The Death of a King and Volatility in the Jordanian Capital Market

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Abstract

The Late His Majesty King Hussein of Jordan, the region's longest-serving leader, died on Sunday, 7 February 1999. Although it came as no surprise, that did not lessen the grief by Jordanians. Indeed, this event in the contemporary history of Jordan is important for its emotional, political and economic implications.

This paper uses the standard GARCH, exponential GARCH (EGARCH) and the GJR models to examine the conditional volatility associated with two major dates associated with King Hussein. These are the official denial that Hussein may die within three months and the date of his death.

The results indicate that King Hussein's health "rumors" and the date of his death caused extremely high volatility in the Jordanian capital market. Moreover, the results suggest that these events are discounted in at least three days following their respective dates.

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I. Introduction

The Hashemite Kingdom of Jordan occupies an area of about 89,000 square kilometers. Its population is about 4.5 million and with an annual increase of about 3.0%, Jordan is considered to be one of the fastest growing countries in the world. The demographic profile of Jordan is similar to that in most advanced economies. The urbanization rate is about 70%, life expectancy is around 70 years and the adult literacy rate is about 85%.

Jordan’s natural resources base is very limited. Other than Potash and Phosphate, the country has no natural resources. This is why, traditionally, the economy has relied heavily on foreign aid, worker’s remittances and external debt.

Any attempt to analyze the economic performance of Jordan is fraught with numerous difficulties. The country has passed through many internal and external disturbances (economic and political) and these make the detection of any underlying economic trends extremely difficult. These disturbance sources include the 1967 Arab Israeli War, the 1970 Civil War, the 1973 War, the 1989 devaluation of the Jordanian Dinar and the introduction of the IMF supported austerity measures, the 1991 Gulf War, the 1994 signing of the peace treaty with Israel, the 1998 beginning of the late His Majesty King Hussein's (HMKH) chemotherapy for non-Hodgkin's lymphoma, the 1999 death of HMKH, and more recently the 2001/2002 Intifada in the Palestinian territories.

The Hashemite Kingdom of Jordan (HKJ) was blessed with a pivotal figure "The Late His Majesty King Hussein". Hussein ibn Talal was only a teenager when he assumed the throne of the HKJ in 1952. At the age of 15, he witnessed the assassination of his grandfather. He inherited a poor Kingdom, unstable and awash in refugees from the 1948 Arab-Israeli War. Moreover, Hussein's early life was complicated. He survived a number of assassination attempts, his authority was challenged by his own prime ministers, threats from other Arab countries and occasional riots by Arab nationalists. Within a few years, Palestinian guerilla movements challenged the King's authority and after the break-out of the 1973 Arab-Israeli War, Hussein had to face the invasion of Kuwait by Iraq. Despite of these "disturbances", the late King Hussein was known as a force for peace and stability and in 1994, he signed a peace treaty with Israeli Prime Minister Yitzhak Rabin.

The Amman Securities Market (ASM) was established in 1978. Since its formation, the market has experienced some growth in a number of aspects. In 1978, for example, the total number of listed companies was 66. By the end of 2002, this number increased to 161. Moreover, the fact that the market capitalization of all listed companies as a proportion of GDP is equal to about 76% (2002) is an indication of the relative importance of the market. However, similar to many emerging markets, the ASM suffers from a number of weaknesses. In 2002, for example, 10 companies only accounted for about 70% of the total market in terms of market capitalization and trading volume. In other words, the market is concentrated in terms of market capitalization and trading volume and most listed shares are thinly traded on the secondary market.

Relative to the above-mentioned political and economic instability sources, it can be argued that the most natural occurrence and peaceful change that Jordan had to face, the death of King Hussein, was, potentially, the most important as far as its impact on ASM's share prices. Indeed, this event in the contemporary history of Jordan is important for its emotional, political and economic implications. King Hussein's death was felt far outside the grieving Kingdom. At the funeral, former presidents Clinton, Bush, Carter, and Ford represented the United States. The British prime minister, the French president, and the German Chancellor were also present. The former president of Russia (Yeltsin), despite of his illness, also attended the funeral. In a show of unusual political diversity, leaders of most Arab leaders were side by side with many western political leaders.

Given the special status of the late His Majesty King of Hussein, this paper attempts to examine the impact of his death on the conditional volatility of the ASM. In Table 1, we report the events surrounding the date of Hussein's death.

Table 1
Highlights of King's Last Days

July 1998	Begins chemotherapy for non-Hodgkin's lymphoma
September 21, 1998	King Hussein assures his people about his health.
October 1998	Helps stave off the collapse of the Israeli-Palestinian peace accord by leaving hospital and appearing at the Wye River peace talks.
October 20, 1998	Jordan categorically denied a report by the British "Foreign Report" intelligence bulletin that King Hussein is in his last days and may die within three months.
January 19, 1999	Returns to a tumultuous welcome in Jordan after cancer treatment.
January 25, 1999	Appoints his eldest son, Prince Abdullah, as heir and hours later, he returns to the USA for further treatment.
February 4, 1999	Hussein's private physician announces that the King's treatment failed and king return home.
February 7, 1999	King Hussein dies

The issue of stock market volatility has received great attention in the finance literature. High levels of volatility can adversely affect stock markets and undermine the financial system as a whole. Volatility also discourages risk-averse investors and savers, and stock market fluctuations may raise the cost of capital to corporations[1] and may also increase the value of the "*option wait*" and hence delay investments. Volatility tends also to discourage firms from seeking a stock market listing or attempting to raise funds by new issues. Thus, high levels of market volatility can impede investment and slow overall economic growth (De Long *et al.,* 1989) [2].

A large number of theoretical and empirical studies have attempted to explain the sources of volatility in stock market returns[3]. The debate surrounding non-fundamentals in equity markets has been rekindled in recent years by the publication of the volatility tests of Shiller (1981) and LeRoy and Porter (1981). They both found, based on a simple present value model with a constant discount rate, that stock market volatility is greater than could be justified by subsequent changes in dividends. These studies were then followed by Roll (1988) who found that only approximately one-third of the monthly variation in individual stock returns can be explained by systematic economic influences. The results of Cutler et al. (1989) indicate that macroeconomic news can explain only between one-fifth and one-third of the movements in stock market indices. These conclusions can also be found in Schwert (1989) who found that, although there is weak evidence that macroeconomic

[1] See for example Bekaert and Wu (2000), Singh (1992, 1997, 1999), Glen, *et al.,* (2000), Singh and Weisse (2000) and Kim and Singal (2000).

[2] Bittlingmayer (1998) finds that stock market volatility had a strongly negative effect on investment and industrial production in Germany during the interwar period.

[3] See for example, Flood and Graber (1984), Flood and Hodrick (1986), De Long et al. (1989, 1990) and Diba and Grossman (1988).

volatility can help predict stock return volatility, the amplitude of the fluctuations in aggregate stock market volatility is difficult to account for using simple models of stock valuation, especially during the Great Depression.

In addition to the impact of economic variables, it is plausible to argue that non-economic variables could contribute to stock market volatility. While there have been many papers that examined the impact of political events on business cycles[4], few papers have examined the impact of political events on financial markets. This may due to the lack of data or difficultly of modeling political events. Among the limited studies are Willard et al. (1996) who found some significant evidence that the turning points in the US Civil War were reflected in the price of the Greenbacks. Erb et al. (1996) also found a significant relationship between equity market volatility and political risk as measured by the ICRG political risk ratings in emerging markets. Recent work by Bittlingmayer (1998) suggests a close relationship between political risk and market volatility during the transition from the Imperial to Weimar Germany. However, Cutler et al. (1989) found little evidence of political news having a significant impact on the US market.

This paper attempts to add to this “growing” literature by focusing on the explanatory power of the sad and somewhat expected death of King Hussein on the volatility of equity returns in the Jordanian capital market. The analysis of volatility in leading finance journals has been advanced by the development of sophisticated econometric models in which the conditional variance of returns is permitted to vary over time.

[4] See, among others, Alesina (1987), Alesina and Cukierman (1990), Alesina et al. (1996), Alesina and Perotti, 1996, Caselli et al. (1996) and Campos et al. (1999).

The principle advantage of employing such models is the ability to capture the common empirical observations in daily time series: fat tails due to time-varying volatility, skewness resulting from mean non-stationarity, non-linearity dependence, and volatility clustering.

In this paper, we employ three different Autoregressive Conditional Heteroscedasticity (ARCH) specifications to examine the impact of the death of King Hussein on the volatility in the ASE. Specifically, we use the standard GARCH, exponential GARCH (EGARCH) and the GJR models. Then, we employ various specification tests to determine which model provides an adequate explanation of returns and volatility in the Jordanian market during the period under investigation.

The empirical findings have important implications for market participants as well as policy makers in Jordan and other emerging markets. An empirical investigation of how markets process new information about political news may broaden our general understanding of equity return volatility, and help investors price such risks effectively. For policymakers, the evidence indicates that political news has strong implications for stock market volatility. In turn, stock market volatility is known to have growth implications in emerging economies[5]. Highly volatile market returns due to political news may scare investors, i.e. especially foreign investors.

The remainder of the paper is organized as follows. In Section II, we provide a description of the methodology used in the paper. In Section III, some statistical

[5] Levine and Zervos (1998) and Spyrou and Kassimatis (2001) reported that stock market development measured by volatility of stock returns has negative effect on economic growth.

analyses are carried out to verify that the often-cited properties of daily financial time-series data are represented in our sample. Section IV contains a description of the model and a discussion of the empirical evidence. Finally, section V concludes the paper.

II. Methodology

Prior to estimating the impact of the somewhat expected death of King Hussein on the volatility of the ASM, we need to determine an appropriate model that can best describe the behaviour of stock returns during the period under consideration. In this study, we employ three different Autoregressive Conditional Heteroscedasticity (ARCH) specifications: the standard GARCH, exponential GARCH (EGARCH) and the GJR models. We employ various specification tests to determine which model provides an adequate explanation of returns and volatility in the Jordanian market. Finally, the appropriate model is used to calculate the conditional volatility of stock returns over time i.e., time-varying volatility.

The GARCH class of models used in this study has proven to be particularly suited for modeling the behavior of financial data. As emphasized by Pagan (1996), these models are capable of capturing the common characteristics of many financial time series. First, asset prices are generally non-stationary and often have a unit root, whereas returns are usually stationary. Second, returns series usually show little autocorrelation, while serial independence between the squared values of the series is often rejected pointing towards the existence of non-linear relationships between the subsequent observations. Volatility of returns appears to be clustered. Returns go through periods of high and low variances. These facts point towards time-varying conditional variances. Most empirical evidence indicates that the empirical distribution of returns differs significantly from the identical Gaussian distribution. The series are characterized by leptokurtosis, which could be related to the time-variation in the conditional variance. Finally, some series exhibit asymmetric behavior in the conditional variance (leverage effects).

The autoregressive Conditional Hetroscedasticity model (ARCH) has been introduced by Engle (1982) and generalized by Bollerslev (1986). The specification of the conditional variance in a $GARCH(p,q)$ model is given in Equation 1 below:

$$\varepsilon_t = h^{1/2} u_t$$
$$h_t = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j}^2 \qquad (1)$$

with u_t being IID, $\omega > 0,\ \alpha_i \geq 0,\ \beta_j \geq 0 \ \ and \ \sum_{i=1}^{p} \alpha_i + \sum_{j}^{q} \beta_j < 1$.

In practice, numerous studies have demonstrated that the $GARCH(1,1)$ specification is the most appropriate. In this model, the conditional variance is a function of three terms: First, the mean, ω. Second, news about volatility from the previous period, measured by the lag of the squared residual from the mean equation, ε_{t-1}^2 (the ARCH term). Third, last period's forecast variance, h_{t-1}^2 the (GARCH term). The coefficients of the model are easily interpreted. The estimate of α_1 shows the impact of current news on the conditional variance process and the estimate of β_1 the persistence of volatility to a shock or, alternatively, the impact of "old" news on volatility. Engle and Bolleslev (1986) show that the persistence of shocks to volatility depends on the sum of $\alpha + \beta$. Values of the sum lower than unity imply a tendency for the volatility response to decay over time, and at a slower rate the closer the sum is to unity. In contrast, values of the sum equal to (or greater) unity imply indefinite (or increasing) volatility persistence to shocks over time.

It is often observed that downward volatilities in financial markets are followed by higher volatilities than upward movements of the same magnitude. However, the GARCH model imposes symmetry on the conditional variance structure that may not be appropriate for modeling the behavior of stock returns. To deal with this problem, Nelson (1991) proposes the exponential GARCH or EGARCH model. Under the EGARCH (1,1) the conditional variance is given by:

$$\log(h_t) = \omega + \alpha\left[\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/\pi}\right] + \beta \log(h_{t-1}) + \delta \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \qquad (2)$$

where $\omega, \alpha, \beta, and \delta$ are parameters.

The EGARCH model has three distinct advantages over the GARCH model. First, the logarithmic construction of equation 2 ensures that the conditional variance is strictly positive, thus, the non-negative constraints used in the estimation of the GARCH are not necessary. Second, since the parameter δ typically enters Equation 2 with a negative sign, bad news, $\varepsilon_t < 0$, generates more volatility than good news. Finally, the degree of persistence in this model is measured only by the δ parameter: if $\delta < 1$, the model is not integrated.

A frequently used alternative specification to the conditional volatility process is the model proposed by Glosten et al. (1993). This model (the GJR) extends the GARCH model to allow for asymmetric effects by including an indicative dummy as shown by the following equation:

$$h_t = \omega + \alpha \ \varepsilon_{t-1}^2 + \beta \ h_{t-1} + \delta \ d_{t-1} \varepsilon_{t-1}^2 \qquad (3)$$

where d_{t-1} is a dummy variable that takes the value of unity if $\varepsilon_{t-1} < 0$ and zero otherwise.

The GJR model is closely related to the threshold GARCH, or TGARCH model of Rabemananjara and Zakoian (1993) and Zakoian (1994). According to the GJR model, if bad news has greater impact on volatility than good news, a leverage effect exists, and we expect $\delta > 0$. The impact of good news will be α while bad news has an impact of $\alpha + \delta$. The β parameter measures the degree of persistent in the conditional variance. The sum of the parameter values of $\alpha, \beta, \text{ and } \delta$ measures the persistence in volatility shocks. If the sum of these parameters is less than one, the shock dies out over time; a value close to one means that a shock will affect the conditional variance and the forecast of it for quite some time**.** If the sum of the parameters is equal to one, the shock will affect volatility into the indefinite future.

Models with the sum of these parameter values that equal one are called integrated GARCH models or IGARCH.

To complete the GARCH model, a mean equation must be specified. Thus, we propose the following specification for the mean equation:

$$LogP_t = \mu + LogP_{t-1} + \varepsilon_t \qquad t = 1,..., T \qquad (4)$$

where, P_t and P_{t-1} are the stock prices at time t and t-1 respectively, and ε_t is a random error (independent and normal distribution, $\varepsilon_t \sim IND(0, \sigma^2)$).

If Equation 4 is re-arranged so that the lagged logarithmic stock price is moved to the left-hand side of the equal sign, we get a function that states that relative stock returns will be a linear function of a constant and news (residuals) - the mean equation. In the empirical test, we will add a moving average term, MA(1), on the right-hand side of the mean equation to cope with any serial correlation which may be caused by non-synchronous trading in the stocks.

The main assumption under the GARCH models mentioned above is that the conditional distribution of returns is normal, i.e. the standardized residuals of these models should be normal. However, in practice, despite the flexible functional forms specified above, there is often excess kurtosis in the standardized residuals of GARCH models. To deal with this problem, Bollerslev and Wooldrige (1992) studied quasi-maximum likelihood (QML) estimation of GARCH models. They argued that under a correct specification of the first and second moment, consistent estimates of the parameters of the model could be obtained by maximizing a likelihood function constructed under the assumption of conditional normality. Consistent parameter estimates can then be obtained using a robust covariance matrix estimator. Therefore, in this study we compute the QML covariance and standard errors using the methods described by Bollerslev and Wooldrige (1992) and Glosten et al. (1993).

To determine which specification provides an adequate explanation of returns and volatility in the Jordanian market, some diagnostic tests are performed. First, we examine whether the standardized residuals of the estimated models display excess skewness and kurtosis. If properly specified, the GARCH models should be able to significantly reduce the excess skewness and kurtosis present in normal returns. Second, we examine whether the squared standardized residuals of the models are independent and identically distributed. Third, we examine whether the standardized residuals of the estimated models display ARCH effects (ARCH-LM test). Properly specified models should be able to significantly remove the ARCH effects. Fourth, we test whether the standardized residuals of the estimated models display non-linearity relationships (Ramsey (1969) REST test). The Schwartz Information Criterion (SIC) is also reported for each specification used, which allows degrees of freedom free comparison of the models' performance.

III. Data Description

To investigate the effect of the death of King Hussain on the volatility of the ASM, the daily closing price index of the market for the period from January 1998 to

December 1999 is used. The daily stock returns, r_t, are calculated using the first differences of the logarithmic price index, i.e. $r_t = Ln(P_t) - Ln(P_{t-1})$ where P is the price index in days t and t-1 respectively. After excluding non-trading days, the daily time series consists of 486 observations.

The daily logarithmic returns and squared returns are first tested for the presence of autocorrelation and stationarity. Table 2 reports descriptive statistics which show that the returns exhibit skewness and significant kurtosis.

The series indicates significantly flatter tails than does the stationary normal distribution. The coefficients of skewness indicate that the series typically has asymmetric distributions skewed to the right. In addition, the return series displays excess kurtosis. In this case, the null hypothesis of coefficients conforming to the normal value of three is rejected. Thus, the return series is leptokurtic. That is, its distribution has thicker (flatter) tails than the normal distribution. The hypothesis of normality is rejected by the bivariate Jarque-Bera test and this confirms the results based on either skewness or kurtosis. From the Ljung-Box test statistics for twelfth-order serial correlation for the levels, the returns show autocorrelation. We thus reject the null hypothesis of no serial correlation and homoscedastic daily returns (uncorrelated squared returns). Furthermore, the ARCH-LM test statistics report highly significant changing volatility. These results suggest the presence of time-varying volatility. This is the so-called stylized fact of volatility clustering in return series.

Table 2
Stock Market Returns: Some Basic Statistics

Mean	-0.00001
Standard Deviation	0.00649
Kurtosis	5.1980
Skewness	0.3673
Q(12)	70.520*
Q^2 (12)	78.766*
Normality	103.628*
ADF	-9.784*
PP	-15.868
ARCH(6)-LM	11.072*
REST(12;6)	12.352*

Normality represents the Jarque-Bera (1980) normality test, which follows a chi-squared distribution, with two degrees of freedom. Q(2) and $Q^2(12)$ are Ljung-Box tests for serial correlation in the returns and squared returns data respectively. ADF and PP are Augmented Dickey Fuller and Phillips-Perron tests for a unit root, respectively. ARCH (6)-LM is a test for conditional heteroscedasticity in returns for sixth order. The OLS-regression $y^2 = \alpha_0 + \alpha_1 * y_{t-1}^2 + ... + \alpha_6 * y_{t-6}^2$. $T * R^2$ is used and is χ^2 distribute with 6 degrees of freedom. T is the number of observations, y is returns and R^2 is the explained over total variation. α_0, $\alpha_1 ... \alpha_6$ are parameters. REST (12,6) is a test for non-linear dependence linearity in conditional mean of return: 12 is the number of lags and 6 is the number of moments that is chosen in the implementation of the test statistic. $T * R^2$ distributed with 12 degrees of freedom. * Significant at the 1 percent level.

Table (2) also shows that the Phillips-Perron (PP) and the Augmented Dickey Fuller (ADF) unit root tests strongly reject the hypothesis of non-stationarity, indicating that the return series displays a degree of time dependence. These results support the behavior of stock prices being characterized by a martingale process. The REST (Ramsey, 1969) test statistic suggests the presence of non-linearity in the series.

Based on the above, the ASM stock returns tend to be characterized by positive skewness, excess kurtosis and deviation from normality. These findings are consistent with the findings from other emerging markets[6]. The results also display a degree of

[6] Bekaert et al. (1998) provide evidence that 17 out of the 20 emerging countries examined (the sample includes Jordan) had positive skewness and 19 out of 20 have excess kurtosis, so that normality was rejected in more than half of the countries.

volatility clustering[7] and non-linear dependence in returns. Following Diebold (1986), these characteristics suggest that the GARCH specification provides a good approximation that captures the time-series characteristics of the daily returns in the Jordanian stock market during the period under consideration.

IV. The Empirical Results

Prior to estimating the impact of King Hussein's health "rumors" and the period surrounding the date of his death on the volatility of ASM, we need to determine the appropriate model that can best describe the behavior of stock returns during the period under consideration. It is well-known that the GARCH-type models provide an appropriate model for stock returns. Previous studies have reported that a GARCH (1,1) specification captures the conditional volatility of the returns quite well. In this paper, as discussed earlier, we employ three different conditional variance specifications: the standard GARCH, EGARCH, and the GJR models, in order to examine the sensitivity of the results to employing a variety of volatility specifications.

Table 3 reports the results of the different GARCH specifications for the stock market returns during the period of January-1998 to December-1999.

[7]Bekaert and Harvey (1997) found that most emerging stock markets including Jordan exhibit time-varying volatility.

Table 3
Estimates of Volatility Models

Mean Equation: $R_t = \mu + \gamma \ MA(1) + \varepsilon_t$
Variance Specifications:
Standard GARCH (1,1): $h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}^2$

EGARCH(1,1):

$$\log(h_t) = \omega + \alpha\left[\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/\pi}\right] + \beta \ \log(h_{t-1}) + \delta \ \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$$

GJR: $h_t = \omega + \alpha \ \varepsilon_{t-1}^2 + \beta \ h_{t-1} + \delta \ d_{t-1}\,\varepsilon_{t-1}^2$

	GARCH	EGARCH	GJR
μ	-0.00041	-0.00003	-0.0003
	(-1.5042)	(-0.8931)	(-1.1769)
γ	0.2741*	0.2743*	0.2587*
	(5.9423)	(4.8094)	(5.1965)
ω	0.00008*	0.00009*	-4.7318**
	(2.8288)	(3.9248)	(-2.3076)
α	0.26319*	0.35711*	0.4043*
	(3.7561)	(3.5882)	(3.4988)
β	0.53236*	0.49784*	0.5761*
	(5.0433)	(5.0108)	(2.9569)
δ	--	-0.18175**	-0.12585
		(-2.0864)	(-1.4225)
Log likelihood	1817.140	1818.738	1813.087
SIC	1810.4242	1810.6781	1805.0271
Q(12)	18.659***	19.310***	20.502**
$Q^2(12)$	14.919	11.340	22.739**
Skewness	0.2408	0.1848	0.1942
Kurtosis	3.6166	3.5731	3.8558
Jarque-Bera	39.333*	32.961*	36.629*
ARCH(6)-LM	1.9329***	1.3248	3.0727*
REST(12,6)	6.6538**	3.2149	5.9672**

Bollerslev and Wooldridge (1992) quasimaximum likelood t values in brackets. SIC is the Schwartz Information Criterion: SIC=L-0.5 *P**log(T), where *P* is the number of estimated parameters. See Table 1 for definition of the Jarque-Bera, Q(12), $Q^2(12)$, ARCH(6)-LM and REST(12,6) test statistics. *, **, *** significant at 1%, 5% and 10% respectively

The mean equation in all specifications includes an MA(1) term in order to remove any serial correlation in the returns which may be caused by non-synchronous trading in the stocks. Starting with the mean equation results, we observe that the MA(1) term is highly significant in all specifications. This indicates that the returns exhibit serial correlation. In other words even after we take into consideration the impact of non-synchronous trading, the market reflects inefficiency during the period of the study.

The estimated α *and* β parameters in the conditional variance equation for the model with GARCH(1,1) specification show significant ARCH and GARCH with $\alpha + \beta$ less than unity. This implies that the effect of shocks on volatility tends to decay within a few time lags (the duration of a shock to volatility is estimated to be less than one month) [8]. When the conditional variance equation is specified as an EGARCH(1,1) or GJR(1,1) almost similar results to the GARCH(1,1) specification are found. The estimated β parameter in EGARCH(1,1) is around 0.50, indicating a tendency for the volatility response to shocks to display a shorter memory. A leverage effect is also detected in this model - a significant negative value of the δ parameter. Similarly, the GJR specification results provide a clear evidence of asymmetry in the returns, as indicated by the statistically significant coefficient of δ-bad news has a greater impact on conditional volatility than good news. Thus, the asymmetry impact of shocks on volatility is captured by both models.

Turning to the specification statistical tests, the bottom of Table 3 shows that the EGARCH model has the highest log-likelihood value and thus the best model. The SIC also ranks this model first followed by the GARCH and GJR models. Although the log-likelihood and SIC slightly favour the EGARCH, all other specification tests (the diagnostics statistical tests) also suggest that this model provides a better fit and captures most of the time series characteristics of the returns during our sample

[8] See Lamoueux and Lastrapes (1990).

period. As a first diagnostic test, the twelfth order Lung-Box is calculated for the standardized residuals[9] Q(12) and squared standardized residuals $Q^2(12)$ for all the three models. For all the models, Table 3 shows significant evidence of serial correlation in the standardized residuals (Q(12)) at the 10 percent level. However, for the squared residuals up to lag 12 ($Q^2(12)$), the EGARCH reports no significant evidence of autocorrelation. The values of kurtosis and skewness for the standardized residuals have lower values in all models. Hence, the EGARCH suggests clearly more normal residuals. While the ARCH-LM (6) test statistics report conditional hetroscedasticity for the GARCH and GJR, the homosdacticity is detected in the EGARCH. Although the REST test statistics rejected linearity in the mean for the GARCH and GJR, linearity cannot reject in the EGARCH.

Since, all the specification tests suggest that the EGARCH model seems to capture most of the market dynamics appropriately during the sample period of this study, we report the conditional volatility of the ASE based on this model. Figure 1 plots the conditional volatility of the ASE for the period from January 1998 to December 1999. As can seen, volatility shows a cyclical pattern with significant volatility during May-October 1998 and January-March 1999. This provides some evidence about the significant effect of King Hussein's health "rumors" (October 1998) and the period surrounding the date of his death (February 1999).

[9] Standardized residuals are calculated as $\varepsilon_t / \sqrt{h_t^* \upsilon_i / (\upsilon_i - 2)}$ where υ is the degree of freedom in the student-t distribution.

Fig. 1 Estimated Conditional Volatility of the Stock Returns

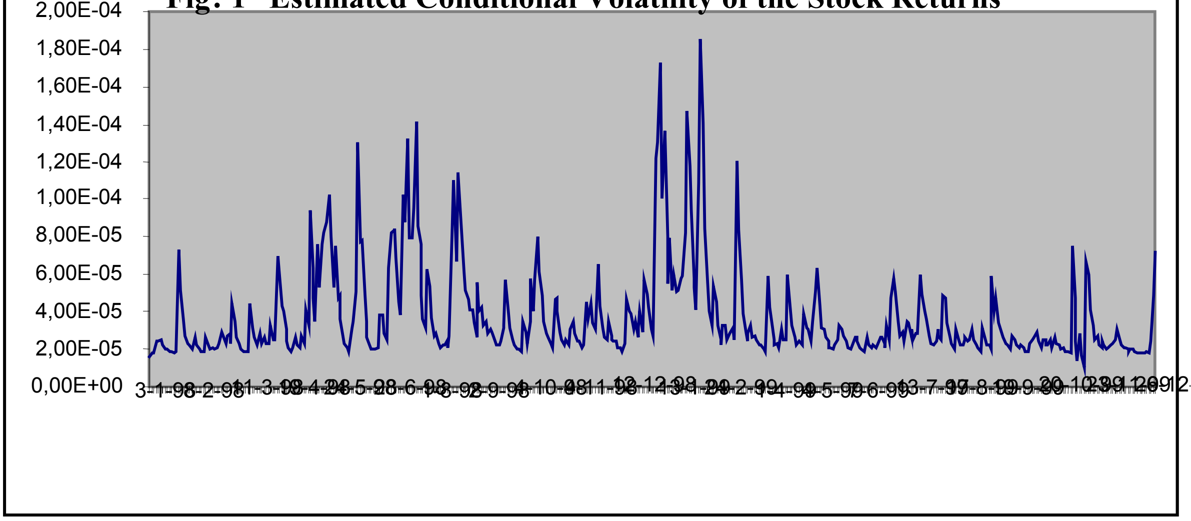

Table 4
Conditional Volatility Surrounding King Hussein's Last Days

Trading Days	Jordan categorically denied that King Hussein may die within three months. October 20 1998	Death of King Hussein February 7 1999
-5	-27.608	-20.304
-4	-18.587	-19.919
-3	-6.6404	37.779
-2	-13.567	9.5244
-1	-11.019	21.049
0	124.261	161.373
+1	19.119	69.528
+2	14.079	24.140
+3	26.524	39.887
+4	-16.074	32.937
+5	-12.483	-28.394

Moreover, Table 4 reports the time varying percentage change in volatility surrounding the two dates: rumor denial and death of the King. Clearly, we can see that after three trading days, following the government's denial that King Hussein may die, conditional volatility started to decrease. Similarly, it took the market four trading days after the death of King Hussein to reduce its volatility.

For a more formal test of the impact of King Hussein's health "rumors" and the period surrounding the date of his death on the volatility of ASE, we use two further tests. First, we regress the time-paths of the conditional volatility (V) obtained from the above EGARCH specification on the current and five-lagged dummy variable (D) which takes a value of 1 when there is a main event and 0 otherwise. Second, we re-estimate the EGARCH model after adding the current and five-lagged dummy variable (D) mentioned above to the conditional volatility equation. The current and lagged values of up to five days are used in both tests to allow the market to completely absorb the effects of such events. The dates of these events are reported in Table 1. The estimated equations are given as follows:

$$V_t = \rho + \sum_{i=0}^{5} \eta_i D_{t-i} + \varepsilon_t \tag{5}$$

$$\log(h_t) = \omega + \alpha \left[\left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| - \sqrt{2/\pi} \right] + \beta \log(h_{t-1}) + \delta \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \sum_{i=0}^{5} \eta_i D_{t-i} \tag{6}$$

The results of these two tests are reported in Table 5. As can be seen, the results lend qualified support to the above evidence that suggests that King Hussein's health "rumors" and the period surrounding the date of his death were the prime culprits behind the extremely high volatility of the ASE during the period of interest. Moreover, the results of both tests indicate that the events are discounted in at least three days following the dates of the respective events. To explain these results, one can rely on either of the following two arguments. First, there is a high level of information asymmetry in the market that makes participants take a long time to arrive at a new equilibrium. Second, given the fact that the loss of King Hussein was a big event, it is natural for the market to take a number of days to completely adjust it self to a new level.

Table 5.
The Impact of Dates Surrounding King's Death

OLS Estimation:

$$V_t = \rho + \sum_{i=0}^{5} \eta_i D_{t-i} + \varepsilon_t$$

EGARCH(1,1):

Mean Equation: $R_t = \mu + \gamma\ MA(1) + \varepsilon_t$

Variance Specifications:

$$\log(h_t) = \omega + \alpha\left[\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/\pi}\right] + \beta\ \log(h_{t-1}) + \delta\ \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \sum_{i=0}^{5} \eta_i D_{t-1}$$

	OLS	EGARCH
μ	0.000027* (5.96122)	-0.00056** (-2.50045)
γ		0.24778* (4.7148)
ω		0.00078* (3.7853)
α		0.15711* (2.3483)
β		0.39617* (6.6583)
δ		-0.06131** (--1.9598)
η_0	0.000289* (4.55852)	0.79310* (5.53755)
η_1	0.000239* (4.28462)	0.66626* (4.44484)
η_2	0.000205** (2.574139)	0.42755* (2.81878)
η_3	0.0000744** (2.098954)	0.256383** (2.12853)
η_4	0.0000768** (2.044708)	0.181389 (0.94781)
η_5	0.0000767** (2.002506)	0.110958 (0.794972)
R^2	0.654326	
Log likelihood	4553.046	1884.558
SIC	18.84171	1844.401
Q(12)	119.19*	14.971
$Q^2(12)$	9.3877	11.229
Skewness	4.0547	-0.11269
Kurtosis	17.695	3.1841
Jarque-Bera	254.250*	1.6979
ARCH(6)-LM	1.37925	1.7506
REST(12,6)	50.2854*	2.3293

Notes:*, **, *** significant at 1%, 5% and 10% respectively.

V. A Summary and Conclusions

The recent history of the Hashemite Kingdom of Jordan shows that the country has passed through many internal and external disturbances (economic and political). These include the 1967 Arab Israeli War, the 1970 Civil War, the 1973 War, the 1989 devaluation of the Jordanian Dinar and the introduction of the IMF supported austerity measures, the 1991 Gulf War, the 1994 signing of the peace treaty with Israel, the 1998 beginning of the late His Majesty King Hussein's (HMKH) chemotherapy for non-Hodgkin's lymphoma, the 1999 death of HMKH, and more recently the 2001/2002 Intifada in the Palestinian territories.

It can be argued that the most natural occurrence and peaceful change that Jordan had to face, the death of King Hussein, was, potentially, the most important as far as its impact on ASM’s share prices. Indeed, this event in the contemporary history of Jordan is important for its emotional, political and economic implications. King Hussein's death was felt far outside his grieving Kingdom.

This paper used the standard GARCH, exponential GARCH (EGARCH) and the GJR models to examine the conditional volatility associated with two major dates associated with King Hussein. These are the official denial that Hussein may die within three months and the date of his death.

The results indicate that King Hussein’s health “rumors” and the date of his death caused extremely high volatility in the Jordanian capital market. Moreover, the results suggest that these events are discounted in at least three days following their respective dates.

On January 25, 1999 the late King Hussein of Jordan named his eldest son heir to the throne. His Majesty King Abdullah attended military school in England and the United States and served as commander of the Jordanian Army’s special forces. In his first appearances, he showed much of his father’s charisma. Moreover, it is hoped that His Majesty King Abdullah (and Jordan) will experience greater political and economic stability than that faced by the late King Hussein.

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