)
ARCH-LM(60)	151.944*** (0.000)	66.570 (0.261)	48.967 (0.844)	37.499 (0.990)	15.880 (1.000)	54.129 (0.689)	62.007 (0.404)	62.997 (0.371)	79.170** (0.049)	51.243 (0.782)	41.316 (0.968)	59.348 (0.499)	86.701** (0.013)	49.318 (0.836)	137.160*** (0.000)	50.384 (0.807)	5.560 (1.000)	53.404 (0.713)	85.041** (0.018)	52.228 (0.752)

Note: p-values are reported in parentheses under the corresponding coefficient. (*), (**) and (***) correspond to significance at 10%, 5% and 1% levels.

South Africa, South Korea, Taiwan and Turkey have statistically significant positive estimates of L, which indicates that a positive surprise actually increases volatility, while a negative surprise decreases volatility. The estimate of D is positive and statistically significant for all sample countries.

We have also elaborated on how sensitive the estimates of the return specifications are to the way we handle the volatility of returns. We consider what happens when the estimations of Table 1 are replicated without considering DOW effects in the conditional volatility equation, i.e. we look for the possible effects of modeling the volatility by explicitly using the DOW dummies on the dynamics of the return specifications alone. ***Table 2*** suggests that the estimates of Table 1 are robust up to excluding the DOW effects in volatilities. Therefore, the basic inferences of Table 1 are not altered after the DOW dummies have been dropped from the conditional variance specification. All in all, DOW effects on returns and DOW effects on volatilities seem to be disjoint.

3.3 Specification Tests

With regard to the quality of our specifications, we first look at the estimated coefficient for P in the EGARCH specification. In order to satisfy the non-explosiveness of the conditional variance, the estimated coefficient for P should be less than unity. It is actually less than 1 for all sample countries except Poland. However, we cannot significantly reject the null hypothesis that it is less than unity for Poland. Therefore, the non-explosiveness condition for variances is satisfied.

Secondly, we provide non-parametric bias tests. These tests are the Sign Bias Test, the Positive and Negative Size Bias Tests and the Joint Test. To compute the statistics for these tests, normalized residuals, e_t, are obtained by dividing the residuals by the square root of the conditional variance. Then two dummy variables denoted by m_t and p_t are defined such that m_t equals 1 if the normalized residual is negative and equals 0 otherwise; and p_t equals 1 if the normalized residual is positive and equals 0 otherwise. Then two interactive variables are defined as $sm_t = m_t e_t$ and $sp_t = p_t e_t$. Next, e_t is regressed on constant term, m_t, sm_t and sp_t. For the sign test, we assess the null hypothesis that $H_0 : m_t = 0$; for the negative size tests we assess the null hypothesis $H_0 : sm_t = 0$; and for the positive size tests we assess $H_0 : sp_t = 0$. For the joint test, we jointly assess all three null hypotheses. Non-parametric bias-test statistics and p-values are reported in *Panel III* of Table 1. These show that the p-values are above 5-percent in all these tests, indicating a failure to reject the null hypothesis that the parameter of interest is equal to zero. Thus, we conclude that the sign and the size effects are not present for our sample countries.

The likelihood ratio test results suggest that we can reject the null hypothesis of "no DOW effects" for the conditional variance equation. The likelihood ratio tests are reported in *Panel II* of Table 1a, 1b, 2a and 2b and all country statistics greater than χ^2_4 value of 9.488 at the 5-percent level of significance.

For the specification of the model, the presence of autocorrelation of the standardized residual conditional standard deviations is tested by using Ljung-Box *Q* Statistics for 5-, 10-, 20-, 30-, and 60-day lags. These statistics are reported in *Panel III* of Table 1. For China, Malaysia, and Poland Ljung-Box *Q* Statistic is not significant at 5-day lags. For Bulgaria, it is not significant for 20- and 60-day lags. The statistics for Mexico are not significant at 60-day lags and not significant at 5- and 10-day lags for Slovenia. Regarding the remaining countries, we cannot reject the null hypothesis that the residuals are not autocorrelated.

Next, we tested the presence of the ARCH effect by using the Lagrangian Multiplier test (LM). In order to perform the LM test, the squared estimated residual terms are regressed on constant term and on their 5-, 10-, 20-, 30-, and 60-lags using the ordinary least squares. These statistics are reported in *Panel III* of Table 1. For Bulgaria LM(ARCH) *p*-values are not significant at 20-, 30- and 60-day lags. For Mexico, *p*-value is not significant at the 5-day lag. Poland and South Africa have an insignificant *p*-value at 5- and 60-days lag. For Thailand, statistics are not significant at 20-, 30- and 60-days lag. For the remaining countries, we fail to reject the null hypothesis that the ARCH effect is not present. The formal specification tests having been passed, in the next section we discuss our empirical findings.

4. Discussion of Empirical Findings

The estimates which were presented in Section 3 provided us with country-by-country evidence for the presence (or absence) of DOW effects. Specifically, we have seen in Section 3 that when the estimates were interpreted at the 1-percent level of significance, for 3 countries the DOW effect is present in returns; for 5 countries it is present in volatility; and it is present in both for only one country. That is, restricting ourselves to a tight level of significance, we can conclude that DOW effects exist only in a maximum of 5 of the sample countries, which is equivalent to asserting that "the DOW effect is not strongly present in our data sample".

The efficient market hypothesis implies that investors will develop strategies to explore any regular pattern that may exist in financial markets. Hence, the presence of DOW effects is often promoted as conflicting with this hypothesis. Similarly, the absence (or disappearance) of the DOW patterns can be interpreted as high (or increased) efficiency in the markets. Our major conclusion that the DOW effect is not strongly present in our sample, therefore, forms evidence for the efficiency of the examined stock markets. Consequently, sticking to the 1-percent level of statistical significance, we might conclude the paper at this point. Nevertheless, some digression from the conventional use of a tight significance level can yield further findings, as discussed below.

By the very nature of the statistical significance phenomenon, more cases of DOW effects are revealed when the significance criterion is widened, e.g. to 5 % or 10 %. The results of this exercise are presented in ***Table 3***. Pushing the significance level up to the widest of the conventional levels (10 %), we are able to say that in 9 of the emerging markets DOW effects are pre-

TABLE 3 Sensitivity of Captured DOW Effects to the Selected Level of Statistical Significance

Selected Level of Statistical Significance	DOW in returns	DOW in volatilities	DOW in both returns and volatilities
1%	3	5	1
5%	11	10	5
10%	13	12	9

Note: The figures in the table are the number of countries displaying DOW effects in returns, volatilities or in both.

sent in both returns and volatilities.[10] At the same time, it should be admitted that these findings are statistically less tangible than the ones at the 1-percent level. Having stated the main conclusion of our analysis as the DOW effects not being *strongly* present in our sample, we still utilize our estimates which are significant at the 10-percent level of significance in the following discussion,[11] where we turn our attention to the common patterns in our sample.

While examining the common patterns of interest, we have reconsidered our estimates in three ways. Firstly, we look for the common points among the 20 countries without classifying them into groups. Secondly, we check for whether the sample countries being Pacific Rim or post-communist states implies a meaningful pattern. Finally, we look for the possible effects of Account Settlement Days on our estimates. Thus, we try to consolidate our estimates in some plausible ways.

The search for common patterns among the sample countries is facilitated by a number of counting exercises. In this regard, we first determine the days with maximum (or minimum) returns (or volatilites) for each country. Then we highlight the correspondences between the minimum and maximum return (or volatility) days. In *Panel I* of Table 1, it is seen that for 8 countries Mondays[12], for 6 countries Tuesdays[13], for 5 countries Wednesdays[14], and for one country Thursdays[15] yield the lowest return. There is no case where Fridays yield the minimum return. The maximum return is on Fridays for 9 countries[16], Thursdays for 3 countries,[17] Wednesdays for 4 countries[18], Mondays for 3 countries[19] and Tuesdays[20] for only one. Turning our atten-

[10] A frequentist interpretation suggests that *"DOW effects are present 90 % of the time in nearly half of our sample countries"*. Nevertheless, for a time series with thousands of daily observations, the 1-percent significance level is definitely more appropriate than 5-percent or 10-percent significance levels.

[11] The use of the estimates with lower significance is basically directed toward attaining a deeper understanding of the patterns embedded in our sample data.

[12] Lithuania, Mexico, Estonia, Indonesisa, Malaysia, Slovenia, Thailand and Turkey

[13] Taiwan, India, South Korea, China, Colombia, Poland

[14] Israel, South Africa, Czech Republic, Hungary, Russia

[15] Bulgaria

[16] China, Colombia, Indonesia, Malaysia, Poland, Russia, Slovenia, Thailand, Turkey

[17] Estonia, Czech Republic, Hungary

[18] Lithuania, Mexico, India, South Korea

[19] Taiwan, Israel, South Africa

TABLE 4 DOW Effects: Days with Minimum and Maximum Return

A DOW Pattern in Returns (Table 1 Panel I)

		Maximum				
		Mon	Tue	Wed	Thu	Fri
Minimum	Mon	–	–	2	1	5
	Tue	1	–	2	–	3
	Wed	2	–	–	2	1
	Thu	–	1	–	–	–
	Fri	–	–	–	–	–

B DOW Pattern in Volatilities (Table 1 Panel II)

		Maximum				
		Mon	Tue	Wed	Thu	Fri
Minimum	Mon	–	–	1	–	1
	Tue	6	–	–	–	–
	Wed	–	1	–	–	–
	Thu	–	–	1	–	–
	Fri	9	–	1	–	–

C DOW Pattern in Returns (Table 2 Panel I)

		Maximum				
		Mon	Tue	Wed	Thu	Fri
Minimum	Mon	–	–	2	1	5
	Tue	–	–	2	–	5
	Wed	1	–	–	2	1
	Thu	–	1	–	–	–
	Fri	–	–	–	–	–

Note: The numerical figures indicate the number of countries displaying a certain matching between minimum return (or volatility) on a certain day versus the maximum return (or volatility) on another day of the week.

tion to the match between the lowest and highest return days, there are 5 countries[21] where Mondays have the lowest and Fridays have the highest returns (see ***Table 4***, *Panel A*). *Panel A* in Table 4 suggests that the minimum and maximum return days are located at the beginning and end of the week, respectively. This is in line with the intra-week trading behaviours of investors as reported in the earlier literature.

Repeating the same counting exercise on the estimated volatility equations (*Panel II* of Table 1), the lowest volatility is observed on Mondays for 2 countries[22], Tuesdays for 6 countries[23], and Fridays for 10 countries[24]. Mondays have the maximum volatility in 15 of the 20 countries[25]. *Panel B* in Table 4 suggests that Mondays display higher volatility of returns, whereas the minimum volatility is concentrated on Tuesdays and Fridays. Specifically, for the countries in which Monday has the highest volatility, Tuesdays have the lowest volatility.[26] It is also observed that where Fridays

[20] Bulgaria

[21] Indonesia, Malaysia, Slovenia, Thailand and Turkey

[22] Bulgaria, Israel

[23] Estonia, India, Indonesia, Poland, South Korea, Taiwan

[24] China, Czech Republic, Lithuania, Malaysia, Mexico, Russia, South Africa, Slovenia, Turkey and Hungary

[25] Estonia, India, Indonesia, Poland, South Korea, Taiwan, China, Czech Republic, Lithuania, Malaysia, Mexico, Russia, South Africa, Slovenia, and Turkey

[26] Estonia, India, Indonesia, Malaysia, Poland, South Korea, Thailand and Turkey

have minimum volatility, Mondays have the highest volatility with the exception of Hungary.

There is no apparent pattern of negativity or positivity in the ARCH-in--Mean effect in Table 1. Moreover, the leverage effect is positive except for 4 countries, whereas the remaining estimates (which are negative) are not statistically significant, except for Lithuania. The results of the counting exercise remain unchanged when we consider the estimates of Table 2, in which the volatility specification includes no DOW dummy variables (*Panel C* in Table 4).

Regarding the possibility of the effects of geographical clustering, one may recognize that most of the sample countries can be divided into either of two major subsets[27] as Pacific Rim countries (China, Colombia, Indonesia, Malaysia, Mexico, South Korea, Taiwan and Thailand) and post-communist states (Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Poland, Russia and Slovenia). We have checked for whether such a separation of countries implies a meaningful pattern.[28] Re-examining our estimates on that basis reveals that the most visible DOW pattern in the Pacific Rim sub-sample is the negative returns on Mondays (namely in Indonesia, Malaysia and Thailand). This finding is the same as the one reported by Choudhry (2000). In the case of the post-communist countries, the only common pattern is observed as the minimum Wednesday returns in the cases of the Czech Republic, Hungary and Russia. This might be indicative of the entanglement and/or similarity of these three markets. The rest of the country evidence seems to be mixed.

Finally, we have elaborated on the possible effects of Account Settlement Days on our estimates as well.[29] Specifically, we looked at a possible visual match between the estimated DOW effects and the settlement days in our sample countries. However, this exercise did not yield any regular pattern.

All in all, the analysis of the common patterns among our sample countries did not reveal strong results in terms of either the Pacific Rim/post--communist classification or the account settlement days. However, we have the observations that (1) the higher returns are concentrated around Fridays, (2) the volatilities are higher on Mondays and (3) they are the lowest on Tuesdays and Fridays.

As mentioned earlier, the existing literature offers a number of explanations for the DOW effects; such as the "absence of brokers' advice over the weekend" (Miller, 1988) and "high incidence of unfavourable news arriving at the weekend" (Penman, 1987), (Dyl – Maberly, 1988), (Berument – Kiymaz, 2001). Financing discontinuities associated with the account settlement period, the relative scarcity of funds while finance is held in banks' suspense and transmission accounts on settlement day and firms' reluctance to hold money during non-trading periods were also addressed (Bell – Levin, 1998). The effects of macroeconomic and political news and private

[27] India, Israel, South Africa and Turkey are omitted.

[28] Although this was not a basic motivation of our analysis, countries' being Pacific Rim states or post-communist states might suggest a meaningful pattern in our estimates.

[29] The account-settlement days cover the period between the trading day and the actual payments related to the assets traded.

information on the market volatility were also documented (Kiymaz – Berument, 2003). However, our analysis of the estimated DOW effects did not lend support to any of these except the "weekend effect". Indeed, the efforts of the earlier literature toward explaining the structural reasons for the DOW effects remain inconclusive. In reality, many factors might induce the DOW effects in a given country, and the factors generating the DOW effects might differ among countries. Consequently, the DOW effects estimated for a set of countries and the reasons behind the DOW effects do not necessarily display a one-to-one correspondence, which makes the recognition of common patterns even harder. At the bottom line, the analysis of the structural-institutional motives of the DOW effects remains on our further research agenda.

5. Conclusion

In the literature, the DOW-effect anomaly is studied extensively in both equity and non-equity markets. The DOW-effect patterns in returns and volatility might enable investors to take advantage of relatively regular shifts in the market by designing trading strategies which take such predictable patterns into account. This study investigates the DOW effect on stock-market volatility for 20 emerging stock markets using a conditional variance framework.

Consolidating our findings at the 1-percent level of statistical significance, the DOW effects are present in market returns for 3 countries and in market volatility for 5 countries in our sample. They are present in both return and variance specifications for only 1 country in our sample. Neither of them exists for 13 countries and at least one of them exists for 7 countries. This forms some evidence for the existence of calendar anomalies for our sample of emerging markets. However, the evidence is not widespread over the sample at the 1-percent level of significance, i.e. the DOW effect is not strongly present in our data, which is a sign of efficiency in the examined markets. Nevertheless, further analysis of the DOW effects with lower statistical significance suggests that higher returns are concentrated around Fridays, whereas the volatilities are higher on Mondays and the lowest on Tuesdays and Fridays. The analysis of the impacts of institutional factors in each country's case is left to the future research agenda.

REFERENCES

ABRAHAM, A. – IKENBERRY, D. L. (1994): The individual investor and the weekend effect. *Journal of Financial and Quantitative Analysis*, vol. 29, 1994, pp. 263–77.

AGGARWAL, R. – RIVOLI, P. (1989): Seasonal and day-of-the week effect in four emerging stock markets. *Financial Review,* vol. 24, 1989, pp. 541–550.

AGRAWAL, A. – TANDON, K. (1994): Anomalies or illusions? Evidence from stock markets in eighteen countries. *Journal of International Money and Finance*, vol. 13, 1994, pp. 83–106.

ARIEL, R. A. (1987): A monthly effect in stock returns. *Journal of Financial Economics*, vol. 17, 1987, pp. 161–74.

ARIEL, R. A. (1990): High stock returns before holidays: Existence and Evidence on Possible Causes. *Journal of Finance*, vol. 45, 1990, pp. 1611–26.

ATHANASSAKOS, G. – ROBINSON, M. J. (1994): The day-of-the-week anomaly: The Toronto stock exchange experience. *Journal of Business Finance and Accounting*, vol. 21, 1994, pp. 833–856.

AYDOGAN, K. (1994): Abnormalities in Asset Pricing. (in Turkish) *Isletme ve Finans*, vol. 100, 1994, pp. 83–9.

BAILLIE, R. T. – GENNARO, R. P. de (1990): Stock returns and volatility. *Journal of Financial and Quantitative Analysis*, vol. 25, 1990, pp. 203–214.

BALABAN, E. (1995): Day of the week effects: New evidence from an emerging stock market. *Applied Economics Letters*, vol. 2, 1995, pp. 139–43.

BELL, D. – LEVIN, E. (1998): What causes intra-week regularities in stock returns? Some evidence from the UK. *Applied Financial Economics*, vol. 8, 1998, pp. 353–7.

BERUMENT, H. – KIYMAZ, H. (2001): The day of the week effect on stock market volatility. *Journal of Economics and Finance*, vol. 25, 2001, pp. 181–93.

BERUMENT, H. – INAMLIK, A. – KIYMAZ, H. (2004): The day of the week effect on stock market volatility: Istanbul Stock Exchange. (in Turkish) *Iktisat, Isletme ve Finans*, vol. 223, 2004, pp. 91–102.

BOLLERSLEV, T. (1986): Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, 1986, pp. 307–27.

BROOKS, C. – PERSAND, G. (2001): Seasonality in Southeast Asian stock markets: Some new evidence on day-of-the-week effects. *Applied Economic Letters*, vol. 8, 2001, pp. 155–8.

CAMPBELL, J. Y. – HENTSCHEL, L. (1992): No news is good news: an asymmetric model of changing volatility in stock returns. *Journal of Financial Economics*, vol. 31, 1992, pp. 281–318.

CHAN, K. C. – KAROLYI, G. A. – STULZ, R. M. (1992): Global financial markets and the risk premium on U.S. equity. *Journal of Financial Economics*, vol. 32, 1992, pp. 137–167.

CHANG, E. – PINEGAR, M. – RAVICHANDRAN, R. (1993): International evidence on the robustness of the day-of-the-week effect. *Journal of Financial and Quantitative Analysis*, vol. 28, 1993, pp. 497–513.

CHOUDHRY, T. (2000): Day of the Week Effect in Emerging Asian Stock Markets: Evidence from the GARCH Model. *Applied Financial Economics*, vol. 10, 2000, pp. 235–42.

CORHAY, A. – RAD, A. T. (1994): Statistical properties of daily returns: evidence from European stock markets. *Journal of Business Finance and Accounting*, vol. 21, 1994, pp. 271–282.

CORHAY, A. – FATEMI, A. – RAD, A. T. (1995): On the presence of a day-of-the-week effect in the foreign exchange market. *Managerial Finance*, vol. 21, 1995, pp. 32–43.

COSIMANO, T. F. – JANSEN, D. W. (1988): Estimates of the variance of U.S. inflation based upon ARCH model. *Journal of Money, Credit and Banking*, vol. 20, 1988, pp. 409–21.

CROSS, F. (1973): The behavior of stock prices on Friday and Monday. *Financial Analysts Journal*, vol. 29, 1973, pp. 67–9.

DAVIDSON, S. – FAFF, R. (1999): Some additional Australian evidence on the day-of-the-week effect. *Applied Economics Letters*, vol. 6, 1999, pp. 247–49.

DUBOIS, M. L. (1986): The day-of-the-week effect: The international evidence. *Journal of Banking and Finance*, vol. 20, 1986, pp. 1463–1484.

DUBOIS, M. – LOUVET, P. (1996): The day of the week effect: International evidence. *Journal of Banking and Finance*, vol. 20, 1996, pp. 1463–84.

DYL, E. A. – MABERLY, E. D. (1988): A possible explanation for the weekend effect. *Financial Analyst Journal*, vol. 44, 1988, pp. 83–4.

ENGLE, R. (1982): Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation. *Econometrica*, 1982, pp. 987–1007.

ENGLE, R. (1993): Statistical models for financial volatility. *Financial Analysts Journal*, vol. 49, 1993, pp. 72–78.

FLANNARY, M. J. – PROTOPAPADAKIS, A. A. (1988): From T-bills to common stocks: investigating the generality of intra-week return seasonality. *Journal of Finance*, 1988, pp. 431–449.

FRENCH, K. (1980): Stock returns and the weekend effect. *Journal of Financial Economics*, vol. 8, 1980, pp. 55–70.

FRENCH, K. – SCHWERT, G. – STAMBAUGH, R. (1987): Expected stock returns and volatility. *Journal of Financial Economics*, vol. 19, 1987, pp. 3–30.

GAY, G. – KIM, T. (1987): An investigation into seasonality in the futures market. *Journal of Futures Markets*, vol. 7, 1987, pp. 169–181.

GESSER, V. – PONCET, P. (1997): Volatility patterns: Theory and dome Evidence from the dollar-mark option market. *Journal of Derivatives*, vol. 5, 1997, pp. 46–61.

GIBBONS, M. – HESS, P. (1981): Day of the week effects and asset returns. *Journal of Business*, vol. 54, 1981, pp. 579–96.

GLOSTEN, L. R. – JAGANNATHAN, R. – RUNKLE, D. E. (1993): On the relation between the expected value and the volatility of the nominal excess returns on stocks. *Journal of Finance*, vol. 48, 1993, pp. 1779–1801.

HAMILTON, J. (1994): *Time Series Analysis*. Princeton University Press, Princeton, New Jersey, 1994.

HSIEH, D. A. (1988): The statistical properties of daily foreign exchange rates: 1974–1983. *Journal of International Economics*, vol. 24, 1988, pp. 129–45.

JAFFE, J. – WESTERFIELD, R. (1985): The weekend effect in common stock returns: The international evidence. *Journal of Finance*, vol. 40, 1985, pp. 433–454.

KAROLYI, A. G. (1995): A multivariate GARCH model of international transmission of stock returns and volatility: The case of the United States and Canada. *Journal of Business and Economic Statistics*, vol. 13, 1995, pp. 11–25.

KEIM, D. – STAMBAUGH, R. (1984): A further investigation of the weekend effect in stock returns. *Journal of Finance*, vol. 39, 1984, pp. 819–35.

KIYMAZ, H. – BERUMENT, H. (2003): The day of the week effect on stock market volatility and volume: International evidence. *Review of Financial Economics*, vol. 12, 2003, pp. 363–80.

KOHERS, G. – KOHERS, N. – PANDEY, V. – KOHERS, T. (2004): The disappearing day-of--the-week effect in the world's largest equity markets. *Applied Economics Letters*, vol. 11, 2004, pp. 167–71.

LAKONISHOK, J. – LEVI, M. (1982): Weekend effects in stock returns: a note. *Journal of Finance*, vol. 37, 1982, pp. 883–9.

LAKONISHOK, J. – SMIDT, S. (1988): Are seasonal anomalies real? A nintey year perspective. The *Review of Financial Studies*, vol. 1, 1988, pp. 403–25.

LAUTERBACH, B. – UNGAR, M. (1995): Real vs Nominal Stock Return Seasonalities: Empirical Evidence. *International Review of Economics and Finance*, vol. 4, 1995, no. 2, pp. 133–47.

LIN, C.-T. – LIM L. K. (2001): On the Disappearance of Tuesday Effect in Australia. *School of Finance and Business Economics, Edith Cowan University*, *Working Paper Series*, no. 01-12.

MILLER, E. M. (1988): Why a weekend effect? *Journal of Portfolio Management*, vol. 15, 1988, pp. 42–8.

MORIN, N. (2001): *GARCH.SRC (RATS code for estimating the ARCH-GARCH family of models).* http://www.estima.com/ARCH-GARCH.shtml [downloaded: 04. 10. 2001]

NELSON, D. B. (1991): Conditional heteroskedasticity in asset returns: A new approach. *Econometrica*, vol. 59, 1991, pp. 347–370.

PENMAN, S. H. (1987): The distribution of earnings news over time and seasonalities in aggregate stock returns. *Journal of Financial Economics*, vol. 18, 1987, pp. 199–228.

ROGALSKI, R. J. (1984): New findings regarding day-of-the-week returns over trading and non-trading periods: A note. *Journal of Finance*, vol. 35, 1984, pp. 1603–1614.

SAVVA, C. S. – OSBORN, D. R. – GILL, L. (2005): *The day of the week effect on stock market volatility using EGARCH framework.* University of Manchester, unpublished manuscript.

SMIRLOCK, M. – STARKS, L. (1986): Day-of-the-week and intraday effects in stock returns. *Journal of Financial Economics*, vol. 17, 1986, pp. 197–210.

SOLNIK, B. – BOUSQUET, L. (1990): Day of the week effect on the Paris Bourse. *Journal of Banking and Finance*, vol. 14, 1992, pp. 461–468.

SUMMARY

JEL Classification: C22, G10, G12
Keywords: day-of-the-week effect; EGARCH-M; emerging-market economies; volatility

The Day-of-the-Week Effect on Stock-Market Volatility and Return:
Evidence from Emerging Markets

Yeliz YALCIN – Department of Econometrics, Gazi University, Ankara, Turkey (yyeliz@gazi.edu.tr)
Eray M. YUCEL – Research and Monetary Policy Department, Central Bank of the Republic of Turkey, Ankara, Turkey and Department of Economics, Bilkent University, Ankara, Turkey (eray.yucel@tcmb.gov.tr)

This study investigates day-of-the-week (DOW) anomalies in the stock markets of twenty emerging economies. The authors use a modified exponential generalized autoregressive conditional heteroskedasticity in-mean (EGARCH-M) modeling strategy that allows for the simultaneous examination of DOW effects on market return and variability. The effects on both are limited in the authors' sample. To summarize, DOW effects are present in market returns for only three countries, in market volatility for only five countries, and they are present in both for only one country, when the estimates are evaluated at the 1 percent significance level. Despite this, at lower levels of significance the common qualitative patterns in the estimates are extracted such that the higher returns are concentrated around Fridays, whereas volatility is highest on Mondays and lowest on Tuesdays and Fridays.